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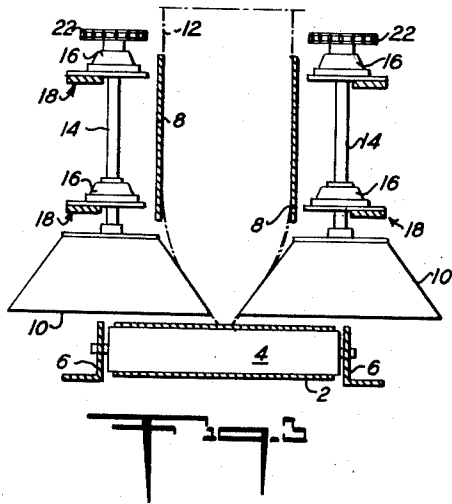
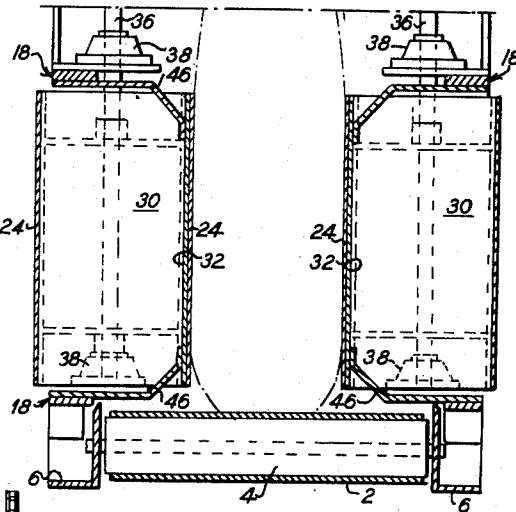
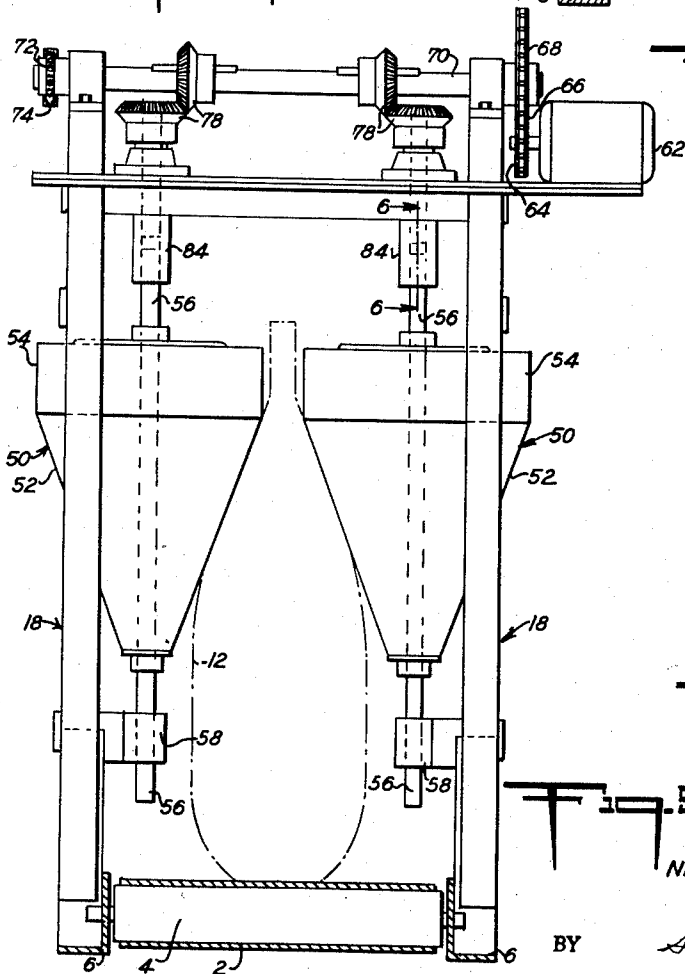
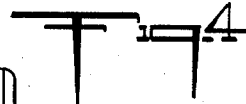
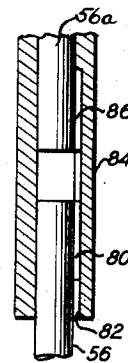
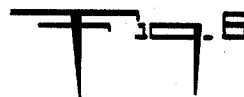
N. H. HARTMAN

2,856,741

METHODS AND APPARATUS FOR HANDLING BAGS

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INVENTOR

NEWTON H. HARTMAN

BY

Swecker + Mathis

ATTORNEYS

1

2,856,741

METHODS AND APPARATUS FOR HANDLING BAGS

Newton H. Hartman, Knoxville, Tenn., assignor to Knoxville Fertilizer Company, Knoxville, Tenn., a corporation of Tennessee

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This invention relates to methods and apparatus for handling bags, and more particularly, to methods and apparatus for handling bags filled with pulverulent material.

In the packaging of pulverulent material, such as fertilizer, cement, etc., in large bags, the filled bags must be shaped somewhat and their mouths closed prior to the sewing of such mouths. The operations of shaping the bags and feeding them to the head of the sewing machine heretofore have been carried out manually for the most part in spite of the fact that several machines for automatically performing these operations have been proposed. Such machines were too elaborate, expensive, and space consuming to be practical.

Moreover, the handling operations to which the filled bags have been subjected have resulted frequently in the tearing of the bags. Such bags are usually formed of paper or cloth, and they cannot withstand severe stresses.

It is a general object of this invention to provide improved methods of and apparatus for handling bodies wherein the stresses applied thereto are minimized. A related, but more specific object is the provision of improved methods of and apparatus for handling bags filled with pulverulent material whereby the tearing or breaking of the bags may be minimized.

Another object of this invention is the provision of improved methods of and apparatus for automatically shaping and closing bags of pulverulent material.

According to the present invention filled bags first are placed upon a generally horizontal conveyor. Then the bags are centered with respect to the axis of the conveyor by novel apparatus and a novel method. The apparatus applies lifting forces to each bag while shifting it laterally toward the center of the conveyor. The conveyor next moves the centered bags between two vertically disposed conveyor belts which converge in the direction of their travel toward the axis of the horizontal belt. The purpose of these converging vertical belts is to press against the sides of a bag so as to assure that the bag will be upright as it is discharged from the space between the two vertical conveyers.

The top of each bag is shaped and closed in a desirable manner by a pair of inverted conical rollers rotating about vertical axes disposed on opposite sides of the path of movement of the bags along the horizontal conveyor. The surfaces of these shaping rolls apply pressure to the top of the bag so as to shift the pulverulent material therein into such a position that the top of the bag may be closed.

A better understanding of the invention and its many features and advantages will be gained from the following detailed description of a single embodiment thereof, illustrated in the accompanying drawings in which:

Fig. 1 is a side elevational view of apparatus according to the invention;

Fig. 2 is a horizontal cross-sectional view taken along the line 2—2 in Fig. 1;

2

Fig. 3 is a transverse vertical cross-sectional view taken along the line 3—3 in Fig. 1;

Fig. 4 is a transverse vertical cross-sectional view taken along the line 4—4 in Fig. 1;

Fig. 5 is a transverse vertical cross-sectional view taken along the line 5—5 in Fig. 1; and

Fig. 6 is a detailed cross-sectional view taken along the line 6—6 in Fig. 5.

The illustrated apparatus includes a long horizontal conveyor belt 2 which carries paper or cloth bags filled with pulverulent material, such as fertilizer or cement, along through the positioning and shaping stations. The conveyor belt 2 is an endless belt which is supported and driven by a large number of horizontal rollers 4, mounted for rotation in guide rails 6 which may be secured to the floor. One or more of the rollers 4 preferably is driven by an electric motor, not illustrated.

The filled bags are placed upon the left end portion of the conveyor 2 between two vertically extending plywood guides 8 rigidly secured to the frame of the machine. This operation may be carried out manually by an attendant or automatically by suitable machinery. These bags rest on their bottom ends with their mouths, or upper ends, open, and, as the upper run of the conveyor belt 2 moves them from left to right in Fig. 1 along the channel defined by the upright guides 8, the guides hold them approximately upright.

In placing the bags upon the conveyor belt 2, the operator may not position the bags at the exact center of the conveyor belt. The operation of transferring the filled bags from the filling station to the conveyor belt must be carried out rapidly, and some variations in the positioning of the bags on the belt are inevitable. In order to center the bags with respect to the conveyor belt, the apparatus of this invention includes a pair of centering rollers 10 disposed above the conveyor belt 2 near the left end thereof as shown in Fig. 1. The two centering rollers 10 are shown in their proper relation to each other and to the upper surface of the conveyor belt 2 in Fig. 3.

Each of the centering rollers 10 is shaped as a frustum of a cone and its larger end is disposed in close proximity to the upper surface of the conveyor belt 2. The lower end portions of the centering rollers 10 approach each other rather closely as indicated in Fig. 3. The spacing between the two centering rollers is less than the thickness of one of the bags 12 being handled.

The rollers 10 are fixed on vertical shafts 14 carried by bearings 16 attached to a suitable frame structure indicated generally by the numeral 18. The upper ends of the shafts 14 carry sprockets 20 which are driven by chains 22 to cause rotation of the centering rollers.

The nature of the operation carried out by the centering rollers 10 can best be appreciated when the character of the bags being handled is kept in mind. These bags are usually made of paper, although other materials are sometimes employed. Moreover, they are quite heavy. For example, materials such as fertilizer are frequently packaged as 50 or 100 lb. bags. Such bags are particularly subject to rupture because of the tendency of the pulverulent material to shift its position within the bag so as to produce large localized stresses.

The centering rollers 10 represent a new mode of handling such bags. The lower end portions of the conical rollers 10 move underneath the sides of the bottom of each bag as indicated in Fig. 3 to pick up the bag and shift it transversely of the conveyor belt to the center thereof.

A number of advantages result from this type of operation. First, the frictional resistance of the bag to movement laterally of the conveyor belt is greatly reduced. Second, the twisting moment applied to the bag

in shifting it laterally is minimized because the shifting force is applied to the bag at about the same level as the frictional force resisting motion of the bag. Third, there is a shaping of the bottom of the bag that is significant in connection with later operations.

It will be seen that the centering rollers 10 represent an important advance over such prior art centering techniques as the use of converging vertical guides and the use of inclined conveyor belts for supporting the bags. The inclined guides of the prior art tended to break the bags because of the frictional resistance offered to motion of the bags. Inclined supporting belts, on the other hand, were undesirable because it was very difficult to place the bags on them so that they would be upright.

After the bags are centered with respect to the longitudinal axis of the conveyor belt 2, they are caused to assume an upright position by vertically disposed belts 24. As shown in Fig. 2 there are two endless belts 24, and they are arranged so that their inner runs converge in the direction of travel of the conveyor belt 2. Each of the vertical belts 24 surrounds idler rollers 26 and 28, a driving roller 30, and a guide plate 32. One of the idler rollers, such as the one designated by the numeral 28, may be movably mounted so that the proper tension may be maintained on the endless belt 24. The details of this mounting form no part of the present invention and they will not be described specifically.

The rollers 26 and 30 are mounted on shafts 34 and 36, respectively, which are carried by bearings 38 attached to the frame structure 18. The upper end of each shaft 34 carries a sprocket 40 which drives one of the chains 22 for rotating the centering rollers 10. Each of the shafts 36 carries at its upper end a gear which meshes with a gear upon a transversely extending shaft 44. The drive for shaft 44 will be explained hereafter.

Each of the guide plates 32 is attached to the frame of the machine by means of a plurality of brackets 46. These brackets hold the guide plates securely in positions such that they will cause the vertical belts 24 passing thereover to converge and apply pressure to the side walls of the bags 12 being fed along the conveyor belt 2. The belts 24 are driven at the same speed as the conveyor belt 2. As pressure is applied to the sides of a bag, its bottom is flattened by a shifting of the pulverulent material from the position indicated by the bag shape shown in Fig. 3. The settling of the material at a time when the sides of the bag are under pressure from vertical surfaces assures that the bottom of the bag will extend at right angles to the vertical. This gives a bag which is easy to handle during shipping and storage.

When a bag passes on from between the upright belts 24, it has been centered with respect to a vertical axis and with respect to the longitudinal axis of the conveyor belt 2. The next step in the operation of preparing the bag for sewing is to shape the upper end of the bag so that its mouth may be closed. According to the present invention, this step is carried out by a pair of shaping rollers 50 shown in Figs. 1 and 5. Each of these shaping rollers has a bag contacting surface which includes the lower, inverted, conical portion 52, and an upper cylindrical portion 54, and each is fixed to a shaft 56 carried by suitable bearings 58 on the machine frame 18. The shafts 56 are rotated in a manner which will be explained fully below. The two rollers 50 are spaced opposite each other transversely of the conveyor belt 2, as indicated in Fig. 5, so that the upper portions of the bags 12 must assume the desired shape in order to pass therebetween.

The shaping rollers 50 apply pressure to the upper portions of the bags 12 in a particularly advantageous manner. The contact between a bag and the rollers 50 is established gradually, beginning at the top of the bag and working down, because of the dispositions of portions 52, which are shaped as frustums of cones. Also, the pattern of pressure distributions varies according to

the portions of the shaping rollers being contacted by the various parts of the upper portions of the bags. The result of this is the shifting of the pulverulent material in the bag so as to produce the desired inverted V-shape.

This is brought about in a single operation with a minimum of pressure on the walls and bottom of the bag.

By reducing the areas of contact between a bag and the surfaces of the shaping means 50, and by applying the maximum forces to the bag near its center in the zone where the pulverulent material may shift most readily, the total loads imposed upon the bags have been minimized. This fact can be appreciated by a comparison between the loads imposed upon the bags by applicant's inverted, conical bag-shaping rollers 50 and those applied by converging belt systems such as that shown in Belcher et al., Patent No. 2,362,462. The lower loads involved in the use of applicant's rollers minimize bag breakage and serve to speed up the entire bag closing operation. This is particularly so in the case of dense pulverulent materials such as fertilizer and cement, for these materials are especially difficult to handle by high pressure methods.

The cylindrical upper portions 54 of the shaping rollers 50 serve as guides for closing the mouth portions of the bags, as shown in Fig. 5.

After being discharged from the shaping rollers the bags 12 are carried along by the conveyor belt 2 toward a sewing head which sews the closed mouth of the bag to complete the packaging operation. In Fig. 1 there has been illustrated, at the extreme upper right, a small portion of a guide belt arrangement for gripping the closed mouths of the bags 12 and feeding them into the sewing machine. This structure is designated generally by the numeral 60. Since it is conventional in the art, this structure and the sewing machine structure will not be described herein in detail.

The bag centering rollers 10, the upright belts 24, and the bag shaping rollers 50, are all driven from a single electric motor 62. The drive shaft of this motor carries a sprocket 64 which engages a chain 66, the other end of which passes about a sprocket 68 fixed on a transverse shaft 70. The transverse shaft 70 carries another sprocket 72, and another drive chain 74 extends from the sprocket 72 to a sprocket 76 upon the transverse shaft 44. The shaping rollers 50 are driven from the transverse shaft 70 by means of gears 78 shown in Fig. 5. Reference has already been made to the connections between transverse shaft 44 and the upright belts 24, and the centering rollers 10.

The speeds of the various parts of the apparatus of this invention are carefully selected so as to minimize the stresses imposed upon the bags being handled. The conveyor belt 2, which is driven by an electric motor not illustrated in the drawings, moves at the same speed as the upright belts 24, and the centering and shaping rollers 10 and 50 rotate at such speeds that the circumferential velocities of their smaller end portions approximate the speed of the conveyor belt 2.

In Fig. 6 there has been illustrated an arrangement for permitting vertical adjustment of the shaping rollers 50 to accommodate bags of different heights. As illustrated, the shaft 56 carries a key 80 which engages an open keyway 82 in a sleeve member 84. The other end of the sleeve member 84 is disposed about the lower end of a shaft 56a which extends upwardly and carries the gear 78. The shaft 56a has a key 86 thereon for engaging the keyway 82 in the sleeve 84. This arrangement permits some endwise shifting movement of the shaft 56 relative to the shaft 56a.

Other arrangements for adjusting the vertical position of the shaping rollers 50 will be apparent to persons skilled in the art. In Fig. 1 the frame structure has been illustrated as being bolted together in many places.

This type of construction permits rearrangement of the

parts to accommodate bags of different sizes with a minimum of trouble.

Although a single embodiment of the invention has been described by way of example, numerous variations and modifications will be apparent to persons skilled in the art. Therefore, it is intended that the scope of the invention be determined from the following claims.

I claim:

1. Apparatus for handling a series of bodies comprising conveyer means for supporting and moving such bodies from one location to another, first body-centering means having a body-contacting surface above said conveyer means, and second body-centering means having a body-contacting surface above said conveyer means at a location spaced transversely of said conveyer means opposite the body-contacting surface of said first body-centering means, each of said surfaces being shaped as a portion of the surface of a cone having a substantially vertical axis so that the two body-contacting surfaces define a passageway which converges downwardly to a level close to the central portion of said conveyer means and converges forwardly in the direction of travel of said conveyer means, the minimum width of the bottom of said passageway being less than the maximum width of the bodies being handled so that each of said bodies contacts said surfaces as it moves along said conveyer means and is caused to move toward the center of said conveyer while at least a portion of the weight of the body is being borne by said body-centering means.

2. Apparatus for handling a series of bodies comprising conveyer means for supporting and moving such bodies from one location to another, a first centering roller mounted for rotation about a substantially vertical axis and having a body-contacting portion above one side of said conveyer means corresponding in shape to a frustum of a cone, a second centering roller mounted for rotation about a substantially vertical axis spaced transversely of said conveyer means from said first roller and having a body-contacting portion above the other side of said conveyer means corresponding in shape to a frustum of a cone, the body-contacting portions of said rollers being of greater diameter just above said conveyer means and being spaced apart a distance less than the thickness of the bodies being handled, and means for rotating said centering rollers in opposite directions so that the adjacent surfaces of their body-contacting portions move in the same direction as said conveyer means, whereby said rollers lift said bodies relative to said conveyer means and simultaneously shift said bodies to the center of said conveyer means.

3. Apparatus for handling bags of pulverulent material comprising an endless conveyer belt having a generally horizontal run upon which said bags are placed, a first centering roll mounted for rotation about a substantially vertical axis and having a bag-contacting portion above one side of said run of the conveyer belt shaped as a frustum of a cone, a second centering roll mounted for rotation about a substantially vertical axis spaced transversely of said run from the axis of said first roll and having a bag-contacting portion above the other side of said run shaped as a frustum of a cone, the bag-contacting portion of said rolls being of greatest diameter just above said run of the conveyer belt and being spaced apart a distance less than the thickness of the bags of pulverulent material, and means for rotating said rolls in opposite directions so that the adjacent surfaces of their bag-contacting portions move in the same direction as said run of the conveyer belt, whereby said rolls shift said bags to the center of said run and simultaneously exert lifting forces on the side portions of the bottoms of said bags to shape said pulverulent material and to reduce the friction between the bottoms of said bags and said run of the conveyer belt.

4. Apparatus for handling bags of pulverulent material comprising an endless conveyer belt having a generally

horizontal run upon which said bags are placed, a pair of vertically extending guides above said run for holding said bags upright as they move along said run, a first centering roll mounted for rotation about a substantially vertical axis and having a bag-contacting portion above one side of said run of the conveyer belt shaped as a frustum of a cone, a second centering roll mounted for rotation about a substantially vertical axis spaced transversely of said run from the axis of said first roll and having a bag-contacting portion above the other side of said run shaped as a frustum of a cone, the bag-contacting portion of said rolls being of greatest diameter just above said run of the conveyer belt and being spaced apart a distance less than the thickness of the bags of pulverulent material, and means for rotating said rolls in opposite directions so that the adjacent surfaces of their bag-contacting portions move in the same direction as said run of the conveyer belt, whereby said rolls shift said bags to the center of said run and simultaneously exert lifting forces on the side portions of the bottoms of said bags to shape said pulverulent material and to reduce the friction between the bottoms of said bags and said run of the conveyer belt.

5. Apparatus for closing the mouths of bags containing pulverulent material which comprises conveyer means for supporting such bags and moving them from one place to another, means for centering the bags along the axis of the conveyor, means contacting opposite sides of the centered bags simultaneously to cause the bags to assume an upright position, and first and second shaping rollers above said conveyer means mounted for rotation about substantially vertical axes and spaced from each other to permit the passage therebetween of the upright bags, each of said shaping rollers having a bag-contacting surface which includes a portion corresponding in shape to the surface of a frustum of an inverted cone for shaping the pulverulent material in the upper parts of the bags so as to permit the closing of the mouths of the bags.

6. Apparatus for closing the mouths of bags containing pulverulent material which comprises conveyer means for supporting such bags and moving them from one place to another, means for centering the bags along the axis of the conveyor, a pair of vertically disposed endless belts converging in the direction of travel of said conveyer means for contacting opposite sides of the centered bags simultaneously to cause the bags to assume an upright position, and first and second shaping rollers above said conveyer means mounted for rotation about substantially vertical axes and spaced from each other to permit the passage therebetween of the upright bags, each of said shaping rollers having a bag-contacting surface which includes a portion corresponding in shape to the surface of a frustum of an inverted cone for shaping the pulverulent material in the upper parts of the bags so as to permit the closing of the mouths of the bags.

7. Apparatus for closing the mouths of bags containing pulverulent material which comprises an endless conveyer belt having a generally horizontal run upon which said bags are placed, a pair of transversely spaced conical centering rolls mounted for rotation above said run about vertical axes and having their larger ends disposed close to said conveyer run so as to contact said bags, a pair of vertically disposed endless belts converging in the direction of travel of said conveyer run for contacting the sides of the centered bags simultaneously to cause the bags to assume an upright position, a pair of transversely spaced shaping rolls of inverted cone shape mounted for rotation above said conveyer run about vertical axes and positioned to contact the upper portions of said bags, and drive means for driving said belts at the same speed and for rotating said rolls so that their smaller end portions have approximately the same surface speed as said belts.

8. Apparatus for shaping the upper portions of bags containing pulverulent material which comprises a first

shaping roller mounted for rotation about a substantially vertical axis and having a bag-contacting surface of a shape corresponding to the surface of a frustum of an inverted cone, a second shaping roller mounted for rotation about a substantially vertical axis and having a bag-contacting surface of a shape corresponding to the surface of a frustum of an inverted cone spaced slightly from the bag-contacting surface of said first shaping roller to permit the introduction of the upper portion of a bag into the space between said surfaces, and means for rotating said rollers in opposite directions so that the adjacent portions of said surfaces move in the same direction.

9. Apparatus for shaping the upper portions of bags containing pulverulent material which comprises conveyer means for supporting such a bag, a first shaping roller above said conveyer means having an inverted conical bag-contacting surface, a second shaping roller above said conveyer means having an inverted conical bag-contacting surface, means mounting said rollers for vertical adjustment relative to said conveyer means to accommodate bags of different heights and for rotation about substantially vertical axes spaced apart transversely of said conveyer means, and means for rotating said rollers in opposite directions so that their adjacent surface portions move in the same direction as said conveyer means.

10. Apparatus for closing the mouths of bags containing pulverulent material which comprises first and second shaping rollers mounted for rotation about substantially vertical axes and spaced from each other to permit the introduction of the upper portion of a bag therebetween, each of said shaping rollers having a bag-contacting surface which includes a lower, inverted conical portion and an upper, cylindrical portion adjacent to and of the same diameter as the larger end of said conical portion, said conical portions serving to shape the pulverulent material in a bag and said cylindrical portions serving to close the mouth of such bag, and means for rotating said rollers in opposite directions so that the adjacent portions of said surfaces move in the same direction to feed the bags between the rollers.

References Cited in the file of this patent

UNITED STATES PATENTS

1,886,896	Nelson	Nov. 8, 1932
2,041,891	White	May 26, 1936
2,220,550	Sheperdson	Nov. 5, 1940
2,348,650	Rose	May 9, 1944
2,356,472	Rothaug	Aug. 22, 1944
2,362,462	Belcher et al.	Nov. 14, 1944
2,524,248	Albertoli	Oct. 3, 1950