

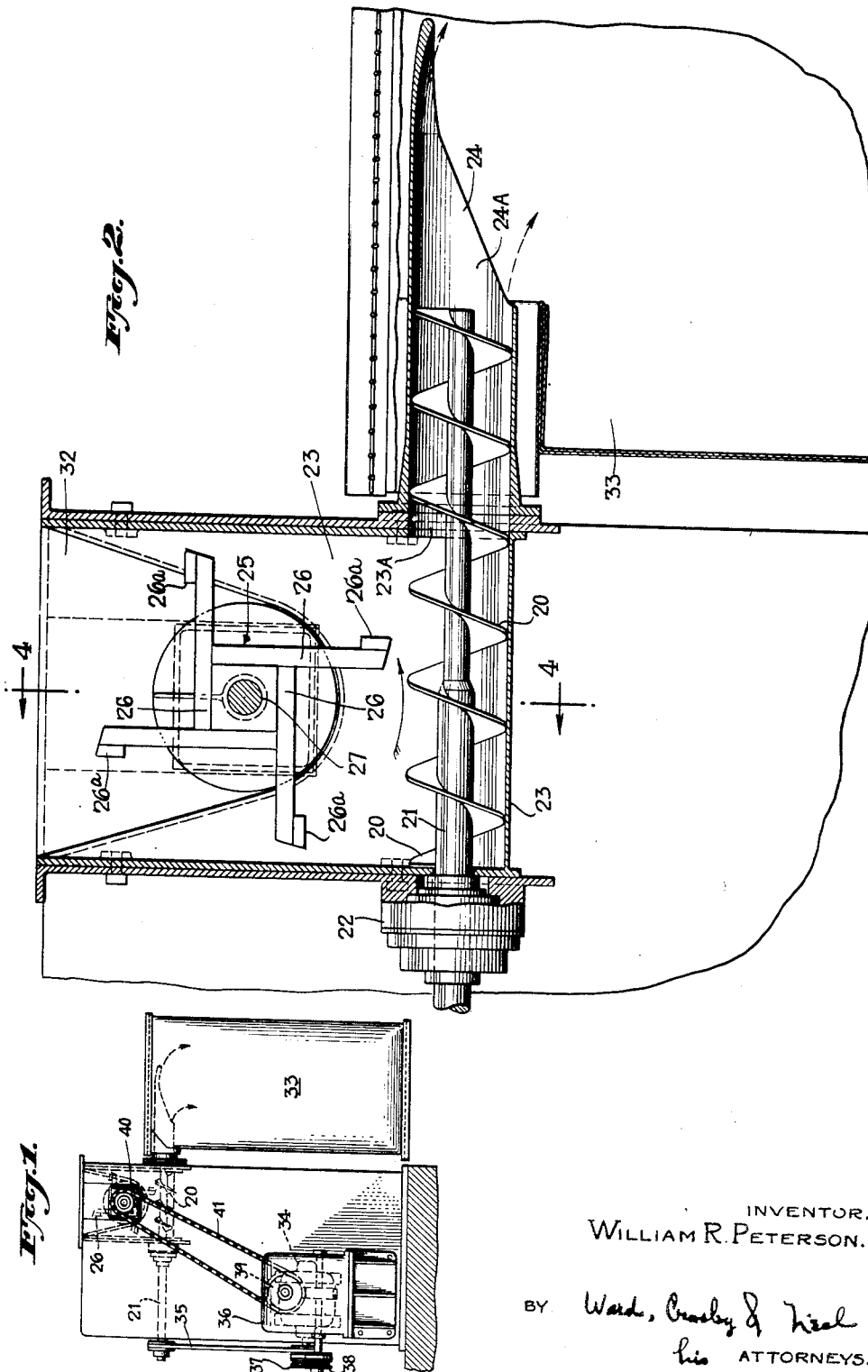
Aug. 24, 1954

W. R. PETERSON
SCREW TYPE FILLING MACHINE

2,687,244

Filed Dec. 15, 1948

10 Sheets-Sheet 1



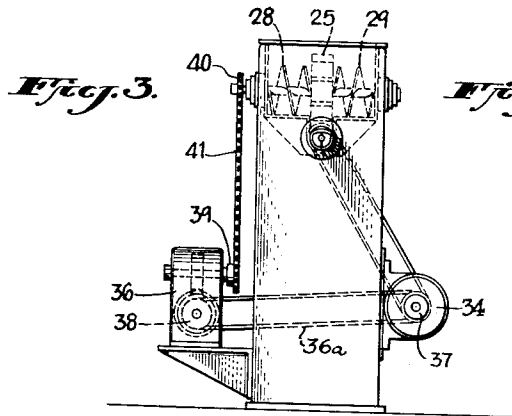
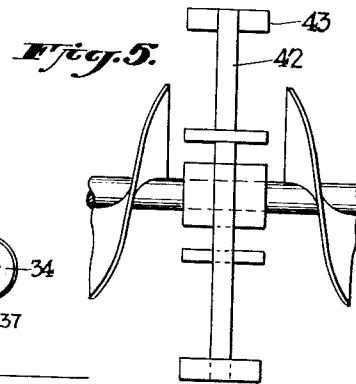
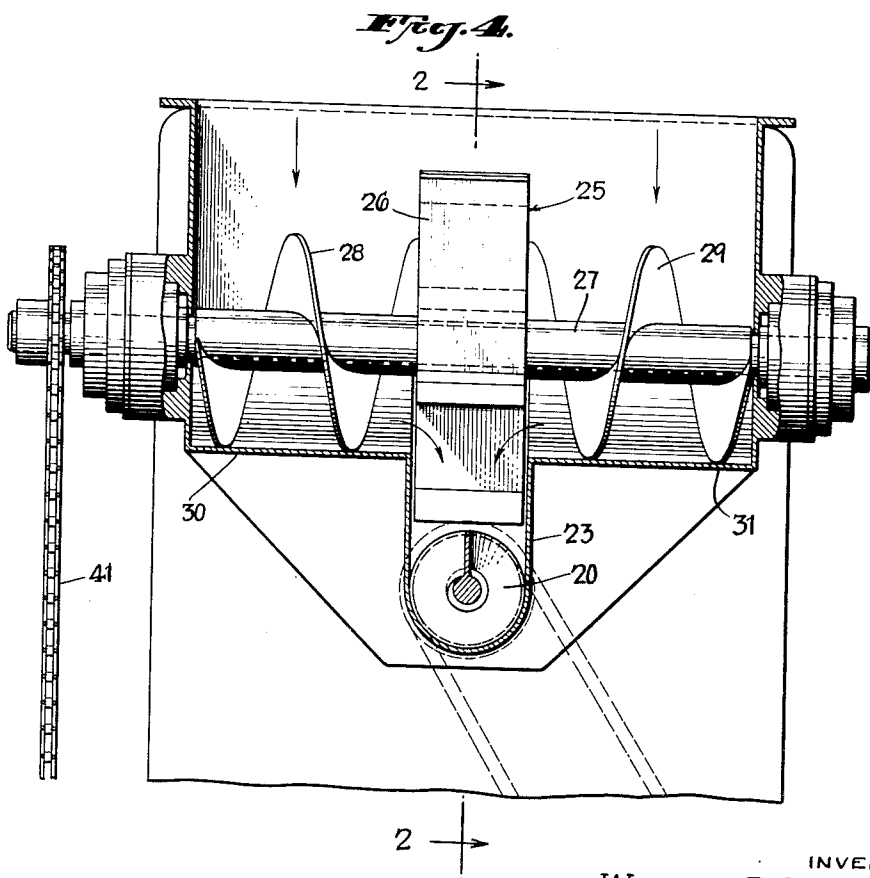
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SCREW TYPE FILLING MACHINE

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10 Sheets-Sheet 2



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SCREW TYPE FILLING MACHINE

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10 Sheets-Sheet 3

Fig. 6.

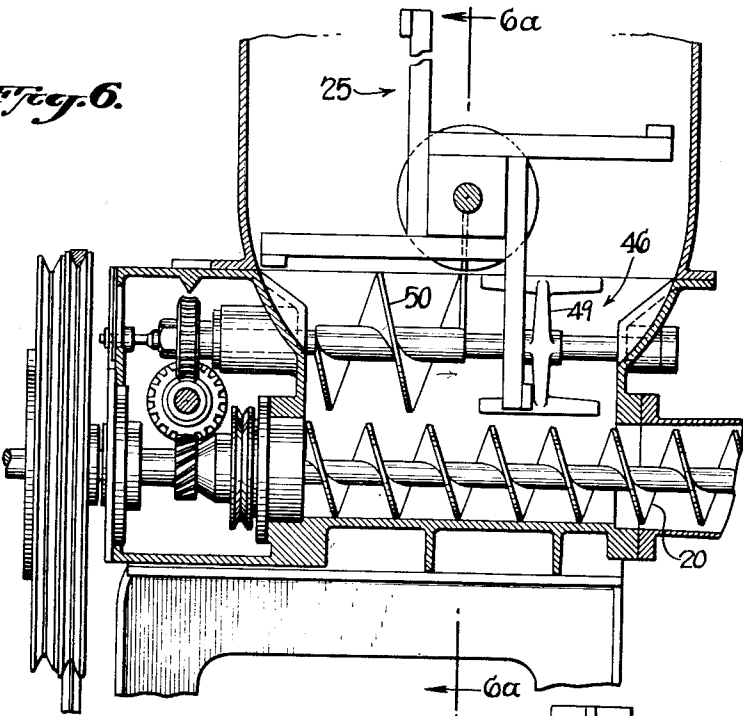


Fig. 6a.

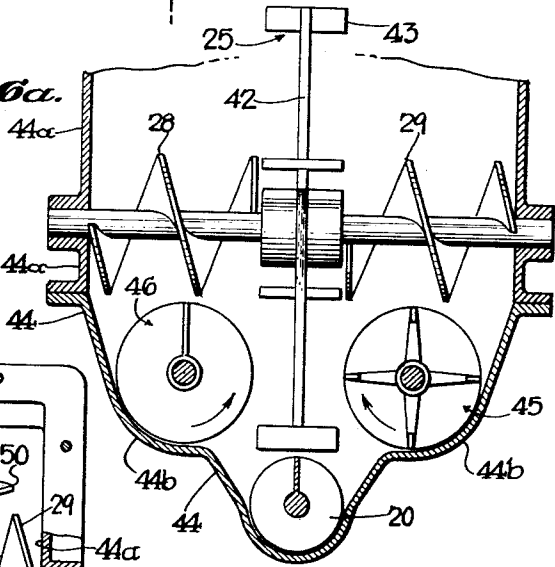
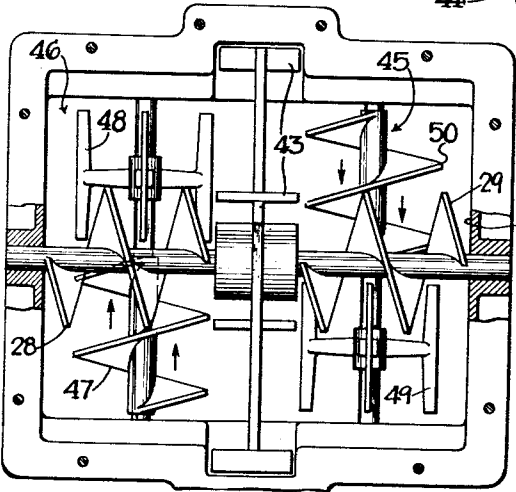


Fig. 7.



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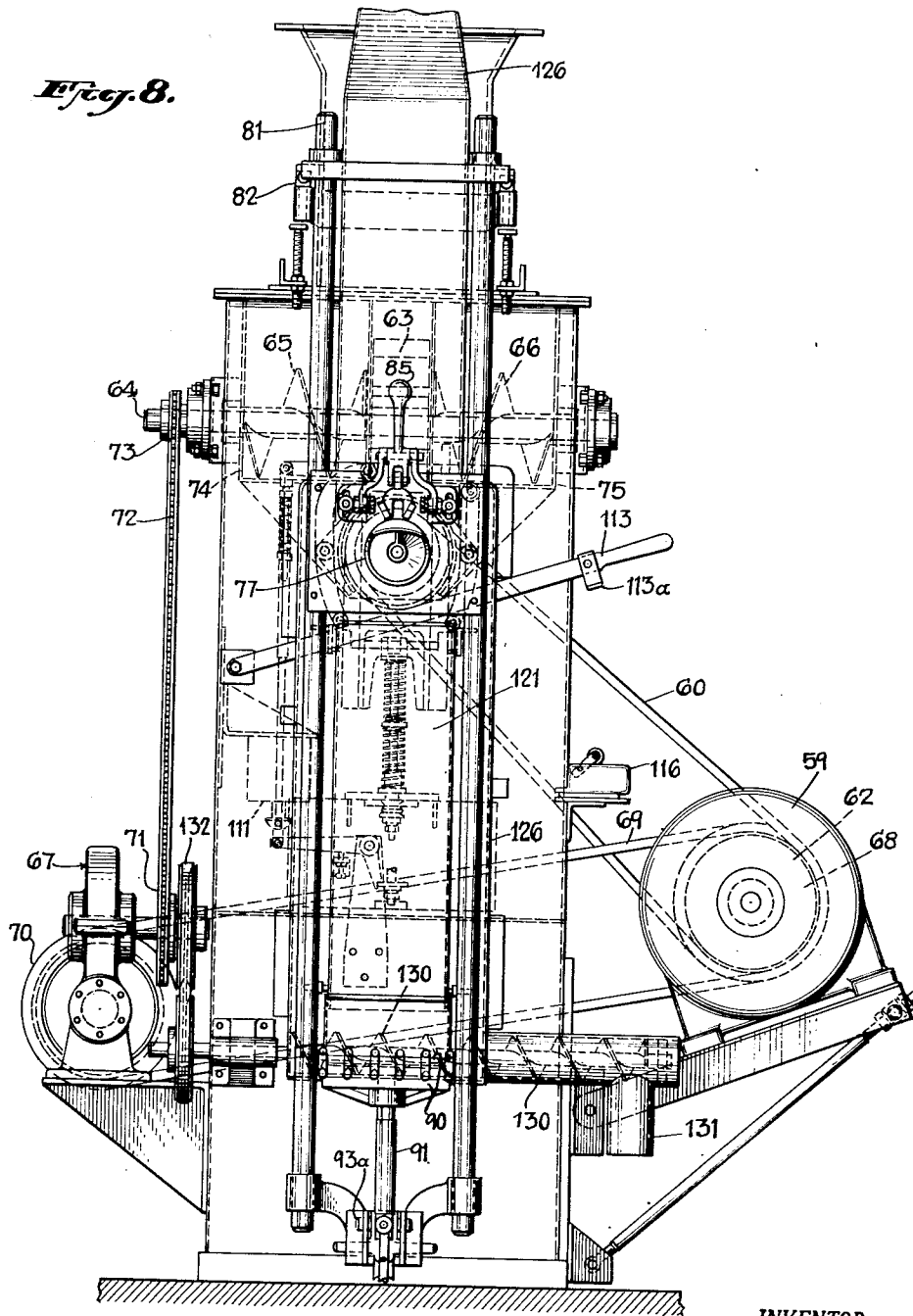
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SCREW TYPE FILLING MACHINE

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10 Sheets-Sheet 4



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SCREW TYPE FILLING MACHINE

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Filed Dec. 15, 1948

10 Sheets-Sheet 5

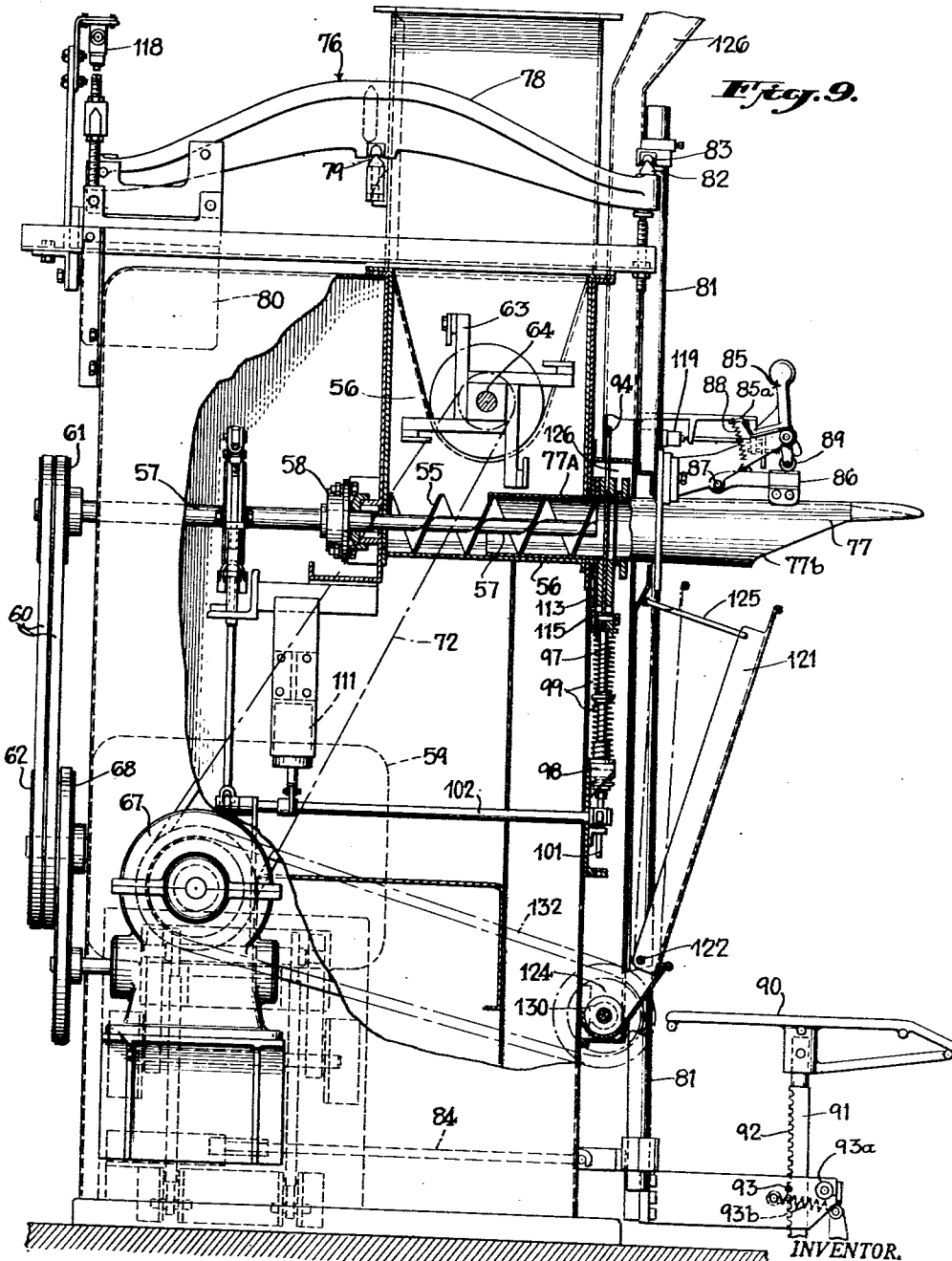


Fig. 9.

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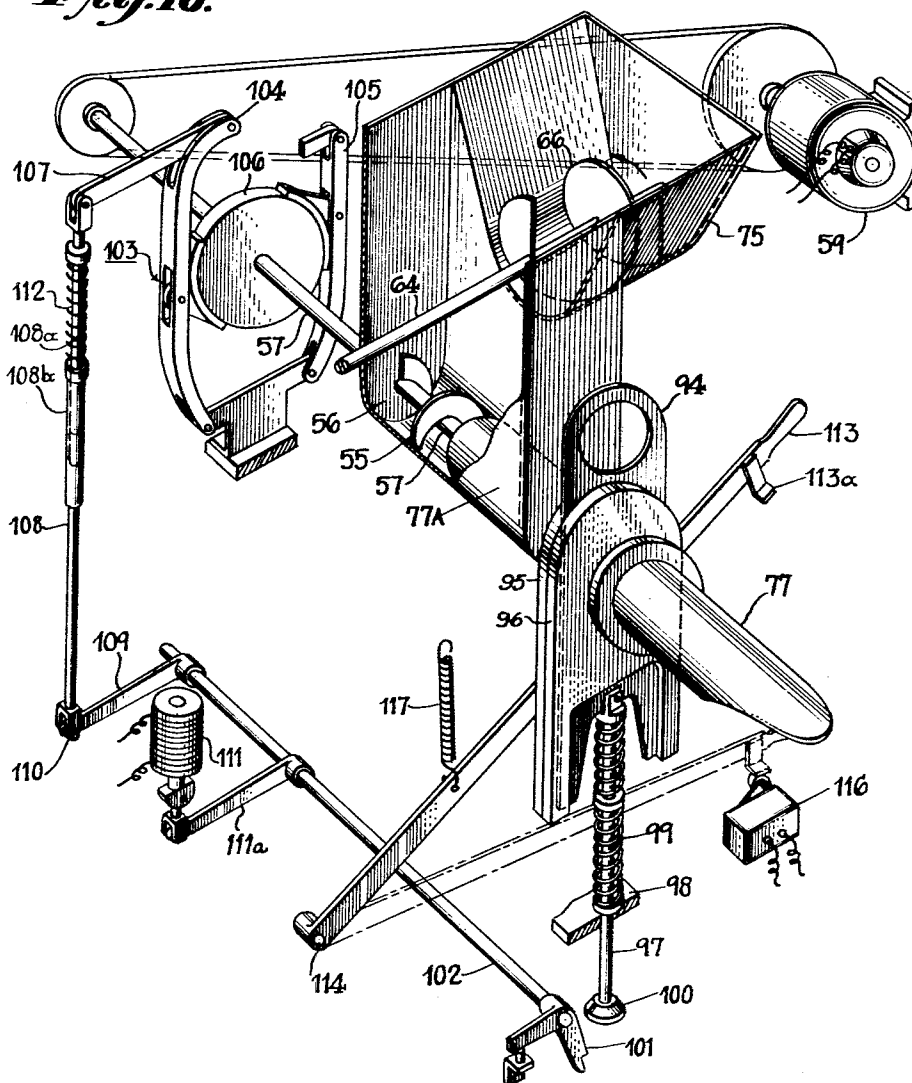
W. R. PETERSON
SCREW TYPE FILLING MACHINE

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Fig. 10.



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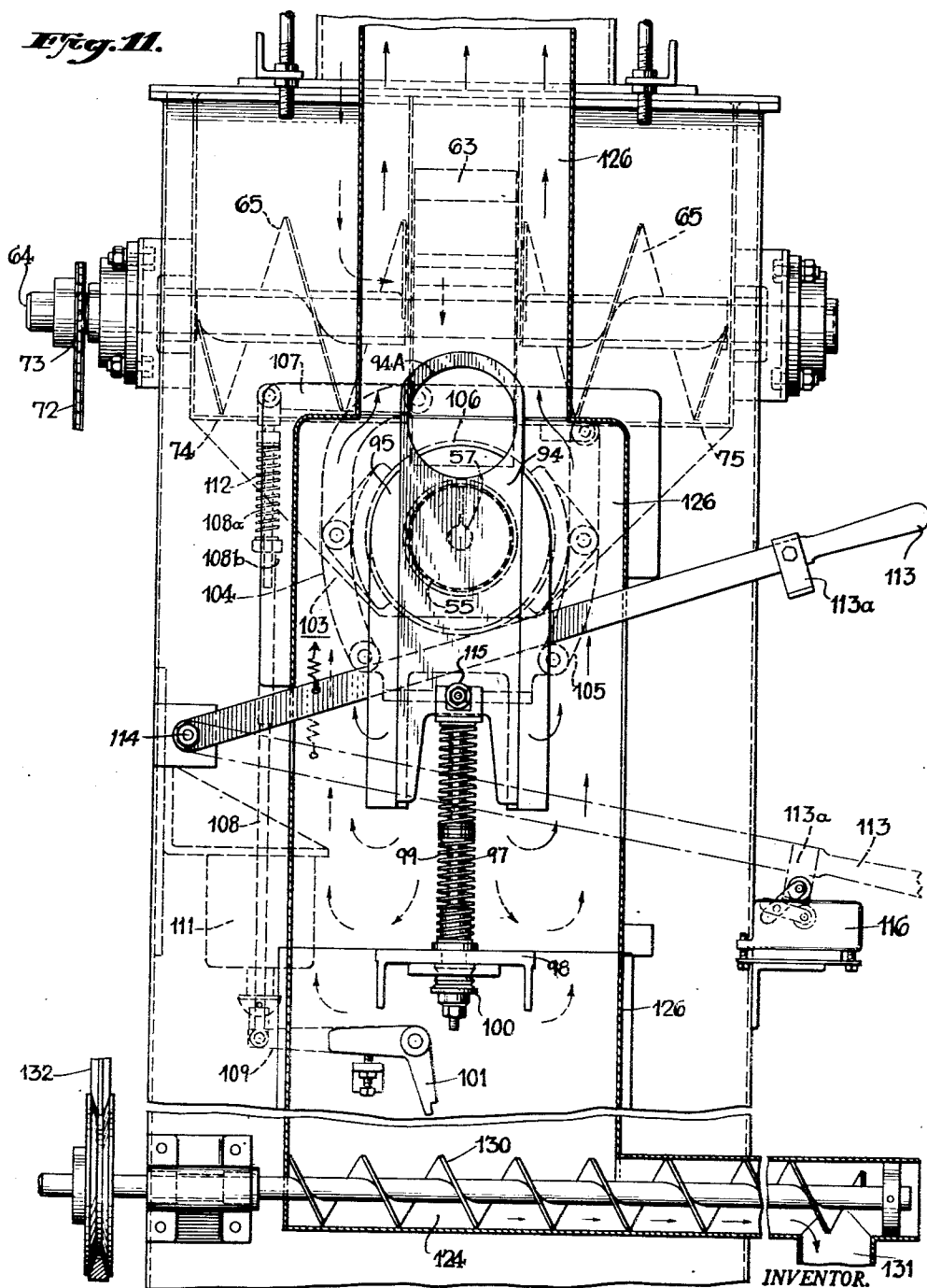
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Fig. 11.

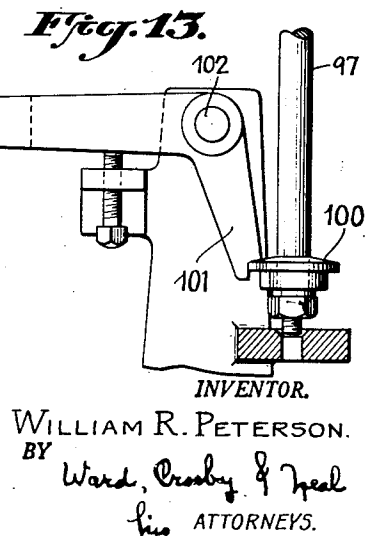


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SCREW TYPE FILLING MACHINE

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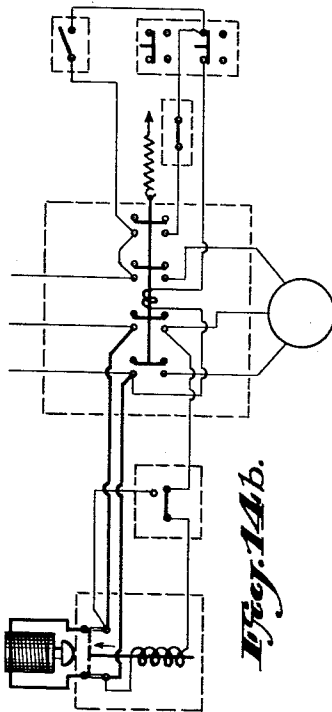
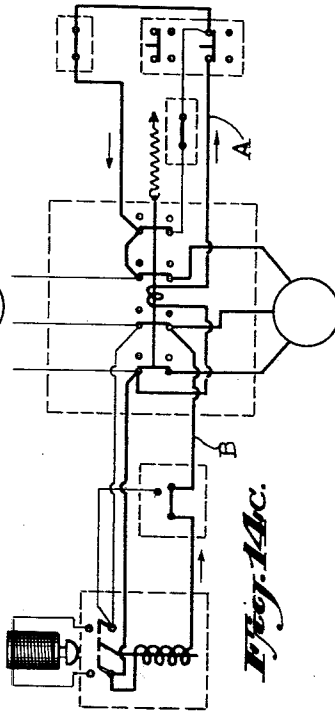
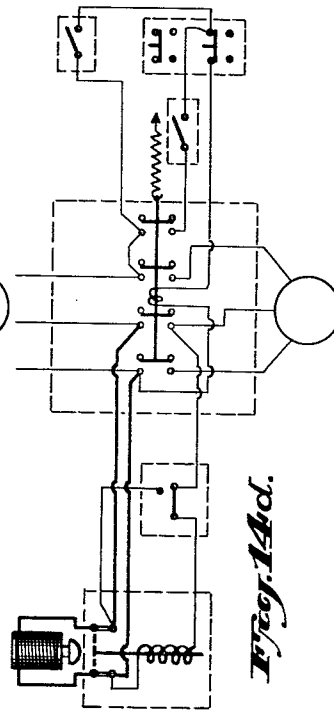
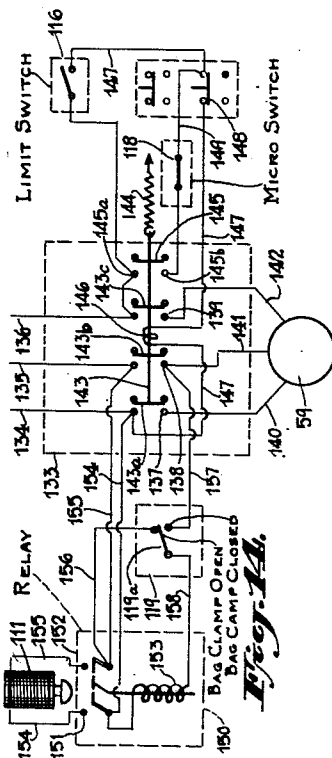
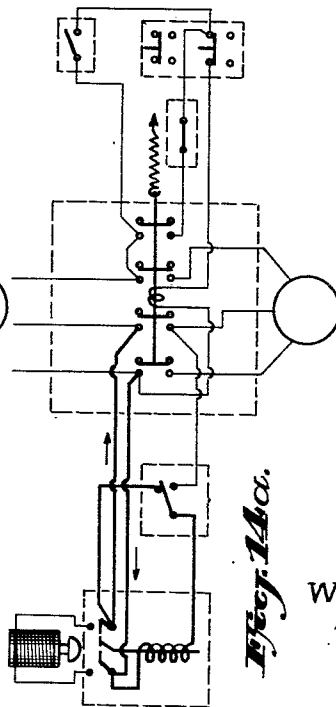
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10 Sheets-Sheet 9



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Fig. 16.

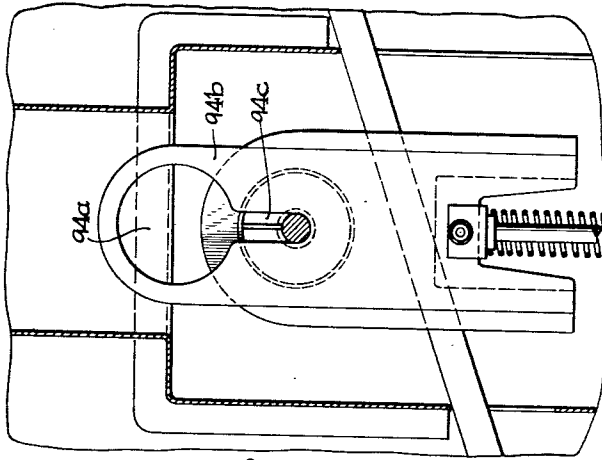


Fig. 15.

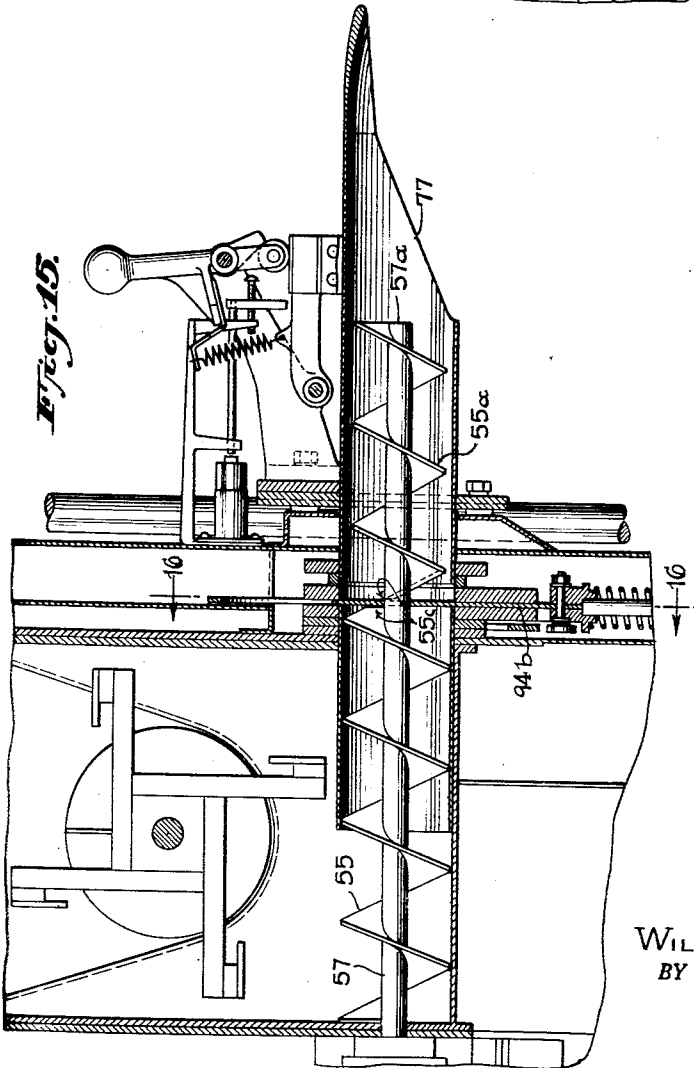


Fig. 18.

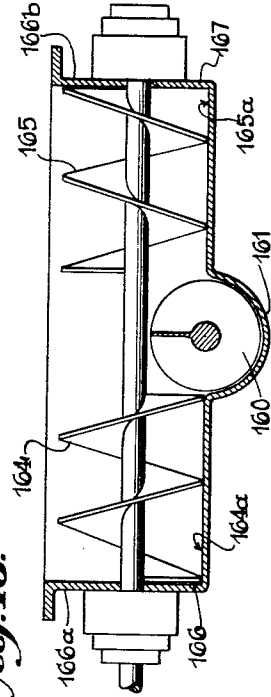
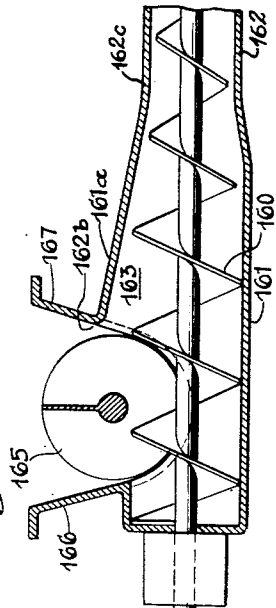


Fig. 17.



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UNITED STATES PATENT OFFICE

2,687,244

SCREW TYPE FILLING MACHINE

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Application December 15, 1948, Serial No. 65,395

10 Claims. (Cl. 226—48)

1

This invention relates to filling machines employing augers or screws for forcing granular or pulverulent material into containers, and more particularly to means for increasing the feeding efficiency of such machines.

The invention in one aspect thereof is constituted by a multi-blade centrifugal impeller used in combination with a filling screw, the centrifugal impeller being adapted for urging material into the spaces between the helical surfaces of the screw to increase the filling efficiency of the latter. Also in combination with the impeller are means for urging material into the spaces between the blades thereof. The filling screw is situated at the bottom of the casing or trough-like device and is in alignment with a filling tube which is adapted for insertion, for example, into the valve of a valve bag. The filling screw may extend partially into the filling tube. The blades of the impeller reach down into close proximity with the filling screw and thus into the trough in which the latter is located, whereby material is forced into the screw under the influence of centrifugal force and by a wiping action of the impeller blades. The efficiency of the filling screw and the volume of material which it is capable of moving is increased to a point not heretofore attained and the output of filled containers per hour, with particular reference to light and fluffy material, is increased many fold as compared to the output of conventional or well known apparatus.

Apparatus which have been suggested in the past for increasing the efficiency of a discharge screw or filling screw for a container filling machine have relied upon mere agitation or upon gravity for urging the material into the screw. However, such apparatus in many instances have proved unsatisfactory with certain types of material, for example of the light fluffy variety, and have been unable to achieve a desirable output of filled containers per unit time.

In the handling of some types of material, particularly of said light and fluffy variety or such varieties which tend to mass and to cling together, many serious problems arise which prior types of filling apparatus have been incapable of overcoming. For example, apparatus suggested in the past for packing such special types of materials have been incapable of attaining a desired high output of filled valve bags per hour, and simultaneously with the filling thereof to weigh each charge of material accurately.

According to the present invention, apparatus is provided for greatly increasing the speed at

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which containers, such as valve bags, can be filled and for eliminating the above-mentioned difficulties.

Various, further and more specific objects, features and advantages of the invention will clearly appear from the detailed description given below taken in connection with the accompanying drawings which form a part of this specification and illustrate by way of example preferred arrangements of apparatus for carrying out the invention. The invention consists in such novel combinations and features of apparatus as may be shown and described in connection with the apparatus herein disclosed.

Fig. 1 is a side elevation illustrating one embodiment of the present invention employed in connection with a valve bag packer;

Fig. 2 is a side elevation of one form of the invention on an enlarged scale with parts broken away and partly in section taken substantially on line 2—2 of Fig. 4;

Fig. 3 is a front elevation of the apparatus shown in Fig. 1;

Fig. 4 is a front view of the novel packing means embodying the invention, the view being partly in section and with parts broken away and taken substantially on lines 4—4 of Fig. 2;

Fig. 5 is a front view with parts broken away of a paddle agitator or centrifugal impeller which can be employed in the present invention;

Fig. 6 is a side elevation partly in section and with parts broken away of a second embodiment of the invention;

Fig. 6a is a sectional view taken substantially on line 6a—6a of Fig. 6;

Fig. 7 is a plan view of the agitator mechanism shown in Fig. 6;

Fig. 8 is a front elevation partly in section and with parts broken away of a filling machine illustrating a third embodiment of the present invention;

Fig. 9 is a side elevation also partly in section and with parts broken away of the apparatus illustrated in Fig. 8;

Fig. 10 is a schematic perspective representation of the novel filling means and certain of its control devices employed in the embodiment of Fig. 8;

Fig. 11 is a view in greater detail of certain of the parts illustrated in Fig. 8, with special reference to the dust collecting and removal means;

Fig. 12 is an enlarged detailed view partly in section and with parts broken away of the bag filling tube, the feed gate and certain related parts as employed in the embodiment of Fig. 8;

Fig. 13 illustrates one form of feed gate latching arrangement which can be employed in the present invention;

Fig. 14 is a schematic representation of a wiring diagram which can be employed for interconnecting the electrically operable parts of the invention;

Figs. 14a to 14d, inclusive, show the wiring diagram of Fig. 14 and illustrate certain electrical circuits which are made during the operation of the apparatus, said circuits being shown in heavy lines;

Fig. 15 is a side view partly in section and with parts broken away of a modification of the invention;

Fig. 16 is a front view of the parts shown in Fig. 15 with certain parts omitted for clarity; and

Figs. 17 and 18 are respectively sectional side and front views of still another modification of the invention.

Referring to the drawings in further details, one embodiment of the present invention is illustrated in Figs. 1-4, inclusive, and is constituted by a novel filling screw device adapted for use, for example, with pre-weighed charges of material or in apparatus where the filling screw is controlled by mechanism such as a timing device which operates same during predetermined periods for filling a valve bag.

A filling screw 20 is provided having a central shaft 21 which is mounted for rotation in a suitable journal 22 and situated with a portion thereof within a trough 23 and another portion thereof within a filling tube 24. Trough 23 is defined as an elongated channel-like casing having a rounded bottom, there being suitable enclosures at opposite extremities of such trough. One of such enclosures is provided with an opening through which the filling screw urges material. The filling screw 20 is adapted for rotation at the bottom of the trough 23, the width of which, as shown in Fig. 4, and for a purpose to appear below, is substantially equal to the outer diameter of screw 20. The outer diameter of the screw portion within the filling tube 24 is substantially equal to the inner diameter of said tube, there being suitable clearance to permit free rotation of the screw. In the form shown, the pitch and diameter of filling screw 20 are constant and the latter terminates preferably just short of a throat 24a of the filling tube.

In order greatly to increase the efficiency of the filling screw, that is, its ability to move material out of the trough 23 and through the tube 24, novel means are provided for forcing material down into the flights of the filling screw comprising a multi-blade centrifugal impeller, as at 25, having blades or paddles 26 which, as shown in Fig. 4, are of constant width from the hub to the extremities thereof. The blades 26 sweep down into close proximity with the filling screw 20 and force material therein, the direction of rotation of the impeller being counterclockwise as viewed in Fig. 2, whereby material is forced into the screw and toward a trough outlet 23a which constitutes the entrance to the filling tube 24. The ability of the impeller 25 to force material down into screw 20 is increased by making the width of the blades 26 substantially equal to but slightly less than the width of trough 23, as in Fig. 4. However, the invention is not limited thereto.

The impeller 25 is mounted upon a rotatable shaft 27 which preferably is in a plane perpen-

dicular to the axis of filling screw shaft 21. Thus the impeller plane of rotation, namely, the plane through the center of the impeller and perpendicular to its axis of rotation, substantially contains the axis of rotation of the filling screw 20.

The blades 26 of the impeller 25 preferably extend outwardly along axes which are non-radially disposed with respect to the shaft upon which they are mounted. That is, the inner ends of the longitudinal axes of such blades are spaced from the axis of rotation, for example, the axis of shaft 27 (Fig. 2). Such inner ends of the longitudinal axes refers to the portion thereof closest to the shaft 27. The blades 26 have substantially plane forward surfaces which initially engage the material. Secured to the outer extremities of such forward surfaces of the blades are so-called impeller tip members which assist the impeller blades in effecting a troweling action of the material down into the flights of the filling screw. Thus the aforementioned non-radial disposition of the blades 26 is substantially tangential to the hub upon which they are mounted and aids in urging the material outwardly, the tip members 26a assisting in filling the flights of the filling screw 20.

Subsidiary impeller means are provided for feeding material from either side of the rotatable impeller 25 into the spaces between the blades thereof comprising, for example, packer screws or auxiliary screws 28 and 29 located respectively on the left and right sides thereof, as viewed in Fig. 4, said packer screws preferably being coaxial with the impeller and mounted upon the same shaft therewith. In order to assist in providing a positive feed to the impeller 25, the packer screws 28 are mounted at the bottom of troughs 30 and 31, respectively, said troughs comprising the lower surfaces of a hopper 32 into which material is delivered to be fed into a valve bag as at 33 shown in filling relation with said filling tube 24. The ends of troughs 30, 31 adjacent the impeller 25 are open.

With reference to the relative rotational velocities of impeller shaft 27 and the filling screw 20, these velocities can be expressed in terms of the frequency of blade impulses and the R. P. M. of the filler screw. For example, as shown in Fig. 2, the impeller 25 is provided with four blades. Consequently when the shaft 27 rotates at 200 R. P. M. there will be 800 blade impulses per minute adjacent the filling screw. Thus if it is desired for a blade to deliver material to the screw for each revolution of the latter, impeller shaft 27 should rotate at 200 R. P. M. and screw 20 at 800 R. P. M. thereby effecting a ratio of blade impulses to screw speed of one to one. In certain instances, for example, with material such as flour mixes containing shortening, it has been found desirable to increase the R. P. M. of the filling screw to a point approximately twice the frequency of the paddle impulses.

As shown in Fig. 1, a common power source comprising a motor as at 34 is employed for driving both the filling screw 20 and the impeller shaft 27. A belt 35 interconnects a suitable pulley upon the shaft of motor 34 with a pulley upon screw shaft 21 of the filler screw 20. The motor 34 may transmit its power to the impeller shaft 27 through the intermediary of a suitable reduction gear 36 which can receive power by a conventional belt connection with motor 34, such as a belt 36a (Fig. 3) passing over pulleys 37 and 38. The output shaft of the reduction gear 36 is provided with a suitable wheel, such as a

sprocket wheel 39, which is operatively connected to a suitable sprocket wheel 40 upon shaft 21 by means of a sprocket chain 41. If desired, the reduction gear 36 can be of a variable type whereby the ratio of impeller impulses to filling screw

5 speeds can be adjusted.

The form of the impeller 25, as shown in Fig. 4, indicates impeller blades 26 which, as above mentioned, are of substantially constant width throughout their lengths, that is, the width of each blade measured axially along the axis of rotation of the impeller is substantially constant. However, it is possible to employ a type of impeller as illustrated in Fig. 5 having blades which are not of constant width, but which comprise arms 42 of relatively small width measured from the hub to arm extremity and each of which is provided, for example, with a relatively large paddle surface at the extremity thereof. As shown in Fig. 5, each blade is constituted by said relatively slender arm 42 extending from the impeller hub, and a paddle 43 is mounted at the extremity of each arm. Suitable right and left auxiliary or packer screws, of course, may be mounted coaxially with and upon the same shaft with such an impeller, and driven at the same speed therewith. The length of each paddle 43 preferably is approximately equal to the diameter of the filling screw 20 and to the width of trough 23 whereby the paddles cooperate with the trough sides to direct and force material into the filling screw.

In the embodiment illustrated in Figs. 6, 6a and 7, the structure is somewhat similar to the embodiment previously described with the exception that the right and lefthand packer screws do not operate in individual troughs but instead such troughs are eliminated and a supplementary impeller-packer device is employed beneath each such screw. Such supplementary impeller-packer devices thus are located one on each side of the main impeller 25 and are positioned to force material into the spaces between the blades of said main impeller whereby the packer screws 28, 29 are assisted in their task. Each supplementary impeller-packer device comprises, in the form shown, a rotatable supplementary shaft which is preferably parallel to the shaft of the filling screw 20. Upon each such supplementary shaft is a small supplementary impeller to which material is urged by a feeder screw. Preferably the feeder screws and supplementary impellers are respectively located in diagonally opposed positions.

As shown in Fig. 6a, the filling screw 20 is rotatable within a suitable trough 44 in a manner substantially similar to that shown in Fig. 4. However, trough 44 is broadened in cross-section, as compared to trough 23, above the filling screw 20 in order to accommodate supplementary impeller-packer mechanisms 45 and 46, respectively upon the right and lefthand sides thereof and above said filler screw 20. Mechanism 46 is constituted, for example, by a screw 47 which urges material toward an impeller 48. Screw 47 and impeller 48 rotate preferably in a counter-clockwise direction (Fig. 6a) and the latter urges material toward the main impeller which, for example, is of the type shown in Fig. 5. Thus it will be seen that the impeller 48 urges material toward and between the downwardly moving paddles 43 of the main impeller thereby assisting in filling the main impeller and the main filling screw 20.

The other supplementary packer 45 is similar

to mechanism 46. However, its disposition is reversed in that an impeller 49 is located diagonally opposite impeller 48 (Fig. 7). The impeller 49 is mounted upon a suitable shaft parallel to and above the screw 20. A feeder screw 50 also is mounted upon said shaft which urges material toward the said impeller 49. The direction of rotation of impeller 49 and screw 50 is clockwise as viewed in Fig. 6a whereby the impeller 49 urges material toward the main impeller 42.

The action of the impellers 48, 49, in addition to urging material toward the main impeller 25, also may force some material by virtue of centrifugal force toward and down into the filler screw 20.

In the embodiment of Figs. 6, 6a and 7 right and lefthand packer screws 28 and 29 preferably are mounted on either side of the main impeller 42 in a manner analogous to that shown in Fig. 4. Suitable means (not shown) are provided for rotating the supplementary packers 45 and 46 in a desired speed ratio to the main impeller 25 and the filler screw 20.

A consideration of Fig. 6a indicates that the lower portion of the trough 44 in cross-section is substantially in the shape of a V with the filling screw 20 rotating in the bottom thereof. Below the region where the upper extremities of the sides of the V join the vertical sides of a hopper 44a, there are respectively situated the above-described supplementary impeller-packers 45 and 46, the sides of the V being rounded as at 44b to accommodate such packers.

The embodiments of the invention previously described have been adapted for use, for example, in the packing of pre-weighed charges or in the packing of charges by timing the period of operation of the filling screw 20. In both of these cases, simultaneous filling and weighing of the container does not occur and consequently it is not necessary to have a movable scale and a so-called "divorce line" in the filling tube in order to permit a weighing movement of part of such tube relative to a stationary part thereof.

In the embodiment of the invention illustrated in Figs. 8-14, inclusive, a filling screw and centrifugal impeller means are employed which are somewhat similar to the embodiment shown in Fig. 4 with the exception, for example, that such screw and impeller are employed in combination with a packer which is adapted for simultaneously filling and weighing containers such as valve bags.

Referring to Figs. 8, 9 and 10, the filling screw and impeller mechanism, which is similar in certain respects to the embodiment in Fig. 4, is constituted by a filling screw 55 which is located in the bottom of a filling screw trough 56. Filling screw 55 is provided with a central shaft 57 which is journaled for angular movement in a suitable bearing 58 and which extends rearwardly, as viewed in Fig. 9, for interconnection to an electric motor 59 by means of belts 60 which operate over conventional pulleys 61 and 62, respectively, upon the shaft 57 and the shaft of motor 59. A second bearing or journal can be provided for shaft 57 adjacent pulley 61. A rotating impeller with cooperating packer or side screws is employed which is preferably identical with that shown in Figs. 4 and 5 and is constituted by a centrifugal impeller 63 mounted upon a shaft 64, the latter being above and extending transversely of the filling screw shaft 57. Mounted upon either side of the impeller 63 are auxiliary packer screws 65 and 66 (Fig. 8) respectively on the left

and right thereof. Packer screws 65, 66 preferably are mounted upon the shaft 64, the latter being operatively connected to the electric motor 59 through the intermediary of a suitable reduction gear 67 in a well known manner. For example, a pulley 68 upon the shaft of motor 59 is drivably connected by means of a belt 69 to an input pulley 70 of the reduction gear 67. The impeller shaft 64 is interconnected to an output sprocket wheel 71 of said reduction gear by means of a conventional sprocket chain 72 which passes over a suitable sprocket wheel 73 keyed to the impeller shaft 64.

If desired, means (not shown) can be provided for adjusting the reduction ratio of the reduction gear 67.

The right and lefthand packer screws 65 and 66 are rotatable within and at the bottom of their respective troughs 74 and 75 in a manner identical to that shown in Fig. 4.

In order to provide for simultaneous weighing and filling of a valve bag, a suitable scale 76 (Fig. 9) is provided which supports a portion of a bag filling tube 77 which is adapted for undergoing weighing movement therewith. As shown in Fig. 9, the scale 76 is constituted by a conventional scale beam 78 which rests upon a suitable knife edge 79 and has secured thereto upon one side of said knife edge a weight 80. Suspended on the scale beam 78 upon the other side of said knife edge is a so-called weighing frame or bag frame 81 upon which is mounted said filling tube portion 77 in a manner to appear more fully hereinafter. Frame 81 is supported by the beam 78 preferably through the intermediary of a conventional knife edge 82 and cushion 83.

In order to insure a parallelogram vertical movement of the frame 81, a conventional check rod 84 is pivotally associated with the lower extremity of said frame.

A bag clamp handle 85 is pivotally mounted upon the frame 81 and adapted for opening and closing a bag clamp 86 in a well known manner. For example, the bag clamp 86 is pivotally mounted at 87 and is urged upwardly toward an open position by means of a spring 88 which is secured at one extremity to an arm 85a upon the handle 85. The latter is pivotally mounted intermediate the extremities thereof and provided with a suitable roller 89 which is adapted for engaging and closing the clamp 86 when the handle 85 is pushed in a counterclockwise direction (Fig. 9).

A bag chair 90 is associated with the lower portion of frame 81 and is adapted for adjustment in a vertical direction by means, for example, of a vertical rod 91 which supports said chair, and is provided with a serrated surface 92 which cooperates in a well known manner with a detent 93. An eccentric cam 93a resiliently urges serrations 92 against detent 93 by means of a spring 93b.

I have found novel means for increasing the compression of material into the flights of the filling screw whereby a more forceful and positive feed into said screw is obtained which effects a substantial improvement over the performance of the embodiment shown in Figs. 1-4, inclusive, with particular reference to such light materials as diatomaceous earth. Such novel means are indicated as in Figs. 9 and 10 and are constituted by a stationary filling screw shroud 77a which protrudes inwardly into the filling tube trough 56 partially to cover the filling screw 55. The shroud 77a constitutes a part of the filling tube

77 and is normally in alignment therewith and assists in delivering material thereto in a more efficient manner. The shroud 77a extends into the filling tube trough 56 preferably to a point approximately beneath the center line of the impeller shaft 64. Thus the opening through which material can be urged into the filling screw is considerably reduced but with advantageous results. The termination of the shroud 77a at a point substantially beneath the center line of shaft 64 occurs approximately at the region where the downward thrust of each impeller blade changes direction toward the horizontal. Thus any tendency of the material in the filling screw to boil up and to recirculate in the region near the outlet of the trough 56 is inhibited. A considerable resistance to the flow of material may occur within the filling tube portion 77 which, under normal circumstances, might produce such boiling or recirculation.

In order to reduce such resistance to the flow of material in the filling tube 77, and to aid in preventing clogging, the tube preferably is formed with a so-called reversed taper, that is, it is slightly larger at the outlet thereof and at the inlet. Such a taper, for example, can be one degree from inlet to outlet.

Filling screw 55 terminates approximately at the divorce line between tube 77 and shroud 77a and preferably just short thereof in such a manner that the movable tube 77 can undergo weighing movement without obstruction.

When a complete charge has been fed into a bag, a weighing movement of the scale 78 takes place which is adapted for tripping a latch device and thereby closing a slidable feed cut-off gate 94 (Figs. 9, 10 and 11). Gate 94, as shown in Fig. 11, is provided with an opening 94a which can move into register with the outlet of shroud 77a to permit the passage of material. Suitable guide plates 95 and 96 are provided for directing the sliding movement of said gate.

A gate control rod 97 is attached, for example, to the lower portion of the gate 94, and is adapted for sliding movement through a guide bracket 98. A coil spring 99 is interposed between the bracket 98 and the gate 94 for urging the latter toward a closed position. Latching means for holding the gate 94 open are shown in Fig. 10 and constitute, for example, a latch disc 100 secured to the lower extremity of rod 97 and which is adapted for cooperation with a latch 101 (Fig. 13). The latter is angularly shiftable upon a shaft 102 and is governed in a manner which will appear hereinafter whereby the latch is tripped and the gate is closed when a desired weight of charge has been reached.

In view of the use of shroud 77a, it is desirable to arrest immediately the angular motion of the filling screw 55 when such desired weight has been reached and the gate 94 is closed, whereby a coasting of the filling screw and excessive pressures upon the gate 94 are avoided. A brake 103 (Fig. 10) is provided for this purpose which can be of any desired conventional type and which, in the form shown, is constituted by a pair of pivotally mounted brake arms 104 and 105 having respective braking surfaces which engage a brake drum 106 mounted upon the filling screw shaft 57.

The brake 103 is preferably operatively connected to the gate latch 100, 101 by suitable linkage whereby the brake is applied at the same time that said latch is tripped and the gate 94 is closed. Such operative interconnection, as shown in Fig. 10, is constituted by a brake lever

107 which, by means of a brake rod 108, is angularly shiftable with the latch shaft 102 by virtue of an arm 109 which is secured to shaft 102 and is pivotally connected at 110 with said rod 108.

Thus it is apparent that by angularly shifting the latch shaft 102 in a clockwise direction (Fig. 10), the brake 103 will be applied and the latch 101 will be released to close gate 94. A solenoid 111 is provided for this purpose which may be energized in response to weighing movement of the scale 76 in a manner to be explained below, and which can angularly shift the latch shaft 102 by means of an interconnecting arm 11a (Fig. 10). It is desirable to have the shaft 108 divided into yieldingly telescoping portions 108a and 108b which are normally urged apart by means of a coil spring 112 which surrounds the former and acts against suitable collars on said portions. When the solenoid 111 is energized, the brake 103 is yieldingly engaged and latch 101 is positively withdrawn from latching engagement with disc 100. When the solenoid 111 is deenergized, gravity is effective to disengage brake 103 and re-position latch 101 in position to engage the disc 100.

Manually operable means are provided for opening the gate 94 and initiating the operation of the apparatus comprising a handle 113 which is pivoted as at 114 and adapted for engaging a roller 115 (Figs. 9, 11 and 12) attached to said gate 94, the engagement occurring when handle 113 is shifted downwardly. When said handle is shifted from the position shown in solid lines in Fig. 10 to the position shown in the broken lines, the gate 94 is latched in an open position, and a normally open limit switch 116 (Fig. 10) is closed momentarily to start the machine. A switch arm 113a is secured to handle 113 for engaging switch 116. After said handle is manually released, a coil spring 117 will return same to its normal position. The closing of the limit switch 116 actuates the motor 59, as will be explained below. When a desired weight of material has been fed into a bag upon the filling tube 77, weighing movement occurs, and the lefthand extremity of the scale beam 78 (Fig. 9) will move upwardly to open a normally closed switch 118 whereby the solenoid 111 is energized, the brake 103 is immediately applied, latch 101 is tripped, gate 94 is closed, and the motor 59 deenergized.

In order to avoid overheating of the solenoid 111, it is desirable to adapt same for energization only when the bag clamp 86 is closed. Thus during periods of idleness and during the period between the application of bags upon the tube 77, the solenoid will be deenergized. In order to accomplish this a switch 119 (Fig. 12), which can be a double throw type, is operatively associated with the handle 85 by means of a linkage 120 in such a manner that when the bag clamp is open, an electric circuit to the solenoid 111 is interrupted, and when the bag clamp is closed, said solenoid electric circuit is interrupted until the desired weight of material is reached in the container.

A novel spill chute 121 (Fig. 9) is provided which is pivoted at the lower extremity thereof as at 122 upon the movable frame 81 and which empties into a fixedly mounted spill trough 124 (Figs. 9 and 11). The pivotal mount of the spill chute 121 is positioned in such a manner that gravity normally urges the chute outwardly in a clockwise direction. An arm 125 is provided for limiting such outward angular movement to a point where the tip of the chute, at its outermost posi-

tion, is to the right of a throat 77b of the filling tube 77 as viewed in Fig. 9. Thus, when a bag is removed from the tube 77, the spill chute 121 is pulled by gravity to the position shown in Fig. 9 and is adapted for catching any spill from said throat 77b.

A dust suction hood 126 (Figs. 9 and 12) is positioned between the movable frame 31 and the fixed support for the apparatus and is mounted upon the latter. Such hood is adapted for surrounding the so-called divorce line between the movable filling tube 77 and the fixed guide plate 96 whereby any spill at the divorce line is either sucked away or directed to the trough 124.

The suction hood 126 is fixed, being secured at 126a to the fixed support or framework of the apparatus. The filling tube 77 is, of course, movable and extends through said hood. Thus the latter must be conformed so as not to obstruct movement of the filling tube. A removable panel 126b is provided at the front of the hood 126 or at the right thereof as viewed in Fig. 12. Panel 126b in turn is provided with an outwardly extending flanged portion 127 having a slot 127a through which filling tube 77 extends and in which it can move vertically.

The movable filling tube 77 is secured to the weighing frame 81 by means of a flange 128 (Fig. 12), the latter being spaced preferably a small distance from the inner extremity of said tube, thereby forming a shoulder for supporting a flexible washer 129 preferably of a material such as felt which is movable with the filling tube and is in frictional contact with the front surface of the guide plate 96, whereby an adequate movable seal is obtained between a stationary opening 96a in guide plate 96 and the movable entrance into the filling tube 77. Opening 96a is, of course, in alignment with the outlet of tube or shroud 77a.

Thus any material which escapes past the seal between washer 129 and guide plate 96 will be carried away by the dust suction hood 126 which is in communication with a suitable suction device. Any heavy material which cannot be carried away through the hood will fall into the trough 124 where it can be carried away, for example, by a waste removal screw 130 (Figs. 8 and 11) which is mounted for rotation in the bottom of said trough, the latter being provided with an outlet as at 131 preferably at one side of the machine. A waste container can be placed beneath the outlet 131. The waste removal screw 130 is operatively connected to the motor 59, for example, by means of a belt 132 which connects the shaft of the reduction gear 67 with the shaft of said screw, said belt passing over conventional pulleys.

The filling tube portion 77a in one form of this invention need not protrude into the filling screw trough 56 but may extend outwardly therefrom and be attached to the discharge outlet of said trough. In such form of the apparatus the operation thereof will be similar to the embodiment of Figs. 1-4. However, one of the advantages of the inwardly protruding filling tube portion is to shorten the length of the scale beam 78. If the filling tube portion 77a protruded externally from the filling screw trough 56, it would be necessary to increase the length of scale beam 78 whereby the divorce line between the movable filling tube portion 77 and the fixed portion 77a will be properly positioned.

A preferred means for electrically associating the above-described switches 116, 118, 119 with

the motor 59 and the solenoid 111 is indicated in Fig. 14 and includes a so-called magnetic starter 133 for the motor 59 which is under the influence of said switches, as will appear below. The motor 59, for example, is of a three-phase variety and is connectable to a three-phase power source having electrical power leads 134, 135 and 136. Three input terminals of the motor 59 are respectively electrically connected to three electrical switch terminals 137, 138 and 139 by means of leads 140, 141 and 142. A three-pole movable switch arm 143 is provided which can be, for example, axially shifted simultaneously to connect said three switch terminals with respective of said power lines. Normally the three-pole switch arm is held in an open position by means, for example, of a suitable spring 144. The three switch arms are indicated as at 143a, 143b, and 143c. A fourth switch arm 145 is mounted therewith for completing a so-called magnetic interlock circuit, as will be explained hereinafter. The interlock switch arm 145 is adapted for interconnecting interlock terminals 145a and 145b.

The switch 133 can be closed by overcoming the pressure of spring 144 by means of a starter coil 146. An electric circuit through the starter coil 146 is effected by means of a lead 147 which is connected, for example, across leads 134 and 136. Interposed in the lead 147 is a start-stop switch 148 and the above-described switch 116 which is under the influence of the handle 113. Thus when the handle 113 is thrust downwardly to its lowermost position, the normally open switch is closed to complete the starter coil circuit and thus to close the motor switch 133. Lead 147 also interconnects the above-mentioned terminals 145a with the power line 136 in order that an interlock circuit can be formed for holding switch arms 143 in a closed position after the switch 116 is opened. Since the switch 116 is only momentarily closed, an interlock circuit is needed and is formed by means of a lead 149 which interconnects the interlock terminal 145b to a point intermediate the switch 116 and the start-stop switch 148. Interposed in the lead 149 is the above-described scale operated switch 118 which thus is adapted for breaking said interlock circuit, deenergizing the starter coil 146 and opening the starter switch when a desired weight of a charge has been reached.

The switch 119, which is under the influence of the bag clamp 85, is associated with the apparatus in such a manner that when the packer is idle, that is, when the bag clamp is open and the motor 59 is arrested, the solenoid 111 is deenergized. Thus the danger of burning out of this solenoid during long periods of idleness is avoided. The solenoid is energized only when the bag clamp is closed (with motor idle) and before weighing movement has taken place. Solenoid hum is confined to such latter period.

The electrical connection of the solenoid 111 into the circuit of the apparatus is as follows: A solenoid relay 150 governs solenoid 111 in conjunction with the above-described bag clamp electrical switch 119 in such a manner that when the bag clamp and the magnetic starter 133 are open, said solenoid is deenergized. Also when the bag clamp is closed and the magnetic starter 133 also is closed to energize motor 59, the solenoid 111 is deenergized. However, said solenoid is energized whenever the magnetic starter is open and simultaneously therewith the bag clamp is closed, which situation will occur when weigh-

ing movement of scale 76 takes place, as will appear below.

The relay 150 may be of conventional type and can comprise, for example, a pair of normally closed electrical contacts 151 and 152 which are under the influence of a relay coil 153 in a well known manner. The solenoid 111 is connected, for example, across power leads 134, 135 by means of leads 154 and 155, respectively, the normally closed relay contacts 151, 152, respectively, being interposed in the leads 154, 155.

The relay coil 153, by means of the bag clamp electrical switch 119, is adapted for being connected (1) across the power leads 134, 135 when the bag clamp is in the open position whereby the relay contacts 151, 152 are maintained also in an open position and thus the solenoid is deenergized; and (2) across the power lead 134 and the motor lead 141 (at terminal 138) when the bag clamp is closed, whereby the relay coil 153 is energized when the magnetic starter is closed and the bag clamp is closed.

The bag clamp switch 119 thus is adapted for moving into electrical connection with either the power lead 135 or the motor lead 141. Switch 119 for this purpose is provided with a switch arm 119a which is adapted for moving into contact either with an electrical lead 156 connected to power lead 135, or with a lead 157 connected to the motor lead 141. The switch 119a is connected to one extremity of relay coil 153 by a lead 158, the other extremity of coil 153 being connected to lead 154 at a point intermediate contact 151 and the power line 134.

In operation of the embodiment of Figs. 1-4, inclusive, a charge such as a pre-weighed charge is delivered into the hopper 32 and the portion thereof which is substantially above the centrifugal propeller 25 falls in between the blades thereof and is immediately forced down into the flights of the filling screw 20. The blades 26 (or 42, 43) with the assistance of gravity hurl the material into the spaces between the screw surfaces of the filling screw. The packer or auxiliary screws 28, 29 urge material laterally into the spaces between the rapidly rotating blades of said propeller whereby a positive and forceful feed thereto is continuously maintained until the material in the troughs 30, 31 has been exhausted. The trough 23 in which the filling screw 20 rotates assists in guiding the material directly into the filling screw, there being no lateral passage through which such material can escape. Thus the sides of said trough 23 cooperate with the rotating impeller to direct the discharge from the latter directly into the filling screw. The troughs 30, 31 act in a somewhat similar manner in that they guide material which has fallen therein directly into their respective packer screws by which the material is immediately urged into the spaces between the rotating impeller blades.

In operation of the embodiment of Figs. 6, 6a and 7, the main centrifugal propeller 25 is fed not only by the auxiliary screws 28, 29 but also by supplementary packer devices 45, 46 all of which urge material into the spaces between the rotating impeller blades. Furthermore the supplementary impellers 48, 49 will assist in feeding the packer screws 28, 29 respectively thereby increasing the efficiency of the structure.

In operation of the embodiment of Figs. 8 to 14, inclusive, the following conditions exist at the outset:

(1) The magnetic starter 133 is open, that is, the starter contacts 143 are in the position

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shown in Fig. 14a. Such contacts 143 are open because a circuit for the starter coil 146 is open and the spring 144 is able to hold said starter contacts open. The starter coil is connected electrically across the leads 134 and 136 through the intermediary of the above-mentioned start-stop switch 148, and the switch 116 which is closable by the handle 113.

(2) The bag clamp 86 is open and switch arm 119a is in its uppermost position (Fig. 14a). Thus an electric circuit is completed, for relay coil 153, across the power leads 134, 135, as indicated in heavy lines in Fig. 14a. Solenoid 111 is deenergized.

(3) Because of the deenergized condition of solenoid 111, the filling screw brake 103 is released and the gate latch device 100, 101, under the action of gravity, is in a latchable condition, that is, the latch 101 is in position for engaging the latch disc 100.

(4) The gate 94 (Figs. 9 and 10) is closed under the influence of the coil spring 99.

(5) The switch 116 is open, as is normally the case unless held closed by the handle 113.

(6) The scale switch 118 is closed, as is normally the case.

A quantity of material to be filled into a valve bag is delivered into the hopper above the troughs 74, 75 and the filling tube 77 is inserted into a valve of a bag. Thereafter the bag clamp handle 85 is pushed in a counter-clockwise direction to the position shown in Fig. 9, whereupon the bag clamp 86 clamps the bag upon the tube 77. This movement of the bag clamp handle 85 shifts the switch arm 119a from the position shown in Fig. 14a to that shown in Fig. 14b, namely, from a "clamp open" to a "clamp closed" position. This has the effect of deenergizing the relay coil 153 which momentarily creates the circuit indicated in heavy lines in Fig. 14b. The momentary completion of the latter circuit is of no significance but is a mere peculiarity of this particular overall electrical circuit. The circuit shown in heavy lines in Fig. 14b continues only until the handle 113 is thrust downwardly to open gate 94 and start motor 59, as will appear below.

Referring to Figs. 10 and 14c, the handle 113 thereafter is thrust downwardly to the position shown in broken lines in Fig. 10 and then is released to turn to its normal position, as shown in solid lines. This has the following results:

(1) The cut-off gate 94 is latched open.

(2) The normally open switch 116 is momentarily closed because of its engagement with the arm 113a upon handle 113.

(3) The momentary closing of switch 116 serves to complete the circuit of starter coil 146 whereby spring 144 is overcome and the starter switch arms 143a, 143b, 143c are thrust to a closed position. The closing of said switch arms provides a direct interconnection between the three power leads and the three motor leads, as above described. Moreover, the movement of the member 143 to a closed position carries with it the so-called interlock member 145 which maintains the electrical circuit of the starter coil 146 after the switch 116 is again opened and in its normal position. Such starter coil circuit is indicated in heavy lines at A in Fig. 14c.

(4) The closing of the starter contacts or switch arms 143 has two effects, namely, the energization of motor 59 and the deenergization of solenoid 111. Thus the momentary completion of the solenoid circuit, as illustrated in Fig. 14b, is terminated by virtue of the closing of the

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magnetic starter and immediately solenoid relay coil 153 is energized by completion of the circuit therefor across power line 134 and contact 138 as shown in heavy lines at B in Fig. 14c.

(5) The motor 59 thus starts simultaneously with the release of the brake 103, the latter having been momentarily applied during the completion of the circuit shown in heavy lines in Fig. 14b.

(6) The filling screw 57 and the centrifugal propeller, together with the packer screws associated therewith, are actuated whereby the material in the troughs 74, 75 and above the centrifugal propeller 63 is fed into the screw 55 and into the valve bag. The packer screws 65, 66 urge material toward the centrifugal propeller 63 and into the spaces between the blades thereof, whereby the latter forcefully and positively urge material down into the spaces between the exposed filling screw surfaces, that is, the material is urged into that part of the filling screw which is not covered by the inwardly protruding filling tube portion 77a. The filling tube portion 77a terminates substantially beneath the center line of the shaft 64 of the centrifugal propeller whereby full advantage is taken of the downward thrust of each of the blades of said propeller and thus material which is urged into the spaces between the filling screw surfaces will not tend to be carried away by the forward and upward motion of the impeller blades, as viewed in Fig. 9. I have found that an advantageous ratio of propeller blade impulses (which act to force material into the screw) to the angular velocity of the filling screw to be approximately 800 to 1800 when the material used is, for example, diatomaceous earth or silene.

When the desired weight of material is reached in the valve bag, a weighing movement of scale beam 78 takes place whereby the lefthand extremity thereof (Fig. 9) moves upwardly to open the normally closed switch 118, as shown in Fig. 14d, whereby the so-called interlock circuit for the magnetic starter is broken and the spring 144 urges the starter contacts to their open position.

When said weighing movement takes place, the gate 94 is immediately closed and the motion of the filling screw 55 is simultaneously arrested. These two things take place simultaneously by virtue of the energization of solenoid 111 immediately upon the opening of the magnetic starter 133. The opening of said starter breaks the circuit of the solenoid relay coil 153 whereby the solenoid relay contacts 151, 152 are closed and the solenoid circuit, as shown in heavy lines in Fig. 14d, is completed. The energization of the solenoid 111 accomplishes simultaneously (a) the applying of the brake 103 through the above-described linkage 107, 108 and 109; and (b) the tripping of the gate latch 101 by angularly shifting its shaft 102, and the closing of gate 94.

Thereafter the bag clamp is opened, switch 119 reverts to its position, as shown in Fig. 14a, and the circuit therein shown in heavy lines is recompleted whereby the solenoid 111 is again deenergized. Then, of course, the filled bag is discharged from the apparatus.

A modification of the invention is illustrated in Figs. 15 and 16 which is somewhat similar to the parts shown in Figs. 11 and 12, with the distinction that the filling screw, instead of being terminated just short of the divorce line, that is, short of the gate 94 as in said figures, extends into the outer portion of the filling tube 77 past

the divorce line. The portion which extends beyond the divorce line is indicated generally at 55a, and is of slightly smaller diameter than the portion of the filling screw 55 which is to the left of said divorce line. The reason for this is to permit a free weighing movement of the filling spout 77 through a predetermined distance without engagement with the filling screw. The filling screw 55, 55a, of course, is unable to move vertically to accommodate weighing movement of the tube 77, and consequently, there must be a reduction in the diameter of the portion 55a to accommodate such movement.

A gate 94b is employed in the modification of Fig. 15 which is similar to gate 94 of Fig. 12 with the exception that it is slotted as at 94c to accommodate shaft 57 of the filling screw when the gate is moved to a closed position as in Fig. 16. The flights or screw surfaces of said screw are interrupted or discontinued for a short distance on shaft 57 as at 55c in order to permit the slotted gate 94b to move upwardly whereby shaft 57 enters slot 94c. The interruption at 55c of the screw surfaces occurs intermediate the adjacent extremities of the screw portions 55, 55a at a point which is in alignment with the "divorce line."

The filling screw 55a and the gate 94b, are associated with the remainder of the apparatus precisely as described above in connection with the embodiment of Figs. 8-14, inclusive.

The modification of Fig. 15 is important because it permits a more forceful urging of material through the filling spout and into the valve bag and assists in reducing the filling time by overcoming any frictional or other resistances which might be encountered within the portion of the filling tube which undergoes weighing movement. Also, the filling screw portion 55a makes it unnecessary to have a so-called "reverse taper" upon the portion of the filling tube 77, as shown in Fig. 12, in order to prevent a clogging of the filling tube. The possibility of a clogging of filling tube portion 77 (Fig. 15), is nullified by virtue of the filling screw portion 55a.

Another modification of the present invention is shown in Figs. 17 and 18, in which a centrifugal impeller, shown in the above modifications at 25 and 63, is omitted, and the auxiliary or packer screws are lowered so that they are capable of feeding directly into the main filling screw.

I have determined that this latter modification of the invention can achieve a lower filling time with certain types of material, such as soda ash, than has ever before been obtained, and thus that the output of filled bags per hour can be increased a substantial amount.

It has been found desirable, under some circumstances, so to eliminate the centrifugal impeller because it may tend to throw the material upward. Where a substantial head of material is employed above a centrifugal impeller, the tendency to throw the material upward is suppressed. However, when the filling machine is operating with pre-weighed charges, the head of material over the filling screw and its associated feeding impellers is usually initially somewhat low and diminishes rapidly as the charge is filled into a bag. Thus the centrifugal impeller type of the invention is better adapted for use where a substantial head of the material continuously exists and the modification of Figs. 17 and 18 is desirable where pre-weighed charges are to be filled.

As shown in Figs. 17 and 18, a main filling

screw 160 is mounted within a casing 161, which tapers down to a reduced diameter as at 62. The filling screw 160, of course, is reduced in diameter accordingly. The top portion of the screw casing, as at 161a, is sloped downwardly from a point as at 162b which is slightly above the upper reach of the filling screw, said casing portion 161a sloping to a point as at 162c which is closely adjacent the upper reaches of the filling screw, thereby defining a compression chamber 163 between said casing portion 161a and the screw 160.

A pair of packer screws 164 and 165 are mounted for rotation on opposite sides of and upon an axis transverse to that of said filling screw in such a manner that they feed directly into the main filling screw. In the form shown, the low point of the path of the screws 164, 165, as at 164a and 165a, is substantially on the same level as the axis of the main filling screw. However, it is possible to lower further the screws 164 and 165.

A pair of channel members, for respective of said packer screws is indicated as at 166 and 167, which channel members have rounded bottoms in which respective of such screws are rotatably mounted. The channel members 166, 167 have closed outer extremities at 166a and 166b, which extremities form a portion of a hopper for containing the material. The inner extremities of the channel members, that is, the ends thereof which are adjacent the filling screw 160, are of course open in order to permit the feeding of material to the main filling screw.

Although certain embodiments of the present invention have been illustrated and described which have given satisfactory results, it is to be expressly understood that the invention is not limited thereto, reference being had to the appended claims for the limitations of the invention.

What is claimed is:

1. In apparatus of the class described, a filling screw trough having an outlet at one extremity thereof; a filling screw in said trough adapted for forcing material through said outlet; a centrifugal impeller having a plurality of blades and positioned adjacent said filling screw, the blades of such impeller being movable into proximity with such filling screw for forcing material into the spaces between the screw surfaces of said filling screw, the axis of rotation of said impeller being transversely disposed relative to the axis of rotation of said filling screw; and subsidiary impeller means positioned on at least one side of said first-mentioned impeller and having impeller surfaces for urging material laterally into the spaces between the blades of said first-mentioned impeller.

2. In apparatus for feeding pulverulent material, a filling screw trough having an outlet; a filling screw in said trough in alignment with the outlet for forcing material therethrough; a centrifugal impeller positioned with the axis of rotation thereof above and transversely disposed relative to said filling screw, said impeller having a plurality of blades which move lengthwise of said trough and pass in close proximity to said filling screw for forcing material into the spaces between the screw surfaces thereof; a filling tube protruding into said trough through said discharge opening and surrounding a portion of said filling screw, said filling tube protruding into said trough to a point substantially beneath such transversely disposed axis of rotation of said centrifugal impeller; and subsidiary impeller means positioned at least on one side of

said first-mentioned impeller for urging material parallel to the direction of said transversely disposed axis of rotation and into the spaces between the blades of such first-mentioned impeller.

3. In apparatus of the class described, a casing having a discharge opening adjacent the bottom thereof, a filling screw in said casing in alignment with the discharge opening for forcing material therethrough, the width of said casing being substantially equal to the outer diameter of said filling screw; a centrifugal impeller having a plurality of blades which pass in close proximity to said filling screw for forcing material into the spaces between the screw surfaces thereof; a member interposed between said filling screw and said centrifugal propeller and extending from the discharge outlet substantially to the point where said blades come closest to said filling screw; and subsidiary impeller means positioned beside said first-mentioned impeller and actuatable simultaneously therewith for forcing material laterally into the spaces between the blades thereof.

4. In apparatus of the class described, a trough, a filling tube for a valve bag, a filling screw partially in said trough, and partially in said tube for forcing material through the latter, a rotatable shaft mounted above and transversely disposed relative to said screw, a multi-blade impeller mounted on and rotatable with said shaft, a plane perpendicular to the axis of rotation of said impeller and passing substantially through the center of the blades thereof substantially containing the axis of rotation of said screw, a packer screw mounted on said shaft on one side of said impeller for feeding material towards the impeller, a packer screw mounted on said shaft upon the other side of said impeller also for feeding material toward said impeller, and a pair of troughs each mounted beneath respective of said packer screws.

5. In apparatus of the class described, the combination comprising: a filling tube for a valve bag; a filling tube trough mounted in alignment with said tube; a filling screw mounted in said trough and extending into said tube; a main feed trough mounted above and transversely of said filling screw trough, said main feed trough having a central opening; a multi-blade impeller mounted for rotation in said main feed trough, the blades of said impeller extending into said filling screw trough through said opening, the axis of rotation of said impeller being transverse to said filling screw and a plane perpendicular to such axis of rotation and containing the axis of rotation of said filling screw also passing through the blades of said impeller; a packer screw mounted upon one side of said impeller in said main feed trough for forcing material toward the impeller; another packer screw mounted in said main feed trough upon the other side of said impeller for forcing material thereto, and power means for rotating said filling screw, impeller and packer screws.

6. In apparatus of the class described, a filling tube for a valve bag; a filling screw trough in alignment with said filling tube; a filling screw mounted for rotation within said trough and extending partially into said tube; a multi-blade impeller mounted above said filling screw, the axis of rotation of said impeller being transverse to the axis of rotation of said filling screw; and right and lefthand packer screws mounted on opposite sides of said impeller for urging material toward said impeller.

7. In a filling apparatus the combination comprising a filling screw trough having an outlet; a filling screw in said trough in alignment with said outlet; a tube member in said trough for embracing a portion of said filling screw, said member being in communication with the outlet of said trough; an impeller having a plurality of paddles and mounted for movement into close proximity with said filling screw whereby material is forced into the exposed portion of said screw in said trough; and a pair of auxiliary screws mounted one on each side of said impeller for feeding material thereto.

8. In apparatus of the class described, the combination comprising: a righthand trough; a lefthand trough substantially co-axial with said righthand trough; a multi-blade impeller mounted between said troughs, the path of movement of the extremities of the blades thereof extending beneath said troughs; mechanism in said troughs for urging material between the blades of said impeller; a filling screw trough having an outlet and mounted beneath said impeller and transversely of the axis of rotation of the latter; a filling screw mounted in said filling screw trough beneath and outside of the path of movement of the extremities of said impeller blades, the latter passing into said filling trough and into proximity with said filling screw; and a filling tube in register with the outlet of said filling screw trough, said filling screw extending partially into said filling tube.

9. In apparatus of the class described, the combination comprising: a filling screw; a trough having a rounded bottom in which such filling screw is rotatable, there being an outlet at one extremity of said trough through which material can be forced by said filling screw, the width of such trough being substantially equal to the outer diameter of said filling screw; a multi-blade centrifugal type impeller mounted for rotation adjacent said filling screw, said impeller being positioned with the axis of rotation thereof above and transversely disposed relative to said filling screw, the blades of such impeller being movable down into such trough for urging material substantially lengthwise thereof and down into the spaces between the screw surfaces of the filling screw; and subsidiary impeller means positioned at least on one side of said first-mentioned impeller for urging the material at one side of such first-mentioned impeller into the spaces between the blades thereof.

10. In apparatus of the class described, the combination comprising: a filling screw; a trough having a rounded bottom in which such filling screw is rotatable, there being an outlet at one extremity of said trough through which material can be forced by said filling screw, the width of such trough being substantially equal to the outer diameter of said filling screw; a multi-blade centrifugal type impeller mounted for rotation adjacent said filling screw, said impeller being positioned with the axis of rotation thereof above and transversely disposed relative to said filling screw, the blades of such impeller being movable down into such trough for urging material substantially lengthwise thereof and down into the spaces between the screw surfaces of the filling screw, the blades of such impeller extending substantially tangentially with respect to the hub thereof, each blade having a tip member secured to the forward face thereof at its outer extremity; and subsidiary impeller means positioned at least on one side of said first-mentioned impeller for urging the material at one side of

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such first-mentioned impeller into the spaces between the blades thereof.

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