March 31, 1953 H. F. DAVIES 2,633,280

BAG PACKAGING METHOD AND MACHINE

Filed Dec. 17, 1945

5 Sheets-Sheet 1

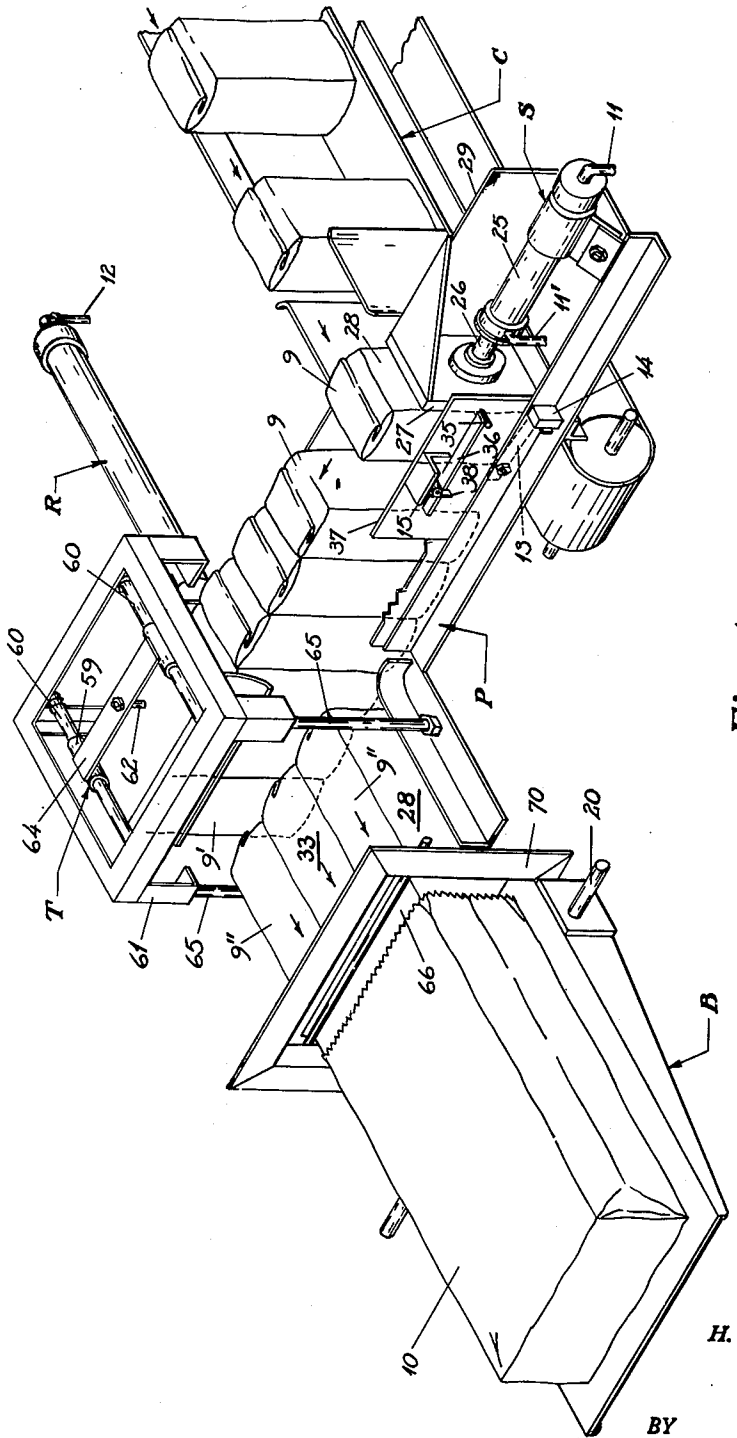


Fig. 1

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5 Sheets-Sheet 2

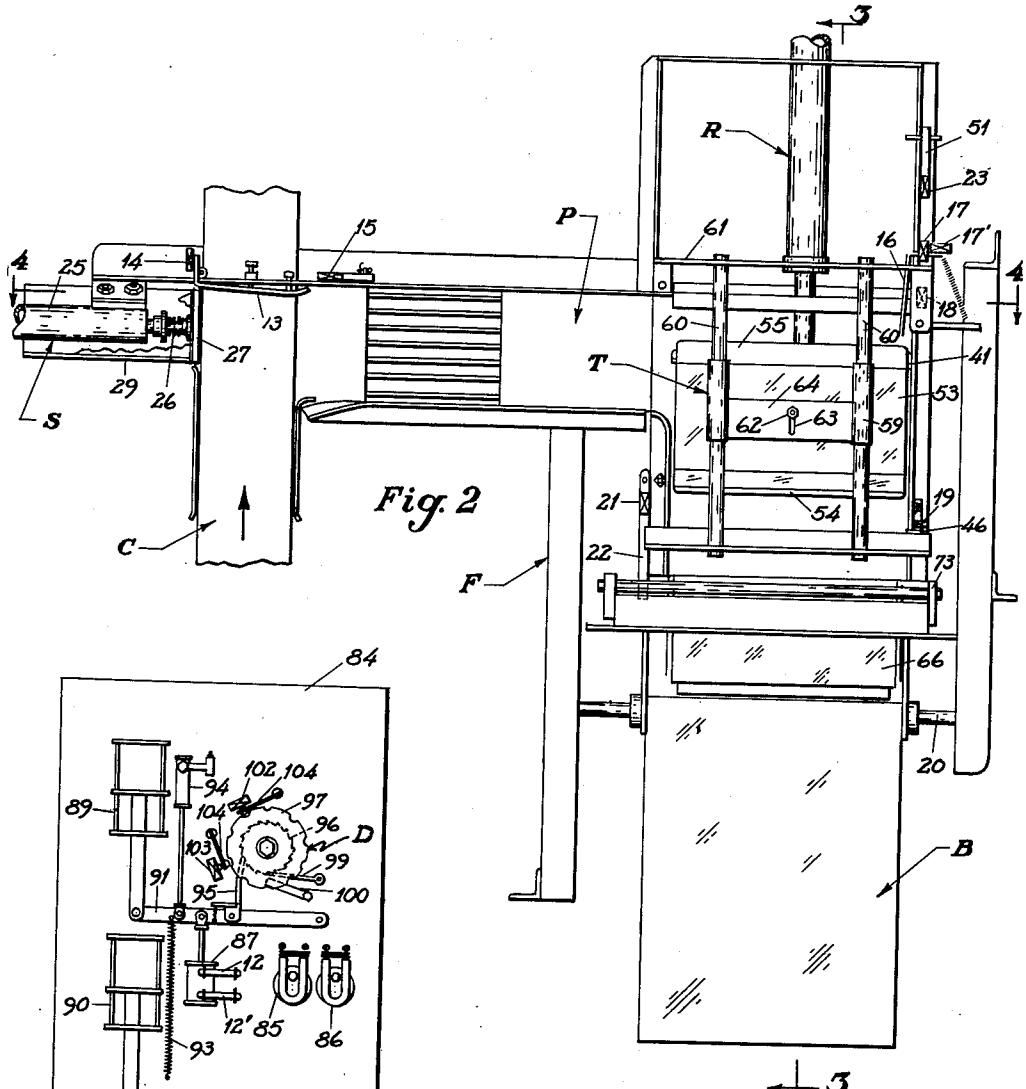


Fig. 2

Fig. 6

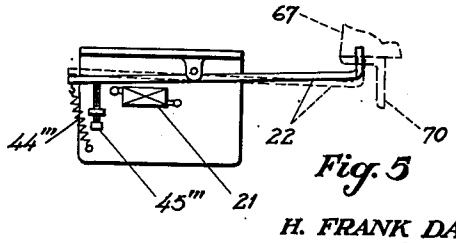


Fig. 5

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BAG PACKAGING METHOD AND MACHINE

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5 Sheets-Sheet 3

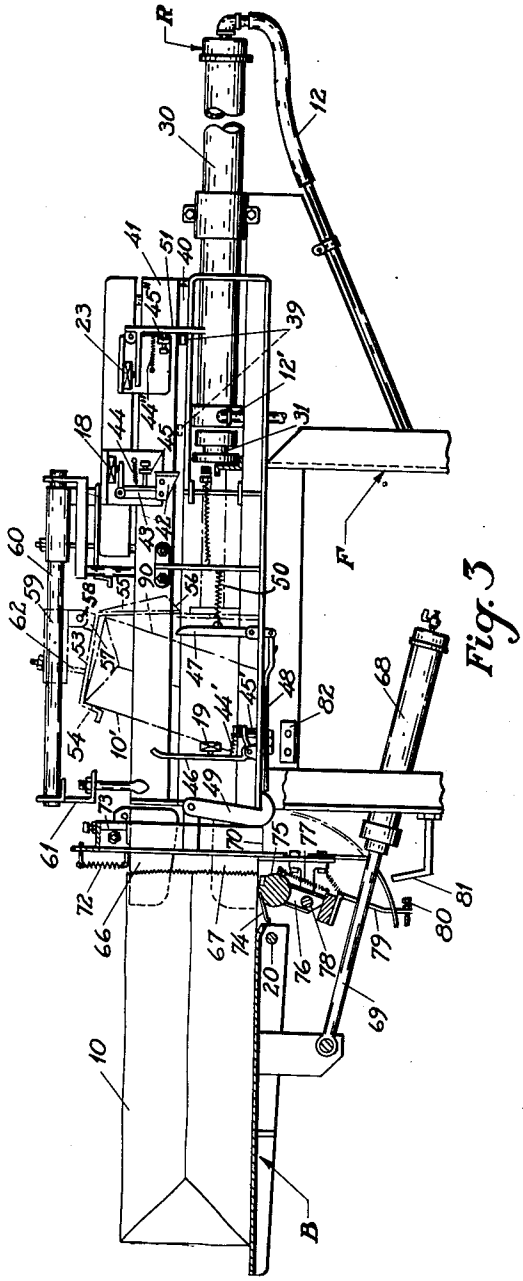


Fig. 3

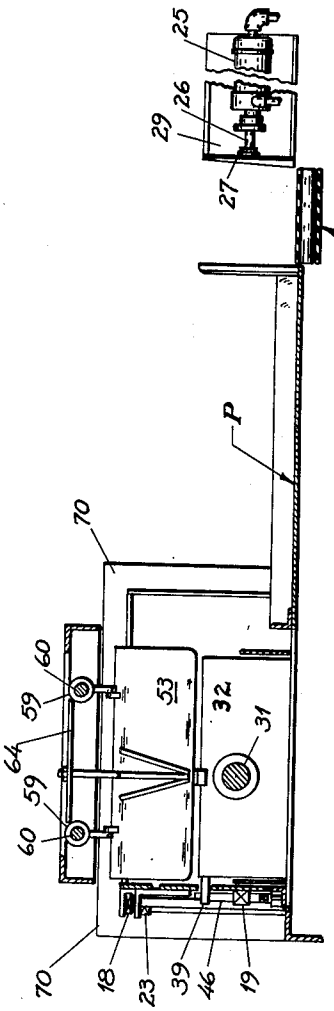


Fig. 4

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BAG PACKAGING METHOD AND MACHINE

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5 Sheets-Sheet 4

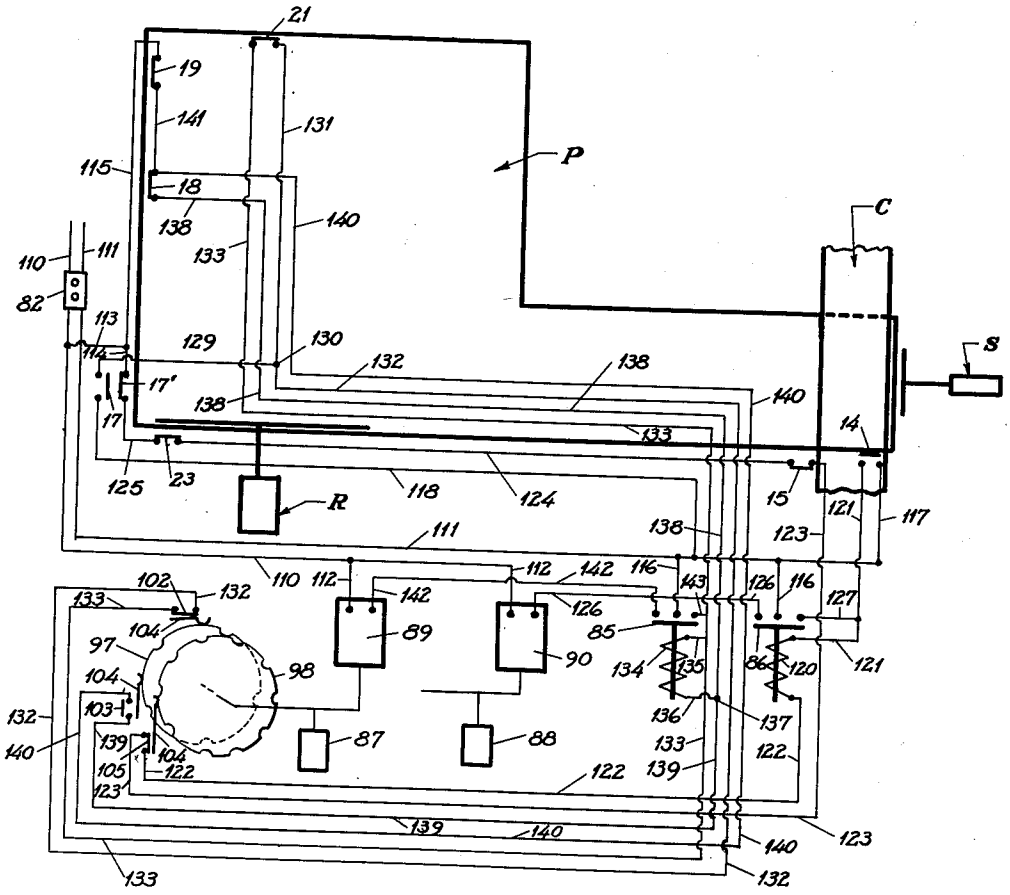


Fig. 8

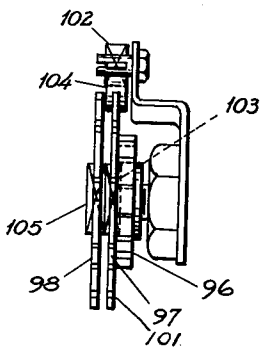


Fig. 7

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BAG PACKAGING METHOD AND MACHINE

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5 Sheets-Sheet 5

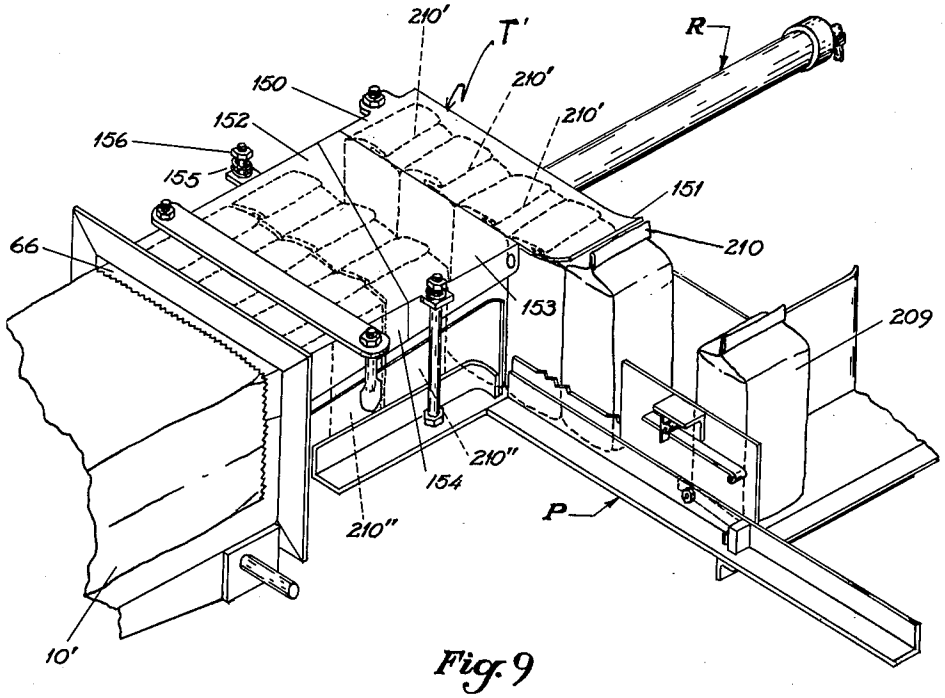


Fig. 9

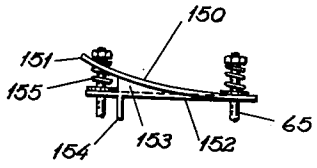


Fig. 10

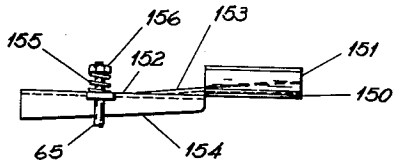


Fig. 11

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UNITED STATES PATENT OFFICE

2,633,280

BAG PACKAGING METHOD AND MACHINE

H. Frank Davies, Loveland, Colo., assignor to The Great Western Sugar Company, Denver, Colo., a corporation of New Jersey

Application December 17, 1945, Serial No. 635,574

25 Claims. (Cl. 226—14)

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This invention relates to a bag packing method and machine, and more particularly to a method and machine for packing a plurality of packages or bags containing relatively loose material, such as sugar, into a bale, sack, or similar receiver for the bags.

In the packaging of sugar, it is desirable for commercial purposes to fill bags adapted to contain a smaller amount of sugar, such as 2, 5 or 10 pounds, in bales having a greater weight, such as 60 pounds. The 2, 5 and 10 pound packages are sold at retail, while the 60 pound bales are more readily handled for shipping and warehousing purposes. The 2, 5 and 10 pound bags are usually filled with the required weight of sugar by automatic machines, and the bags are then closed in a suitable manner, as by sewing across the top. The bales in which the bags are packed may be made of burlap, paper, or any other suitable material. At present, it is customary to pack twelve 5 pound bags, six 10 pound bags, or thirty 2 pound bags in a 60 pound bale, the 2 pound bags being inserted sidewise in five series of six bags each, the 5 pound bags being inserted sidewise in four series of three bags each, and the 10 pound bags being inserted endwise in two series of three bags each.

The bags filled with sugar tend to become rounded, due to the hydraulic effect of the relatively loose material, and it is difficult, when packing the bales by hand, to force the bags into a square or rectangular shape. Attempts to do so often result in tearing or mutilation of a bag, with a consequent loss of sugar. Also, manual bale packing operations are time consuming, thus requiring an undue amount of labor and giving rise to unduly high labor costs. Consequently, any machine which will reduce the amount of labor required, and particularly which will reduce losses due to the breakage or mutilation of the bags, is a highly valuable aid to economical operation of a sugar refinery or warehouse. Also, a method or machine which results in the bags being "squared-up" when packed in the bale produces more uniformity in bale shape and facilitates handling of the bales, as well as reducing the space occupied by bales during shipment and in storage.

Among the objects of this invention are to provide a novel method of packing bags containing relatively loose material, into a bale or the like; to provide such a method by which the bags are effectively squared-up prior to packing; to provide such a method which is fast and relatively easy to perform; to provide such

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a method by which different sizes or weights of bags can be readily accommodated; to provide a packing machine especially adapted to carry out the above method; to provide such a machine which is substantially automatic in operation; to provide such a machine which will square-up the bags in at least two perpendicular directions; to provide such a machine which will automatically handle a series of bags filled with relatively loose material; to provide such a machine which is adjustable to accommodate different sizes or weights of bags; to provide such a machine which is adapted to pack larger bags into a bale in a desired position; to provide such a machine which has suitable safety features to prevent mutilation or tearing of bags, and also to prevent attempted packing of a bale in the event that a bale is not in position to receive the bags; to provide such a machine which will handle many times the number of bags which can be packed by hand by even several workmen; to provide such a machine which requires a minimum number of operators; and to provide such a machine which is reliable in operation and sturdy in construction. Additional objects and the novel features of this invention will become apparent from the description which follows.

In accordance with this invention, a method of packing a plurality of bags, filled with relatively loose material, into a receiving bale or the like, may comprise moving the filled bags in succession and in a predetermined direction by force exerted over a large portion of one side of the bag, and then moving a plurality of bags toward or into the bale by a force exerted over a large portion of another side of the bag and in a direction perpendicular to the first force. A bag packing machine constructed in accordance with this invention, and particularly adapted to carry out the above method, may comprise first and second rams movable horizontally but in perpendicular directions, and a platform extending between the rams, the first or shuttle ram moving the filled bags along the platform to the second or packing ram and the second ram moving a plurality of bags across the platform and substantially perpendicular to the direction of movement of the first ram. In the event that the bags are moved sidewise into the bale, the second or packing ram is controlled so as to move a series of bags a relatively short distance toward the bale, to clear a space for movement of a succeeding series of bags into position before the packing ram, and the packing ram then moves the entire series of bags into

the bale by a long stroke. In the event that the bags are to be moved endwise or in flat position into the bale and are in an upright position when first encountered by the packing ram, the packing ram is controlled to produce a relatively short stroke to move the bags in upright position toward the bale, and a tipping device is associated with the packing ram, so that as the packing ram moves backward from the first short stroke, the bags will be tipped over on their sides. The packing ram is further controlled to produce a second short stroke to push the bags endwise toward the bale, to clear a space for movement of the next series of bags into position before the packing ram. After a predetermined number of series of bags is thus tipped over and pushed toward the bale, the packing ram is further controlled to produce a relatively long stroke to push the entire series of bags into the bale.

Additional features of a machine constructed in accordance with this invention, including a timing device for controlling the strokes of the packing ram and various safety features, are illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of a bag packing machine constructed in accordance with this invention;

Fig. 2 is a top plan view of a bag packing machine similar to that of Fig. 1, but in which the packing ram moves in an opposite direction;

Fig. 3 is a side elevation, partially in section taken along line 3—3 of Fig. 2;

Fig. 4 is a vertical section taken along line 4—4 of Fig. 2;

Fig. 5 is an enlarged partial side elevation illustrating the operation of a safety switch forming a portion of the machine of Fig. 2;

Fig. 6 is a front elevation of a control panel forming a portion of the machine of Fig. 2;

Fig. 7 is an end elevation of a timing device mounted on the control panel;

Fig. 8 is a wiring diagram illustrating the electrical circuit and associated parts for controlling the operation of the machine of Fig. 2;

Fig. 9 is a partial perspective view, similar to Fig. 1, of a bag packing machine for handling bags which do not require turning;

Fig. 10 is a rear elevation of a bag top folding device of the machine of Fig. 9; and

Fig. 11 is a side elevation of the bag folding device.

The principal parts, of the machines of Figs 1 and 2, include a conveyor C for moving bags 9 to a position in front of a shuttle ram S, which moves the bags across a platform P to a position in front of a loading ram R which, in turn, moves the bags into a bale 10 placed on a bale table B. The platform P and rams S and R are suitably supported, as by a framework F. As will be understood, the machines of Figs. 1 and 2 are similar in construction, the principal difference being that the packing ram R of the machine of Fig. 1 moves in an opposite direction to the ram R of Fig. 2. Such difference in direction of movement may be desired to accommodate different floor spaces or general arrangement of conveyors, etc., associated with the machine, and particularly the position of a sewing machine or the like for closing the filled bales, or a conveyor for moving the filled bales to such sewing machine or the like.

Rams S and R are actuated in a suitable manner, as by air under pressure supplied thereto through hoses 11, 11' and 12, 12', respectively. As each bag 9 reaches a suitable position before ram S, the bag abuts against an arm 13 which closes a control switch 14 for initiating the forward movement of ram S. As the bag 9 is pushed forwardly a predetermined distance by ram S, in a direction perpendicular to the direction of movement along conveyor C, the ram trips a switch 15 which causes the ram to return to its initial position. As soon as a file of bags extends across platform P so that a series of bags, such as three, are in position before packing ram R, the first bag abuts against an arm 16, as in Fig. 2, to actuate switches 17 and 17', switch 17 being adapted to cause ram R to begin its forward movement and switch 17' being adapted to open the control circuit for shuttle ram S and thereby render the ram S inoperative as soon as the packing ram R is in operation.

In the event that smaller bags are to be packed in bale 10, the packing ram R makes one short stroke to push the series, such as three bags, a sufficient distance to provide clearance for the next series of bags, ram R tripping a switch 18 to cause the ram to return from the short stroke. The bags remain in upright position, and when the last series of bags, sufficient to fill bale 10, is in position before ram R, the ram makes a long stroke to push all the bags into the bale. Control of ram R to provide such long stroke at the desired time may be produced by a suitable timing device, explained in detail later. Also, at the end of the long stroke, ram R actuates a switch 19 of Fig. 2, to cause the ram to return to its initial position. A single short stroke for each series of bags, with a long stroke for the last series of bags for the bale, are utilized when the bags are moved sidewise into the bale, as in the case of 5 pound bags which are packed in the bale in four series of three bags each, as illustrated in Fig. 9.

In the case of 10 pound bags, which are packed in two series of three bags each, it is necessary to tip the bags to a flat or recumbent position, before moving the bags endwise into the bales. Thus, 10 pound bags are tipped over to the position of bags 9'' of Fig. 1, so that the bags can be pushed endwise into bale 10. For such purpose, a tipping device T is associated with packing ram R, as in Fig. 1, device T being in a rear position while shuttle ram S is in operation, so that the upper ends of the bags will move into the device. The tipping device T also moves forward with the bags to the end of a short stroke of ram R, as to the position of Fig. 2. Device T then engages the forward upper corner of each bag on the next backward stroke of ram R (as shown in dotted lines in Fig. 3), so that the bags will be tipped backwardly onto the platform P. Through suitable control mechanism, the ram R makes another short stroke to move the tipped bags endwise to the position of bags 9'' of Fig. 1, which clears the way for the next series of bags pushed to the packing ram R by the shuttle ram S. After the second series of 10 pound bags has been tipped over, the packing ram R makes a long stroke, pushing both series of bags endwise into the bale 10.

In the case of 5 pound bags, which are packed in four series of three bags each, or 2 pound bags, which are packed in five series of six bags each, the bags are moved sidewise into the bale, and since the end of each bag is not engaged by either ram, it is desirable to flatten the tops of the bags, which operation also tends to square

the bags in the third dimension. For this purpose, a bag top folding device T', as in Fig. 9, may be utilized in lieu of the tipping device T, the other parts of the machine remaining the same. Thus, for packing a plurality of 5 lb. bags 209 of Fig. 9, which are pushed across platform P by the shuttle ram S (not shown in Fig. 9), each bag is moved in turn until three bags 209 have been moved under device T', whereupon ram R is actuated in the same manner as before. Top folding device T' is adapted to fold the tops 210 of the bags down, as the bags move under the device, and also to maintain the tops in folded position until entering the bale 10'. Ram R makes a short stroke each time a series of three bags has been moved in front of the same, to move each series to successive positions, as occupied by bags 210'', until the fourth series is reached when the ram R makes a long packing stroke to push the four series of bags into bale 10'. For packing 2 lb. bags, a similar device T'' may be utilized.

Referring again to Fig. 1, bale table B is pivotally mounted, as on a rod 20, and is also held in a horizontal position in any suitable manner, but is adapted to be released to tip backwardly as ram R returns from its long stroke pushing the required number of bags into bale 10. This permits the filled bale to slide off the bale table, either onto a loading platform or onto a conveyor or the like for removing the bales to a sewing machine, etc., for closing the same.

A switch 21 is mounted adjacent the front end of bale table B, and is adapted to prevent a long stroke of ram R unless the bale table B is in a horizontal position indicative of a bale to be filled having been placed on bale table. Switch 21 may be actuated by a lever 22, in turn engaged and disengaged by bale table B when in the horizontal and down positions, respectively.

An additional safety feature comprises a switch 23, which opens whenever packing ram R moves forward, and thereby renders shuttle ram S inoperative until packing ram R moves back to its initial position.

The shuttle ram S, as in Figs. 1 and 2, comprises a cylinder 25 in which a plunger 26 is reciprocable by air under pressure and supplied through hoses 11 and 11', respectively, as in Fig. 1. A face plate 27 is attached to the front end of ram plunger 26, and applies a force over a large or substantial portion of a side 28 of bag 9, thereby straightening that side of the bag. A sleeve 29 is also mounted on plunger 26, to maintain succeeding bags carried by the conveyor in spaced position and prevent a succeeding bag from becoming jammed in or interfering with the operation of the ram or its plunger. Similarly, ram R, as in Fig. 3, includes a cylinder 30 in which a plunger 31 is reciprocable by air under pressure and supplied through hoses 12 and 12', respectively. A face plate 32 is mounted on the forward end of plunger 31 to apply a force over a large or substantial portion of a side 33 of bag 9, at 90° to side 28. As will be evident, plate 32 also applies a force over substantially the entire end of each bag 9'', when the bag is in recumbent position and when pushing one series of bags out of the way for the next series or pushing the entire set of bags into the bale 10.

The effect of forces applied over a large or substantial portion of one side, then a side perpendicular thereto, as in the packing of 2 and 5 pound bags, and in addition over substantially the entire end of each bag, as in the packing of 10 pound bags, is of considerable importance. Such forces "square-up" the bag, and also are distributed over a sufficient area that rupture or damage to the bag is avoided. When each of a series of bags is squared-up, the bags fit together more closely and occupy only the space intended for them. Also, such a series of squared-up bags fits more readily into the bale, and tends less to misshape the bale. Thus, with the bales more perfectly rectangular in section, a greater number of bales can be stored or stacked in a given space, thus reducing warehousing and transportation costs. As will be evident, the perpendicular relationship of the rams S and R is therefore of considerable importance in effectively squaring-up the bags.

Additional features of ram S include a lug 35, attached to plate 27 and adapted to move forwardly and backwardly in a slot 36 formed in a side plate 37, to engage a lever 38 to open switch 15 to open the control circuit for the shuttle ram S and cause the same to return to its initial position. Additional features of ram R, as in Fig. 3, include a transverse bar 39 extending through a slot 40 in end wall 41 of platform P. Bar 39 engages a pivoted lug 42 on a lever 43 to open switch 18 and reverse the movement of ram R at the end of a short stroke. Lever 43 maintains switch 18 normally closed, through the tension of a spring 44, and the normal position of the lever may be adjusted by a set screw 45. Bar 39 also is adapted to engage a lever 46 to open switch 19 and cause ram R to return from a long stroke, while pivoted lug 42 permits bar 39 to pass the lever 43 without action on switch 18 on return from the long stroke. Lever 46 maintains switch 19 closed through tension of a spring 44', while the normal position of lever 46 may be adjusted by a set screw 45'. In addition, bar 39, during the return of ram R from the long stroke, engages a lever 47 to actuate a push rod 48 which trips a latch 49, thereby permitting bale table B to pivot downwardly to discharge a full bale 10. During the forward movement of ram R on the long stroke, bar 39 merely pushes lever 47 forwardly and passes over the same without affecting latch 49, a spring 50 returning the lever to a position for engagement by bar 39 on return from the long stroke.

When ram R is in the rear position, bar 39 also presses against a lever 51, as in the full position of Fig. 3, to maintain switch 23 closed, but when ram R moves forwardly, switch 23 is opened by lever 51 through tension of a spring 44'', a set screw 45'' acting as a stop or abutment to limit the movement of lever 51. Switch 23 thereby maintains the control circuit for shuttle ram S open during the time that ram R is in operation.

The tipping device T, as in Figs. 2 and 3, comprises a bag engaging member 53, having a short forward flange 54 and a longer rear flange 55 provided with a block 56 at its lower edge. Block 56 is adapted to be engaged by plate 32 of ram R, as in Fig. 3, to pull the tipping device back with the ram on the return portion of the short tipping stroke. A projection 57 is attached to each rear upper corner of bag engaging member 53, and each is pivotally attached to a projection 58 depending from a slide 59. Slides 59 are moved backwardly and forwardly along a pair of guide rods 60 which are mounted on a framework 61, in turn mounted on vertical studs 65. The front end of member 53 is adapted to pivot upwardly, but downward movement below a horizontal position is prevented by an adjustable

stop bolt 62 which projects through a slot 63 in a plate 64 connecting slides 59.

When in receiving position, as in Fig. 1, the bag engaging member 53 is in alignment with bags moved by shuttle ram S. When a series of three bags has been received, and switch 17 of Fig. 2 is closed, the ram R moves the bags forwardly and the bags move member 53 forward with them. At the end of the short stroke, i. e. when bar 39 opens switch 13 and the ram begins to return, each of the bags tends to remain in position on the loading platform P due to friction. However, front flange 54 engaging the upper front corner of each bag begins to pull the bags over backwardly, as shown in the dotted position of Fig. 3. Upon further rearward movement of ram R, the tipping device pulls the bags further, until the bags fall into a recumbent position. The bag engaging member 53 tips upwardly with the tops of the bags, but falls back to a horizontal position as soon as the bags are tipped over onto the platform.

As the three bags are tipped backwardly onto the platform, the first or end bag again engages arm 16 to close switch 17, thereby causing ram R to make another short stroke, which pushes the bags to the position 9'' of Fig. 1, and thereby clears the way for the next series of bags to be moved into loading position by the shuttle ram S. When the desired number of bags to fill bale 10, such as two series of three bags each, have been placed in recumbent position, the ram R is controlled, as by a timing device described in detail hereinafter, so that a long stroke is made to push all of the bags into bale 10. As will be evident, during the second short stroke, and also during the long or packing stroke, the tipping device remains in a rear position, since the bags no longer move the tipping device forwardly.

When push rod 48 disengages latch 49 and permits bale table B to pivot downwardly, the packed bale may be deposited on a conveyor or conveyor loading platform, for removal to a sewing machine or the like, for closing the upper end of the bale. The bale table B is then in position for insertion of a new bale over upper and lower spouts 66 and 67, respectively, which maintain the open end of the bale in spread position, as in Fig. 3. As indicated previously, bale table B is pivotal about rod 20, as in Figs. 2 and 3, while a pneumatic cylinder 68 may be provided to slow the downward movement of the bale table when a full bale is thereon. Piston rod 69 thereof may be pivotally attached to the underside of bale table B.

Bale spouts 66 and 67, as in Fig. 3, are mounted on a framework 70 formed of angle iron or the like, at the front end of the bale table, lower spout 67 being fixedly mounted thereon, while upper spout 66 is pivoted about a rod 71. A spring 72 pulls spout 66 upwardly to maintain bale 10 in open position, the upward movement of spout 66 being limited by an adjustable stop screw 73. When the bale table B is down, after a full bale has slipped off or has been removed, an empty bale is slipped over the spouts, the operator merely depressing upper spout 66 slightly. An extending clip 74 adjacent the lower spout 67 guides the lower edge of the bag onto the lower spout. The operator then moves the bale table upwardly, whereupon latch 49 engages, and the packing operation on the new bale is speedily completed.

When the bale table is moved upwardly, an eccentric roller 75 engages and holds the bale against the lower spout 66, to maintain the bale in desired position during the filling operation. Roller 75, to which spring clip 74 is attached, is mounted eccentrically with respect to bale table B, being pivoted on a short arm 76, and is forced against the bale by a tension spring 77. Arm 76 is, in turn, pivoted on a rod 78, so that when the bale table B moves to the down position, roller 75 will move away from spout 67 by eccentric pivotal movement of arm 76 on rod 78, through the action of a lever 79 provided with an adjustable stop 80 which engages an abutment 81 mounted on framework F at a suitable height. Again, as the bale table B pivots upwardly, the roller 75 will move toward lower spout 67, and clip 74 will hold the new bale in position and prevent the bale from moving rearwardly off the bale table during packing.

As indicated previously, switch 21 may be mounted on framework F adjacent the bale table, and is actuated by lever 22. As in Fig. 5, when the bale table is down, lever 22 is in the full position, so that switch 21 is open due to lever 22 being held against switch 21 by a spring 44''', movement of lever 22 being limited by an adjustable set screw 45'''. When the bale table moves back to a horizontal position, the end of lever 22 is engaged by spout framework 70, to move lever 22 away from switch 21, as shown in dotted lines in Fig. 5. Thus, a long or packing stroke of ram R is prevented until the table is in horizontal position.

As an additional safety feature, a suitable switch, such as push button switch 82, may be mounted on the machine in a convenient position adjacent the bale table, as in Fig. 3, so that the operator may shut off the entire machine if the occasion should demand.

Control of the operation of the rams R and S may be accomplished through a suitable electrical circuit, such as illustrated in the wiring diagram of Fig. 8. Most of the switches are mounted in specific positions on the machine, as indicated previously, and the remaining parts of the control apparatus may conveniently be at one location, such as by mounting on a control panel 84 of Fig. 6. The control panel may be mounted on framework F, or at any other suitable location. Mounted on control panel 84 are a timing device D, a pair of relay switches 85 and 86, and a pair of air control valves 87 and 88, which control the flow of air under pressure to rams R and S, respectively. In turn, air valves 87 and 88 are operated by solenoids 89 and 90, respectively, and controlled by relay switches 85 and 86, also respectively. Air valve 87 sends air through pipe or hose 12 to cause ram R to move forwardly and through pipe or hose 12' to cause ram R to return, while air valve 88 sends air through pipe or hose 11 to cause ram S to move forwardly, and through pipe or hose 11' to cause ram S to return. The position of air valves 87 and 88 is controlled by movement of levers 91 and 92, respectively, solenoids 89 and 90 being connected to the respective levers. Current passing through the solenoids causes the levers to be pulled upwardly, while gravity and springs 93 pull the levers down. A dashpot 94 prevents too rapid movement in either direction of lever 91, on which is also mounted a pawl 95 for turning a ratchet wheel 96 of timing device D.

The timing device D also includes inner and outer cam discs 97 and 98, respectively, as in Fig. 7, which are attached for conjoint rotation with ratchet wheel 96. As in Fig. 6, a ratchet

catch 99 is provided to prevent back turning of the cam discs while pawl 95 is moving downwardly. Also, a brake comprising a spring steel arm 100 adapted to press against disc 97 may be provided. As will be evident, each time solenoid 89 moves lever 91 upwardly, as ram R moves forward on either a short stroke or a long stroke, wheel 96 is advanced one notch. For convenience, wheel 96 may be provided with twenty notches, so that the wheel and discs 97 and 98 will make a complete revolution for each twenty complete strokes of solenoid 89 and lever 91.

Inner cam disc 97 is provided with a plurality of equally spaced peripheral slots or notches 101, such as five in number, to actuate switches 102 and 103 by means of fingers 104 a predetermined number of times per revolution, which thus may correspond to each four strokes of the solenoid and lever. Switch 102 is adapted to open the circuit for ram R after a predetermined number of short strokes if bale table B is down, i. e. after a short tipping stroke and a short advancing stroke on the first series of three bags, and a short tipping stroke on the second series of bags, ram R will be rendered inoperative for the next or long stroke if the bale table is down. Switch 103 is adapted to short circuit switch 18 to permit ram R to make the long packing stroke, i. e. after the above short strokes, switch 103 is closed to permit ram R to make the long packing stroke.

Cam disc 98 is provided with a plurality of equally spaced peripheral notches or slots 101, such as ten in number, to open a normally closed switch 105 through finger 104 to insure that shuttle ram S is inoperative during each tipping short stroke of ram R. Cam disc 98 thus actuates switch 105 twice as frequently as cam disc 97 actuates switches 102 and 103.

The above operations apply to the packing of 10 pound bags in two series of three each to a bale. For packing 5 pound bags, as in four series of three each to a bale, certain changes will be desirable in the timing device. Thus, outer cam disc 98 and switch 105 may be eliminated since it is not necessary to tip the bags, but cam disc 97 and switches 102 and 103 remain, since ram R will make three short strokes and then a long stroke, as before. For packing 2 pound bags, as in five series of six bags each, cam disc 98 and switch 105 may be eliminated, while a cam disc having only four notches 101 may be substituted for cam disc 97, so that ram R will make five short strokes and then a long stroke.

The timing device D and the various switches and other parts may be connected as in the wiring diagram of Fig. 8, wherein power leads 110 and 111 are connected with any suitable source of electricity, such as 110 volts A. C. Push button switch 82 may be used to start and stop the machine for normal operation, and also to stop the machine quickly for emergency purposes. Lead 110 is connected by wires 112 with one side of solenoids 89 and 90, and also by a wire 113 with wires 114 and 115 connected to one side of switches 17' and 19, respectively. Lead 111 is connected by wires 116 with the central contacts of switches 85 and 86, and is also connected by wires 117 and 118 with one side of normally open switches 14 and 17, respectively.

With the circuit switches in the normally open and normally closed positions of Fig. 8, as bags are fed along conveyor C, the first bag causes normally open switch 14 to close. This supplies current from lead 111 to winding 120 of switch 86, through wire 121 connecting switch 14 and winding 120. The circuit through winding 86 is completed through a wire 122 to normally closed switch 105, from switch 105 through a wire 123 to normally closed switch 15, from switch 15 through a wire 124 to normally closed switch 23 and then through a wire 125 to normally closed switch 17'. Switch 17' is, of course, connected to lead 110 by wires 114 and 113. As will be evident, opening of any one of normally closed switches 15, 17', 23 or 105 will open the circuit through winding 120 of relay switch 86, so that each of such switches must be closed for switch 14 to cause relay switch 86 to close.

When relay switch 86 closes, the central contact is connected with the two outside contacts. Through one of the outside contacts, a wire 126 completes the circuit through solenoid 90, which thereby operates air valve 88 to cause shuttle ram S to make a forward stroke. At the same time, the other outside contact of switch 86 is connected by a wire 127 with wire 121, thus short circuiting switch 14 and insuring that the shuttle ram S will complete its forward stroke even though switch 14 is opened, as the bag which caused it to close is moved by ram S off conveyor C onto platform P. Of course, when ram S causes switch 15 to open, the circuit through winding 120 of switch 86 is opened, thereby causing switch 86 to open and solenoid 90 to be deenergized, with the result that air valve 88 moves to a position to effect the return stroke of ram S. Successive bags, causing switch 14 to close, will be pushed across platform P by ram S in the above manner until the leading bag causes switch 17' to open, which opens the circuit through winding 120 of switch 86 and prevents a succeeding forward stroke of ram S.

When switch 17' is opened, normally open switch 17 is simultaneously closed, thereby starting ram R on the first short stroke. As indicated previously, one side of switch 17 is connected by wire 118 with lead 111, while the opposite side of switch 17 is connected by a wire 129 with a junction 130 from which a wire 131 leads to one side of switch 21 and another wire 132 leads to one side of cam actuated, normally closed switch 102. The opposite sides of switches 21 and 102 are connected by a wire 133, these switches being in parallel and also in series with winding 134 of relay switch 85 by means of wire 135 connecting one end of winding 134 with wire 133. The other end of winding 134 is connected by a wire 136 with a junction 137, from which a wire 138 leads to one side of normally closed switch 18, and another wire 139 leads to one side of normally open switch 103. Switches 18 and 103 are in parallel as well as in series with winding 134, as the opposite sides of switches 18 and 103 are connected by a wire 140. The opposite side of switch 18 is also connected by a wire 141 with one side of normally closed switch 19. The normal circuit through winding 134 is completed through wires 115 and 113 to lead 111.

When switch 17 is closed, winding 134 is energized, switch 85 closes, and solenoid 90 is energized through current passing thereto from one of the outside contacts of switch 85 through a wire 142. Solenoid 90 moves air valve 87 to a position to start ram R on a forward stroke, and also moves lever 95 of Fig. 6 upwardly to advance cam discs 97 and 98 one notch, whereupon cam 98 causes switch 105 to open and render shuttle ram S inoperative. As soon as ram R begins the forward stroke, normally closed switch 23 opens, so that the circuit through winding 120

of switch 86 is opened. Also, when relay switch 85 closes, the other outside contact, through a wire 143 leading to wire 133, short circuits switch 17, so that ram R will continue on its stroke even though switch 17 opens when the bags are moved from a position closing such switch. As soon as ram R opens normally closed switch 18, in the manner previously indicated, the circuit through winding 134 is broken, so that solenoid 89 is de-energized and valve 87 returns to its initial position, whereupon ram R is returned. During the return stroke, the tipping device T functions as described previously, and as the bags 9 fall backwardly onto platform P, switch 17 is again closed to start ram R on the second short stroke. Switch 17' is also opened, to prevent feeding of more bags by shuttle ram S when switch 105 closes, until ram R completes the second short stroke which occurs in the same manner as the first short stroke, except that tipping device T does not move forwardly and the space in front of ram R is clear for reception of the next series of bags moved across the platform by ram S. As soon as ram R returns from the second short stroke, the ram closes switch 23, and shuttle ram S pushes three additional bags into position before ram R, in the manner previously indicated.

When the end bag of the file extending across the platform reaches the end of the platform, switch 17 is closed and switch 17' is opened, so that shuttle ram S is stopped after its return stroke and ram R begins another short stroke. Of course, on each stroke of ram R, cam discs 97 and 98 are advanced another notch, and on the first short stroke on the second series of bags, cam 97 is turned so that switch 102 is open. With switch 102 open, switch 21 must be closed before ram R can make the long packing stroke, since switches 21 and 102 are in parallel but in series with winding 134 of relay switch 85. Also, as soon as solenoid 89 moves upwardly to cause the packing stroke to begin, cam 97 is turned another notch, so that switch 103 is then closed, thus short circuiting short stroke limit switch 18 and permitting ram R to make the long packing stroke. The packing stroke continues until ram R opens limit switch 19, to cause the ram to return. On return from the long packing stroke, ram R trips the bale table latch 49, and the filled bale 10 is deposited on a conveyor or loading platform, as described previously.

When ram R returns from the long packing stroke, switch 23 will be closed, and shuttle ram S will begin pushing additional bags across platform P to ram R. After the filled bale is removed, the operator places an empty bale on the table and moves the table up to place the bale in position for filling. The ram R will continue to operate, until the long packing stroke, before stopping when the bale table is not up. Thus, the operator has relatively considerable time to remove the filled bale and place a new bale in position.

The operation of the machine of Fig. 9 is similar to that described above, with the variations indicated when the tipping stroke is eliminated. Also, as indicated above, timing disc 98 and switch 105 may be eliminated, the machine and its parts and wiring connections otherwise being the same. The top folding device T', substituted for the tipping device T when the bags are to be moved sidewise into the bale, is mounted on studs 65, as in device T of Fig. 1. Device T', as in Figs. 9–11, may comprise tipped rear top plate 150, having an upwardly curving entrance section 151, and a flat front plate 152, the rear and front plates being connected by a curved section 153. As the bags are pushed beneath rear plate 150, the top 210 of the first bag 209 is folded substantially completely down, while the tops of the second and third bags 209 are partially folded down. As the ram R moves the series of three bags in the perpendicular direction, toward bale 10', the tops of each bag, in passing under section 153, to position 210'', will also be completely folded down, and plate 152 will hold the tops in the folded down position until the bags are pushed beneath upper spout 66 and into bale 10'. A side plate 154, which may be formed integrally with or attached to front plate 152 and curved section 153, guides the bags during movement. A plurality of coil springs 155 may surround studs 65 beneath adjusting nuts 156, to yieldably press device T' against the tops of the bags, so as to more effectively fold over the bag tops.

From the foregoing, it will be apparent that the method and machine of this invention fulfill to a marked degree the requirements and objects hereinbefore set forth. Briefly, by the method of this invention, the bags are adequately squared-up and speedily and efficiently packed in the bale. The machine of this invention is substantially completely automatic in operation and operates effectively and efficiently, while the numerous safety features prevent loss of material, such as sugar, and also prevent damage to the machine and its parts. The machine is fast, yet the operator is given ample time for the only hand operation—placing new bales in position—because the ram R can make three strokes, as on 10 pound bags, or two short strokes, as on 5 pound bags, before it is necessary that a new bale be in position to prevent ram R from stopping.

It will be understood that other embodiments of this invention may exist, and that various changes may be made in the embodiment herein described, all without departing from the spirit and scope of this invention.

What is claimed is:

1. A method of packing a plurality of filled bags of relatively loose material in a receiving bale, which comprises moving said bags in succession in a predetermined direction to a predetermined point; moving said bags by force exerted over a large portion of one side thereof and in a direction perpendicular to said predetermined direction of movement; moving a plurality of bags toward said bale by a force exerted over a large portion of another side of each bag, and in a direction perpendicular to said second movement, for a predetermined distance; exerting a rearwardly directed force against the forward upper portion of said bags to tip the same over; and moving a plurality of bags into said bale by a force exerted against the ends of said bags, and also in a direction perpendicular to said second movement.

2. In a bag packing machine, a platform; means adapted to move bags filled with relatively loose material across said platform in an upright position, said bags being of at least two different sizes; a tipping device adapted to engage the upper edge of one size of bag when moved to a predetermined position, and constructed and arranged to move forwardly and then rearwardly so as to tip the engaged bag to a reclining position on said platform, and bag-moving means alined with said tipping device for depositing the

upright and reclining bags in a storage container.

3. In a bag packing machine, as defined in claim 2, wherein said tipping device comprises a movable framework engageable with the upper ends of said bags and constructed and arranged to be moved rearwardly by said bag-moving means.

4. In a bag packing machine, a platform; a ram of the variable stroke type adapted to move at least one bag filled with relatively loose material across said platform with sufficient force to flatten at least one side of the bag; a receiver in position to receive bags moved therein by said ram; pneumatic drive means for causing said ram to make at least a short stroke to flatten and move one or more bags toward said receiver to permit additional bags to be moved before said ram, and a long stroke when a predetermined number of flattened bags are in position to be moved into said receiver, and means for changing the air supply to said drive means during operation of the machine so as to vary said long and short strokes in accordance with changes in bag size on the machine.

5. In a bag packing machine, a platform; a ram adapted to move at least one bag filled with relatively loose material across said platform; a tipping device adapted to engage the upper edge of said bag opposite said ram, and constructed and arranged to move forwardly with said ram, and to move rearwardly with said ram so as to tip said bag to a different position on said platform; a bag receiver in position to receive bags moved therein by said ram; and means for controlling the operation of said ram to cause said ram to make a short stroke to move one or more bags forwardly and then tip the same rearwardly onto said platform and another short stroke to permit one or more additional bags to be moved before said ram, and to make a long stroke when a predetermined number of bags are in position to be moved into said receiver.

6. In a bag packing machine, a platform; a ram adapted to move at least one bag filled with relatively loose material across said platform; and a tipping device including guides disposed in the direction of movement of said ram, slides movable along said guides, and bag engaging means pivotally mounted at the upper rear edge thereof on said slides and also having a front flange adapted to engage the upper edge of a bag opposite said ram, and a rear flange adapted to be engaged by said ram for causing said device to be moved rearwardly by said ram so as to tip said bag to a different position on said platform.

7. A bag packing machine comprising a receiving platform; a ram of the variable stroke type for moving bags filled with a relatively loose material across said platform with sufficient force to flatten at least one side of the bag; a timing device actuated in accordance with the movements of said ram; pneumatic drive means associated with said timing device for altering the length of stroke of said ram, so as to flatten and move a series of one or more of said bags a predetermined distance across said platform, and then move a predetermined number of said flattened bags into a bale, and means for changing the air supply to said drive means during operation of the machine so as to vary the impact force of said ram.

8. A bag packing machine comprising a receiving platform; a pair of rams for moving bags filled with a relatively loose material across said platform with sufficient force to flatten at least one side of the bag, one said ram being adapted to move said bags to a position before said second ram, said rams moving in a substantially perpendicular direction to each other; a timing device actuated in accordance with the movements of said second ram; and pneumatic drive means associated with said timing device for altering the length of stroke of said second ram, so as to flatten and move a series of one or more of said bags a predetermined distance across said platform, and then move a predetermined number of said flattened bags into a bale.

9. A bag packing machine comprising a receiving platform; a pair of rams for moving bags filled with a relatively loose material across said platform, one said ram being adapted to move said bags to a position before said second ram, said rams moving in a substantially perpendicular direction to each other; pneumatic drive means for moving said rams; a timing device actuated in accordance with the movements of said second ram; and electrical control means associated with said timing device for altering the length of stroke of said ram, so as to move a series of one or more of said bags a predetermined distance across said platform, and then move a predetermined number of said series into a bale.

10. A bag packing machine including a platform; a ram for pushing a series of bags filled with a relatively loose material across said platform with sufficient force to flatten at least one side of the bag; a switch movably mounted at one side of said platform and adapted to be actuated by the first of a series of bags, for starting said ram and varying the length of stroke of the ram at different positions to which it is moved; and a switch actuated in accordance with the distance moved by said ram for completing the reverse movement of said ram.

11. A bag packing machine including a platform; a ram for pushing a series of vertically-disposed bags across said platform; a switch at one side of said platform and adapted to be actuated by the first of a series of bags, for starting said ram; a switch actuated in accordance with the distance moved by said ram for reversing the movement of said ram; and a tipping device operable on the return stroke of said ram to move said bags from a vertical to a horizontal position on said platform, the first of said bags when tipped over being adapted to actuate said switch to cause said ram to make another bag-pushing forward stroke.

12. In a bag packing machine, a platform; a pair of hydraulically actuated rams including a shuttle ram for moving bags to a packing ram which then moves the bags into a bale; a valve for controlling the operation of each ram; a solenoid for controlling each valve; a timing device movable a fraction of a turn by said solenoid controlling said packing ram and including timing discs; a relay switch for operating each solenoid; a switch for starting said shuttle ram; a limit switch for returning said shuttle ram; a safety switch for preventing operation of said shuttle ram unless said packing ram is in a rear position; a bag actuated switch for preventing operation of said shuttle ram as soon as the first of a series of bags reaches a predetermined position before said packing ram, said starting, limit, safety and bag actuated switches being in series with each other and with the winding of one said relay switch; a second bag actuated switch for starting said packing ram, and in series with

the winding of the other relay switch; short stroke and long stroke limit switches for said packing ram also in series with said other relay winding and actuated by said ram for causing said packing ram to return after moving a predetermined distance; a timing disc actuated switch in parallel with said short stroke limit switch for shortcircuiting said short stroke limit switch on the long stroke of said packing ram; a pivoted bale table; a bale safety switch adapted to be closed only when said bale table is in a predetermined position and also in series with said other relay switch winding; and a timing disc actuated switch in parallel with said bale safety switch for preventing a long stroke of said packing ram unless said bale table safety switch is closed.

13. A bag packing machine including a platform; a conveyor adapted to move a plurality of bags to a position at one edge of said platform; a shuttle ram for pushing each bag in turn off said conveyor and across said platform, said shuttle ram having a side sleeve for retarding movement of a succeeding bag until said shuttle ram returns; a packing ram for pushing a series of bags in a direction perpendicular to the direction of movement by said shuttle ram, each said ram having a plate adapted to apply a force against a large portion of a side of each bag, each said ram applying such force to a side of each bag perpendicular to the side against which force is applied by the other ram; a pivoted table for supporting and positioning a bale to receive said bags, said table being locked in a horizontal position by latch means adapted to be disengaged by said packing ram; upper and lower spouts mounted on said table for holding a bag open, said upper spout being pivotally mounted and provided with resilient means for maintaining a bale open; and spring means mounted eccentrically with respect to said table for holding the lower edge of a bale against said lower spout and adapted to disengage when said bale is pivoted downwardly and to engage a new bale when said table is again pivoted upwardly.

14. A method of packing in a receiving bale a plurality of bags containing relatively loose material, each said bag having a top extending above the level of material in said bag, which comprises moving said bags in succession in a predetermined direction to a predetermined point by sufficient force exerted over a large portion of one side thereof to compact said side; moving a plurality of bags toward said bale by a sufficient force exerted over a large portion of another side of each bag, and in a direction perpendicular to said first movement to compact another side of said bag; and exerting a force downwardly against the tops of at least a portion of said bags during the latter part of said first movement, and also against the top of each bag during substantially the whole of said perpendicular movement, to fold over the tops of said bags.

15. In a bag packing machine, a platform; a ram adapted to move at least one bag filled with relatively loose material horizontally across said platform; and a bag top folding device positioned to engage the top of each bag along a downwardly extending line and to maintain downward pressure against said bag top during at least the greater portion of the horizontal movement imparted by said ram.

16. In a bag packing machine, as defined in claim 15, wherein said bag top folding device comprises a rear top plate, a front top plate disposed at a generally lower level, and a curved section connecting said plates.

17. In a bag packing machine in which a plurality of bags are first selectively positioned and then moved into a receptacle, a bag top folding device comprising a tipped rear plate having an upwardly curved entrance section for engaging the top of bags moved beneath said plate in the direction in which said plate is tipped; a front plate disposed at a level substantially the same as the lower portion of said front plate and adapted to engage the tops of bags moved perpendicularly to said first movement; a curved section connecting said plates; and resilient mounting means for said plates.

18. In a method of packing a plurality of filled bags of generally rounded shape and containing relatively loose material in a receiving bale, the steps of moving said rounded bags in succession and while maintained in an upright position along a horizontal course to a predetermined point by force exerted over a large portion of one upright side thereof including impact to flatten a side of each bag, and moving the partially flattened bags while in upright position along another horizontal course toward said bale by a force exerted over a large portion of another upright side of each bag, and in a direction perpendicular to said first movement, together with impact to flatten adjoining sides of each bag by the combined effect of said forces.

19. A bag packing machine comprising first and second rams movable horizontally along substantially perpendicular paths, a conveyor for moving bags in succession to a position before said first ram, a horizontal platform extending between said rams, the first ram being positioned a substantial distance behind said bags out of contact therewith and movable into contact with successive bags with substantial impact so as to flatten at least one side of the bag and move said bag along the platform and the second ram being positioned a substantial distance from a plurality of the bags at the end of said first ram movement and out of contact therewith and movable perpendicular to said first ram movement into contact with the plurality of bags with substantial impact so as to flatten another side of each bag, control means for actuating said first ram when a bag is in position before same, and control means for actuating said second ram operable only when a predetermined number of bags are in position before said ram.

20. In a bag packing machine, a platform, a multiple-movement ram positioned a substantial distance behind a bag filled with relatively loose material and out of contact therewith, said ram being movable into contact with said bag with substantial impact so as to flatten a side of said bag, means for holding a bale normally in position to receive a plurality of bags moved thereinto by said ram, and means including an electric switch for preventing a second movement of the ram to move the flattened bags into the bale unless a bale is in position to receive the same.

21. In a bag packing machine, as defined in claim 20, control means for causing said ram to make at least a short stroke to move one or more bags toward said bale to permit additional bags to be moved before said ram, and a long stroke when a predetermined number of bags are in position to be moved into said bale.

22. In a bag packaging machine, first and second rams movable horizontally along substantial-

ly perpendicular paths, and a horizontally disposed platform extending between said rams and arranged to support filled bags of relatively loose material in an upright position during movement across said platform, the first ram being positioned a substantial distance behind and out of contact with said bags and movable into contact with successive bags with substantial impact so as to flatten at least one side of the bag and move said bag along the platform, and the second ram being positioned a substantial distance from a plurality of the bags at the ends of said first ram movement and out of contact therewith, said second ram being movable into contact with a plurality of the bags with sufficient impact to flatten another side of said previously flattened bags.

23. In a bag packaging machine, first and second rams movable horizontally along substantially perpendicular paths, a horizontally disposed platform extending between said rams and arranged to support filled bags of relatively loose material in an upright position during movement across said platform, the first ram being positioned a substantial distance behind and out of contact with said bags and movable into contact with successive bags with substantial impact so as to flatten at least one side of the bag and move said bag along the platform, and the second ram being positioned a substantial distance from a plurality of the bags at the end of said first ram movement and out of contact therewith, said second ram being movable into contact with a plurality of the bags with sufficient impact to flatten another side of said previously flattened bags, and a control means for actuating said first ram when a bag is in position before the same.

24. In a bag packaging machine, first and second rams movable horizontally along substantially perpendicular paths, a horizontally disposed platform extending between said rams and arranged to support filled bags of relatively loose material in an upright position during movement across said platform, the first ram being positioned a substantial distance behind and out of contact with said bags and movable into contact with successive bags with substantial impact so as to flatten at least one side of the bag and move said bag along the platform, and the second ram being positioned a substantial distance from a plurality of the bags at the end of said first ram movement and out of contact therewith, said second ram being movable into contact with a plurality of the bags with sufficient impact to flatten another side of said previously flattened bags, control means for actuating said first ram when a bag is in position before the same and control means for actuating said second ram when a predetermined number of bags are in position before the same.

25. In a bag packaging machine, first and second rams movable horizontally along substantially perpendicular paths, a horizontally disposed platform extending between said rams and arranged to support filled bags of relatively loose material in an upright position during movement across said platform, the first ram being positioned a substantial distance behind and out of contact with said bags and movable into contact with successive bags with substantial impact so as to flatten at least one side of the bag and move said bag along the platform, and the second ram being positioned a substantial distance from a plurality of the bags at the end of said first ram movement and out of contact therewith, said second ram being movable into contact with a plurality of the bags with sufficient impact to flatten another side of said previously flattened bags, and control means for actuating said second ram when a predetermined number of bags are in position before the same.

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