June 4, 1957 J. W. OWEN 2,794,613

CONTROL APPARATUS FOR HIGH SPEED BAG FILLING MACHINE

Filed Dec. 23, 1953 4 Sheets-Sheet 1

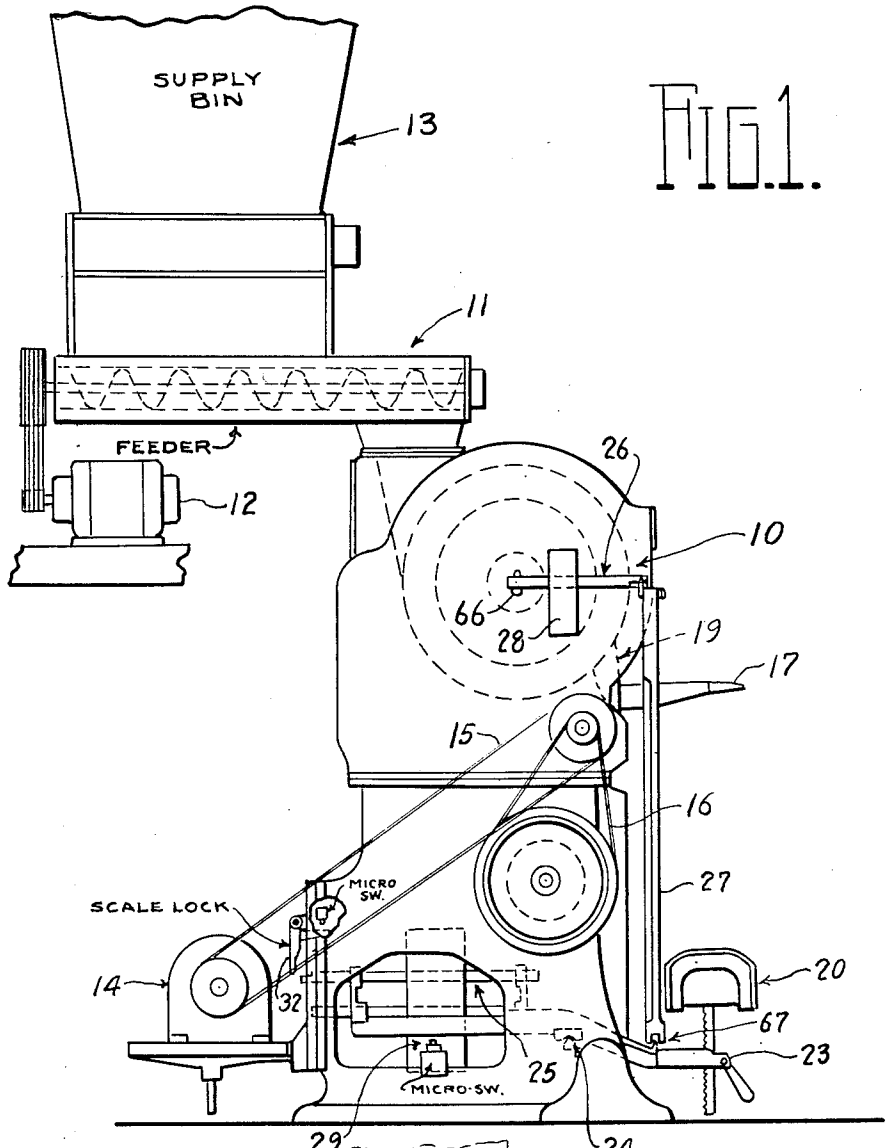


FIG. 1.

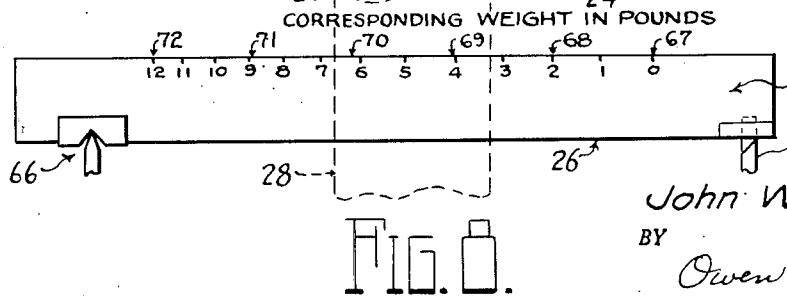


FIG. 2.

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CONTROL APPARATUS FOR HIGH SPEED BAG FILLING MACHINE

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FIG. 2.

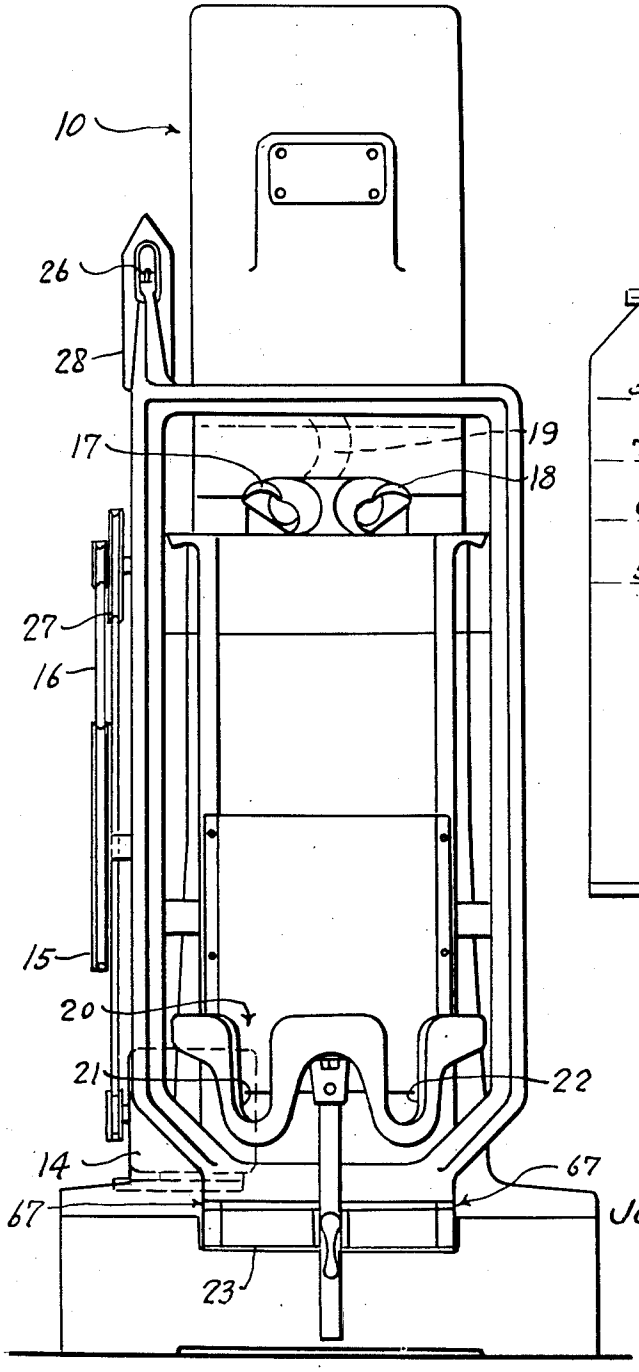
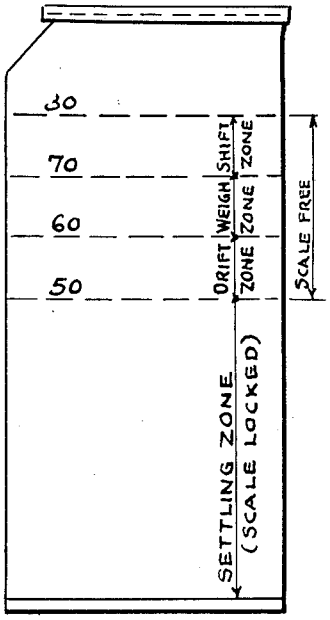


FIG. 3.



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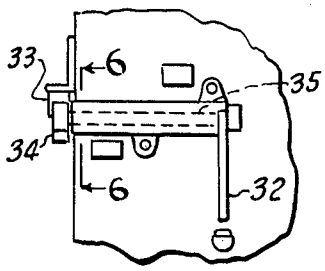
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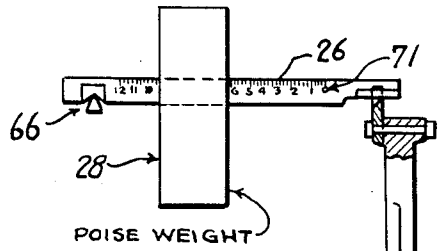
June 4, 1957 J. W. OWEN 2,794,613

CONTROL APPARATUS FOR HIGH SPEED BAG FILLING MACHINE

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FIG. 5.





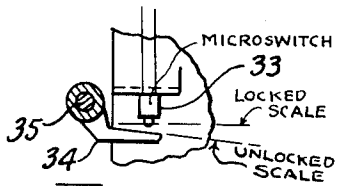


FIG. 6.

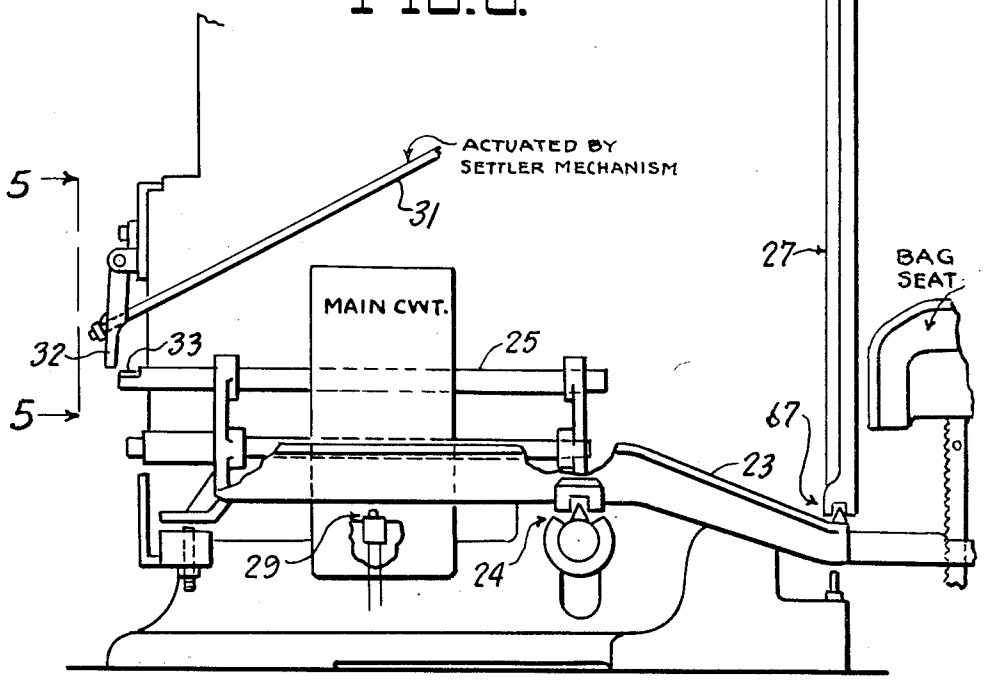


FIG. 4.

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CONTROL APPARATUS FOR HIGH SPEED BAG FILLING MACHINE

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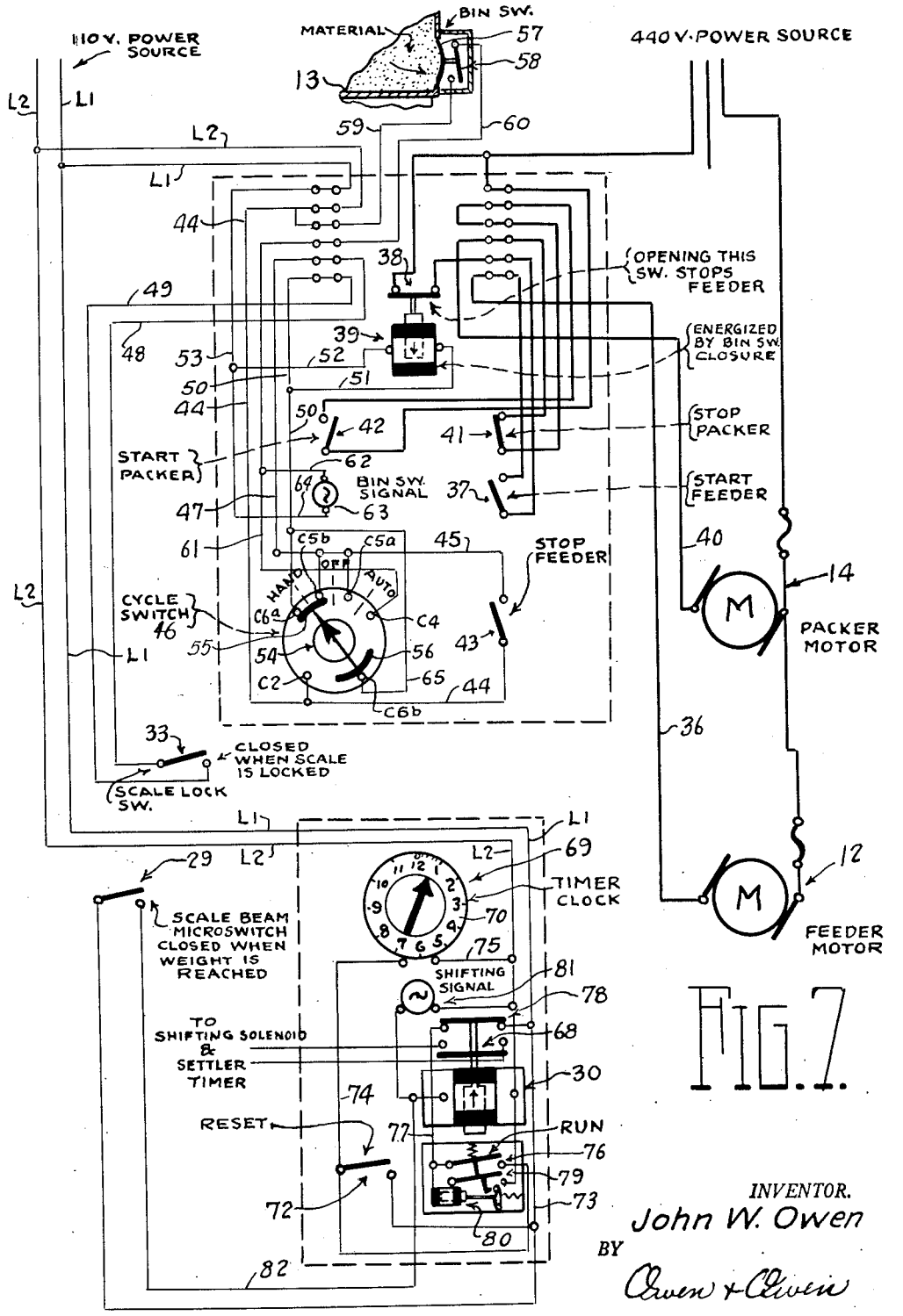


FIG. 7.

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2,794,613

CONTROL APPARATUS FOR HIGH SPEED BAG FILLING MACHINE

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Application December 23, 1953, Serial No. 400,002

4 Claims. (Cl. 249—56)

This invention relates to a control apparatus for a high speed bag filling machine of the type in which the bag to be filled is weighed during the filling operation and wherein the termination of feeding of content material is controlled by the weighing mechanism in the machine.

The apparatus of the invention is particularly concerned with a bag filling machine which feeds at an extremely high speed, i. e., in the order of from 17 to, say, 25 pounds per second, so that an average 80 pound bag may be filled in 3½ to 4 seconds. In a machine operating at this high rate of speed the lag in control reaction and the inertia of moving parts make it difficult to stop the feeding of the material with a close enough control so that all of the bags filled during a "run" of the machine will contain the same quantity of material within, say, 1%.

In a high speed bag filling machine of the type with which the control apparatus of the invention is particularly designed to function, the weighing apparatus is provided with means for supporting two sacks to be filled. The material, for example, granular material such as chemical fertilizer, is fed by high speed feeder means through a nozzle which is automatically switched from one bag to another when the first bag has been filled to a preselected weight. The operator then removes the filled bag and substitutes an empty bag and upon completion of the filling of the second bag the feeding nozzle is automatically switched to the newly placed third empty bag.

If the scale mechanism were so set that the nozzle would not start to shift until a bag had been filled to the desired weight, the inertia of the nozzle moving mechanism and the consequent split second delay would result in there being fed, say, 7 to 12 pounds extra into the bag before the nozzle would be shifted. For this reason such machines usually operate on the basis of initiating the nozzle shifting cycle when the bag being filled approaches the desired final weight and reaches a point removed therefrom by the number of pounds of material which will feed into the bag being fed before the nozzle can be moved away from the bag and to the empty bag.

As long as the feeder operates with nicety, i. e., as long as it feeds precisely the same quantity of material during any specific period of time, this initiation of shifting at a fixed interval of time prior to the effectiveness of the shifting will give accurate control of the final bag weight. Unfortunately, however, almost all granular material and, in particular soluble materials such as fertilizers, salt, sugar and numbers of other materials, do not maintain a constant specific gravity and vary substantially not only in specific gravity but also in flowability between different portions of the same "batch" and, even more drastically, between different

batches. As a result of these variations it is difficult for an operator to set the weighing mechanism of the packaging machine so that it will actuate the nozzle shifting mechanism at the right time to initiate the shifting a length of time previous to the effective shifting so that a proper quantity of material will be fed into the bag to "top off" the weight-measured quantity of material in the bag and to result in the bag having a total quantity of material within the tolerance set when the nozzle finally shifts away from the bag.

The method usually employed in an endeavor to properly set the machine is to test weigh a filled sample bag from time to time and to make estimated compensating adjustments in the weighing mechanism of the machine in order to change the nozzle shifthing point. All such bag filling machines are provided with controls for starting and stopping the various sub-mechanisms in the machine and an operator frequently disturbs these controls to such an extent that as many as 10 to 15% of the bags filled may contain material weighing as much as several pounds less or several pounds more than the intended weight.

It is an object of this invention to provide a simple automatic means for preventing the interference of the operator with the operation of the machine except during periods in the cycle when his interference does not deleteriously affect the accuracy of the machine operation.

It is a further object of this invention to provide a control whereby the operation of the machine itself provides a way of correcting errors made by an operator in setting the machine to produce a fixed weight bag from a batch of material of unknown specific gravity, flowability, or other characteristics which may be different from those of a previous batch of material.

It is yet another object of this invention to provide control means which interconnects and interrelates the various steps in the operation of a high speed bag filling machine so that errors made in one step in the cycle whether by the operator or by the machine are not compounded but can be isolated and corrections therefor easily made.

It is a still further and more specific object of this invention to provide a control apparatus including means for sensing the approach to exhaustion of the supply of material and to thereupon preset the machine so that it will stop its operation at the end of a bag filling cycle before the supply of material reaches a point low enough to introduce errors into the machine operation.

These and other and more specific objects will be better understood from the specification which follows and from the drawings in which:

Fig. 1 is a side view in elevation of a high speed bag filling machine of the type with which control apparatus embodying the invention is intended to be employed.

Fig. 2 is a front view in elevation and on enlarged scale of the machine shown in Fig. 1.

Fig. 3 is a view in elevation of a typical bag to be filled upon the machine illustrated in Figs. 1 and 2 and diagrammatically indicating the various zones of control by time and by weight exercised over the machine by its weighing mechanism and by control apparatus embodying the invention.

Fig. 4 is a fragmentary view in elevation illustrating the bag weighing mechanism with which the machine of Figs. 1 and 2 is equipped and also showing certain controls incorporated in the control apparatus of the invention.

Fig. 5 is a fragmentary view in elevation taken substantially on the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary vertical sectional view taken substantially on the line 6—6 of Fig. 5.

Fig. 7 is a schematic wiring diagram of control apparatus embodying the invention and illustrating its connections with and control of the bag filling machine shown in Figs. 1 and 2.

Fig. 8 is an enlarged view in elevation of a weight control poise as calibrated on a machine controlled by apparatus of the invention.

Inasmuch as the instant invention is not concerned with the particular operation of the bag filling machine itself except insofar as that operation is controlled by the apparatus of the instant invention, the bag filling machine and its sub-mechanisms will be described only in sufficient detail to illustrate and explain the control exercised over their operations. For this reason the drawings of the bag filling machine in Figs. 1 and 2 are not complete and only the major sub-mechanisms and controls are illustrated. A bag filling machine of the type shown in Figs. 1 and 2 is conventional in the art and many modifications in its general structure and operation may be made without rendering the control apparatus of the invention inapplicable.

A high speed bag filling machine of the general type suitable for control by the apparatus of the invention comprises several major sub-assemblies. These include a high speed rotary packer generally indicated at 10 in Fig. 1 but, of course, the utility of the apparatus of the invention is not limited to machine having rotary packers, it being necessary only that the packer operate at high speed and that it be designed for the feeding of material suitable to be packed in bags. Preliminary to the packer 10 the machine is provided with a feeder 11. In Fig. 1 the feeder 11 is illustrated as a screw type feeder driven by its own separate motor 12 for the purpose of feeding material from a major supply bin 13. The bag filling machine of Figs. 1 and 2 has a driving motor 14 suitably connected to actuate the machine mechanisms, for example, by driving belts 15 and 16. The machine has a pair of feeding spouts 17 and 18 (see also Fig. 2) to which material fed by the feeders 10 alternately is delivered through a shifting nozzle connecting the feeder 10 to the spouts 17 and 18, the shifting nozzle not being shown in detail in the drawings but being located at the point generally indicated by the reference number 19. The machine of Figs. 1 and 2 also incorporates a weighing mechanism comprising a bag rest 20 having two bag saddles 21 and 22 which are located respectively beneath the two feeding spouts 17 and 18, the bag rest 20 being adjustably positionable on the forward end of a scale lever 23. The scale lever 23 is pivotally mounted, for example, by the pivot and bearing generally indicated at 24 (Fig. 1), in the lower frame of the machine and is equipped with the usual poise beams 25 for major weight adjustments. A bag filling machine such as that shown in Figs. 1 and 2 also is provided with a fine adjustment poise beam 26 shown in the drawings as being located at an upper accessible part of the machine and connected to the scale lever 23 by a thrust frame 27. The beam 26 has a poise weight 28 for fine adjustments of weight. (See also Fig. 8.)

The operation of the machine in general as so far described is as follows. Assume that the machine is set to feed the particular material at the rate of 20 pounds per second and that the desired weight of the contents of each bag to be filled is 80 pounds and that it takes ½ second for the nozzle shifting apparatus to shift the nozzle 19 between the spouts 17 and 18. Under these conditions if the condition of the material to be fed is such that the feeder will actually feed the material at the rate of 20 pounds per second, the machine will operate accurately to produce bags weighing 80 pounds each with little difficulty and at high speed.

The operator places a bag on one of the saddles 21 or 22 beneath that one of the spouts 17 or 18 to which the shiftable nozzle 19 is not connected. He then depresses the rest 20 with his foot to a distance sufficient enough to cause the closing of a beam actuated microswitch 20 (Figs. 1 and 7). This closes a circuit through the coil of a shift actuating solenoid 30 (Fig. 7) and energizes the shifting solenoid (not shown) which shifts the nozzle 19 between the spouts 17 and 18. At the same time the closing of the circuit to actuate the shifting solenoid also initiates the operation of a "settler" and of its timing mechanism.

The "settler" is a submechanism of the machine shown in Figs. 1 and 2 which is conventional in the art and which consists of mechanical means for agitating the bag rest 20 to settle or densify the material being packaged in the bag. In a machine of the type described where the average filling cycle takes 3½ to 4 seconds, the settler may be so designed as to operate for, say, 2½ seconds. Operation for this length of time fills the bag to the level indicated by the legend "50#" in Fig. 3. This zone of the bag is considered to be the "settling zone."

Because of the agitation of the settler on the bag rest 20 and on the mechanism of the scale lever 23, the settler timer is provided with a link 31 shown fragmentarily in Fig. 4 leading from the settler timer mechanism to the rear of the machine and connected to a scale lock finger 32 adapted to engage in a recess 33 formed in the upper rear end of the main beam 25 of the scale. When the settler is operating and agitating the scale lever 23 and bag rest 20 the scale lever 23 is locked thus preventing damage to the pivot and bearing 24.

With a machine operating under these ideal conditions the settler runs for 2½ seconds and 50 pounds of the material is fed into the bag being filled. At the end of 2½ seconds the settler timer is actuated, which releases the finger 32 and frees the beam 23 of the scale. Material continues to be fed into the bag being filled until its weight reaches 70 pounds. This filling is indicated in Fig. 3 between the line marked "50#" and the line marked "50#" which is shown as the "drift zone" and continuing from the line marked "60#" to the line marked "70#" which is the zone indicated as "weigh zone." The scale mechanism remains free during filling in both the "drift zone" and "weigh zone." As soon as the weight in the bag reaches 70 pounds the microswitch 29 is opened and the machine put through the shifting cycle to shift the nozzle 19 to the other one of the spouts 17 or 18. Because of the inertia discussed above and the high rate of feeding of material, the ½ second delay in shifting the nozzle 19 results in an additional 10 pounds of material being fed into the bag being filled before the nozzle 19 departs from that one of the spouts 17 or 18 to which it is connected.

This operation would be entirely satisfactory and bags of proper tolerances could be repeatedly filled with no difficulty were it not for the problems discussed above and, in particular, for the changing characteristics of the material being placed in the bags. An abrupt change in the flowability produced by change in, for example, specific gravity, grain size, etc., however, destroys the accuracy of the operation outlined immediately above. If, for example, the material changes to such a degree that the packer 10 can pack only 16 pounds per second instead of 20 then only 8 pounds would be packed during the ½ second shift zone between 70 and 80 pounds and the final bag would contain only 78 pounds of material. On the other hand, if the characteristics of the material changed to an extent such that the machine were suddenly feeding 25 pounds per second, 12½ pounds would be added to the weighed 70 pounds in the bag and the bag when filled would contain 82½ pounds of material instead of 80 pounds. Either of these errors in any number of cases is, of course, intolerable, the first because of customer dissatisfaction and the second because of

loss of material. It is for the purpose of eliminating this type of error that the apparatus embodying the instant invention has been developed for the control of machines of the general type illustrated and whose operation has been briefly described.

Apparatus embodying the invention consists primarily of interconnected electrical means associated with the means already described (and existing on the machine itself) for the purpose of controlling their operation and eliminating errors due both to the changing flowability of material and to operator mistakes. In general, the apparatus of the invention provides means by which the operator is prevented from stopping or interfering with the operation of the machine during the critical periods of the cycle and which provides a means for determining whether or not the machine has been properly adjusted for accurate operation and for making necessary compensating adjustments. Therefore, apparatus of the invention includes electrical interconnections by means of which the operator is prevented from stopping the operation of the packer during the zones of its cycle where such stopping would cause errors in results. Machine controlled means are provided for indicating whether or not the poise 28 is properly set to actuate the beam controlled microswitch 29 at the proper point so that the "topping off" occurring in the last ½ second during the "shift zone" will result in the bag being filled to a weight within a specified tolerance. The mechanism of the apparatus includes a scale lock switch 33 (Figs. 6 and 7) which is actuated by the scale locking finger 32 and consists of a stop 34 pinned on one end of a rocker rod 35 mounted on the rear of the machine and to the other end of which the finger 32 is connected. Thus when the finger 32 is in scale lock position the stop 34 is swung upwardly (Fig. 6) to close the switch 33. Conversely, when the scale is unlocked and the finger is swung backwardly, the switch 33 is allowed to open.

Referring now particularly to Fig. 7 the apparatus embodying the invention in its operation for the control of a high speed bag filling machine will be described as it is interconnected into conventional bag machine controls. The motor 12 for the feeder 11 is connected, for example, to a 440 volt power source on one side and through a line 36 to a normally open "start feeder" switch 37. The other side of the start feeder switch 37 is connected to a pair of normally closed contacts 38 of a "stop feeder" control relay 39 and then to the other side of the 440 volt power source. (The direct connections between the power source and the feeder motor 12 as well as the packer motor 14 yet to be described would not exist in an actual machine but are thus shown for purpose of simplification in the wiring diagram of Fig. 7—the intervening magnetic safety switches, for example, controlled by the start feeder switch 37, being well known in the art both in their construction and connections.)

The packer motor 14 is similarly connected between one side of the 440 volt source and by a lead 40 to a normally closed "stop packer" switch 41, from the switch 41 to a normally open "start packer" switch 42 and from the switch 42 directly to the other side of the 440 volt power source. This places the stop packer switch 41 in series with the start packer switch 42 so that the packer motor 14 is started by closing the latter and may be stopped any time by opening the former.

The "stop feeder" relay 39 is actuated to stop the feeder motor 12 under a number of different circumstances. One such circumstance may be the actuation by the operator of a "stop feeder" switch 43. The switch 43 is connected by a line 44 directly to side L2 of a 110 volt power source. The other side of the switch 43 is connected by a line 45 to two adjacent contacts C5*a* and C5*b* of a cycle switch generally indicated at 46. The two contacts C5*a* and C5*b* are connected by a common line 47 to a line 48 leading to one side of the scale lock switch 33. The other side of the scale lock switch 33

is connected by a line 49 to a line 50. The line 50 leads to a branch line 51 connected to one side of the feeder control relay 39, the other side of which is connected by a line 52 to a main line 53 leading to L1 of the 110 volt power source. The line 50 also leads to a pair of spaced contacts C6*a* and (through a branch line 65) C6*b* of the cycle switch 46.

The cycle switch 46 has a knob 54 which may be set in any one of three positions, the positions being indicated by the legend "hand," "off," and "auto" (matic). In Fig. 7 the cycle switch 46 is shown in the "hand" position in which an upper short contactor 55 extends between the contacts C6*a* and C5*b* and a longer lower contactor 56 is in contact with the contact C6*b* only. Under these conditions if the operator actuates the stop feeder switch 43 it establishes a circuit which may be traced as follows: L2, line 44, switch 43, line 45, contact C5*b*, contactor 55, contact C6*a*, lines 50 and 51, relay 39, lines 52 and 53 to L1. This actuates the relay 39 and opens its normally closed contacts 38 breaking the circuit through the "start feeder" switch 37 to the feeder motor 12 and stopping the feeder 11. Stopping the feeder 11 stops the feed of material from the supply bin 13 into the packer 10 and thus stops the feeding of material by the machine. Thus with the cycle switch 46 set at "hand" position the operator can stop the feeder at any time during the cycle of operations.

However, because the inadvertent stopping of the feeder at the wrong time during a cycle of operations, i. e., when the scale is operating, will cause an error in the weight of the bag being packed, when the cycle switch 46 is set at "auto" position, the operator cannot stop the feeder unless the scale lock switch 33 is closed. With the cycle switch 46 at "auto" position the stop feeder circuit exists as follows: L2, line 44, switch 43, line 45, line 47, line 48 to the scale lock switch 33, the switch 33, line 49, the lines 50 and 51, the relay 39 and lines 52 and 53 to L1.

Another source of error in the operation of a machine of this type is the emptying of the supply bin 13 and the failure of the operator to refill the supply bin 13 before it reaches such a low level as to be exhausted during the filling of a particular bag. In a machine having control apparatus according to the invention mechanism is provided for indicating the condition of the level of material in the supply bin 13. This mechanism, generally indicated by the legend "bindicator" in Figs. 1 and 7, consists of a pressure responsive diaphragm 57 controlling a switch 58 mounted on the side of the supply bin 13. When the level of material in the bin 13 is high enough to insure that it will not be exhausted during the filling of a single bag, pressure of the material holds the diaphragm 57 in its outward position and holds the switch 58 open. When, however, the material in the bin 13 falls to a level such that insufficient remains to fill more than one bag, the diaphragm 57 flexes inwardly and closes the switch 58. This establishes a circuit leading from the power line L2 through a line 59 to the switch 58, from the switch 58 through a line 60 to a line 61 which leads through a branch line 62 to a "bindicator" signal light 63 and through a line 64 to the line 53 and L2 of the 110 volt power source. The line 61 also leads to a contact C4 of the cycle switch 46. The contact C4, however, is not connected when the cycle switch 46 is set in "hand" position. Whenever the level of material in the bin 13 drops to the point explained above, the "bindicator" light 63 is energized. This indicates to the operator that he should stop the feeder 11 in order to enable him to refill the supply bin 13.

When it is desired to operate the machine under automatic control the cycle switch 46 is rotated to "auto" position. This swings the contactor 55 across between the contacts C4 and C5*a*. This establishes a circuit to be described by means of which the "bindicator" switch 58 automatically presets the machine to stop the opera-

tion of the feeder 11 as soon as the bag then being filled is completed. When the level of material in the bin 13 falls and the switch 58 is closed this circuit is established as follows: From L2 through the line 59 to the switch 58, the lines 60 and 61 to the branch line 62 and to the contact C4; the circuit then splits (1) through the branch line 62 and "bindicator" signal light 63 and the lines 64 and 53 to L1 of the power source and (2) through the contact C4, contactor 55, contact C5*a*, lines 45, 47 and 48 to the scale lock switch 33 and lines 49 and 50 and 51 to the "stop feeder" relay 39 and the lines 52 and 53 to L1 of the power source. Whenever the level of material in the bin 13 falls the "bindicator" signal light 63 is illuminated and the circuit is automatically preset so that upon the next successive closing of the scale lock 33 (upon the filling of a bag) the feeder 11 will automatically be stopped.

Under "auto" setting of the cycle switch it is impossible for the operator to stop the feeder except when the scale is locked, which situation exists only during the initial settling period of a filling cycle. Since the weighing apparatus is not effective at this time, stopping the machine and the consequent "over-run," due to inertia of the parts, does not introduce an error into the bag weight.

The cycle switch 46 has a third, central, position carrying the legend "off." In this position the contactor 55 bridges contacts C5*a* and C5*b* and the contactor 56 bridges between the contact C6*b* and a contact C2 connected to the line 44 leading to L2 of the power source. This fixes a circuit from L2 through the line 44, contact C2, contactor 56, contact C6*b*, the branch line 65, lines 50 and 51, "stop feeder" relay 39 and lines 52 and 53 to L1. With the cycle switch 46 set in the "off" position the stop feeder relay 39 is energized and cannot be de-energized. This holds the normally closed contacts 38 open and prevents the feeder motor 12 from being energized by closing the "start feeder" switch 37. Under these conditions the feeder motor 12 cannot be started unless the operator deliberately swings the switch 46 to the "hand" or "auto" positions.

By means of the electrical apparatus embodying the invention in that portions thereof which have been so far described, the operation of the bag filling machine and its weighing sub-assembly are interconnected with and related to the control of the packer 10 and feeder 11 and the supply of material in the bin 13. The machine and its weighing mechanism also are interconnected through the apparatus of the invention to the shifting solenoid and "settler" and to the beam actuated microswitch 29 with means for testing the proper setting of the weight adjusting poise 28 (Figs. 1 and 4) and correcting the setting for variations in the rate of feeding of the material being bagged.

As earlier described and as shown in more detail in Figs. 4 and 8, the poise weight 28 is adjustably positionable upon a poise beam 26 mounted by a pivot and bearing 66 near an accessible upper part of the machine and connected by the thrust frame 27 to the scale lever 23, the thrust frame 27 resting upon a pivot and bearing 67. The thrust frame 27 is supported on the pivot and bearing 67 on the same side of the main pivot and fulcrum bearing 24 as the bag rest 20. Therefore when the poise weight 28 is moved to the right (Figs. 1, 4 and 8) a lesser quantity of material in a bag will swing the scale lever 23 to actuate the switch 29. Conversely, when the poise 28 is moved to the left, a greater weight of material in a bag is required to actuate the scale beam microswitch 29. By properly setting the poise weight 28 it is thus possible to pre-select the particular weight at which the scale beam microswitch 29 will be closed to energize the relay 30 to close its normally open shifting solenoid contacts 68 (Fig. 7) and actuating the shifting solenoid.

A change in the weight at which the scale beam microswitch 29 will be closed is required by a variation in the flowability of the material being packed and a resulting change in the pounds per second which are fed into the bag by the packer. In operating a high speed bag filler without apparatus embodying the instant invention, an operator has to check weigh a filled bag before he can determine whether or not the poise weight 28 is properly set to initiate the nozzle shifting operation at the proper point. He must then guess as to the degree of change necessary in the position of the poise weight 28 to compensate for the error in the weight of the tested bag. This is necessary not only at the start of each day's work and at the beginning of a new batch of material but it is also necessary during the course of bagging a single batch of material because of differences in the flowability of different portions of the same batch. Even where such bag checking is resorted to and, of course, it requires that the machine be stopped during the bag checking since only 3½ to 4 seconds is required to fill a single bag, it has been almost impossible for skilled operators to produce more than 85 to 90% acceptable bags. The special labor and special handling required for the bags which are out of weight is so high that most baggers do not even attempt to insure the accurate weight of their bags.

Apparatus embodying the invention includes means for checking the operation of the bag packer at any desired time while continuing its operation and also providing means for indicating the setting of the poise weight 28 in order to correct for such variations as may have occurred in the flowability of the material being packed. Both of these operations can be performed while the bag packing cycle continues and both are tied in with the machine to minimize human errors. The sensing and control mechanism incorporates a constant speed timer clock generally indicated at 69 in Fig. 7. In the embodiment of the invention illustrated in the drawings this timer clock runs at a constant speed of 25 R. P. M. and bears 12 major indicia arranged around an indicia ring 70 in a clockwise manner. As appears in Fig. 4 the beam 26 also has a series of indicia 71 from 0 to 12 reading from right to left in that figure and corresponding to the indicia on the indicia ring 70.

The value in pounds of material of the indicia 0–12 on the poise beam 26 depends, of course, upon the setting of the main counterweight of the scale (Figs. 1 and 4) which is carried on the main beam 25. If the machine is being operated to pack bags of 80 pound net weight and the material is of such nature that the packer feeds from, say, 16 pounds per second to 25 pounds per second, depending upon its flowability, it is necessary to provide for variations in scale microswitch actuation weights of some 67 to 72 pounds. It is to be remembered, of course, that the difference between the desired weight of 80 pounds and the scale beam microswitch actuation weight is one half of the rate of the feeding per second. Under these circumstances the indicia 0–12 both on the scale poise 26 and the indicia ring 70 correspond to the range from 67 to 72 pounds.

Two circuits for operating the timer clock 69 are provided. One circuit which may be called the "reset" circuit is controlled by a reset switch 72 which is connected between a line 73 leading to L1 of the 110 volt power source and a line 74 connected to the driving motor of the timer clock 69 which in turn is connected by a line 75 to L2 of the 110 volt power source. Closing the reset switch 72 energizes the motor of the timer 69 so that an operator can reset it to zero. A lock-in type "run" switch 76 is connected in parallel to the reset switch 72 between the line 74 and a line 77 that is in turn connected through normally closed contacts 78 of the relay 30 to L1 of the power source. The "run" switch 76 has a second pair of contacts 79 conventionally connected in series with a solenoid 80 actuating its lock-in mechanism so that the switch 76 is locked when it is closed and remains closed as long as the normally closed contact 78 of the relay 30

remains closed. A "shifting signal" light **81** is connected in parallel with the relay **30** to indicate its actuation.

If it is assumed that the bagging machine has been operating for some period of time, the poise weight **28** will be set somewhere on the beam **26** so that the scale beam microswitch **29** is closed upon the reaching of a weight of material in a bag such that the material fed during the ½ second shifting cycle will "top off" the bag to within the desired tolerance of the total weight to be packed—say, 1 pound in 80 pounds. To simplify further consideration it is assumed that the machine has been operating at a rate of 16 pounds of material per second. Under these conditions the poise beam **28** would be set to counterbalance 72 pounds of material so that the nozzle shifting solenoid would be actuated at 72 pounds and 8 pounds would be "topped off" into the bag in the ½ second shifting cycle. The poise **28** would be located at "12" in the series **71**.

If a new batch of material were now made available in the material bin **13** it would be necessary for the operator to determine whether on not the machine is properly packing this new material. In order to check this fact the operator closes the timer clock reset switch **72** and drives its indicator around until it reaches the "0–12" indicium. He then initiates the shifting cycle by depressing the scale with his foot as explained above until the scale beam microswitch **29** is closed. When the microswitch **29** is closed this establishes a circuit from **L1** through the line **73**, the microswitch **29**, a line **82** and, in parallel, through the shifting signal light **81** and the coil of the relay **30** to **L2**. This closes the normally open contact **68** to actuate the shifting solenoid and the settler timer as earlier described and opens the normally closed contacts **78** of the relay **30** allowing the "run" switch **76** to drop out. Illumination of the signal light **81** signals the operator to close the run switch **76** which he does. This starts the operation of the timer **69**. The material starts to feed into the empty bag and continues feeding during the 2½ second "settling zone" (Fig. 3) and through the "drift zone" and "weigh zone" until the weight of 72 pounds (previous setting of poise weight **28**) is reached. When the scale beam microswitch **29** is closed again, by reaching this preset weight, the circuit through the relay **30** is established which breaks the contact **78** dropping the run switch **76** and stopping the clock **69** at the time the shifting solenoid is energized. The clock **69** has thus measured the time necessary to fill the bag to a weight sufficient to actuate the scale beam microswitch **29**.

Under the conditions mentioned with the scale set to react at 72 pounds if, for example, the new batch of material is of such flowability that it feeds at 24 pounds per second, the scale beam microswitch **29** will close 3 seconds after the cycle is initiated (72 pounds divided by 24 pounds per second). Since ½ second is required to complete the shifting cycle, 12 additional pounds of material will be fed into the bag before the nozzle **19** is shifted away from the spout to which it has been connected. The bag will then contain 84 pounds of material.

The operator then looks at the indicator of the timer **69**. Since the timer **69** operates at 25 R. P. M. one complete revolution consumes 2.4 seconds. During the 3 second period of operation (72 pounds at 24 pounds per second) the pointer will have made one complete revolution and will have reached the indicium 3. It should be observed that the indicia in the series **71** on the beam **26** are not evenly spaced along the beam **26** but each indicium of higher value is spaced a lesser distance from the preceding indicium. In Fig. 8 the legend "corresponding weight in pounds" carries arrows showing locations along the beam where the weights 67 to 72 pounds are located. As will be explained below, while the spacing of the weight positions is uniform, the indicia spacing is not. The indicia in the series **71** are spaced over 12 positions on a decreasing scale from a relative distance of 1.0 between "0" and "1" to a relative distance of 0.6 between "11" and "12." As a result the indicia and weight relationships are approximately as follows:

Table 1

Indicium	Spacing From "0"	Weight in Lbs.
0	0	67
1	1.0	67.52
	1.9219	68
2	1.964	68.02
3	2.8914	68.51
4	3.7825	68.97
	3.8438	69
5	4.6373	69.41
6	5.4558	69.84
	5.7657	70
7	6.2380	70.25
8	6.9839	70.74
	7.6876	71
9	7.6935	71.01
10	8.3668	71.36
11	9.0038	71.69
12	9.60	72

The operator then slides the poise weight **28** to the corresponding indicium 3 in the series **71**. Moving the poise **28** to the right to reach the indicium 3 reduces the weight of material necessary to be filled into the bag in order to close the scale beam microswitch **29**.

Referring to Table 1 above, it is seen that the indicium "3" corresponds to a weight of 68.51 pounds.

Upon the second cycle of operation with the poise weight **28** set at the indicium 3 (68.51 pounds) and feeding at the new rate of 24 pounds per second, the scale beam microswitch **29** will be actuated when 68.5 pounds of material have been fed into the bag being filled and 12 additional pounds will be fed into the bag during the "shift zone" (Fig. 3) making a total weight of 80.5 pounds of material in the bag. This figure is within the acceptable tolerances for the packing of bags of this type.

If the change in conditions were again from one extreme to the other, but in the direction opposite to that just described, i. e., if the scale previously had been feeding at 24 pounds per second and the poise properly located at indicium 2 (68.02 pounds) and the rate now changes to 16 pounds per second, the following conditions result. A test at 16 pounds per second would show 4.25 seconds to fill the bag to 68 pounds. 4.25 seconds on the timer equals one revolution (2.4 seconds) plus 1.85 seconds or an indication of

$$\frac{1.85}{2.4}\times 12=9.25$$

Reference to the table above reveals that indicium 9.25 corresponds to slightly more than 71 pounds.

Moving the poise **28** to 9.25 pounds, therefore, results in feeding 71 pounds plus 8 pounds (½ second shifting time at 16 pounds per second) or a total of slightly more than 79 pounds into the bag—again within the tolerance.

The mechanism of the invention thus enables an operator to test and to correct the setting of the poise weight **28** for fluctuations in the flowability and thus the pounds per second packed by the machine.

If at any time during the operation of the machine the operator suspects that the specific gravity or other characteristics of the material have changed, it is a simple matter for him to close the run switch **76** the next time the signal light **81** is energized and to run a test on the timer **69**. As soon as the timer stops he can then check his indication against the poise weight **28** and if there has been any change in the characteristics of the material and thus the rate of feed, the disparity between the indication on the clock **69** and the setting of the poise weight **28** will be apparent and can be corrected.

I claim:

1. Control apparatus for a high speed bag filling machine having mechanism for feeding material to be bagged alternately to either of two filling spouts and including a

nozzle shiftable therebetween, weighing scale mechanism for supporting a pair of bags beneath said spouts in position to be filled, and including movable poise means for setting a weight at which said weighing mechanism responds, mechanical means for settling the material being fed into a bag for a predetermined period of time at the beginning of a filling cycle, and a lock for said weighing mechanism that is locked by and during the operation of said settling means, said apparatus comprising, in combination, a control for said feeding mechanism, a disabling switch for said feeding mechanism control that is closed only when said scale is locked, a scale switch closed by the response of said weighing scale mechanism and electrical means connecting said scale switch to said shiftable nozzle and to said settling mechanism for starting a filling cycle for a second bag.

2. Apparatus according to claim 1 in which the electrical means includes a switch actuated upon approach of material supply to exhaustion and which establishes a machine disabling circuit under the control of said scale switch.

3. Control apparatus for a high speed bag filling machine having mechanism for feeding material to be bagged alternately to either of two filling spouts and including a nozzle shiftable therebetween, weighing scale mechanism for supporting a pair of bags beneath said spouts in position to be filled, and including movable poise means for settling a weight at which said weighing mechanism responds, mechanical means for settling the material being

fed into a bag for a predetermined period of time at the beginning of a filling cycle, and a lock for said weighing mechanism that is locked by and during the operation of said settling means, said apparatus comprising, in combination, a control for said feeding mechanism, a disabling switch for said feeding mechanism control that is closed only when said scale is locked, a scale switch closed by the response of said weighing scale mechanism, electrical means connecting said scale switch to said shiftable nozzle and to said settling mechanism for starting a filling cycle for a second bag, and a timer that is controlled by said scale switch for measuring the feeding rate of the machine on the particular material being fed.

4. Apparatus according to claim 3 in which the timer indicia and the poise positioning indicia on the poise means are corresponding whereby said timer provides control for poise setting according to machine operation with any particular material being fed.

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