

Oct. 28, 1941.

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2,260,302

MEANS FOR FILLING AND PACKING

Filed Nov. 10, 1937

2 Sheets-Sheet 1

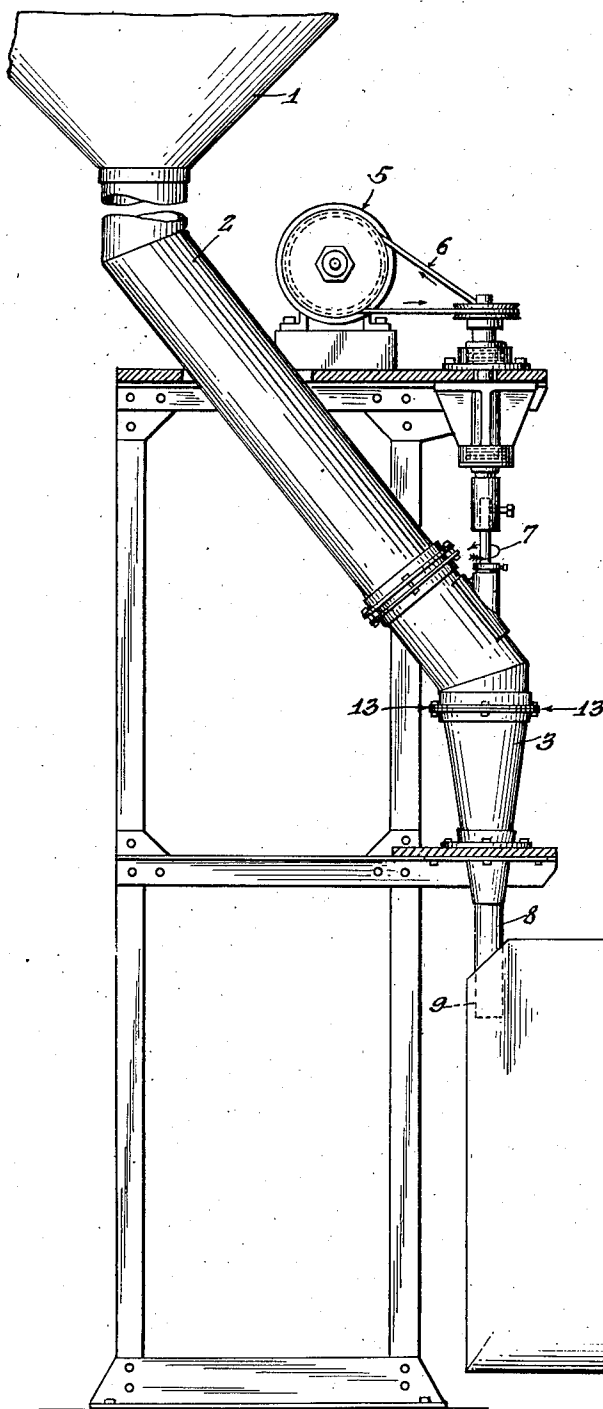


Fig: 1

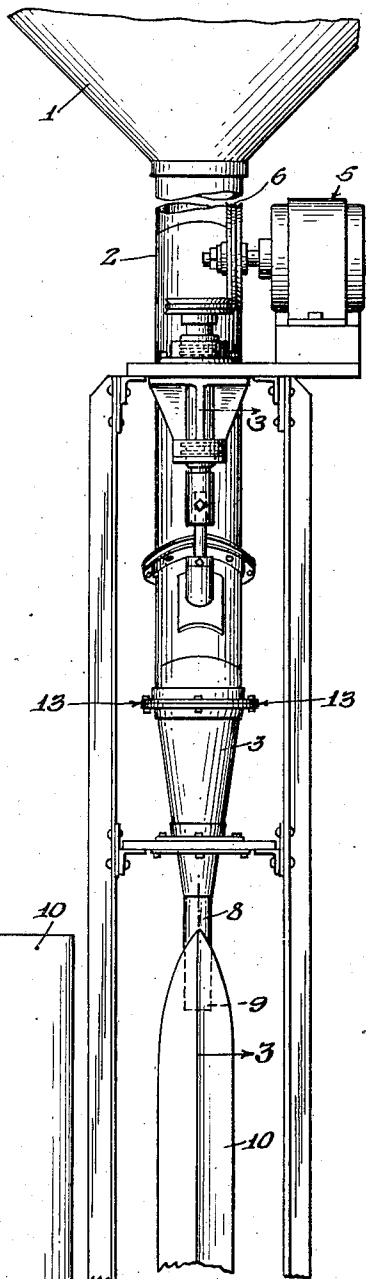


Fig: 2

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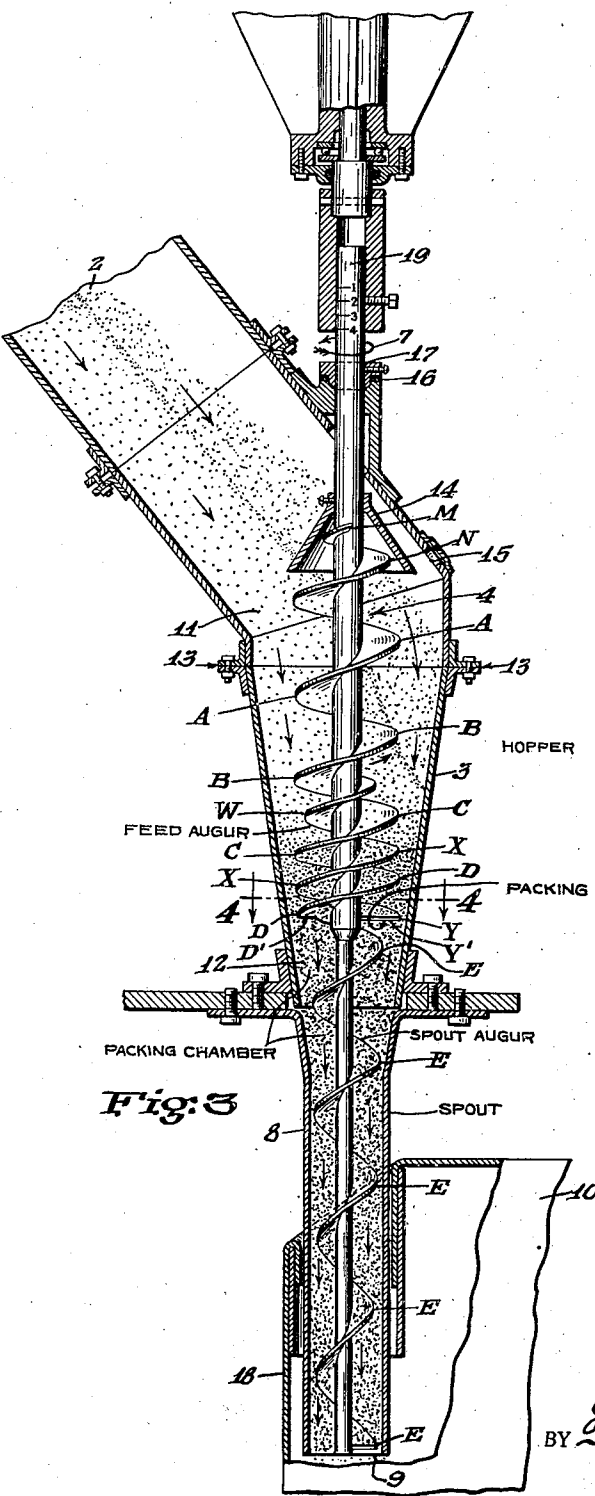


Fig. 3

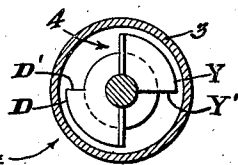


Fig. 4

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UNITED STATES PATENT OFFICE

2,260,302

MEANS FOR FILLING AND PACKING

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Application November 10, 1937, Serial No. 173,894

9 Claims. (Cl. 226—48)

This invention relates to machines for filling and packing containers, bags or casings with granular material such as beet pulp, cyanamid, zinc oxide, bran, granulated cork, oat hulls, grains of all kinds, and, generally, any "free" or "semi-free" material which may be caused to flow through a supply pipe.

Heretofore, it has been found exceedingly difficult if not impossible to speedily fill a bag or container having a relatively small opening by means of an augur-type filling device. In order to obtain packing speed with a machine of this type, it is at present necessary to use a wide-mouthed bag and an augur of such diameter and size that the entire top of the bag must be left open for filling purposes. This necessitates a separate sewing or other closing operation upon the bag after it is filled, and requires that the bag have sufficient excess or waste material to permit the folding over for sewing or other closing operation. The use of a pre-sewn bag which has a relatively small opening which may automatically or readily be closed, such as the Bates valve bags described in Patents Nos. 810,318 and 907,557 (issued Jan. 16, 1906, and Dec. 22, 1908, respectively) would be a distinct advantage in that it saves the added work required in the operation of sewing or tying the bag closed after it is filled.

Accordingly, an object of our invention is to provide a machine of the augur type which may fill and pack with speed through a small opening and may thus be used in connection with bags of the type generally described as "pre-sewn."

Since, heretofore, the use of augur-type filling machines were found to be disadvantageous for packing pre-sewn bags, it has been necessary to use for such purpose machines of the rotary type such as the "Bates Packer." In any such means of filling a pre-sewn bag thus far used, it is found that the material filled is aerated to such an extent that within a short period after filling, the material filled has settled when the air has seeped out. Owing to this condition, it is now necessary to use bags much larger than are ultimately required so that the bag may have full weight at the time of packing. After settling has occurred and the air has escaped, there may be as much as six to eight inches of waste space at the top of a one hundred pound bag. Aside from the added expense incurred in the use of a larger bag,—in such pre-sewn bags as have a closure which is maintained by the pressure of the contents of the bag upon the

closure, the waste space created by the escape of air from the bag permits a relaxation of pressure upon the closure and a consequent "dusting out" of the contents of the bag.

- 5 A further object of this invention therefore, is to provide a machine for filling and packing bags of the pre-sewn type above described at a speed at least approximately equal to that of other filling or packing machines, but which will nevertheless pack in such a manner that the material will not be aerated and will be packed solidly thus leaving no waste space, making it possible to use a smaller and less expensive bag in the first instance, and creating a condition
- 10 which will prevent "dusting out" of the contents of the bag.

- Heretofore, it has been found that the packing speed of a filling machine of the augur type is limited to the extent that the machine loses efficiency and packing speed when the augur rotates at a speed greater than 500 to 1000 R. P. M., different machines beginning to lose their efficiency at different points within this range. Where the augur speed is greatly increased, it is found that the material merely lays up against the augur and does not enter its vanes for speedy transmission downwards into the bag. Owing to this fact, it is necessary, in order to obtain speed with an augur-type machine, to pack in large volume; and the augur of such machine is made of such a size that the entire top of the bag must be left open to permit the entry of material from the augur. This, of course, requires that the augur-type packing machine
- 20 be a heavy cumbersome affair with concomitantly greater cost.

- Accordingly, a further object of this invention is to provide a method for filling and packing a bag by means of a relatively small and light augur-type machine in which the augur may be caused to rotate at relatively unlimited speeds, as high as of the order of 2150 R. P. M. and higher. With such speed, we have found that an augur may be made to pack through an opening as small as two inches in diameter, at speeds greater than that of any known augur-type machine and at least approximately equal to that of other types of filling machines. And that such machine not only will pack and de-aerate, but is not limited to exceedingly dry flowable material, but may also pack material which would "tack" or "wad" in a filling machine of the rotary type such as the Bates Packer.

- It is now necessary to build machines of the augur type with specific dimensions and clear-

ances for specific products. An augur machine that will pack one kind of material such as pulverized zinc oxide cannot be used with any efficiency to pack another type such as beet pulp. A particular machine may thus be used advantageously to pack only a particular product.

Therefore, a further object of our invention is to provide an augur type filling and packing machine which may be readily adjustable for use with diversified materials.

Further objects and uses of this invention will be apparent from the following drawings and specification in which:

Figure 1 is a side elevation of our improved augur type filling and packing machine.

Figure 2 is a front elevation of the machine of Figure 1.

Figure 3 is a sectional view of our machine taken on the line 3—3 of Figure 2.

Figure 4 is a sectional view taken on the line 4—4 of Figure 3.

We have here illustrated the simplest embodiment of our filling and packing machine. The material to be packed is retained in a large container or supply bin, 1. A suitable timed feeding device such as a belt feed conveyor of the conventional type dribbles the granular material, to be packed, into the chute 2 from which such material drops by gravity into the inverted cone 3 striking the augur 4 (Figure 3) angularly at its top and side. A motor 5 (Figures 1 and 2) through a belt drive 6 causes the augur 4 to rotate in a counterclockwise direction indicated by the arrow 7, that being the direction opposite to that in which the vane of the augur descends. The material is packed down by the augur 4 toward the bottom of the inverted cone 3 and is then forced out through the spout 8 to the opening 9.

The foregoing is merely a description of the course of the granular material from the original supply bin into the bag 10. What is far more important is that the invention here shown will fill and pack at much greater speed than machines now commonly known and will do so evenly and smoothly. To effect this result, the augur 4 is to be rotated at a speed of the order of 2150 R. P. M. With such speed, the inverted cone 3, of a particular conformation, becomes absolutely essential; and the relationships between the cone 3 and the augur 4, the clearances and the formation of the vanes of the augur are of the essence.

The material enters the cone at approximately the region 11. At the top of the cone, the clearance between the vane of the augur and the wall of the cone is relatively large, such clearance gradually decreasing toward the bottom of the cone where the clearance is small. Thus, the clearance between the portion A of the vane and the wall of cone 3 is such that the material may flow freely past such portion A, being nevertheless assisted in its downward progress by the down thrust given by the edge of portion A of the vane. The speed of revolution of the augur 4 is such as to permit this slight contact of the material and the edge of portion A of the vane to so increase the rate of flow of the material that the same weight of material entering the cone 3 at region 11 may nevertheless pass at a constant rate of speed to the narrower portion of the cone just below. As the material passes down to portion B of the vane of the augur, the narrowing diameter of the cone causes the wall of the cone to force the material into contact with a greater

area of the surface of portion B of the vane where the downthrust of the vane again compensates for the narrowing of the cone 3 so that the material is now partially compressed and the same weight of material moves at a constant rate of speed in spite of the confined space it must pass through. In the same manner, the material is forced into contact with a still greater area of the surface of portion C of the vane, and is almost solidly compressed at portion D of the vane, where the clearance between the vane and the wall of the cone is one fourth the clearance at portion A of the vane. The function of portions E, E, E of the vane of the augur is then to remove the packed material from the packing chamber 12 through the spout 8 and out of the opening 9 into the bag 10. To assist the packing operation, we have found it advantageous to decrease the pitch of the vane of the augur 4 gradually toward the packing chamber 12 so that the distance between portions B and C of the vane is less than that between portions A and B, and the distance between portions C and D less than that between B and C. We have also found that an additional vane W, X, Y arranged on the augur between portions B, C and D of the main vane assist in packing down the material so that a greater amount of material may be fed into the top of the cone. Since portions E, E, E of the vane must now remove the material which has been compressed and must do so with sufficient speed to prevent material from backing up into the cone, the shaft of the augur 4 is decreased in and below the packing chamber 12 to the smallest diameter consistent with strength so that portions E, E of the vane may have the greatest possible area, and the said portions E, E of the vane are further pitched at the greatest possible angle for swift removal of the material through the spout 8, the pitch increasing toward the opening 9. The clearance in the spout 8 is as small as it is possible to make it without interfering with the rotation of the augur 4. The additional vane, W, X, Y gives not merely added capacity and packing power but also serves to balance the augur during revolution and eliminates the necessity for an additional balancing vane at the bottom of the augur which may interfere with the speed of exit of the material.

It will thus be obvious that the essential consideration here is the combination of cone and augur and the critical relationships between them. The spout 8 and the portions E, E of the vane are merely incidental but useful means for taking away the material as soon as it is packed down. The proper relative dimensions are highly important for the operation of our invention. Thus, at portion A of the vane, the clearance must be wide enough to permit the granular material to be thrust downward as well as to allow room for additional supply. Lower in the cone, the clearances must diminish so that the material will be packed solidly into the vanes, and the width of the tube or exit spout 8 and the pitch of portions E, E of the vane must be such as to permit the reception and carrying down of all material packed down so that the machine will not stall by reason of too little material being taken away from the packing chamber, and it should be such that it will not carry away too much and thus leave a void in the packing area.

For the proper operation of the machine, we have found that all the material should not be thrown down the chute 2 at one time. Sufficient play must be given to the granular material so

that the vane of the augur may act upon it. A too rapid discharge of the material would also clog the supply chute 2. Accordingly, a timed feeding device such as a conveyor belt should be provided between the supply bin 1 and the chute 2 to dribble the material down in such a steady quantity as to enable the vanes of the augur to receive and pass it down at great speed. The dribbling herein described is not intended to mean the slow dripping of material, but a situation in which one hundred pounds of material may fall in a steady flow over a few seconds instead of all at once. We have found that with an experimental model with a spout, 8, two inches in diameter, we have been able to fill and pack materials at speeds greater than heretofore accomplished. Since most packing machines are generally built in such a manner that they have two or three spouts so that an operator may adjust a bag to one spout while the other is filling, capacities are given for such compound machines. With one spout, we have been able to pass five pounds of poultry mash per second; thus, a two spout machine built according to our invention, and of an experimental nature only, can pack as much as 350 one hundred pound bags of poultry mash per hour. And this may be done with a pre-sewn bag, through a two inch opening and in such a manner that the material is not aerated and may thus be packed tightly and will remain tightly packed.

To illustrate the exact relationships of a successful experimental model made according to our invention, Figures 1, 2 and 3 show the exact proportional relationships of the augur, cone and chute of such model, the exit spout 8 of such model being two inches in diameter and the top of the cone on the line 13-13 being five inches in diameter. The economy resulting from the use of such a small machine, which is at least as effective in operation as other filling and/or packing machines, will be apparent. Of course, in larger machines, or different kinds of machines made in accordance with our invention, clearances may be increased; the number and type of feeding, packing and exit vanes may be changed; but they must all be formed in accordance with principles which will now be clear. In every case, the cone 3 must be designed and built to conform with the augur 4, to produce the decreasing clearances toward the packing chamber, to permit a packing of the augur at high speed and the subsequent exit of the compressed material through the spout 8 into the bag 10.

The combination of regulated pre-packing in the bottom of the cone and high speed rotation of the augur is necessary to deliver volume through a small spout adapted to be fitted into a bag of the pre-sewn type with a small opening such as that shown in bag 10 of Figure 3. Indeed, we have found that if the machine is stopped while it is packing and the spout 8 removed, the material packed is seen to be solidly packed into the vane of the augur between the portions of the vanes D and Y and the portion E immediately below, showing the manner in which this invention compresses the material for packing at the entrance to the spout 8. We have also found that the cooperation between the walls of the cone 3 and the augur is illustrated by an experiment in which we applied chalk to the under surface of the vanes of the augur and to the top surfaces as well. We found that, after packing, virtually none of the chalk

was removed from portion A of the vane, only a narrow strip of chalk was removed adjacent to the edge of vane B, vanes W, C and X were progressively polished clean closer to the shaft of the augur, and vanes D, Y and E were polished entirely clean; showing the manner in which the decreasing clearances, between the cone and augur, caused a progressive packing of the material.

When relatively light material is packed, there is a tendency for such material to whirl when striking the portions M and N of the vane of the augur, where such vane tapers off. A very small amount of such material may remain suspended by such whirling action. Placing a shield 14 over such portions M and N of the vane, so that a smooth conical surface is presented to the flowing material around which it may readily flow, prevents such whirling and suspension. After this shield is in place, we found that observation through a small hole at 15 showed the material apparently falling straight down toward the packing chamber. To further prevent leakage and dusting from the machine itself, we provide a felt gasket 16 at the opening 17 through which the augur shaft enters the cone.

As material is ejected under compression and pressure, the bag is filled to capacity and beyond if held to the spout. This eliminates aerating and the consequent settling which produces loosely filled bags and allows a smaller bag to be used, thereby reducing bag cost. As the bag is filled tightly, the contents do not shift or "breathe" when handled; and the added outward pressure of the contents causes the valve 18 or a similar opening in the pre-sewn bag to seal more tightly and further prevent "dusting" and leakage.

In addition, by raising or lowering the augur fractions of an inch, we can adapt the same machine to pack diversified materials. Thus, for freely flowing pulverized material, the augur should be lowered so that the clearances are at a minimum; and for coarse materials, such as beet pulp, the augur should be raised to increase the clearances. At 19, we have shown a means for marking the augur shaft for degrees of coarseness, so that the operator may adjust the augur shaft higher or lower in its mounting according to the gauge of coarseness desired. Other means of automatically raising and lowering the augur and other means of indicating the correct adjustment will be obvious.

In various experiments with the same machine, we have found that we can get speeds at least as great and often greater speeds with many materials than heretofore obtained. Thus, using the same cone spout and augur, we can, with our experimental model, in addition to the figures stated above for poultry mash, pack at the rate of more than 610 ninety-four pound bags of cement per hour or 160 one hundred pound bags of bran per hour,—with a two spout machine. We have also found it possible to pack and compress such materials as asbestos, ground cork and beet pulp.

In addition, since the contents of the bag are to be packed tightly, the valve or other opening of the pre-sewn bag may be made larger, thus permitting even a larger exit spout, a machine of correspondingly increased capacity, and a greater filling speed.

Many other objects and uses of our invention will now be apparent to those skilled in the art.

Having described our invention, we claim:

1. A machine for packing and filling granular material into a container, comprising in combination a conically shaped chamber having a wall so arranged that its diameter decreases toward the base thereof; an auger extending along the axis of said chamber, the clearance between the wall of said chamber and the auger gradually decreasing toward the base; means for rotating the auger in a direction opposite to that in which the vane descends; means for creating a steady flow of material into the top of said chamber, the rotation of the auger and the said decreasing clearance forcing said material into said auger; said auger in its rotation compressing the material toward the base of said chamber; and means for removing said material from the base of said chamber, the pitch of the said auger decreasing toward the base of said chamber, and said auger having an additional vane interpolated between the spirals of its main vane in that portion of the auger immediately above the base of said chamber, said decreased pitch and interpolated vane assisting in further compression of the material.

2. A machine for packing and filling granular material into a container, comprising in combination a conically shaped chamber having a wall so arranged that its diameter decreases toward the base thereof, an auger extending along the axis of said chamber, the clearance between the wall of said chamber and the auger gradually decreasing toward the base; means for rotating the auger in a direction opposite to that in which the vane descends; means for creating a steady flow of material into the top of said chamber; the rotation of the auger and the said decreasing clearance forcing said material into said auger; said auger in its rotation compressing the material toward the base of said chamber; and means for removing said material from the base of said chamber, said means comprising a spout immediately below the base of said chamber, the said auger extending into said spout, the pitch of the said auger being increased in said spout to assist in rapid removal.

3. A machine for packing and filling granular material into a container, comprising in combination a conically shaped chamber having a wall so arranged that its diameter decreases toward the base thereof; an auger extending along the axis of said chamber, the clearance between the wall of said chamber and the auger gradually decreasing toward the base; means for rotating the auger in a direction opposite to that in which the vane descends; means for creating a steady flow of material into the top of said chamber, the rotation of the auger and the said decreasing clearance forcing said material into said auger; said auger in its rotation compressing the material toward the base of said chamber; and means for removing said material from the base of said chamber, said means comprising a spout immediately below the base of said chamber, the said auger extending into said spout, said auger having a decreased diameter in said spout, means for raising and lowering said auger; said raising and/or lowering said auger being adapted to adjust the machine to pack materials at the entrance to the spout at differing densities.

4. An apparatus for packing and filling granular material into a container, said apparatus comprising in combination a hopper, packing chamber and a spout; said spout being of a size adapting it for insertion into the valve opening of a

bag; an augur extending along the axis of said hopper, packing chamber and spout; said augur having a reduced diameter in said packing chamber and spout, and a larger diameter in said hopper; said packing chamber being at the lowest extremity of and in communication with said hopper; the portion of said augur in said hopper being diametereed and pitched to feed and pack a predetermined amount into said packing chamber; the vane of said spout augur being filled in said packing chamber; the pitch of said augur being increased downwardly from flight to flight in said spout; said spout and the portion of the augur in said spout being proportioned to have a capacity and speed of ejection substantially equal to the capacity of the feed portion of the augur to fill said packing chamber.

5. An apparatus for packing and filling granular material into a container, said apparatus comprising in combination a hopper, a packing chamber and a spout; said spout being of a size adapting it for insertion into the valve opening of a bag; an augur extending along the axis of said hopper, packing chamber and spout; said augur having a reduced diameter in said packing chamber and spout; said augur having a larger diameter in said hopper; said packing chamber being at the lowest extremity of and in communication with said hopper; the portion of the augur in said hopper being diametereed and pitched to feed and pack a predetermined amount into said packing chamber; the vane of said spout augur being filled in said packing chamber; the pitch of said augur being increased downwardly from flight to flight in said spout; said spout and the portion of the augur in said spout being proportioned to have a capacity and speed of ejection substantially equal to the capacity of the feed portion of the augur to fill said packing chamber; and an adjustment for raising and lowering the augur which varies the cubic dimension of the packing chamber and the compressive action thereof in packing the vane of the spout portion of the augur.

6. An apparatus for packing and filling granular material into a container; said apparatus comprising in combination a hopper, a packing chamber and a spout; said spout being of a size adapting it for insertion into the valve opening of a bag; an augur extending along the axis of said hopper, packing chamber and spout; said augur having a reduced diameter in said packing chamber and spout, and a larger diameter in said hopper; said packing chamber being at the lowest extremity of and in communication with said hopper; the portion of said augur in said hopper being diametereed and pitched to feed and pack the granular material at a predetermined rate into said packing chamber; the diameter of said feed augur being proportioned to meet the requirements of the bulk and density of the material to be packed; said packing chamber being proportioned to compress said material, the vane of the spout augur being filled in said packing chamber with said compressed material at a predetermined rate; means for varying the cubic dimension of the packing chamber and the compressive action thereof in packing the vane of the spout portion of the augur; the pitch of said augur being increased downwardly from flight to flight in said spout; said spout and the portion of the augur in said spout being proportioned to have a capacity and speed of ejection substantially equal to the capacity of the feed portion of the augur to fill said packing chamber.

7. An apparatus for packing and filling granular material into a container, said apparatus comprising in combination a hopper, a packing chamber and a spout; said spout being of a size adapting it for insertion into the valve opening of a bag; an augur extending along the axis of said hopper, packing chamber and spout; said augur having a reduced diameter in said packing chamber and spout, and a larger diameter in said hopper; said packing chamber being at the lowest extremity of and in communication with said hopper; the portion of the augur in said hopper being diametered and pitched to feed and pack a predetermined quantity of material at a predetermined rate into said packing chamber; means for increasing the supply of material to the packing chamber and for balancing and equalizing the pressure of said material in the packing chamber, said means comprising an added vane for the feed portion of the augur interpolated between the flights of the principal vane of said augur immediately above the packing chamber; the vane of said spout augur being packed with said material in its compressed state in said packing chamber; the pitch of said augur being increased downwardly from flight to flight in said spout; said spout and the portion of the augur in said spout being proportioned to have a capacity and speed of ejection substantially equal to the capacity of the feed portion of the augur to fill said packing chamber.

8. An augur apparatus for packing and filling granular material at high speed, said apparatus comprising in combination a hopper, a packing chamber and a spout; said spout being of a size adapting it for insertion into the valve opening of a bag; an augur extending along the axis of said hopper, packing chamber and spout; said augur having a reduced diameter in said packing chamber and spout, and a larger diameter in said hopper; said packing chamber being at the lowest extremity of and in communication with said hopper; the portion of said augur in said hopper

being diametered and pitched to feed and pack a predetermined quantity of material at a predetermined rate into said packing chamber; an added vane interpolated between the flights of the principal vane of the augur immediately above the packing chamber; said added vane immediately above the packing chamber equalizing and balancing the pressure within the packing chamber; the vane of the spout augur being packed in said packing chamber, the material being forced into said vane against the centrifugal force generated by said augur; said spout and the portion of the augur in said spout being proportioned to have a capacity and speed of ejection substantially equal to the capacity of the feed portion of the augur to fill said packing chamber.

9. An apparatus for packing and filling granular material into a container, said apparatus comprising in combination a hopper, a packing chamber and a spout; an augur extending along the axis of said hopper, packing chamber and spout; said augur being of a reduced diameter in said spout and of a larger diameter in said hopper; the spout portion of the augur extending into said packing chamber; the portion of said augur in said hopper being diametered and pitched to feed a predetermined quantity of material at a predetermined rate into said packing chamber; said material being compressed to its greatest density in said packing chamber; an added vane interpolated between the flights of the principal vane of the augur in that portion of the augur immediately above the packing chamber, the pressure upon the material in the packing chamber being thereby equalized and balanced; the vane of the spout portion of the augur being packed with said material in its compressed state in said packing chamber; the spout portion of the augur being adapted to remove said material from said packing chamber.

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