

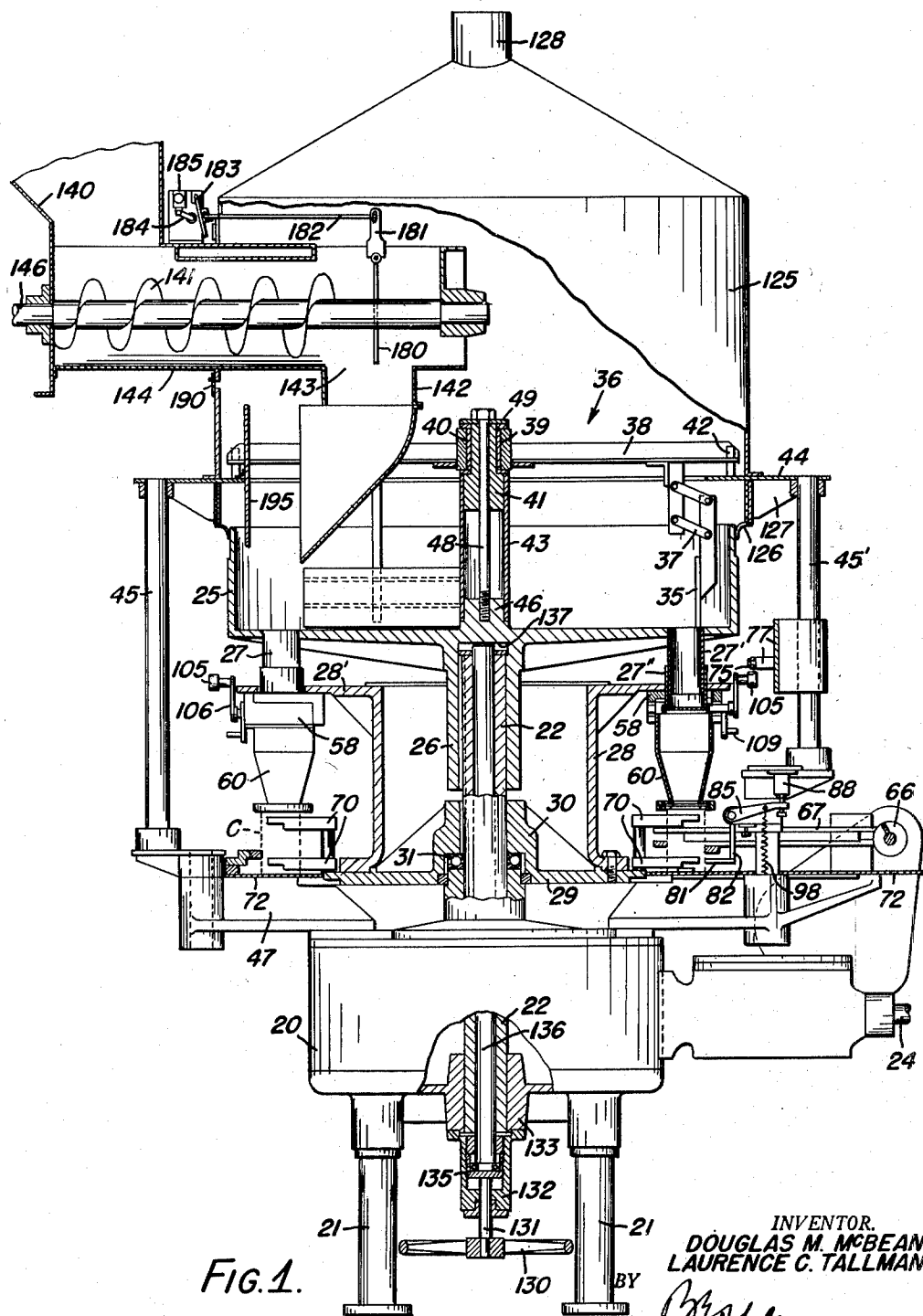
Dec. 3, 1957

D. M. McBEAN ET AL
MACHINE FOR FILLING CONTAINERS WITH
POWDERED AND FLAKY MATERIALS

2,815,046

Filed March 22, 1956

7 Sheets-Sheet 1



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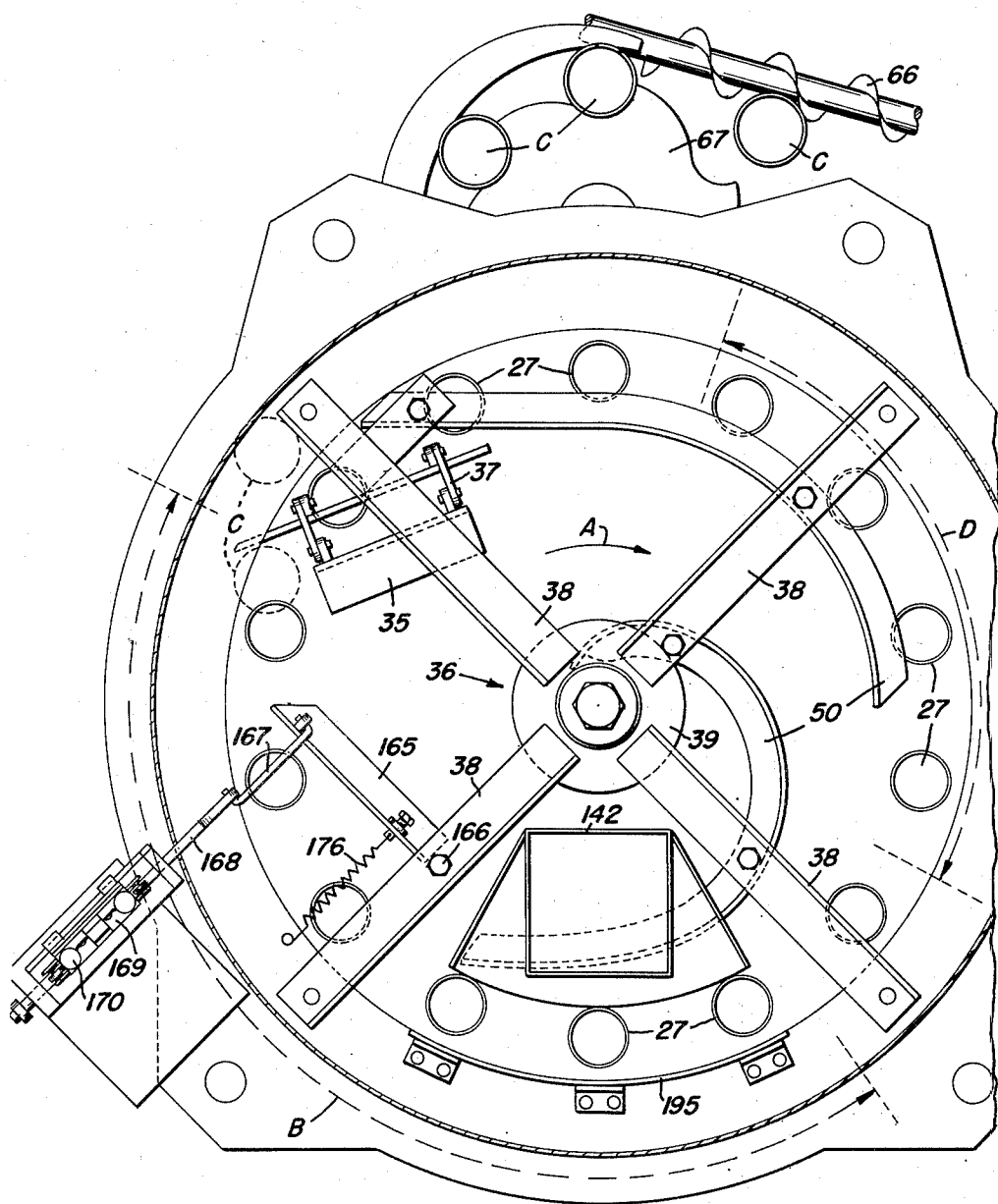


FIG. 2.

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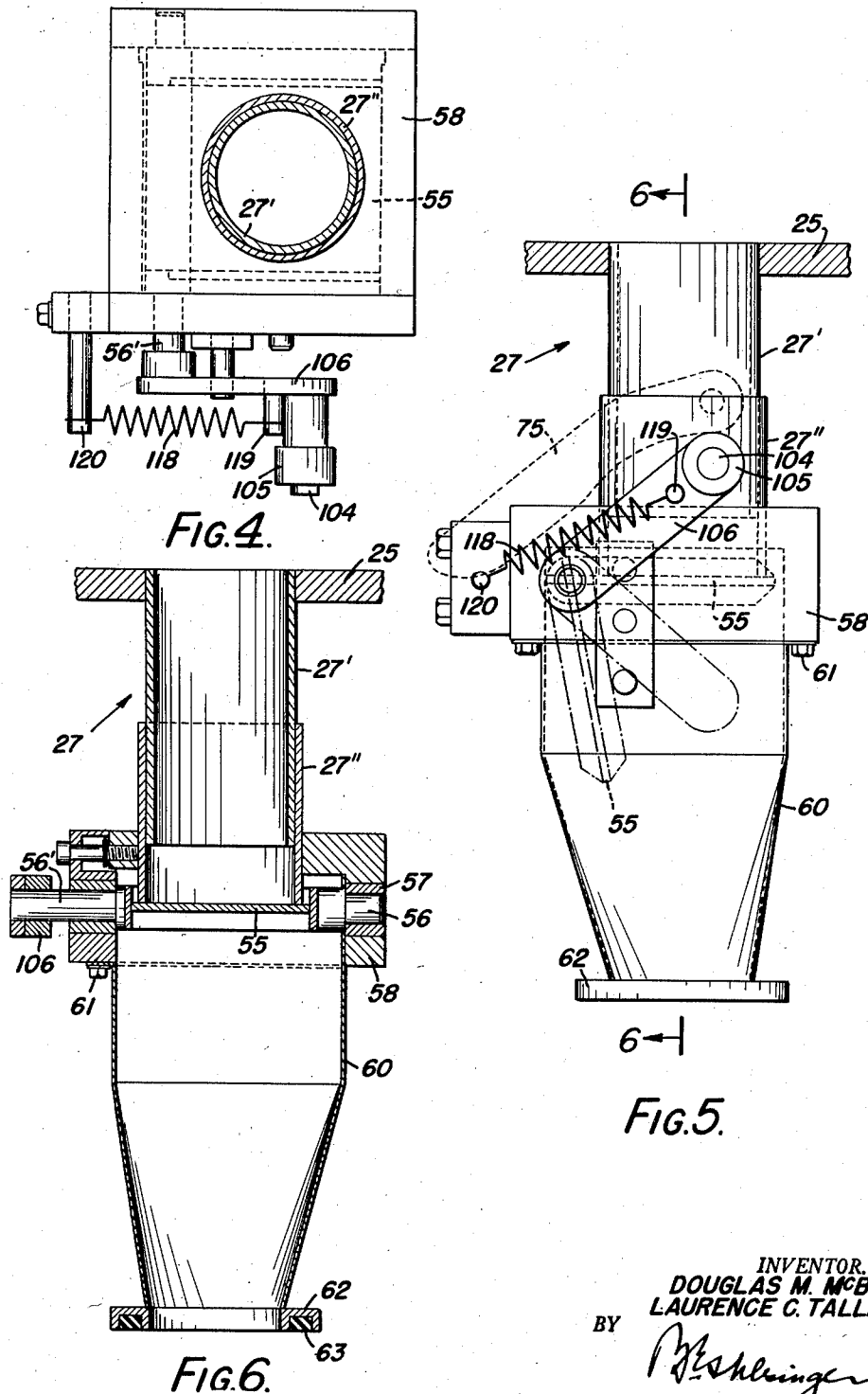
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7 Sheets-Sheet 4



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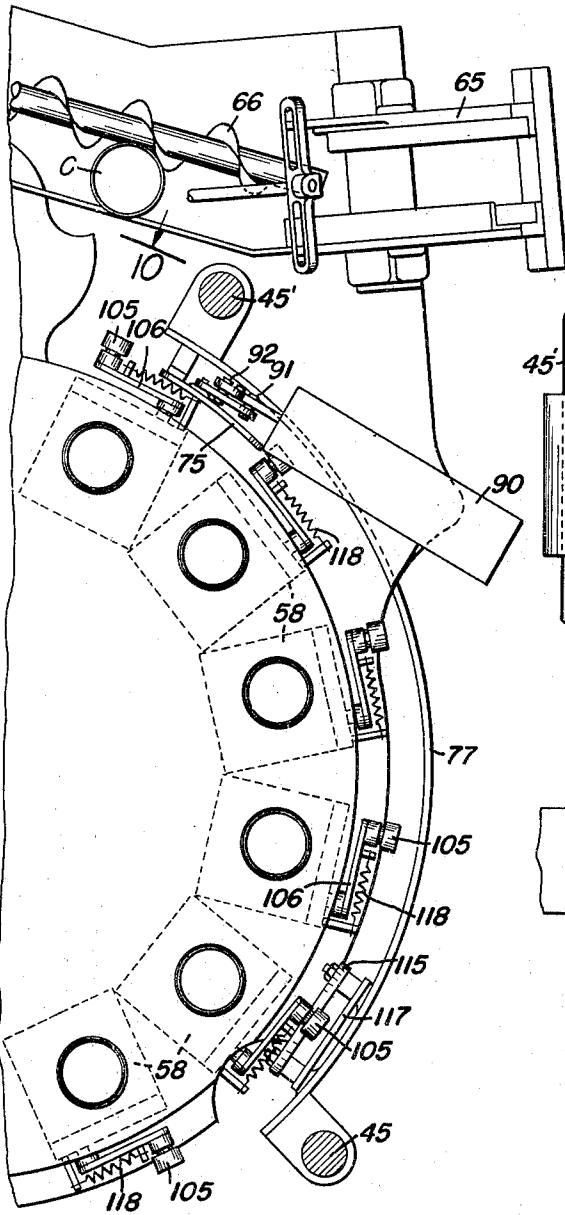


FIG. 7

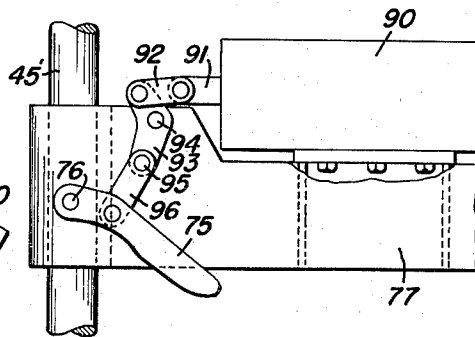


FIG. 8

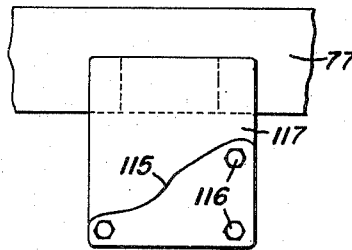


FIG. 9



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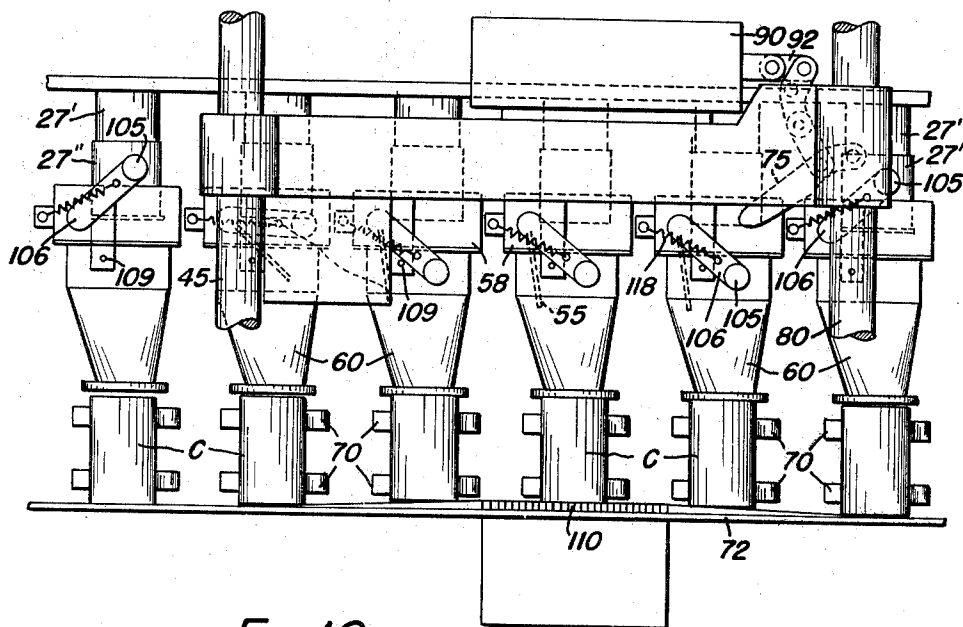


FIG. 10.

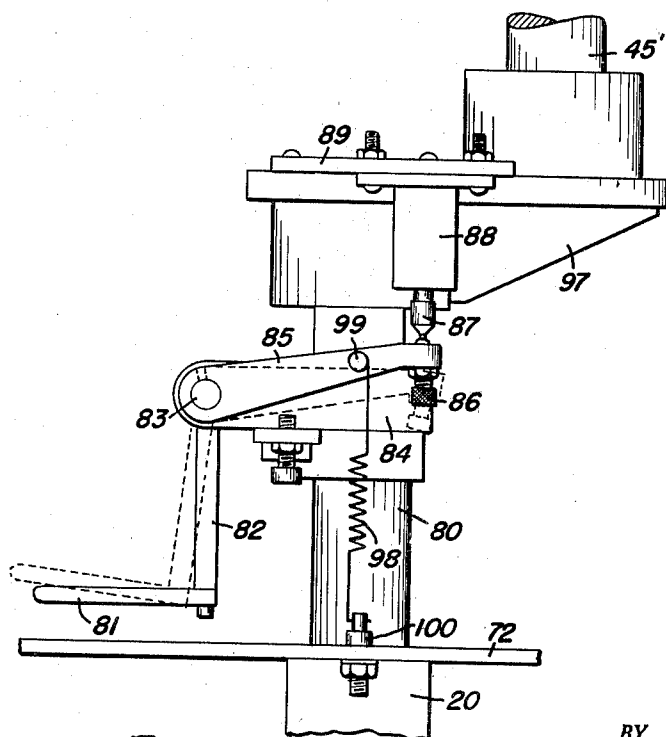


FIG. 11.

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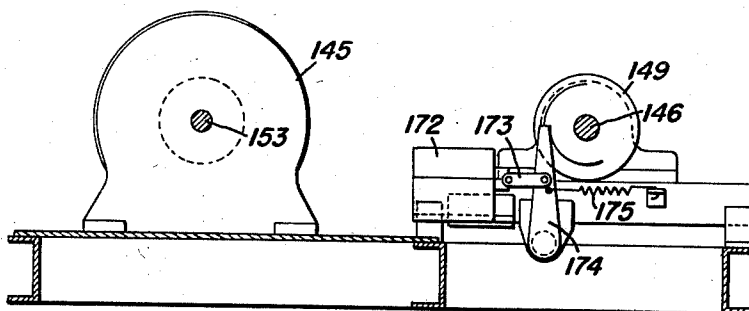
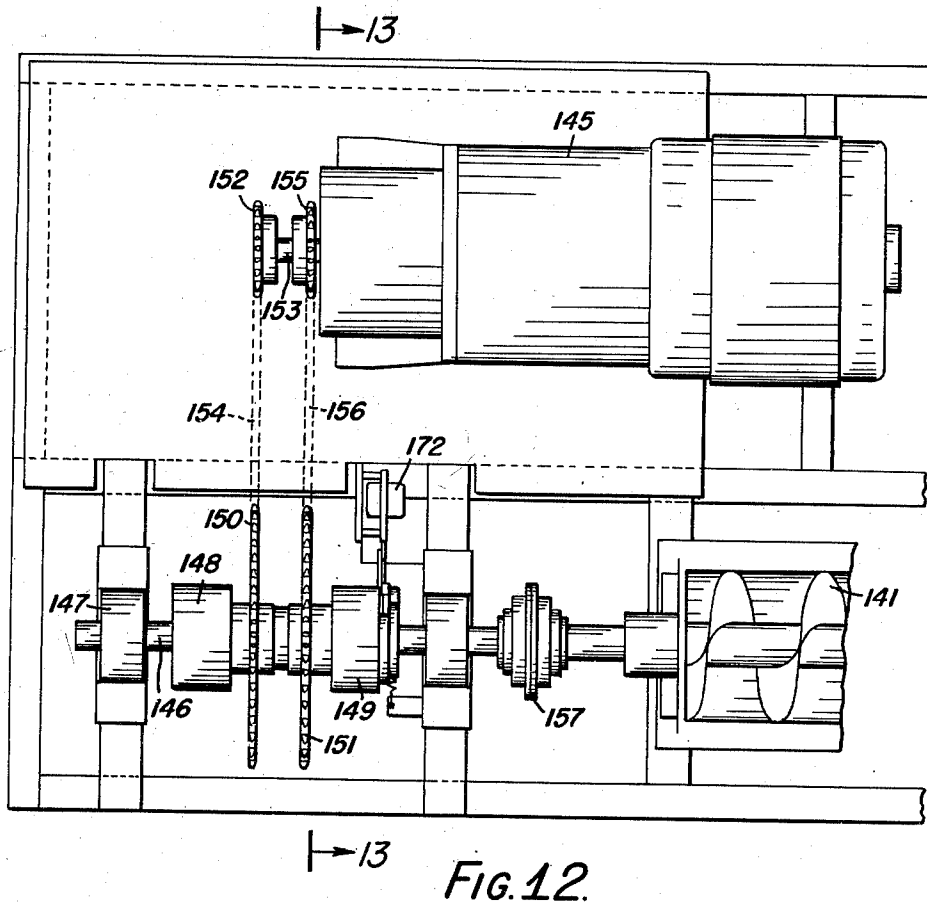
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7 Sheets-Sheet 7



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2,815,046

MACHINE FOR FILLING CONTAINERS WITH POWDERED AND FLAKY MATERIALS

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Application March 22, 1956, Serial No. 573,146

10 Claims. (Cl. 141—79)

The present invention relates to filling machines and more particularly to machines for filling cans, or similar containers, with a powdery or flaky material such as lye or sodium hydroxide.

Conventional powder filling machines will not handle flakes. Flakes overlap and have frictional engagement with one another and will not flow easily.

With any powdered material, moreover, there is always the problem of dust. If the machine is not properly guarded and sealed, dust will get over everything, the shop, the workmen, etc. Where a caustic material, such as lye, is to be packaged, the problem of handling the dust is accentuated, because lye dust is corrosive and will affect the eyes, nostrils and throat; and extra precautions have to be taken in order to protect the personnel and the equipment from the effects of such dust.

One object of the invention is to provide a filling machine for filling containers with dry material which will not flow readily, such as coarse powders and flakes.

Another object of the invention is to provide a machine of the character described which will operate at high speed.

Another object of the invention is to provide a machine for filling powdered and flaky materials in which the problem of dust is eliminated.

Another object of the invention is to design a filling machine of the character described which will handle with safety a dry powdered or flaky material that gives off a toxic dust, or has otherwise hazardous dusting properties.

A further object of the invention is to provide a machine in which the volume of powder or flaky material to be loaded in the individual cans or containers can be very accurately measured prior to loading, so that uniformity in the can content can be attained.

Another object of the invention is to provide a machine of the character described in which not only is precise control of the volumetric content of the container attained, but in which the volumetric content can be changed while the machine is running, in case it is found that the contents of the cans are running light or heavy as compared with the desired content.

Other objects of the invention will be apparent hereinafter from the description and from the recital of the appended claims.

In the drawings:

Fig. 1 is a part side elevation, part vertical section of a filling machine built according to one embodiment of this invention;

Fig. 2 is a horizontal section through the machine showing in plan the filler bowl and the deflectors disposed therein;

Fig. 3 is a section through the machine taken partly in one horizontal plane and partly in another horizontal plane, both below that of Fig. 2;

Fig. 4 is a plan view on an enlarged scale showing one of the volumetric filler units of the machine;

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Fig. 5 is a side elevation of this volumetric filler unit, and showing diagrammatically also the relationship of the valve operating mechanism to the valve of this unit;

Fig. 6 is a section on the line 6—6 of Fig. 5 looking in the direction of the arrows;

Fig. 7 is a fragmentary horizontal section through the machine taken in a plane intermediate the planes of Figs. 2 and 3, and showing the filler valve trip mechanism;

Fig. 8 is a fragmentary side view showing this trip mechanism and its mounting;

Fig. 9 is a side view showing the cam for closing the filler valves;

Fig. 10 is a developed view on the line 10—10 of Fig. 7 looking in the direction of the arrows, and illustrating how the filler valves are operated as the cans are carried around the machine;

Fig. 11 is a side view on an enlarged scale of the no-can no-fill control mechanism for the trip mechanism;

Fig. 12 is a fragmentary horizontal section showing on an enlarged scale the drive to the feed screw for feeding the powdered or flaky material to the machine; and

Fig. 13 is a section on the line 13—13 of Fig. 12 looking in the direction of the arrows.

Referring now to the drawings by numerals of reference, 20 (Fig. 1) denotes the base of the machine which is supported at the desired height above the floor level by the adjustable telescoping legs 21. Mounted centrally in the base 20 of the machine to project upwardly is a hollow shaft 22 which is suitably journaled in the base 20. This shaft is adapted to be driven through gearing or other suitable means (not shown) from a shaft 24 driven by a motor, or other outside source of power (not shown).

Mounted on the upper end of the shaft 22 to rotate therewith is a filler bowl 25. This filler bowl has a depending sleeve or hub 26 which is keyed to shaft 22. This filler bowl is adapted to be loaded with the material which is to be filled by the machine into cans or other containers.

Secured in the base of the filler bowl 25 is a plurality of measuring tubes 27 (Figs. 1 and 6), each of which consists of two tubular telescoping sections denoted at 27' and 27'', respectively. The sections 27' are brazed or welded in openings in the bottom of the filler bowl 25; and the sections 27'' are brazed or welded, or otherwise secured in the upper flange or web 28' of a supporting spool 28. Spool 28 is bolted or otherwise fastened to the web 29 of a hub member 30 which is keyed to shaft 22 and mounted below the sleeve-like extension 26 of the bowl 25. Downward thrust of hub member 30 is taken by an antifriction bearing 31 carried by base 20.

As the filler bowl 25 rotates, powder or flakes, depending upon the material in the bowl, is pushed out of the bowl into the measuring tubes 27, and leveled off in the measuring tubes through action of a leveling scraper 35 (Figs. 1 and 2). This leveling scraper is carried from a stationary supporting spider 36 by the parallel linkage 37. The spider has four radially-extending arms 38 (Fig. 2) welded at their inner ends to its hub portion 39. Hub portion 39 is mounted on a bushing 40 (Fig. 1) that, in turn, is mounted on a plug 41 which is secured in a sleeve 43 that is welded or otherwise secured at its lower end to the hub portion 46 of bowl 25. A bolt 48, that threads at its lower end into hub portion 46, and washers 49 serve to secure plug 41 and spider 36 in place.

The bowl 25 and spider 36 are adjustable vertically to adjust the volumetric capacity of the measuring tubes 27 as will be described hereinafter. The spider is held against rotation and is guided in this vertical adjustment by guide pins 42 which are carried by the stationary ring 44 and which engage in holes in the outer ends of the arms 38 of the spider. The ring 44 in turn is mounted

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upon vertical posts 45 and 45'. Posts 45 are carried by brackets 47 which are supported from the base 20 of the machine. The mounting of post 45' will be described further hereinafter.

Deflectors 50 (Fig. 2), which are bolted to the arms 38 of the spider 36, serve to continuously push the granular or flaky material in the bowl out to the periphery of the bowl over the upper open ends of the measuring tubes 27, thereby to fill these tubes as the bowl rotates. They also serve to deflect the powdered or flaky material entirely away from the top of each measuring tube 27 at the time the contents of the tube are dumped, by rotation of associated valve 55, into a can.

The measuring tubes are closed at their bottoms during loading thereof by pivoted valve members 55 (Figs. 5 and 6) which are shown in Fig. 6 both in open and in closed positions. These valve members are journaled by means of diametrically disposed pins 56, 56' in bushings 57 in blocks 58. The blocks 58 are welded or otherwise fastened to the underside of the flange 28' of the spool 28. Each valve 55, when closed, forms the bottom of a measuring tube 27.

Each valve 55 is operated by rocking an arm 106, which is fixed at one end to the outer end of the pivot pin 56' of the valve. There is a pin 104 carried in the free end of each arm 106; and a roller 105 is mounted on each such pin for a purpose which will appear hereinafter. When the powdered or flaky material has filled the telescoping measuring tubes 27 and has been leveled by the deflectors or scrapers 35 and 50, the flapper valve 55 is rotated downward causing the measured charge of powder or flaky material to be dumped directly into an associated hopper 60. There is one of these hoppers associated with each measuring tube. It is secured by bolts 61 or other suitable means in sealed engagement with the associated block 58 in an opening in that block which registers with the associated measuring tube 27. Since the lower section 27'' of the measuring tube is itself mounted in sealed relation to the associated block 58, and since the associated valve 55 is mounted within each block 58 between a tube 27 and its associated hopper 60, it will be seen that the mounting of the measuring tubes and hopper is dust-tight.

Each valve 55 is, of course, larger in diameter and area than its associated measuring tube 27 to close the lower end thereof when the valve is in its upper position. Each valve is smaller in diameter and area than the upper part of the associated hopper 60, however, so that the valve can readily swing down into the hopper to dump the contents of the tube into the hopper.

Welded to the bottom of each hopper 60 is a ring 62 in which is mounted a sealing ring 63. Prior to the dumping of each valve 55, a can, which is to be filled, is forced upward into direct engagement with the corresponding seal 63 thereby providing a dust-tight connection between the hopper 60 and the can.

It has been common practice in other types of volumetric filtering machines to have a stationary plate forming the bottom of the traveling telescoping filling tubes. It is apparent that this design does not lend itself to good dust-tight operation. With the design of the present invention, however, a dust-tight valve 55 is provided for each filling tube and likewise a dust-tight hopper 60, thereby providing good dust control. With the present invention, also, the air displaced from the can, which is dust-laden, is taken care of, as will be described hereinafter.

The valve of the present invention is simple. It is superior to a sliding type valve because the sliding valve would pull dust or granules with the slider into the slider enclosure, and thus shortly become clogged if shrouded to prevent leakage of dust; and if it were not shrouded, then it would carry fine granules of the product with it.

The means for feeding the cans to the hoppers may be of conventional construction and forms no part of the present invention. As shown, this means comprises a

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track 65 (Fig. 3) over which the cans are fed to the machine, a feed worm 66 for feeding the cans C from the track to the rotary feed member 67, and a plurality of jaw members 70 for receiving individual cans from the rotary star wheel feed member 67, carrying the individual cans around the machine, and delivering them to any suitable conveyor for carrying them off to the can closing machine.

The jaw members 70 are arranged in pairs. The two jaw members of a pair being disposed one above the other in vertically spaced relation and being adapted together to hold a can adjacent its top and bottom. They are bolted to the flange 29 of the hub 28 to rotate with the bowl 25.

Any suitable known means, such as cam plate 72 (Figs. 1 and 10), may be used for raising the cans, which are to be loaded, into sealing engagement with the seals 63 of successive hoppers 60, and for disengaging the cans again from the hoppers after they have been filled.

The opening of the valves 55, to permit the contents of the measuring tubes to be dumped into the associated hoppers 60, is effected by operation of a pivoted cam member 75 (Fig. 8); which is pivoted on a pin 76 mounted on an arcuate plate 77. Plate 77 is secured adjacent opposite ends to the post 45' and to the adjacent post 45.

Mounted on a post 80 (Figs. 3 and 11) in the base of the machine is a non-can-no-fill contactor comprising a shoe 81. Shoe 81 is secured to an arm 82 that is pivoted by means of a pin 83 in a fixed bracket 84. Secured to the pin 83 is an arm 85 which carries an adjustable screw trip member 86 that is adapted to engage the trip member 87 of a micro-switch 88. Switch 88 is fastened to a plate 89 which in turn is secured to a bracket 97 that supports post 45' from post 80. The microswitch 88 is electrically connected to a push-pull solenoid 90 (Figs. 7 and 8) whose armature 91 is connected by means of a link 92 with a bell crank lever 93 that is pivoted at 94 on the arcuate rail 77 and that is connected by means of the pin 95 and link 96 with the cam lever 75.

The shoe 81 is positioned, as shown in Fig. 3, so that as the jaws 70 rotate each can C to filling position, after picking it up from the star wheel 67, the can will engage the shoe. The shoe 81 (Fig. 11) is constantly pressed clockwise about its pivot 83, as shown in Fig. 11 by a coil spring 98, which is fastened at one end by means of the pin 99 to the lever arm 85 and at its opposite end by means of a screw 100 to the bed of the machine. If there is a can in position to be filled, the can will engage the shoe and rock the lever arm 85 (Fig. 11) upwardly to trip the limit switch 88 and energize the solenoid 90 to dispose the cam lever 75 (Fig. 8) in position to engage the roller 105 (Fig. 5) carried by the next valve trip arm 106 which rotates into position as spool 28 and bowl 25 revolve together. Thereby, this next valve trip arm will be rocked downwardly as the roller passes under the cam lever 75, thus rocking the associated valve 55 downwardly, and dumping the contents of the associated measuring tube 27 into the can. If there is no can in position to be filled, then the shoe 81 will not operate to trip the limit switch 88, and the cam lever 75 will not be swung down into operative position; and the valve 55 will not be dumped.

For returning the lever arms 106 to their upper positions, a cam 115 (Figs. 7 and 9) is provided which is secured by means of screws 116 to a plate 117 that is welded or otherwise fastened to the arcuate rail 77.

A toggle spring 118 (Figs. 4 and 5), which is secured at one end by means of a pin 119 to each lever arm 106 and which is secured at its opposite end by means of a pin 120 to each block 58, serves to releasably lock each lever arm in either its upward or downward position.

When a flaky material, such as lye or sodium hydroxide flakes, is filled into a can, the measured charge necessary for each can will not fit into the can when dumped

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from the measuring tube. As a matter of fact, there is considerable surcharge which has to be controlled until the can is vibrated sufficiently to settle the flakes to a point below the sealing line of the can. In order to provide a high-speed filling machine for this type of material, however, it is necessary to dump the entire charge from the measuring tube immediately, so that the flapper valve can be immediately closed to enable the next charge to be measured. We have accomplished this by providing the hoppers 60. The hoppers handle the surcharges until the can is adequately vibrated to settle the flakes.

To prevent the dust of the material being loaded from escaping when the content of a measuring tube 27 is dumped into the associated hopper 60, there is a stationary hood 125 mounted over the top of the filler bowl 25, being secured to the plate 44 by screws or other suitable means (Fig. 1). This hood is made dust tight against the bowl by an annular flexible wiper seal 126 that is carried by a ring 127 which is welded to the underside of plate 44 and mounted upon the posts 45 and 45'. The hood 125 is formed at its top with a connection 128 for a duct that leads to an exhaust fan which conveys the objectionable dust to a suitable disposal device. The fan and disposal system are not part of the present invention.

The exhaust fan will place the filler bowl and dust hood 125 under sub-atmospheric pressure, which will prevent the dust created by the measuring and filling operations from seeping outward into the room. When the powder is dumped into a can the displaced air from the can travels upward through the telescoping measuring tubes 27 up to the filler bowl 25 and thence into the hood 125, due to the reduced pressure in the hood. The velocity of the air stream through the telescoping measuring tube 27 will be relatively high. Therefore, it is possible that large particles of dust may be carried up into the hood 125 above the filler bowl. Due to the enlarged volume in the filler bowl and hood, however, the air velocity will be reduced considerably there; and the heavier particles of dust will settle out of the air stream back into the filler bowl. The fine particles of dust, that cannot be settled out by this means, go on through the fan and to the final disposal system.

A sharp vertical vibration is most effective insuring proper settlement of flaky material, such as lye flakes in a can. Therefore, a saw-tooth section 110 (Fig. 3) is provided in the track 72, over which the cans travel, to insure this vibration. This section of track can be adjusted up or down in order to attain the proper amplitude of vibration. For some materials it may not be necessary to use a vibrator, in which case the sawtooth section 110 may be lowered below the track level.

After the material has been settled in the can to a point below the sealing line of the can by means of vibration, the cam track 72 (Figs. 1 and 10) holding the can in direct contact with the seal 63 (Fig. 6) at the bottom of the valve hopper will cam downward, allowing the can to disengage itself from the seal. The associated flapper valve 55 at this time is still open, allowing the dust-laden air in the filler hopper 60 to pass upward into the dust hood 125, thereby purging the valve hopper of dust-laden air. At a predetermined time interval, after the lowering of the can from the rubber seal, the flapper valve will close. Then the valve tube is ready to measure the next charge.

Adjustment of the volumetric capacity of the measuring tubes 27 is effected by rotation of the hand wheel 130 (Fig. 1). This hand wheel is secured to a shaft 131 that is journaled in a bearing member 132 which is secured to the lower bearing portion 133 of the base 20. The shaft 131 is welded to a nut 135 that threads in the bearing member 133. Mounted within this nut 135 on a thrust bearing is the lower end of a shaft 136 which is rotatable in tubular shaft 22 and which at its upper end seats against a shoulder 137 formed in the base of the bowl 25 at the top of the sleeve or hub 26. Rotation of the hand wheel

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130, therefore, raises or lowers the bowl, and the measuring tube sections 27' carried thereby, with reference to the measuring tube sections 27". The pins 42 serve to guide the bowl in its vertical adjustment.

In a filling machine of the type described, where the product is deflected back and forth across the measuring tubes 27 and where the product must be deflected entirely from above the measuring tube at the time of dumping, it is necessary to maintain close control of the amount of product in the bowl at all times.

To this end, the supply hopper 140 (Fig. 1) for the filling machine is mounted at one side of the filling machine proper, and the powdered, or flaky, material is supplied to the machine from the hopper by a conventional screw type feeder 141 that is driven by drive mechanism such as shown in Figs. 12 and 13. The screw 141 feeds the stock forward into a chute 142 (Fig. 1) which delivers it into the bowl 25.

The drive to screw 141 comprises the variable speed gear motor 145, and the drive shaft 146, which is adapted to be driven thereby. The shaft 146 is journaled in a suitable bearing 147 and is connectable by an overrunning clutch 148 and by a single revolution clutch 149 selectively with the sprockets 150 and 151. It is connected by a standard coupling 157 with the feed screw 141. Sprocket 150 is connected by a chain 154 to a drive sprocket 152, which is mounted on the shaft 153, that is driven by the motor 145. The sprocket 151 is driven through the chain 156 from a sprocket 155, which is also mounted on the shaft 153.

It will be noted that the ratio of the drive comprising the sprockets 152 and 150 and chain 154 is a higher ratio than the drive comprising the sprockets 155 and 151 and the chain 156. Clutch 148 therefore drives the shaft 146 at less than, say approximately 90% of, the rate required to keep the exact amount of flakes in the bowl 25. Clutch 149 when in operation, will drive the shaft 146 at more than, say approximately 10% above, the required rate. When the clutch 149 is in operation, clutch 148 overruns.

Clutch 149 is controlled by the amount of material in the filler bowl 25. The variable speed drive on the motor 145 enables the operator to set the average speed of the feed screw 141 reasonably close to the required rate. The high and low speed feature proved by the clutches 148 and 149 automatically controls the rate of feed as dictated by the quantity of the material in the bowl 25.

There is a deflector 165 (Fig. 2) pivoted by means of the pin 166 on one of the arms 38 of the spider 36. This deflector is connected by means of a link 167 with a cam rod 168 that is reciprocable to operate a relay cut-out switch 169 on movement in one direction and to operate a relay closing switch 170 on movement in the other direction. The switches 169 and 170 are connected to a solenoid 172 (Figs. 12 and 13). The armature shaft of this solenoid is connected by a link 173 with a stop lever 174. This lever is ordinarily held in locking position, to prevent operation of the clutch 149, by a coil spring 175.

When the material in the bowl 25 becomes relatively low, the deflector 165, which is constantly urged outwardly about its pivot 166 by the coil spring 176 (Fig. 2), moves the cam rod 168 to actuate the switch 170 which energizes the solenoid 172, causing the clutch 149 to be engaged to drive the shaft 146 at its high speed. As the material then builds up in the bowl 25, the pivoted deflector is rocked inwardly about its pivot 166 against the resistance of the spring 176, and the cam rod 168 is moved to trip the limit switch 169 which deenergizes the solenoid 172, thus disengaging the clutch 149. The overrunning clutch 148 then becomes engaged and drives the shaft 146 at its slow speed.

If it is necessary for the operator to stop the filling machine for any reason, the feeder will continue to run

until the product builds up in the feed chute 142 (Fig. 1), and until it fills up the opening in the bottom of the feed screw trough 144, causing the material to bridge this opening and to deflect the gate 180. The gate 180 is pivoted on the top of the feed trough 144. It is connected to an arm 181 which is in turn connected to a pull rod 182. This pull rod has a pin and slot connection to a lever 183 so that when the gate 180 is swung clockwise from the position shown in Fig. 1 the lever 183 will be pulled away from the arm 184 of the limit switch 185, permitting this limit switch to operate to shut off the motor 145.

When the filling machine is started again, the drive mechanism to the feed screw 141 will remain inactive until the material backed up in the feed trough 144 falls clear of the gate 180, allowing the gate to rotate back to the position shown in Fig. 1, and allowing the limit switch 185 to operate to restart the motor 145.

To prevent overflow there is disposed opposite the outlet end of the chute 142 a deflector or guard plate 195, which is fixedly secured to the plate 44 (Fig. 1). When the machine is stopped the material will pile up against this plate 195 and be backed up into the chute.

The operation of the machine of the present invention will be understood from the preceding description but may be briefly summed up here.

During operation the feed screw 141 is running continuously to supply the material, which is to be packed, to the filler bowl 25 through chute 142; and the filler bowl is driven continuously from shaft 24 (Fig. 1) in the direction of the arrow A (Fig. 2). As the filler bowl revolves it carries the measuring tubes 25 and their respective associated hoppers 60 around with it. As the filler bowl revolves also it carries the cans C, received from the starwheel 67 (Fig. 3) around with it too, each can being held in jaws 70. As the filler bowl revolves, also, the stationary deflectors 50 (Fig. 2) sweep material out of the filler bowl into the measuring tubes 27, and the deflector 35 levels off the material in each measuring tube. The cans are successively raised and held in sealing engagement with the seals 63 (Fig. 6) of the different hoppers 60 by conventional stationary cam track 72 (Figs. 1 and 3). If there has been a can properly raised into engagement with a hopper 60, then as the measuring tube 27, which is associated with that hopper, approaches cam arm 75 (Figs. 7 and 8) that cam arm will be moved downwardly so that as the roller 105 (Fig. 5) of the arm 106, which is associated with that measuring tube, moves under the cam arm 75, the arm 106 will be rocked downwardly to cause the associated valve 55 to dump the contents of the measuring tube through the associated hopper 60 into the can beneath the hopper. If there is no can under the hopper, the sensing shoe 81 (Figs. 3 and 11) will not operate switch 88, and solenoid 90 (Fig. 8) will not be actuated, and cam arm 75 (Fig. 5) will remain in its upper, inoperative position.

The valve 55 remains open while the can is being vibrated over cam track section 110 (Fig. 3) to settle the powdered or flaky material into the can; then the valve is closed by operation of cam 115 (Figs. 7 and 9) on the roller 105 (Fig. 5) of the arm 106 which is secured to the valve. While the valve 55 is open more material is prevented from dropping through the open measuring tube into the can by the deflectors 50 (Fig. 2). While the valve 55 is open dust and the air exhausted from the can are carried up through the open measuring tube to the filler bowl. The heavier dust particles settle out into the filler bowl while the lighter ones are carried away through the exhaust system which is connected to coupling 128 (Fig. 1) of hood 125.

After a can has been filled it is lowered away from the hopper 60 with which it has been associated and is conveyed out of the machine.

The bowl 25 rotates in the direction denoted by the arrow A in Fig. 2. Through the angular distance de-

noted at B, the volumetric tubes 27 are being filled. Through the angular distance denoted at D, the cans C are being filled.

During operation of the machine the quantity of material in filler bowl 25 is controlled by deflector 165 (Fig. 2) through switches 169 and 170 which control solenoid 172 (Figs. 12 and 13), thereby controlling the speed of rotation of feed screw 141. If the machine is stopped, material backed up in filler bowl 25 will cause gate 180 (Fig. 1) to trip switch 185 and stop the drive motor 145 (Figs. 12 and 13).

While the invention has been described in connection with a specific embodiment thereof, it will be understood that it is capable of further modification; and this application is intended to cover any variations, uses, or adaptations of the invention, following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth and as fall within the scope of the invention or the limits of the appended claims.

Having thus described our invention, what we claim is:

1. A machine for filling containers with a dry material comprising a rotary bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of volumetric measuring tubes communicating with said bowl so that each receives a measured quantity of the material from said bowl, a hopper mounted beneath each tube to rotate therewith and to receive the measured quantity of material from said tube, the volumetric capacity of each hopper being greater than the volumetric capacity of the associated tube, means for carrying a container around with the bowl beneath each hopper during rotation of the bowl, a valve member for shutting off each tube from the associated hopper, means operable to open each valve to permit the measured quantity of material to flow from each tube into a container as said bowl rotates, said last-named means operating to hold said valve open for a period longer than required to fill the container, means for raising a container in sealed engagement with the bottom of a hopper prior to opening of a valve, and for holding said container in such sealed engagement as long as that valve is open and for then moving the container away from the hopper, and an exhaust hood mounted above said bowl and in sealed relation thereto to permit dust created by the dropping of the contents of a measuring tube into a container to be carried off through the open valve associated with that tube and through the bowl and the hood.

2. A machine for filling containers with a dry material comprising a rotary bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of volumetric measuring tubes communicating with said bowl so that each receives a measured quantity of the material from said bowl, a hopper mounted beneath each tube to rotate therewith and to receive the measured quantity of material from said tube, the volumetric capacity of each hopper being greater than the volumetric capacity of the associated tube, means for carrying a container around with the bowl beneath each hopper during rotation of the bowl, a valve member for shutting off each tube from the associated hopper, means operable to open each valve to permit the measured quantity of material to flow from each tube into a container as said bowl rotates, said last-named means operating to hold said valve open for a period longer than required to fill the container, means for raising a container in sealed engagement with the bottom of a hopper prior to opening of a valve, and for holding said container in such sealed engagement as long as that valve is open and for then moving the container away from the hopper, and an exhaust hood mounted above said bowl and in sealed relation thereto to permit dust created by the dropping of the contents of a measuring tube into a container to be carried

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off through the open valve associated with that tube and through the bowl and the hood, and means for agitating each container while the valve of the tube, which is registering with that container, is open.

3. A machine for filling containers with a dry material comprising a rotary bowl adapted to contain a supply of the material, a plurality of volumetric measuring tubes mounted to open at their tops into the bottom of said bowl, means for feeding containers successively into registry beneath successive measuring tubes as said bowl rotates and to hold the successive containers in such position until filled, a valve member for closing each measuring tube at its bottom, means for opening said valve member to permit the contents of the measuring tube to flow into the container which is in registry with the tube, and stationary deflectors mounted in said bowl to push material from said bowl into each measuring tube while the valve member associated with a tube is closed and to prevent material from being pushed into the tube while the valve member associated therewith is open and an exhaust hood mounted above and in sealed engagement with said bowl to carry off dust created when a valve is opened and the contents of a tube are dumped into a container.

4. A machine for filling containers with a dry material comprising a rotary bowl adapted to contain a supply of the material which is to be filled into the containers, a support mounted vertically below said bowl and connected to rotate with said bowl, a plurality of volumetric measuring tubes, each tube comprising a plurality of vertically-disposed telescoping sections, the uppermost section of each tube being secured to said bowl and having its upper end mounted in the bottom of said bowl to communicate with said bowl, the lowermost section of each tube being secured to said support, means for adjusting said bowl and support relatively toward and away from each other to adjust the volumetric capacity of said measuring tubes, a hopper mounted on said support beneath each measuring tube in sealed relation thereto, each hopper having a greater volumetric capacity than its associated measuring tube, a valve for closing each measuring tube at its bottom to prevent dumping of material from the measuring tube into the associated hopper, means for feeding containers into sealed engagement with the hoppers during rotation of the bowl and support, and means for opening each valve at a predetermined point in each revolution of the bowl and support to dump the contents of the associated measuring tube into the container, and an exhaust hood mounted above said bowl in sealed engagement therewith and connected to carry off dust created by the dumping of the contents of a measuring tube into a container.

5. A machine for filling containers with a dry material comprising a rotary bowl adapted to contain a supply of the material which is to be filled into the containers, a support mounted vertically below said bowl and connected to rotate with said bowl, a plurality of volumetric measuring tubes, each tube comprising a plurality of vertically-disposed telescoping sections, the uppermost section of each tube being secured to said bowl and having its upper end mounted in the bottom of said bowl to communicate with said bowl, the lowermost section of each tube being secured to said support, means for adjusting said bowl and support relatively toward and away from each other to adjust the volumetric capacity of said measuring tubes, a hopper mounted on said support beneath each measuring tube in sealed relation thereto, each hopper having a greater volumetric capacity than its associated measuring tube, a valve for closing each measuring tube at its bottom to prevent dumping of material from the measuring tube into the associated hopper, means for feeding containers into sealed engagement with the hoppers during rotation of the bowl and support, and means for opening each valve at a predetermined point in each revolution of the bowl and support to dump the contents of the associated measuring tube into a container, means for agitating each container while the valve thereabove is

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open to settle the material in the container, and an exhaust hood mounted above said bowl in sealed engagement therewith and connected to carry off dust created by the dumping of the contents of a measuring tube into the container.

6. A machine for filling containers with a dry material comprising a bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of volumetric measuring tubes communicating with said bowl, means for deflecting the contents of said bowl into said measuring tube, a feed screw for supplying material to said bowl, and means controlled by the amount of material in said bowl for controlling the rate of rotation of said feed screw.

7. A machine for filling containers with a dry material comprising a bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of tubes communicating with said bowl for conducting the material from the bowl to the containers to be filled, means for deflecting the contents of said bowl into said tubes, a rotary feed screw for supplying material to said bowl, means for driving said feed screw at a relatively fast rate, and separate means for driving said feed screw at a relatively slow rate, separate clutches for selectively connecting one or other of said driving means to said feed screw, and means controlled by the amount of material in said bowl for determining which of said clutches is engaged.

8. A machine for filling containers with a dry material comprising a bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of tubes communicating with said bowl for conducting the material from the bowl to the containers to be filled, means for deflecting the contents of said bowl into said tubes, a rotary feed screw for supplying material to said bowl, means for driving said feed screw at a relatively fast rate, and separate means for driving said feed screw at a relatively slow rate, separate clutches for selectively connecting one or other of said driving means to said feed screw, electrically actuated means for determining which of said clutches is engaged, and a movable deflector mounted in said bowl in position to be moved in one direction by an increase in volume of the contents of said bowl to operate said electrically-actuated means to engage the clutch for the slow-speed feed screw drive, and means for constantly urging the deflector in the opposite direction to engage the clutch for the fast-speed feed screw drive.

9. A machine for filling containers with a dry material comprising a bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of tubes communicating with said bowl for conducting the material from said bowl to the containers to be filled, means for deflecting the contents of said bowl into said tubes, a rotary feed screw for supplying material to said bowl, means for driving said feed screw including a motor, means connecting said motor to said feed screw to drive said feed screw at a relatively fast rate including a clutch, means connecting said motor to said feed screw to drive said feed screw at a relatively slow rate including an overrunning clutch, and means controlled by the amount of material in said bowl for determining when said first-named clutch is engaged.

10. A machine for filling containers with a dry material comprising a bowl adapted to contain a supply of the material which is to be filled into the containers, a plurality of tubes communicating with said bowl for conducting the material from said bowl to the containers to be filled, means for deflecting the contents of said bowl into said tubes, a rotary feed screw for supplying material to said bowl, means for driving said feed screw including a motor, means connecting said motor to said feed screw to drive said feed screw at a relatively fast rate, means connecting said motor to said feed screw to drive said feed screw at a relatively slow rate, means controlled by

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the amount of material in said bowl for determining which of said driving means is operative, and means operated by the amount of material in said bowl when it reaches a predetermined amount to shut off said motor.

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