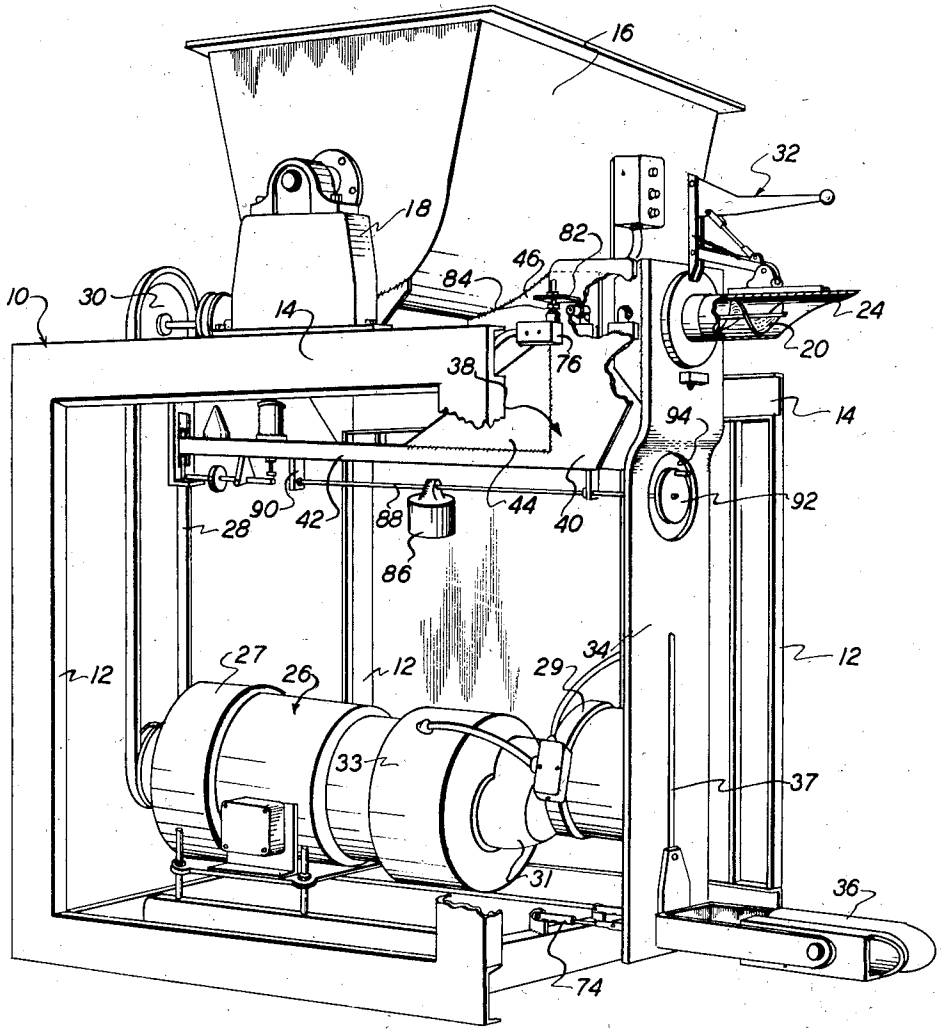
March 18, 1958 E. J. DOUGLAS 2,827,256

BAG PACKER

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FIG. 1.



INVENTOR.
EDWIN J. DOUGLAS

BY
Christie, Parker & Hale
ATTORNEYS

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FIG. 2.

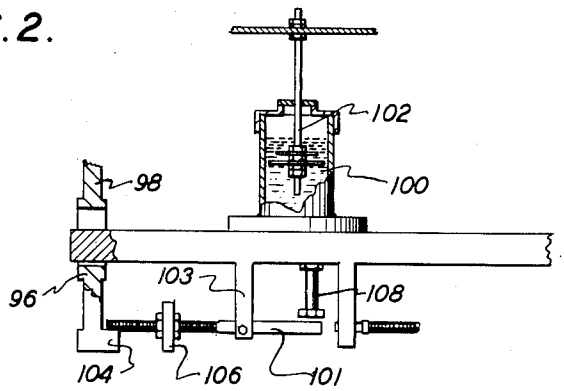


FIG. 3.

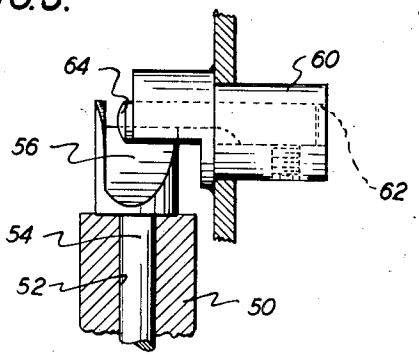


FIG. 4.

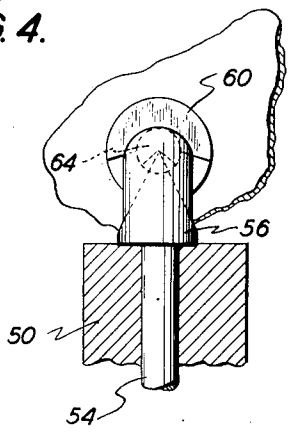
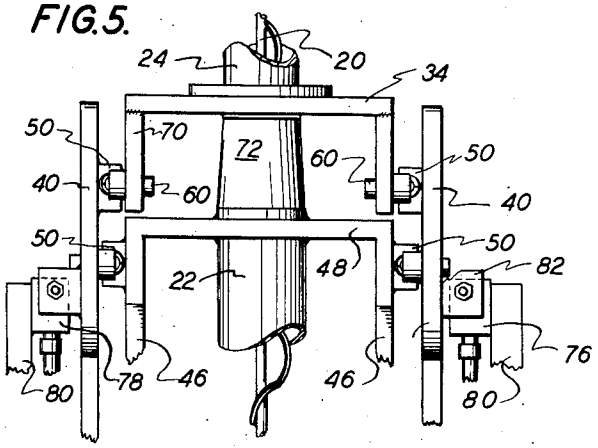


FIG. 5.



INVENTOR.
EDWIN J. DOUGLAS

BY

Christie, Parker & Hale

ATTORNEYS

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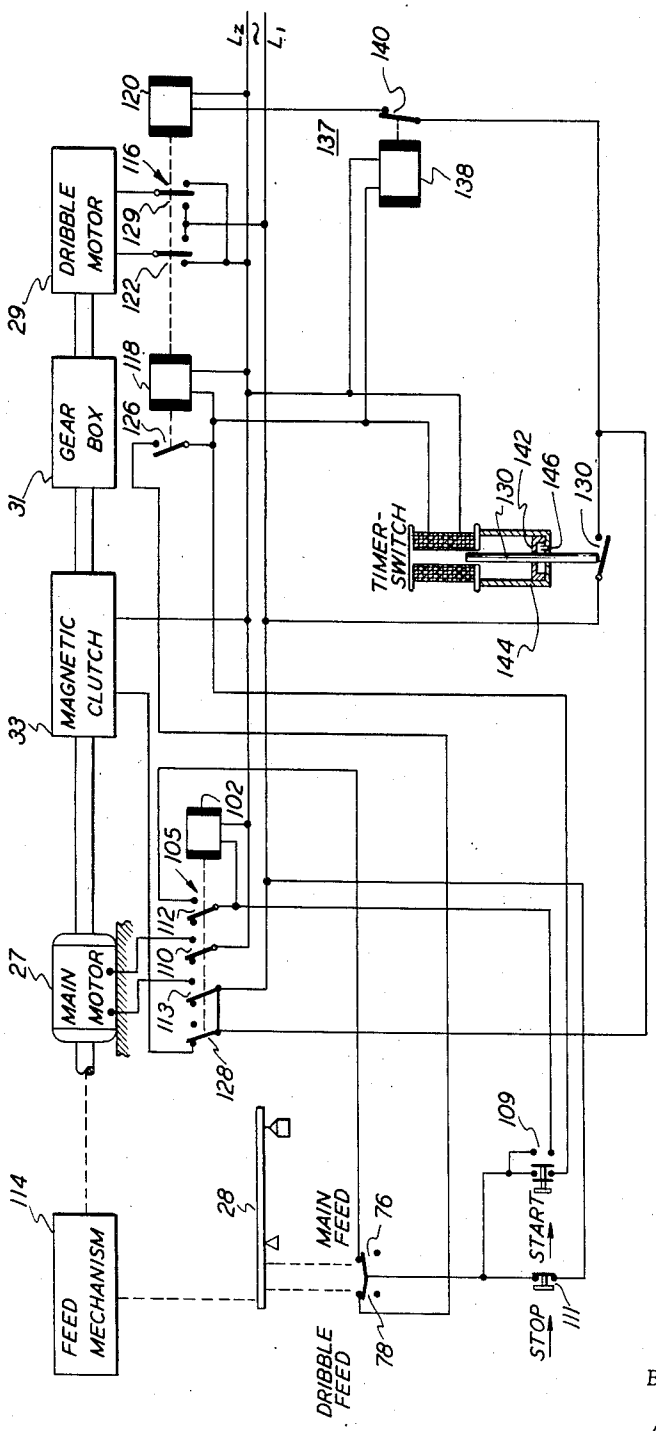


FIG. 6.

INVENTOR.
EDWIN J. DOUGLAS

BY Christie, Parker & Hale

ATTORNEYS

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2,827,256

BAG PACKER

Edwin J. Douglas, Whittier, Calif., assignor to H. L. Stoker Company, Claremont, Calif., a corporation of California

Application February 11, 1957, Serial No. 639,495

14 Claims. (Cl. 249—62)

This invention relates to packaging equipment and, more particularly, is concerned with a packer for filling bags with solid materials capable of being packaged in bags or sacks.

The packaging of all types of finely divided solid materials, such as cement, sand, grain, chemicals, plastics, and the like, in paper bags of all sizes is well known. Various automatic machinery has been developed in the past for automatically filling bags with a predetermined quantity of material, based on the weight of the material. In an effort to decrease costs, such packaging machines have been continuously improved in their performance to obtain faster filling rates for the bags. However, where the material is caused to flow into the bags at ever faster rates, it becomes more difficult to ascertain the end point when the precise weight of material has been delivered to the bag so as to cut off the flow of material into the bag at the correct moment. For example, if material is fed into the bag out of a spout, and the flow out of the spout is to be interrupted when the weight of the bag with the material in it reaches a predetermined level, inaccuracies can exist because at any given moment a quantity of material necessarily has passed the point at which the flow is interrupted and yet has not come to rest in the bag where its weight can be measured. The faster the rate of feed, the greater error is introduced between the measuring of the weight, interruption of the flow, and the amount of material being added to the weight of the bag after the interruption of the flow of material is effected. As the cost of the material being packaged goes up, the additional ounces or even pounds of material, added to the bag's weight after a weight measurement has resulted in the interruption of flow of material into the bag, become more and more of an economic factor in the over-all cost of the packaged item.

The present invention provides bag-packing equipment which is capable of filling bags at a very high rate and yet maintaining high weight accuracies that are reproduceable from bag to bag. The present invention therefore has particular utility where packaging of bulk materials in bags must be done with extreme accuracy to prevent waste by way of overweight of the filled bag. This is accomplished in the present invention by a bag-packer that has a two-speed drive arrangement by means of which the material can be fed into the bag at a high rate of speed until the bag is substantially filled, and at a very slow dribble speed to complete to a high degree of accuracy the filling of the bag. A unique weight-sensing arrangement senses two weight end points in the filling of the bag. Control means actuated at each of these two end points successively reduces the speed of the feed and then reverses and stops the feed by means of a special two-speed reversible drive arrangement.

For a better understanding of the invention, reference should be had to the accompanying drawings, wherein:

Fig. 1 is a perspective view, partially cut away, showing the bag-packer of the present invention;

Fig. 2 is a fragmentary view showing the novel scale beam arrangement for automatically weighing the material that goes into the bag;

Fig. 3 is a fragmentary view showing one of the pivots for the scale beam;

Fig. 4 is an end view of the pivot of Fig. 3;

Fig. 5 is a fragmentary view of the pivot assembly for supporting the main scale beam from the frame; and

Fig. 6 is a schematic wiring diagram of the control circuit for the motor drive.

Referring in detail to the drawings, and in particular to Fig. 1, the numeral **10** indicates generally the main frame of the bag packing machine. The main frame includes four vertical legs **12**, the foremost one in the figure being cut away to reveal details of other parts of the machine. The upper part of the frame **10** includes a pair of parallel side rails **14** which support a hopper **16** by means of suitable brackets **18**.

A screw conveyor communicates with the bottom of the hopper **16**, the conveyor including a screw feed shaft **20** extending from within the hopper through a tube **22** joined at one end to the hopper and out through a bag feeding spout **24**. The shaft **20** is driven from a motor drive assembly indicated generally at **26**, mounted on the bottom part of the main frame **10**, by means of a suitable belt drive **28**, the belt drive rotating a belt sheave **30** mounted on an extension of the feed shaft **20** which projects out of the back of the hopper. It will be understood that suitable bearings are provided for rotatably supporting the feed shaft **20**. The drive assembly **26** includes a main drive motor **27** and a smaller dribble feed motor **29**. The motor **29** is coupled to the shaft of the motor **27** through a gear speed reducer **31** and a magnetic clutch **33**.

The spout **24**, which is supported in a manner here and after described in detail, is designed to support a bag of the well known flap or valve type. The upper end of the bag is slipped over the spout **24** and clamped in position by a suitable clamping lever assembly indicated generally at **32**.

The spout **24** and the clamping assembly **32** are both secured by suitable means to a vertical front plate **34** which extends downwardly to substantially the bottom of the main frame **10**. A lower bag support assembly **36** is adjustably secured to the lower end of the plate **34**, a longitudinal slot **38** being provided in the plate **34** to permit adjustment of the vertical height of the lower bag assembly **36**.

In order to weigh the bag and material as the bag is filled by the screw feed from material stored in the hopper **16** through the spout **24**, the plate **34** is made part of a beam scale assembly which includes a main scale beam **38**. The main scale beam includes, at one end thereof, a pair of spaced parallel plates **40** (see Fig. 5). The parallel plates are secured at their lower ends to a horizontal member **42**, a pair of substantially triangular plates **44** being provided to stiffen the welded assembly of the parallel vertical plates **48** with the horizontal member **42**.

The entire main beam **38** is pivotally supported on the main frame **10** of the machine. To this end a pair of parallel plates **46** are supported by the main frame below the hopper and are positioned on either side of the screw feed conveyor. An end plate **48** extends between and is welded in position to the outwardly projecting ends of the plates **46**, the end plate **48** providing a support for the outer end of the conveyor tube **22**, as best shown in Fig. 5.

The two pivot assemblies between the plates **46** forming part of the main frame **10** and the parallel plates **40** of the main scale beam are best shown in Figs. 3 and 4. Each of the pivot assemblies includes a block

50 welded or otherwise secured to the plate 46 of the main frame. Blocks 50 have a vertical hole 52 therein, which receives a shaft 54 that is integrally formed with the knife-edge block 56. Similarly, blocks 60 are welded or otherwise secured to the parallel plates 40 of the main scale beam 38. The blocks 60 are provided with axially aligned holes 62, which receive knife-edge pivot shafts 64. The shafts 64 are provided with 90° V-shaped slots which are milled therein for receiving the knife-edges 56. Both the knife-edges 56 and the cooperating shafts 64 are made of hardened steel to reduce friction and wear of the pivots.

The pivot assembly is self-aligning and extremely accurate. By machining the holes 62 through the blocks 60 after the blocks are secured to the plates 40 of the main beam assembly 38, axial alignment of the holes is assured. The knife edges, because they are permitted to pivot or turn about a vertical axis, automatically align themselves with the grooves in the pivot shafts 64, which grooves are accurately machined so that the bottom of the V lies along the longitudinal axis of the shaft 64.

The vertical front plate 34 from which the bag is supported, in turn is pivotally supported from the main scale beam 38. The pivotal support assembly is identical to that which supports the main beam 38 from the main frame 10, as above described. Thus the plate 34 is provided with a pair of spaced parallel plates 70 which are welded or otherwise secured in position. Since pivot assembly is identical, the same reference signals are used. Thus the blocks 50 are welded or otherwise secured to the plates 40 of the main scale beam, and the blocks 60 are welded or otherwise secured to the plates 70. Knife edges 56 mounted on the blocks 50, and the pivot shafts 64 mounted on the blocks 60, cooperate to pivotly support the front plate 34 from the main scale beam 38.

It should be noted that a flexible sleeve forms the conduit connection in the feed conveyor assembly between the tube 22 and the spout 24. The flexible sleeve is necessary since the spout 24 is subject to slight vertical motion with tilting of the main beam 38. Since the screw feed shaft 20 is vertically fixed with relation to the main frame 10, sufficient clearance must be provided between the inside of the spout 24 and the screw feed shaft 20 to permit the required vertical movement of the plate 34 as the main beam is tilted during the weighing operation.

In order to maintain the front plate 34 in a substantially vertical position and still permit up and down movement thereof, the lower end of the plate 34 is anchored to the main frame by a pair of parallel substantially-horizontal rods 74 which are pivotally secured at their respective ends to the main frame 10 and to the lower end of the plate 34. It will be seen that the rods 74 permit slight vertical movement of plate 34 and yet secure the plate 34 against rotation about the upper pivotal supports.

Automatic control of the feeding of material from the hopper 16 into the bag to a desired weight is controlled in the manner here and after more fully described by a pair of microswitches, indicated at 76 and 78 and referred to respectively as the main feed switch and the dribble feed switch. The microswitches 76 and 78 are supported from the main frame 10 by suitable brackets 80. Actuating plates 82 secured to the side plates 40 of the main scale beam 38 are provided with adjustable screw stops 84 which engage the microswitch plungers. The microswitches 76 and 78 and cooperating stops are mounted near the pivots between the main scale beam 38 and the main frame so that, because of the short lever distance between the microswitches and pivots, a minimum of loading on the main beam is produced in actuating the microswitches.

The main scale beam 38 is provided with an adjustable counterbalancing weight 86 which threadedly engages a shaft 88 journaled in suitable brackets 90 supported from the main scale beam. The shaft 88 is rotated by means of a crank handle 92 which is accessible through an opening 94 in the front vertical plate 34. The outer end of the horizontal member 42 of the main scale beam 38 is permitted to swing between two limit stops, a lower stop 96 and an upper stop 98. A dash pot 100 mounted on the scale beam 38 has its plunger 102 secured to the main frame. The dash pot damps the movement of the main scale beam 38 between the limits of the stops 96 and 98.

A mechanical anticipator arrangement is provided in the form of an auxiliary scale beam 101 which is pivotly supported from the main scale beam 38 by means of a bracket 103. The auxiliary beam 101 rests on a stop 104 that is secured in fixed relationship with the main frame 10 of the machine. An adjustable weight 106 urges the auxiliary beam against the stop 104. As the main scale beam 38 begins to rise, the auxiliary scale beam pivots about the stop 104, causing the opposite end of the auxiliary scale beam to rise. As it rises, it engages an adjustable stop 108 which is secured to the main scale beam 38.

When the auxiliary scale beam engages the stop 108 it causes the opposite end of the auxiliary scale beam to lift off the stop 104. The result is to add an additional weight to the end of the main scale beam, namely, the weight otherwise carried by the stop 104. It will be seen that as the weight of the bag and its contents increases a point will be reached where the main scale beam is lifted off the stop 96 causing the auxiliary scale beam 101 to engage the stop 108. The main scale beam will then come to rest, its upward movement being halted until sufficient additional weight has been added to the bag and its contents to overcome the weight of the auxiliary beam to lift it off the stop 104. Thus movement of the main scale beam 38 between stops 96 and 98 takes place in two distinct steps. The microswitches 76 and 78 are arranged so that they are respectively actuated during the successive step movements upward of the main scale beam 38.

Control of the filling of the bag by the drive assembly 26 in operation of the screw feed conveyor is effected by the circuit shown in Fig. 6. The main motor 27 is controlled by a multiple switch relay indicated generally at 105. The relay coil 107 of the relay has one side thereof connected through line L_2 to one side of a source of electrical energy (not shown). The other side of the coil 102 is connected to one pole of a normally open pushbutton type double-pole single-throw switch 109. Momentary closing of the switch 109 to start the main motor completes a circuit from the coil 107 to the line L_1 connected to the other side of the electrical energy source. This circuit is completed through a normally closed pushbutton type of single-pole single-throw switch 111, which when momentarily opened, stops the operation of the bag packer.

Energization of the relay 107 closes three normally open switches 110, 112, and 113. Switches 113 and 110 connect the main motor 27 across the lines L_1 and L_2 for energizing the motor. This starts the feed conveyor mechanism filling the bag in the manner above described, the feed mechanism being shown in Fig. 6 as a block 114. The closing of switch 112 of the relay 105 provides an electrical path which bypasses the start switch 109. In order that the main motor 27 may be stopped when the bag is substantially filled, the bypass circuit includes the switch 112 connected in series with the main feed microswitch 76 which is opened by the initial movement of the main scale beam 28 when the bag being filled reaches a predetermined weight.

The dribble motor 29 is controlled by a reversing relay indicated generally at 116 which includes two coils 118 and 120 that actuate a pair of switches 122 and 124 for reversing the connection between the dribble motor 29

and the lines L_1 and L_2. The forward coil **118** is connected across the lines L_1 and L_2 through the start switch **109** and stop switch **111** in a manner similar to the relay coil **107** of the main motor control relay **105**. Once the pushbutton switch **109** is closed to energize the relay coils **107** and **118**, the coil **118** is held energized by a circuit including a switch **126** closed by the relay coil **118** and the dribble feed microswitch **78** connected in series as shown.

Although the start switch **109** energizes the main motor **27** and also the dribble motor **29** in its forward direction, the magnetic clutch **33**, which couples the dribble motor through the gear box **31** to the shaft of the main motor **27**, is not energized. The clutch is controlled by a normally closed switch **128** which is part of the relay **105** and actuated by the relay coil **107**. With the relay coil **107** energized, the switch **128**, which is in series with the magnetic clutch **33**, is opened, thereby de-energizing the magnetic clutch **33** during the time the main motor **27** is driving the feed mechanism **114**.

When the bag is filled to the point that the main feed microswitch **76** is open, the switch **128** again returns to its normally closed condition on the de-energization of the relay coil **107**. This connects the magnetic clutch **33** across the lines L_2 and L_1 through a timer-actuated switch **130** in series with the switch **128**. Switch **130** is actuated by a timing device indicated generally at **132**, which includes a solenoid **134** actuating a plunger **136**. The solenoid **134** is connected in parallel with the relay coil **118** such that the switch **130** is closed whenever the dribble motor **29** is energized in its forward direction.

With the magnetic clutch **33** energized, and the main motor **27** de-energized, the dribble motor **29** continues to fill the bag through the feed mechanism **114** at a greatly reduced rate. This continues until the weight of the bag is sufficient to lift the auxiliary scale beam **101** off the stop **104**. The main scale beam **28** then lifts sufficiently to actuate the dribble feed microswitch **78**, thereby breaking the circuit through the relay coil **118** and the solenoid **134** of the timer switch **132**.

At this time the reverse coil **120** of the relay **116** is energized. This is effected by a relay indicated generally at **137** which has its coil **138** connected in parallel with the forward coil **118** of the relay **116**. The relay **136** includes a normally closed switch **140** connected in series with the reverse coil **120**. The circuit connecting the coil **120** across the input lines L_1 and L_2 is completed by the switch **130** actuated by the timer **132**. When the dribble feed switch **78** is open, thereby de-energizing the solenoid **134** of the timer **132**, the plunger **136** starts to drop but is slowed down in its descent by a piston **142** moving in a cylinder **144**. Such type of pneumatic timer devices are well known and include valve means such as indicated at **146** in the end of the cylinder for controlling the rate at which air escapes, thereby controlling the rate at which the plunger **136** and associated piston **146** drop. When the plunger **136** is fully descended, it opens the switch **130** thereby de-energizing the reverse coil **120** to stop the reverse motion of dribble motor **29**. This completes the bag-filling cycle of operation, which includes filling the bag substantially full at a high rate of delivery of the material being packed, bringing the bag to its full weight by dribbling in additional material at a relatively slow delivery rate, and reversing and stopping the feed when the bag has reached its full weight. Reversing of the dribble motor insures that no additional material can reach the bag after full weight is reached.

From the above description, it will be recognized that an improved bag packer apparatus is provided. The double beam weighing arrangement provides positive two-step action of the main feed microswitch followed by the dribble feed microswitch, which act to control the feed drive. By the two speed feed arrangement, greatly increased accuracies in bag filling are possible without sacrifice of over-all speed.

What is claimed is:

1. An automatic bag packer comprising a main frame, a main scale beam pivotally mounted on the frame, means for pivotally supporting from one end of the main scale beam the bag to be packed, a first stop mounted on the frame for supporting the end of the scale beam opposite from the bag supporting means, means mounted on the frame for feeding material into the bag, reversible two-speed motor drive means for actuating the feeding means to control the rate of feed, an auxiliary scale beam pivotally supported from the main scale beam at the opposite end thereof from the bag supporting means, a second stop mounted on the frame for supporting one end of the auxiliary beam, a limit stop mounted on the main scale beam for limiting rotation of the auxiliary beam about the pivotal support thereof as the main beam rises due to increasing weight of the bag as it is being packed, whereby the auxiliary beam is lifted off the second stop on the frame after the main beam rises a predetermined amount above the first stop, a first switch means actuated by the pivotal movement of the main beam off the first stop, second switch means actuated by the further movement of the main beam when the auxiliary beam lifts off the second stop, means responsive to actuation of the first switch means for reducing the speed of the motor drive means, means responsive to actuation of the second switch means for reversing the motor drive means, and time controlled means for stopping the drive means a predetermined time after the second switching means is actuated.

2. Apparatus as defined in claim 1 wherein the two-speed drive means comprises first and second motors, a speed-reducing gear drive connected to the second motor, and an electrically controlled magnetic clutch coupling the first motor to the output of the gear drive, the first motor being connected to the feeding means.

3. Apparatus as defined in claim 2 wherein the first switch means when actuated cuts off power to the first motor and engages the clutch, and the second switch means when actuated reverses the second motor to back off the feed and stop further filling of the bag.

4. An automatic bag packer comprising a main frame, a main scale beam pivotally mounted on the frame, means for pivotally supporting from one end of the main scale beam the bag to be packed, a first stop mounted on the frame for supporting the end of the scale beam opposite from the bag supporting means, means mounted on the frame for feeding material into the bag, two-speed motor drive means for actuating the feeding means to control the rate of feed, an auxiliary scale beam pivotally supported from the main scale beam at the opposite end thereof from the bag supporting means, a second stop mounted on the frame for supporting one end of the auxiliary beam, a limit stop mounted on the main scale beam for limiting rotation of the auxiliary beam about the pivotal support thereof as the main beam rises due to increasing weight of the bag as it is being packed, whereby the auxiliary beam is lifted off the second stop on the frame after the main beam rises a predetermined amount above the first stop, a first switch means actuated by the pivotal movement of the main beam off the first stop, second switch means actuated by the further movement of the main beam when the auxiliary beam lifts off the second stop, means responsive to actuation of the first switch means for reducing the speed of the motor drive means, means responsive to actuation of the second switch means for stopping the drive means.

5. An automatic bag packer comprising a main frame, a main scale beam pivotally mounted on the frame, means for pivotally supporting from one end of the main scale beam the bag to be packed, a first stop mounted on the frame for supporting the end of the scale beam opposite from the bag supporting means, means mounted on the frame for feeding material into the bag, two-speed motor drive means for actuating the feeding means to control the rate of feed, an auxiliary scale beam, a sec-

ond stop mounted on the frame for supporting one end of the auxiliary beam, means mounted on the main scale beam for picking up the auxiliary beam off the second stop when the main beam has moved a predetermined amount as the main beam rises due to increasing weight of the bag as it is being packed, a first switch means actuated by the pivotal movement of the main beam off the first stop, second switch means actuated by the further movement of the main beam when the auxiliary beam lifts off the second stop, means responsive to actuation of the first switch means for reducing the speed of the motor drive means, means responsive to actuation of the second switch means for stopping the drive means.

6. Apparatus as defined in claim 5 wherein the two-speed drive means comprises first and second motors, a speed-reducing gear drive connected to the second motor, and an electrically controlled magnetic clutch coupling the first motor to the output of the gear drive, the first motor being connected to the feeding means.

7. Apparatus as defined in claim 6 wherein the first switch means when actuated cuts off power to the first motor and engages the clutch, and the second switch means when actuated reverses the second motor to back off the feed and stop further filling of the bag.

8. A bag packer comprising a main frame, a scale beam pivotally mounted on the frame, means for pivotally supporting a bag to be packed from one end of the scale beam, means for feeding material into the bag when it is in position on the supporting means, two-speed drive means for actuating the feeding means at one of two selectable rates, means for normally maintaining the scale beam substantially horizontal until the weight of the bag and material therein exceeds a predetermined value, means for abruptly increasing the counterbalancing weight of the scale beam when the beam rotates a predetermined amount due to the weight of the bag and material feed thereto, means for actuating the two-speed drive means to reduce the feed rate to a lower value in response to the initial rotational movement of the beam about its pivotal support, means for interrupting the feed by said material feeding means when the scale beam is caused to rotate further against the abruptly added additional counterbalancing weight.

9. Apparatus as defined in claim 8 wherein said means for pivotally supporting the scale beam from the main frame includes a pair of knife edge members supported in spaced relationship from the frame with their knife edges projecting upwards and lying in a common horizontal plane, each of the knife edge members being rotatable about a vertical axis, whereby the knife edges can be adjusted for exact alignment with each other, and a pair of shaft members supported in spaced relationship from the scale beam, the shaft members being rotatable about a common axis and having longitudinally extending V-shaped grooves therein, the bottom of the grooves lying along said common axis, whereby rotation of the shaft members does not affect the location of the bottom of the grooves, the knife edge members engaging the grooves in the shaft members for supporting the scale beam.

10. Apparatus as defined in claim 8 wherein the two-speed drive means comprises first and second motors, a speed-reducing gear drive connected to the second motor, and an electrically controlled magnetic clutch coupling the first motor to the output of the gear drive, the first motor being connected to the feeding means.

11. Apparatus as defined in claim 10 wherein the first switch means when actuated cuts off power to the first motor and engages the clutch, and the second switch means when actuated reverses the second motor to back off the feed and stop further filling of the bag.

12. In an automatic bag packer having means for feeding the material into the bag and means for sensing the weight of the bag and material at two separate and distinct values, a two-speed feed drive comprising a first motor having its drive shaft connected to the feeding means, a second motor, speed-reducer means connected to the drive shaft of the second motor, a magnetic clutch coupling the drive shaft of the first motor to the output shaft of the speed-reducer means, and electrical control means for the two motors and the clutch responsive to said weight sensing means, the control means including means for de-energizing the first motor and energizing the clutch when the weight of the bag and material therein reaches the first of said two values, and means for reversing momentarily and then de-energizing the second motor when the weight of the bag and material therein reaches the second of said two values.

13. In an automatic bag packer having means for feeding the material into the bag and means for sensing the weight of the bag and material at two separate and distinct values, a two-speed feed drive comprising a first motor having its drive shaft connected to the feeding means, a second motor, speed-reducer means connected to the drive shaft of the second motor, a magnetic clutch coupling the drive shaft of the first motor to the output shaft of the speed-reducer means, and electrical control means for the two motors and the clutch responsive to said weight sensing means, the control means including means for de-energizing the first motor and energizing the clutch when the weight of the bag and material therein reaches the first of said two values, and means for interrupting the feed by the drive means when the weight of the bag and material therein reaches the second of said two values.

14. In a bag packing device in which the feeding spout supports the bag from a scale beam, pivotal means for supporting the scale beam and associated spout and bag from a main frame of the device comprising a pair of knife edge members supported in spaced relationship from the frame with their knife edges projecting upwards and lying in a common horizontal plane, each of the knife edge members being rotatable about a vertical axis, whereby the knife edges can be adjusted for exact alignment with each other, and a pair of shaft members supported in spaced relationship from the scale beam, the shaft members being rotatable about a common axis and having longitudinally extending V-shaped grooves therein, the bottom of the grooves lying along said common axis, whereby rotation of the shaft members does not affect the location of the bottom of the grooves, the knife edge members engaging the grooves in the shaft members for supporting the scale beam.

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