May 22, 1956 P. E. FISCHER 2,746,223

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

Filed May 9, 1952 12 Sheets-Sheet 1

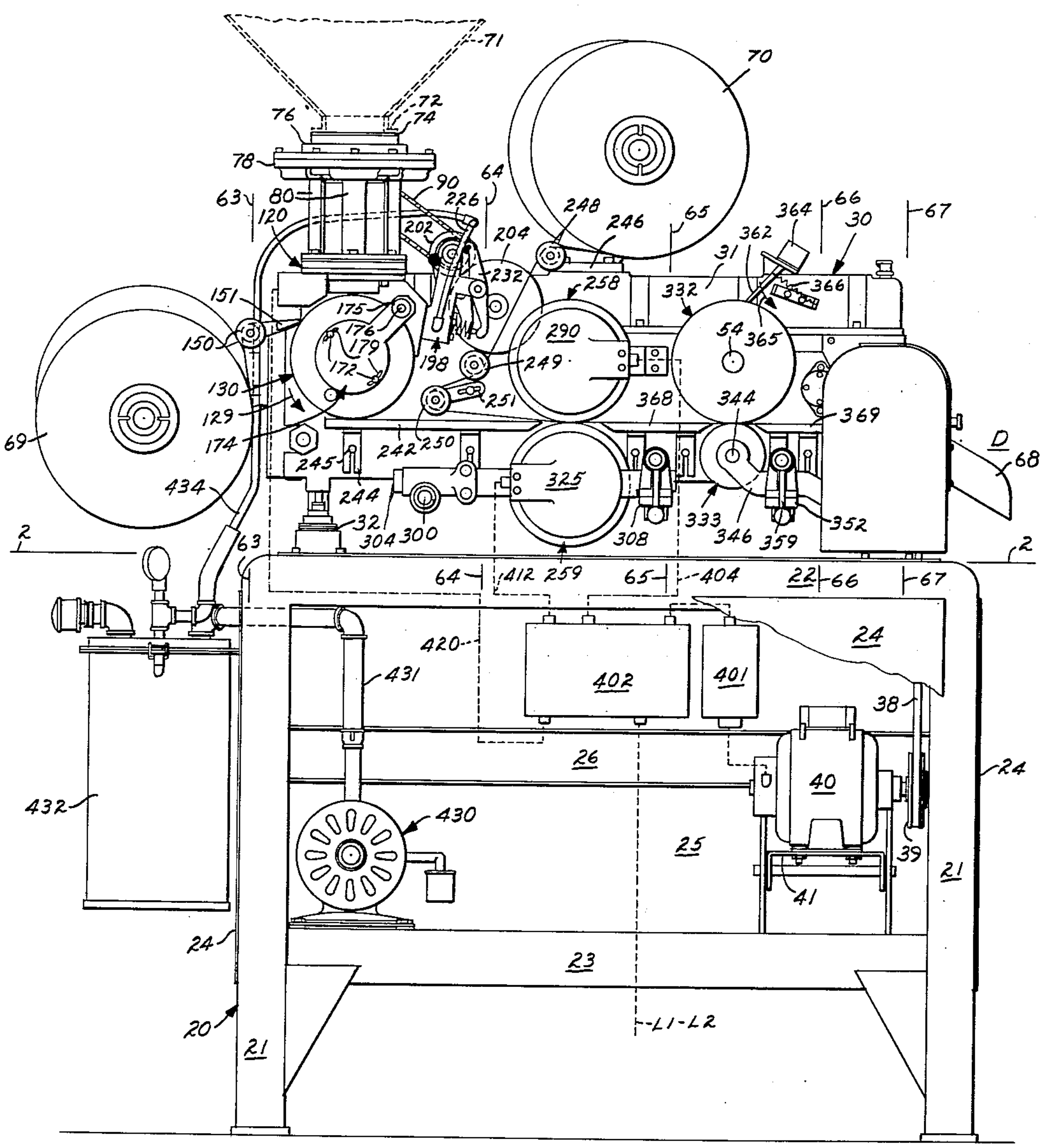

FIG. 1

INVENTOR.
PAUL E. FISCHER
BY Paul, Moore & Hugger
ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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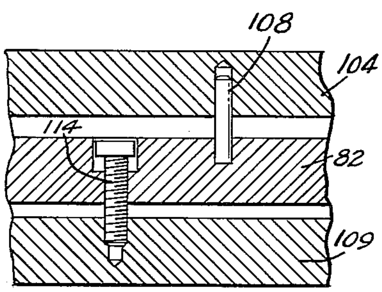

FIG. 7A

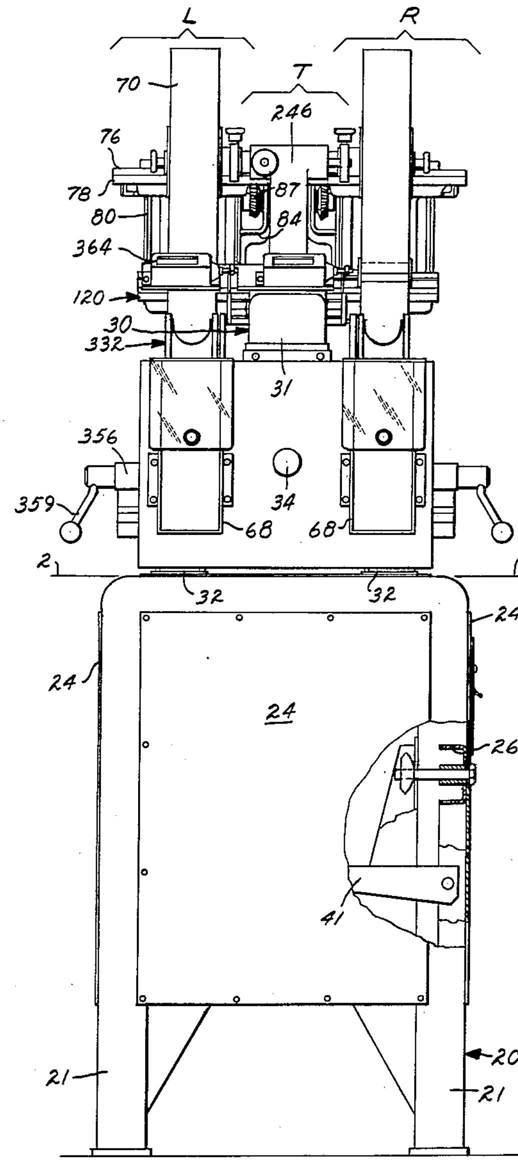

FIG. 2

INVENTOR.
PAUL E. FISCHER
BY
Paul, Moore & Dugger
ATTORNEYS.

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APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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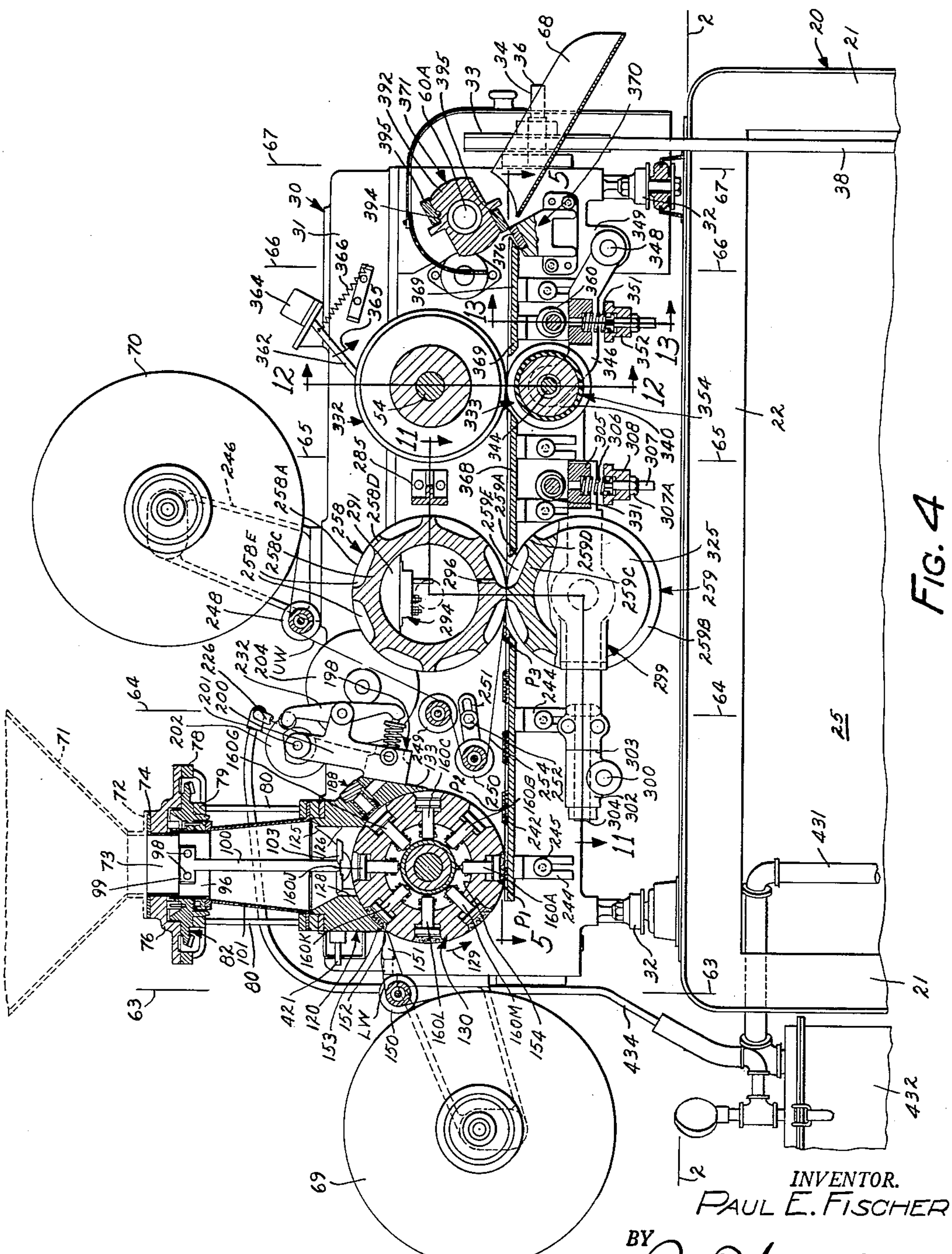

FIG. 4

INVENTOR.
PAUL E. FISCHER

BY Paul, Moore & Dugger

ATTORNEYS

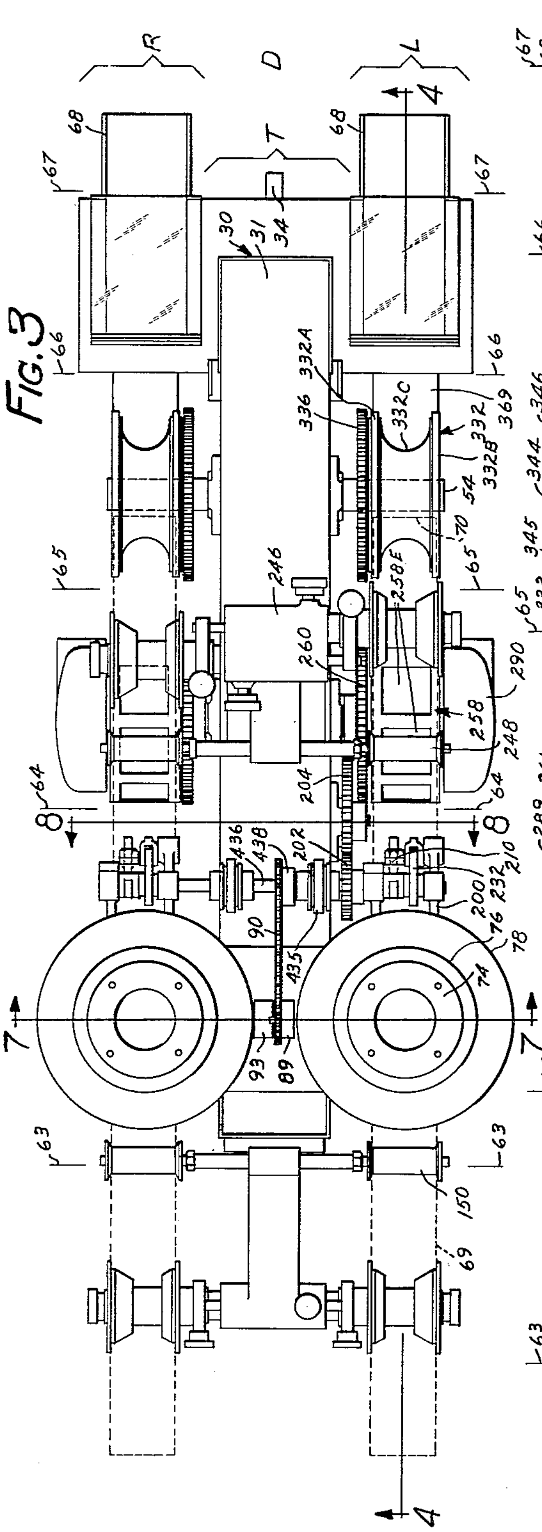

FIG. 3

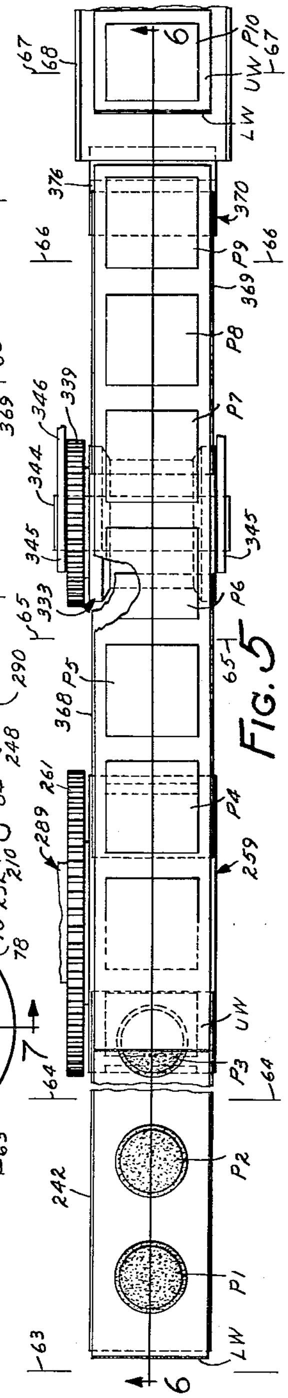

FIG. 5

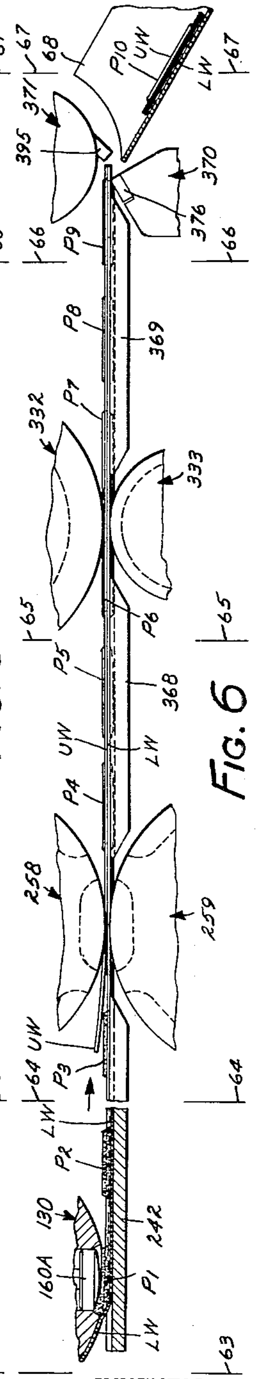

FIG. 6

INVENTOR.
PAUL E. FISCHER
BY
Paul, Moore & Hugger
ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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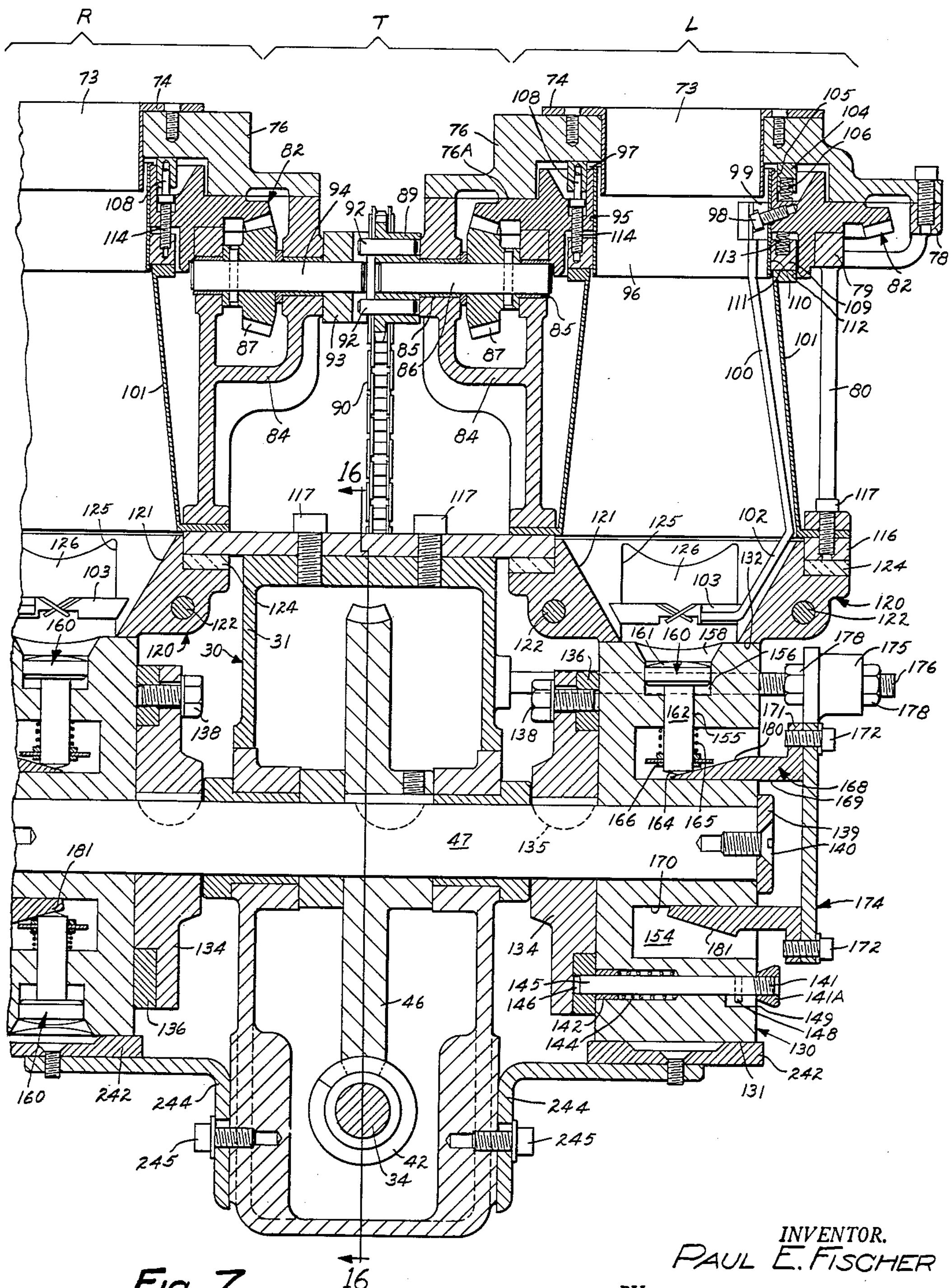

FIG. 7

INVENTOR.
PAUL E. FISCHER
BY Paul, Moore & Lugger
ATTORNEYS

May 22, 1956 P. E. FISCHER 2,746,223

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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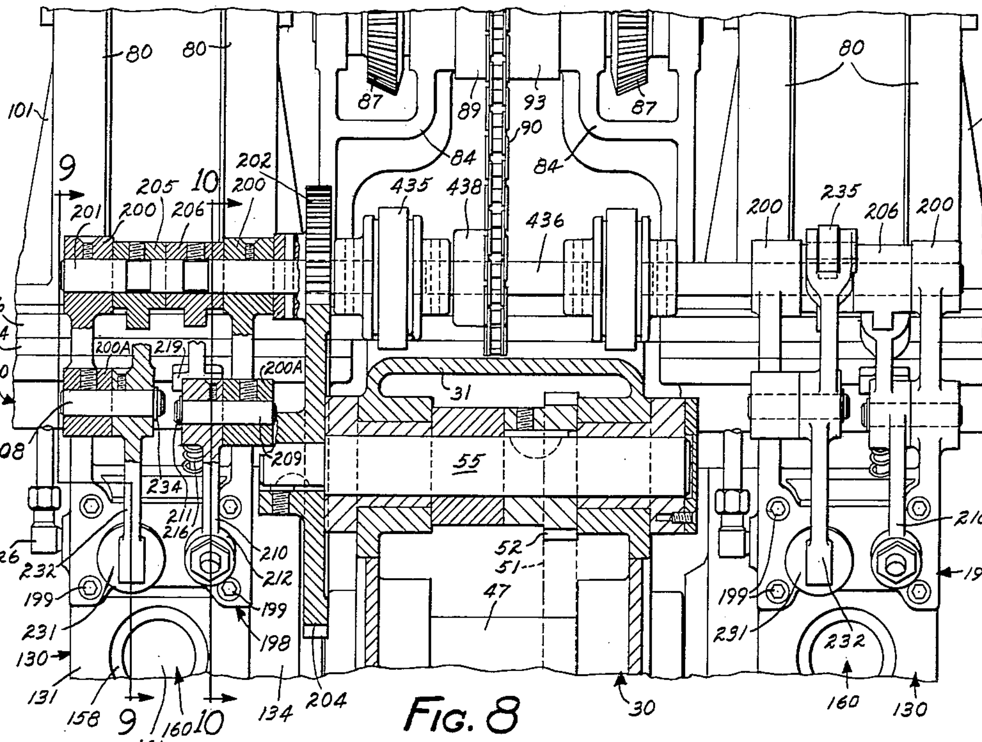

FIG. 8

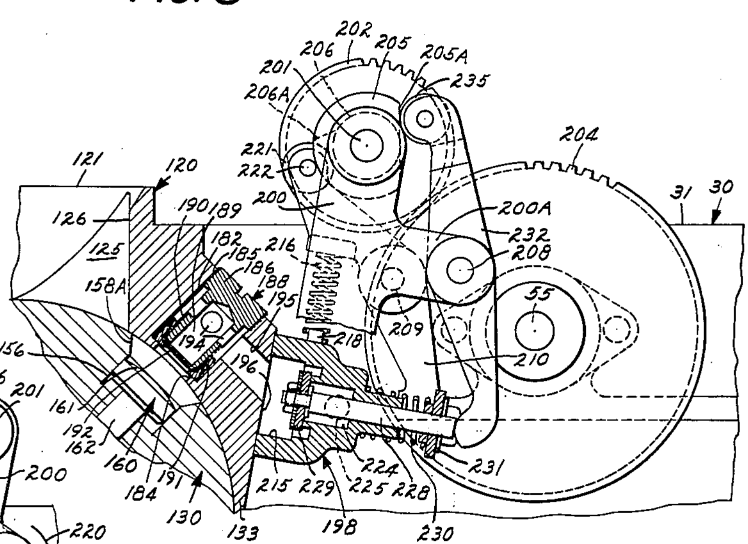

FIG. 9

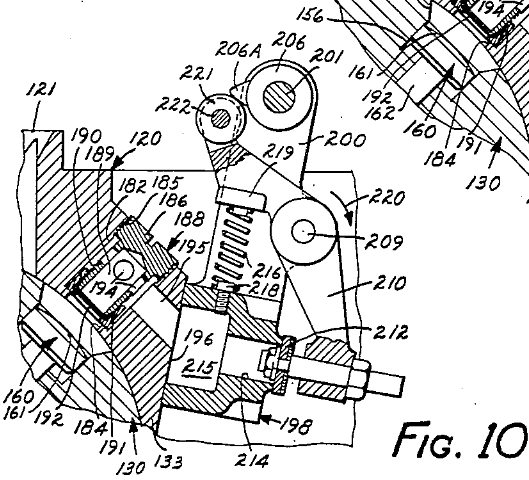

FIG. 10

INVENTOR.
PAUL E. FISCHER
BY
Paul, Moore & Dugger
ATTORNEYS

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APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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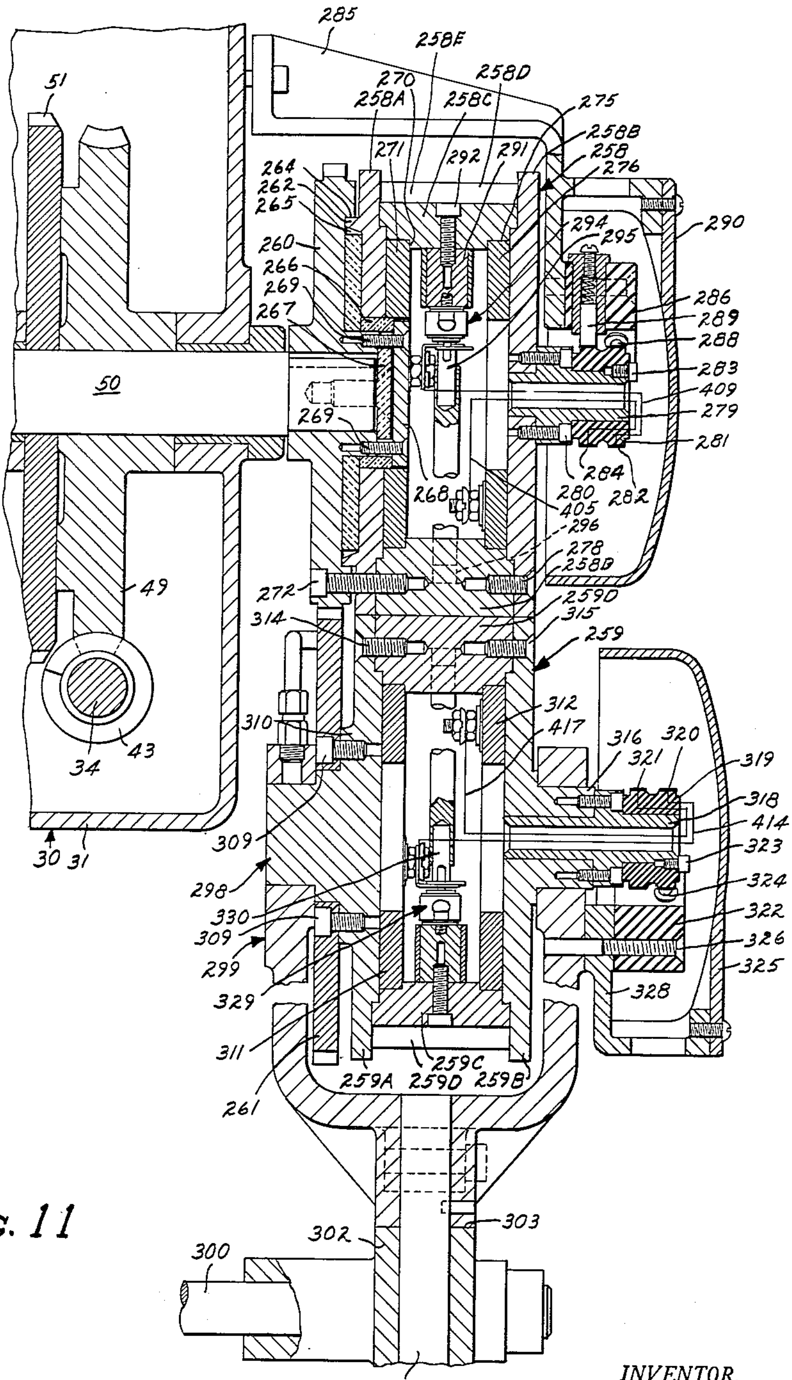

FIG. 11

INVENTOR.
PAUL E. FISCHER
BY
Paul, Moore & Rugger
ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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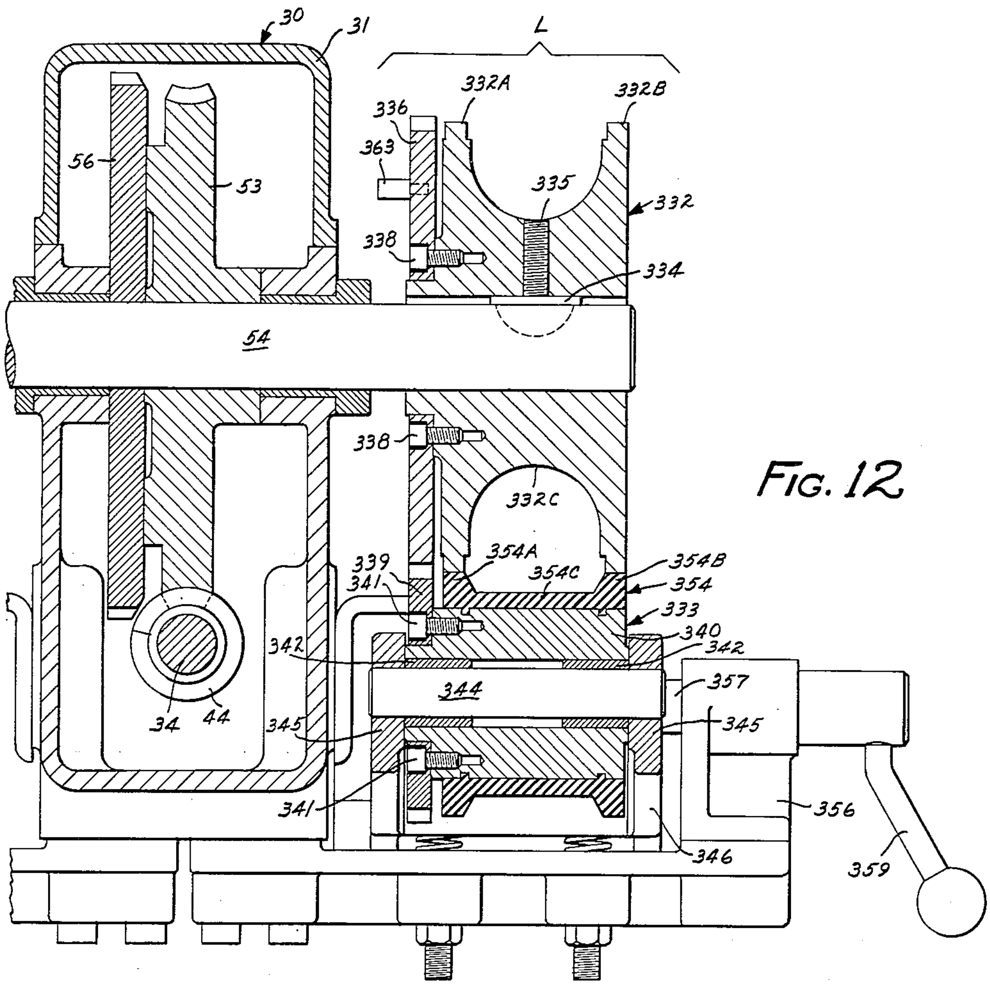

FIG. 12

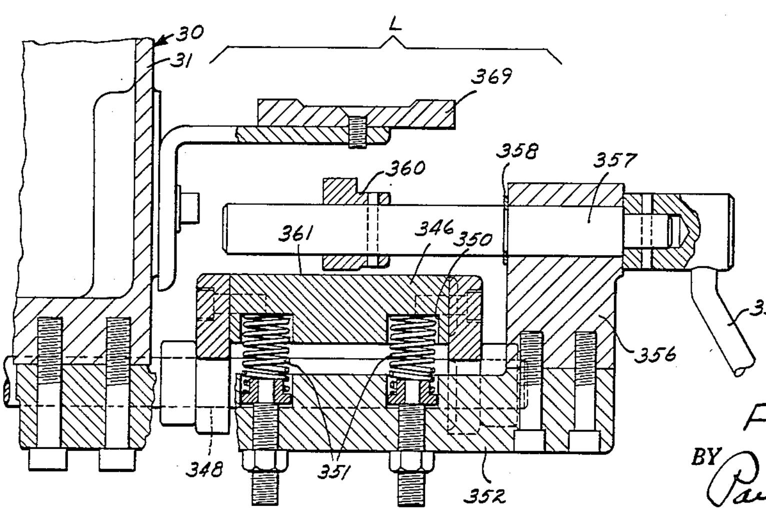

FIG. 13

INVENTOR.
PAUL E. FISCHER
BY Paul, Moore & Lugger
ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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FIG. 16

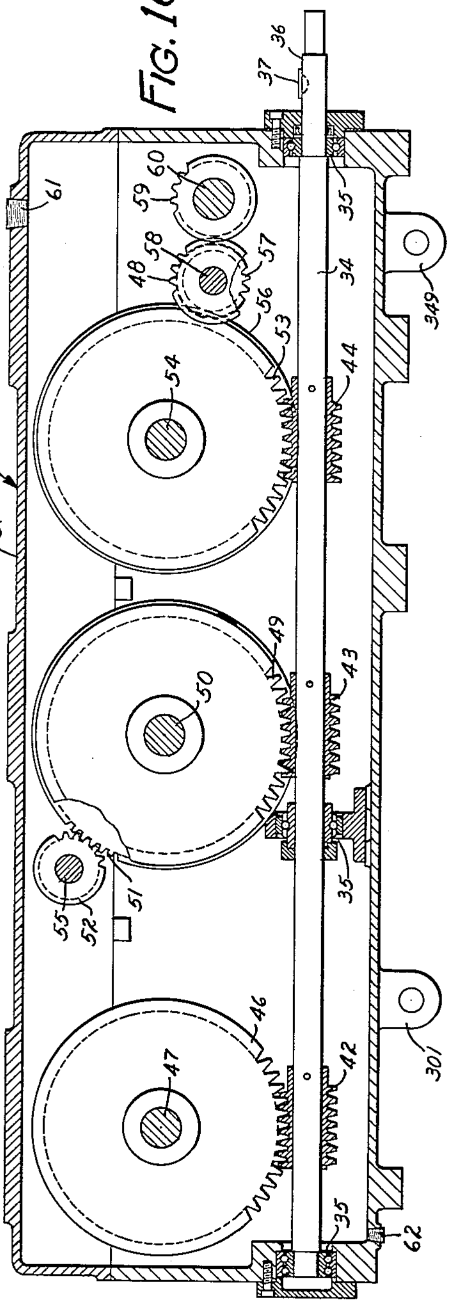


FIG. 15

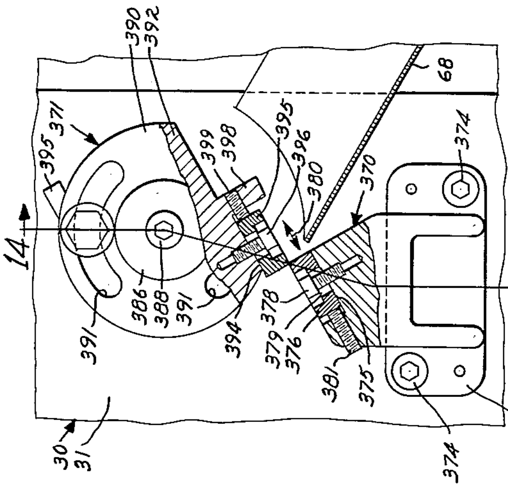
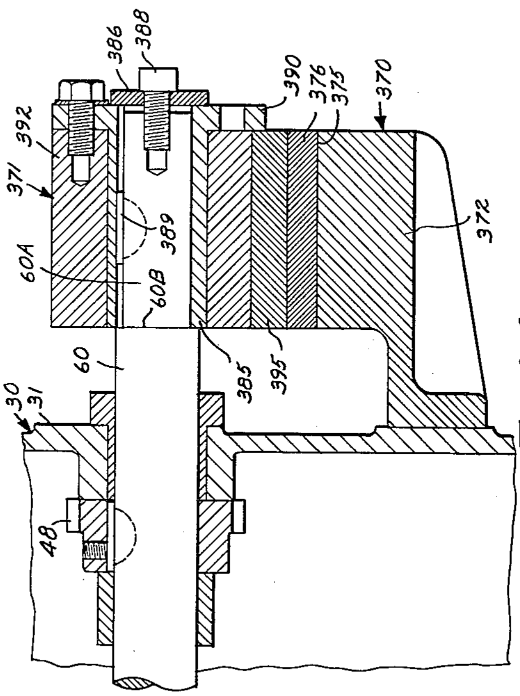


FIG. 14



INVENTOR.
PAUL E. FISCHER
BY
Paul, Moore & Hugger
ATTORNEYS

May 22, 1956 P. E. FISCHER 2,746,223

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

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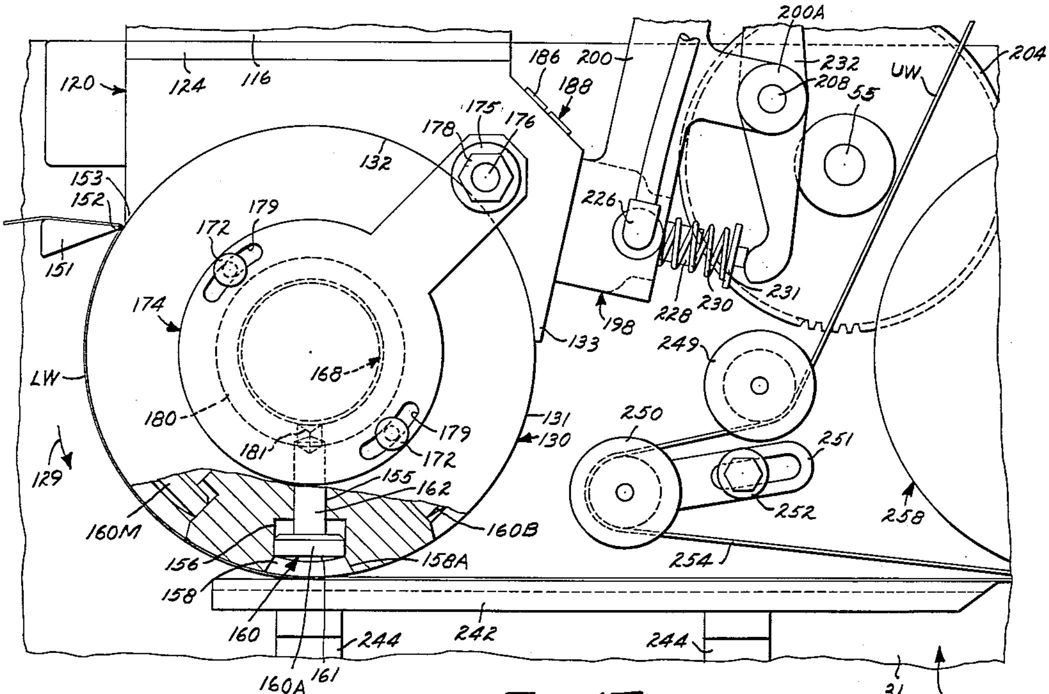

FIG. 17

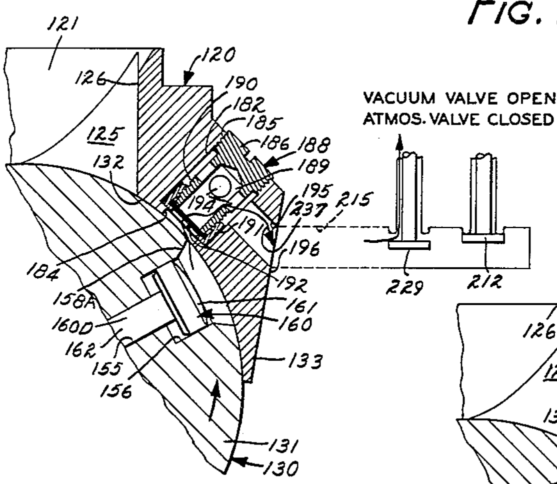

FIG. 18

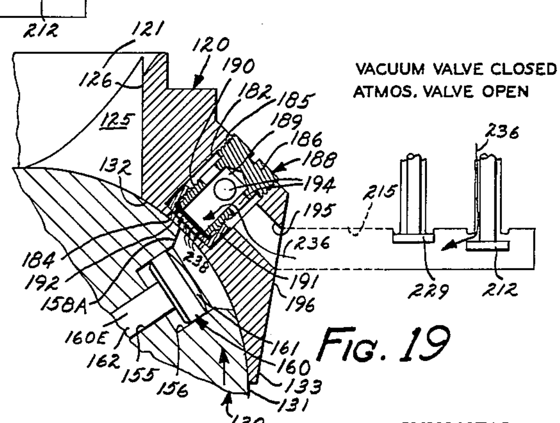

FIG. 19

INVENTOR.
PAUL E. FISCHER

BY Paul, Moore & Lugger

ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

Filed May 9, 1952 12 Sheets-Sheet 11

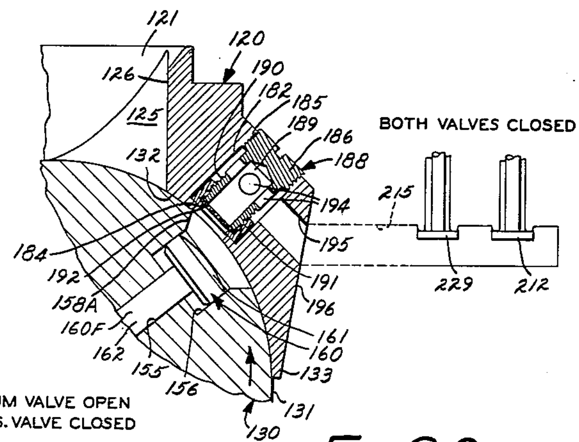

FIG. 20

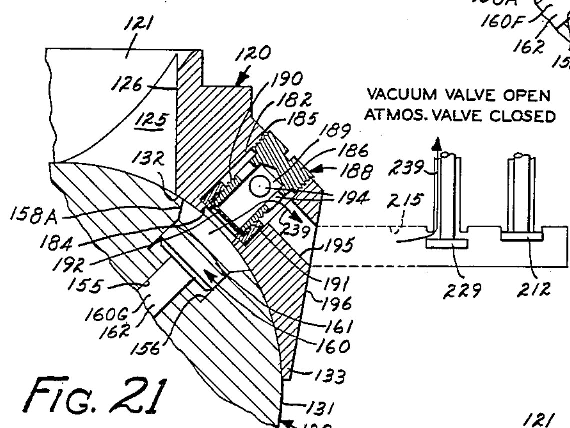

FIG. 21

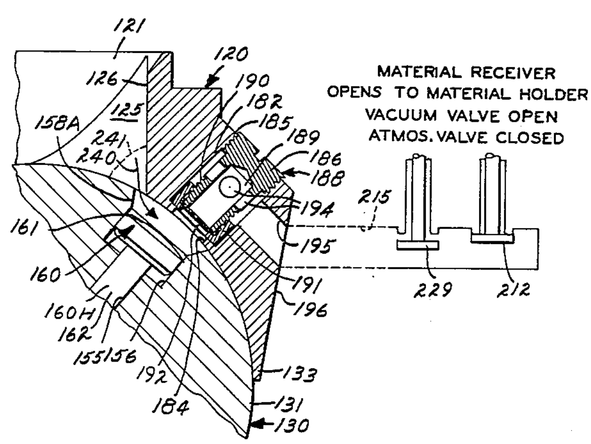

FIG. 22

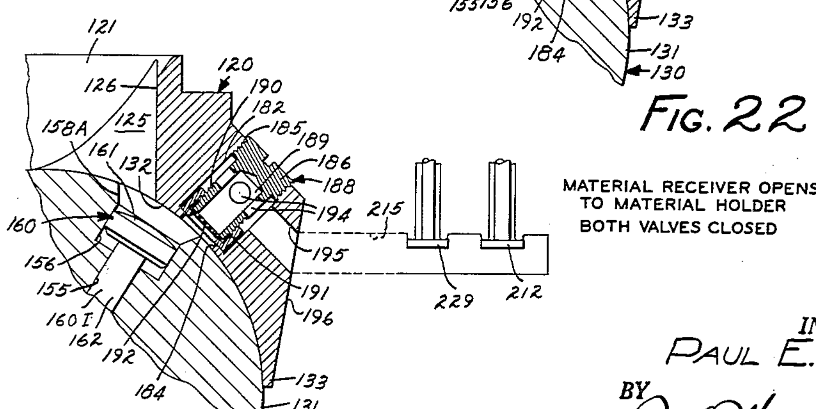

FIG. 23

INVENTOR.
PAUL E. FISCHER
BY Paul, Moore & Rugger
ATTORNEYS

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

Filed May 9, 1952 12 Sheets-Sheet 12

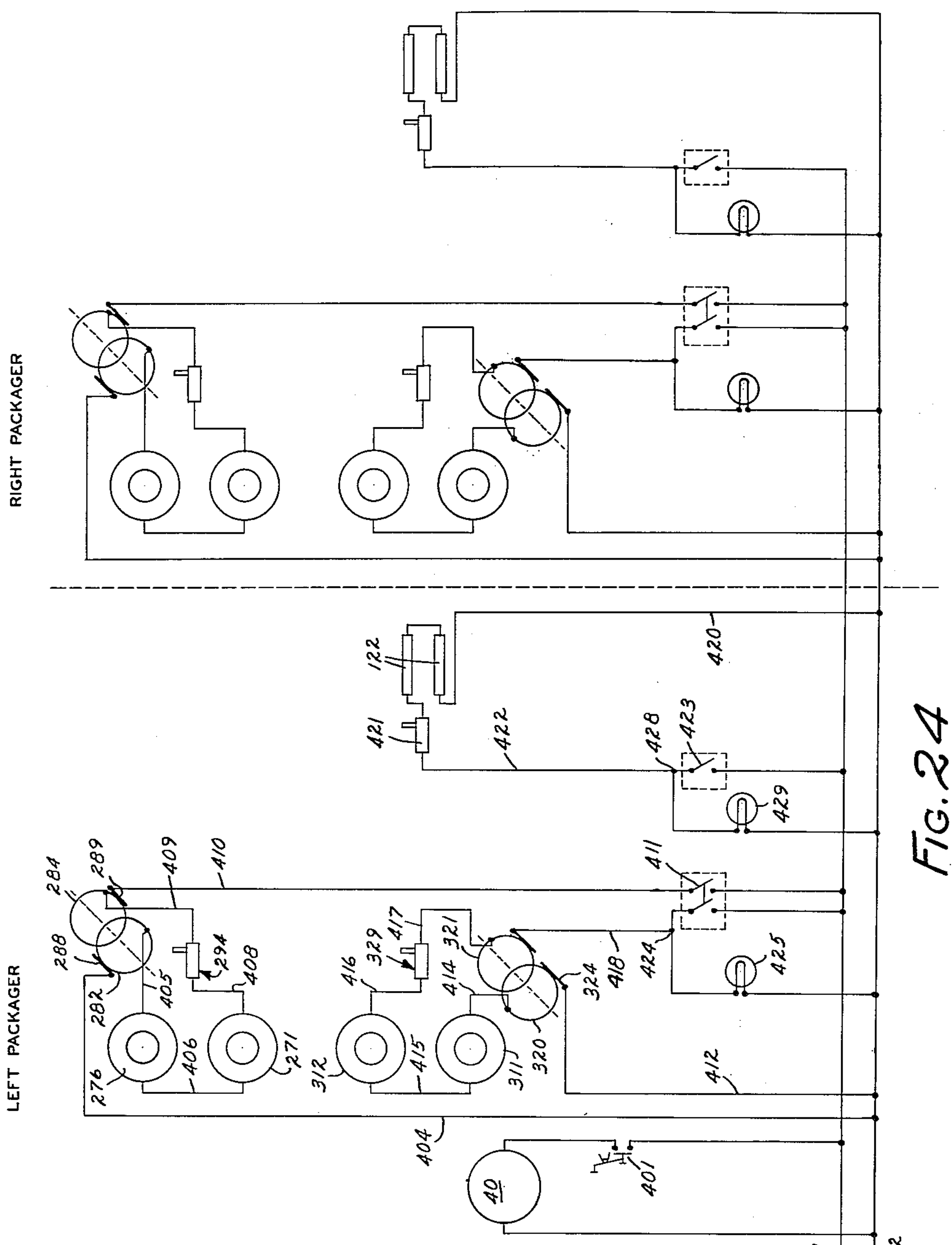

FIG. 24

INVENTOR.
PAUL E. FISCHER
BY
ATTORNEYS

United States Patent Office

2,746,223

Patented May 22, 1956

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2,746,223

APPARATUS FOR PACKAGING OF POWDER IN SMALL QUANTITIES

Paul E. Fischer, Minneapolis, Minn., assignor, by mesne assignments, to E. G. Staude Manufacturing Company, Inc., Concord, N. H., a corporation of New Hampshire

Application May 9, 1952, Serial No. 287,009

15 Claims. (Cl. 53—180)

This invention relates to an apparatus for the accurate packaging of small and accurately determined quantities of powder suitable for single usage of the entire packaged amount. In many applications, both in the medicinal, cosmetic, and food lines, powders of various types are for easy usage advantageously packaged in measured quantities suitable for the preparation of a prescribed amount of liquid solution. Thus, powdered coffee, which is a concentrated deliquescent crystalline solid, is most useful when it is packaged so that one small encapsulation or package can be broken open and the entire contents thereof used for the preparation of a single cup or a prescribed quantity of liquid coffee. Similarly, packaged milk solids are frequently desirably put up in small quantities such that by the opening of one package and dissolving the same in a prescribed quantity of water, a given amount, for example one glass or one cup, of fluid milk can be made.

In the cosmetic and medicinal lines the preparation of relatively small quantities of liquids are likewse very frequent. Thus, in the preparation of liquids for antiseptic or medical purposes, it is frequently desirable to prepare a prescribed quantity from a measured quantity of powder. Thus, a medicant or antiseptic powder packaged as an accurately measured amount may be opened and the whole package used for the preparation of, for example, one quart of antiseptic or medicinal fluid.

The accomplishments of these ends is not without difficulty due to the fact that the powders must be handled in relatively small amounts and with great accuracy, not only that the user may be assured of constancy of results, which is one of the objects of having the powder packaged in a prescribed amount useful in a prescribed amount of water, but also because if more than the amount of powder is introduced into the package, the merchant or manufacturer just loses that much money since additional weight over a prescribed amount does not sell for any more.

Another difficulty with the handling and packaging of small quantities of powder is due to the fact that many of these powders are exceedingly hygroscopic or even deliquescent and accordingly the entire packaging operation must be accomplished in such a way that the powder is protected from the moisture available in the air during the time of its containment in the package until the package is torn open and used.

Heretofore, the successful packaging of powders has not been capable of accomplishment and for such uses the powders have been pressed into tablets and the tablets themselves put into a container or into individual packages, as for example individual tablets of penicillin in sealed foil packages.

It is an object of the present invention to provide an apparatus for the accurate measurement and packaging of relatively small amounts of granular or powdery material, and to provide apparatus whereby such packages may be completely sealed against the admission of moisture into the contained material.

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It is a further object of the invention to provide an apparatus wherein the powder is substantially degassed during the time that it is being packaged.

It is another object of the invention to provide an apparatus wherein the powder to be packaged is introduced into a carrying chamber and then pressed out onto the packaging foil in which it is then contained, the powder however being pressed only sufficiently to maintain shape during the packaging operations.

It is a further object of the invention to provide improvements in apparatus for packaging of powdered material and to provide an apparatus which may be operated for the packaging of small quantities of powdery material at high speeds and at low cost, capable of being operated by relatively unskilled labor and capable of providing uniform accurately filled small packages.

It is a further object of the invention to provide apparatus whereby food powders, medicinal powders, pharmaceutical powders, antiseptics and the like may be accurately measured and packaged in small amounts capable of full use of the package for the preparation of a measured quantity of aqueous liquid in which such powder is dissolved.

It is a further object of the invention to provide a simplified apparatus capable of producing packages of powdered material at extremely high speed.

Other and further objects of the invention are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated with reference to the drawings in which corresponding numerals refer to the same parts and in which

Figure 1 is a side elevation of the apparatus of the present invention;

Figure 2 is an end elevation taken from the right end as shown in Figure 1;

Figure 3 is a plan view of the apparatus;

Figure 4 is a side elevational view in section taken along the line and in the direction of arrows 4—4 of Figure 3;

Figure 5 is a fragmentary plan view taken along the line and in the direction of the arrows 5—5 of Figure 4, showing one of the packaging tapes as the powdered material is laid thereon and the manner in which another packaging tape is applied thereto and sealed so as to produce separate sealed packages of the powdered material;

Figure 6 is a fragmentary sectional view taken along the line and in the direction of arrows 6—6 of Figure 5;

Figure 7 is a fragmentary vertical sectional view somewhat enlarged taken along the line and in the direction of arrows 7—7 of Figure 3;

Figure 7A is an enlarged diagrammatic fragmentary sectional view showing the offset relation of pins and screws for transmitting rotary motion to the upper and lower seal rings of the material holder of the apparatus of this invention;

Figure 8 is a transverse vertical sectional view taken along the line and in the direction of arrows 8—8 of Figure 3;

Figure 9 is a fragmentary enlarged sectional view taken along the line and in the direction of arrows 9—9 of Figure 8;

Figure 10 is a corresponding fragmentary vertical sectional view taken along the line and in the direction of arrows 10—10 of Figure 8;

Figure 11 is an enlarged fragmentary sectional view taken along the line and in the direction of arrows 11—11 of Figure 4;

Figure 12 is a fragmentary vertical sectional view taken along the line and in the direction of arrows 12—12 of Figure 4;

Figure 13 is an enlarged fragmentary vertical sectional view taken along the line and in the direction of arrows 13—13 of Figure 4;

Figure 14 is a transverse sectional view also through the cutting rolls and taken through cutting knife roll and corresponding stationary knife and taken along the line and in the direction of arrows 14—14 of Figure 15;

Figure 15 is a fragmentary vertical sectional view taken through the cut-off rolls;

Figure 16 is a fragmentary longitudinal vertical sectional view of the transmission housing taken along the line and in the direction of arrows 16—16 of Figure 7;

Figure 17 is an enlarged side elevational view partly broken away and partly schematic showing the operation of the camming device by means of which the powder is pressed out in a loose and yet stabilized form upon one of the packaging foils;

Figures 18–23 are a series of six views corresponding generally to Figures 9 and 10 and also schematically illustrating the valve operation of the vacuum and atmospheric valves of the packaging device, and illustrating in sequence the steps in the operation of the packaging device for taking in measured quantities of the powdered material being packaged;

Figure 24 is a wiring diagram of the motor and heating elements etc. of the apparatus.

Referring to the drawings, the apparatus of the invention is illustrated in its entirety in Figures 1, 2 and 3. In general, there is provided a base generally designated **20** having four legs **21—21** and a top **22**. The table is shown below the line **2—2** of Figures 1 and 2. The table has a lower platform **23** and is provided with closure panels **24—24** so as to provide within the base a neat compartment **25** in which there are housed the auxiliaries for the apparatus. A transverse frame **26** within this compartment serves as a mounting for certain of the auxiliaries, the nature of which will be described in greater detail after the description of the apparatus itself has been made.

Above the line **2—2**, which is at the top of the table, there is mounted the machine proper generally designated **30**. Referring to Figures 1 and 3, the delivery end of the machine is at the right, as indicated by the legend D. In general, it may be stated that the machine includes two completely separate packaging lines driven from a common transmission and auxiliaries. Thus, there is shown the right-hand packager shown opposite the bracket R and the left-hand packager shown opposite the bracket L in Figures 2 and 3. The common drive and transmission for the two units is shown opposite the bracket T. Since the right and left packagers are in all respects identical, a detailed description of only one, viz the left-hand unit, need be given, it being understood that the right-hand unit is symmetrically identical.

The frame **31** of the machine also serves as a transmission housing and is provided with suitable attaching feet at **32** by means of which the frame is mounted centrally upon the top **22** of the stand. The attaching feet **32** are preferably constructed so as to minimize the transmission of noise from the machine to the stand and vice versa. Referring to Figure 16 the transmission housing **31** is provided with a drive shaft **34** mounted in precision ball bearings **35**. The shaft **34** has a drive end **36** provided with a key at **37** to which a suitable pulley **33** is attached, over which a belt **38** runs. The belt also runs over the drive pulley **39** of motor **40** carried by a mounting **41**. The motor mounting is preferably of the variety such that it will maintain the belt **38** in proper tension. If desired, the pulley **39** may be of the variable pitch type and in that case the motor mounting **41** is so constructed so as to permit the raising and lowering of the motor **40** to allow variation in diameter of pulley **39** and hence variation in speed of operation of the machine.

Referring again to Figure 16, the transmission housing is provided with three worm screws **42, 43** and **44** on

the shaft **34** that are pinned to the shaft. The worm screw **42** mates with the worm wheel **46** mounted upon the shaft **47**. The worm screw **43** mates with the worm wheel **49** mounted upon the shaft **50**. The worm wheel **44** mates with the worm wheel **53** mounted upon the shaft **54**. Accordingly, as the shaft **34** is turned the power is transmitted and the shafts, **47 50** and **54** are all rotated at a much reduced speed. The gear reduction between the speed of shaft **34** and the shafts **47, 50** and **54** is identical in each case so that the shafts **47, 50** and **54** likewise run at the same speed.

Upon the shaft **50** there is provided a spur gear **51** mating with the pinion **52** mounted on the shaft **55** and accordingly as the shaft **50** is turned the shaft **55** is likewise turned at a higher speed. Similarly, upon the shaft **54** there is provided a spur gear **56** mating with the pinion **57** upon the shaft **58**. Also on shaft **58** is another pinion **48** which in turn mates with the pinion **59**, which is of the same size as pinion **48**, the latter pinion **59** being mounted upon the shaft **60**. Accordingly, as the shaft **54** is turned, the shafts **58** and **60** are run in unison at identical higher speed than the shaft **54**. The gear housing has a fill plug **61** and a drain plug **62**.

It will be understood that all of the shafts **47, 50, 54, 55, 58** and **60** are mounted on suitable journals in the side walls of the gear housing, each of the shafts extending through the journals in said side walls and outside of the housing on either end. These shafts serve as mountings for the various rotative parts of the right packager R and left packager L.

Referring to Figures 1 and 4, in general, the apparatus includes a plurality of stations as follows: Between lines **63** and **64** there is provided a filling station. Between lines **64** and **65** there is provided a sealing station for the package, between lines **65** and **66** there is provided a drive station by which the web of packages is pulled through, and between lines **66** and **67** there is provided a cut-off station where the packages are severed from a continuous web and delivered at chute **68**. The plan of operation involves the feeding of a lower web of sealable material in tape form from the supply roll **69** through the filling station **63—64** and in this station neat files of measured quantities of bulk solid powder are placed on the lower web which then travels from lines **64** to **65**, during which an upper web or tape of sealable material from the supply roll **70** is fed down and the two tapes sealed together with the piles of powder therebetween. The entire tape is pulled along by the pulling rolls between stations **65** and **66** and is then severed between the piles of sealed-in material in the cut-off station **66—67**. The thus severed packages then slide down the chute **68**.

Referring to the filling station between lines **63** and **64** this station generally comprises a hopper **71** having a downwardly converging bottom terminating at the flange **72**. A nipple **73** likewise has a flange **74** and the two flanges are held on the cover plate **76** of the frame **78** which has an inner ring **79** supported by posts **80**. Between the cover plate **76** and the inner ring **79** there is supported a gear generally designated **82** which rotates on the ring **79**, and is held in place by the lower surface **76A** of the cover plate. The lower frame, including the post **80**, also has a gear housing **84** in which are journals **85—85** supporting the drive shaft **86** on which a mitre gear **87** is pinned, so as to rotate with the shaft. At the outer end of the shaft **86** there is provided a chain sprocket **89** over which a drive chain **90** extending upwardly from the transmission housing, is adapted to be driven. It will be noted that the drive sprocket **89** is also provided with drive pins **92** which mate with a coupling **93** on the corresponding drive shaft **94** of the opposite unit. A common drive is thus provided for the two shafts and everything driven from them. The purpose of the gear **82** is to provide a rotary motion within the sealed filling hopper for gently agitating the column of powdery material and thereby assisting in its downward flow. To this end the gear 82 is rotated but it is sealed to its upper and lower surfaces from the column of material flow as follows:

On the inner surface 95 there is mounted a tubular member 96 which is suspended by the flange 97 and held in place by the screw 98. The screw 98 also fastens in place a block 99. From the block 99 there is a downwardly extending rod 100 which is shaped so that it is closely adjacent the downward and outwardly converging spout 101. The rod is bent at 102 and terminates in the agitator blading 103. Accordingly, as the gear 82 rotates the rod 100 revolves rather slowly within the column of powdered material flowing downwardly from nipple 73 through the tubular member 96 and thence through the spout 101.

In order to prevent the powdered material, which in many instances is light and fluffy, from coming out against the gear 82, there are provided upper and lower seal rings. Thus, an upper seal ring is provided at 104 that is machined to fit with an up and down sliding fit on the surface 105 of the gear. The seal ring is pushed up by the springs 106. At one or more places around the gear there are provided pins 108 which serve to transmit the rotary motion of the gear to the seal ring. Similarly, a lower seal ring is provided at 109, this ring being machined to fit the outer surface 110 of the tubular member 96 and also to fit the surface 111 of the upper flange 112 on the spout 101. Springs are provided at 113 which force the seal ring down and the seal ring is compelled to rotate by one or more screws 114 which extend through the web of the gear 82 and into the seal ring. The screws 114 and the pins 108 which drive the lower seal ring 109 and the upper seal ring 104, respectively, are not made integral but are spaced apart from each other around the circumference of the gear 82, although this might seem so from the drawings. One form which this offset spaced apart relationship may assume is shown in Figure 7A. The entire framing 80—84 and the spout 101 are carried upon the plate 116 that is in turn mounted by means of the cap screws 117 on the top of the frame and transmission housing 31. Below the plate 116 there is mounted the filling horn casting generally designated 120. This filling horn has a downwardly converging inner surface 121 onto which a solid column of the powder being packaged is delivered from the outwardly converging spout 101. The casting has integral cast-in heating elements 122 by means of which the entire filling horn may be heated as desired for the handling of particular materials. In order to prevent the heat from the casting from flowing into adjacent portions of the apparatus, there is provided an insulating ring at 124. The downwardly converging partial cylindrical bottom surface 121 is gradually blended into the rectangular opening at 125 having an entering wall 126 and a trailing wall 128. This nomenclature is with reference to the direction of rotation shown by the arrow 129 of the filling drum or material receiver generally designated 130. The aggregate of the inner surfaces of the hopper 71, nipple 73, tubular member 96, spout 101 and filling horn 120 comprises the outer surface of a material holder. This material holder defines the outer wall for a column of solid material flowing downwardly therethrough. The filling drum or material receiver has a smooth outer peripheral surface at 131 which runs with close fitting seal against the corresponding partial cylindrical surface 132 forming the under periphery of the filling horn. The drum 130 is mounted upon the shaft 47 driven as previously described from the transmission 31, see Figure 16. The shaft 47 has a drive flange 134 thereon which is keyed to the shaft at 135. On the drive flange there is a replaceable drive ring 136 held in place by the cap screws 138. The filling drum or material receiver 130 is held in place on shaft 47 by means of the end cap 139 that is attached by the screw 140, but otherwise the filling drum 130 is free to rotate on the shaft 47. A drive from the drive flange 134—136 to the filling drum 130 is accomplished by means of the drive pin 141 which has a finger hold 141A that is screwed tightly in place on the pin. The pin extends through a transverse aperture in the filling drum or material receiver 130 and has a tightly pressed-on collar at 142 that works in a suitable enlargement of the aperture. Behind the collar is the spring 144. The protruding end 145 of the pin 141 is aligned to slip into a hole 146 in the replaceable ring 136 on the drive flange 134. When the pin is in the position shown in Figure 7, the drive flange 134 and ring 136 are coupled to the filling drum 130 and serve to rotate it. However, if one or the other of the left or right sides of the machine are desired not to be operated, it is only necessary to pull out the pin 141 slightly by means of the finger hole 141A. This causes the detent pin 148 to slide out of the slot 149 in the material receiver and when outside the receiver a slight turn on the pin 141 causes the detent 148 to rest on the outer surface of the receiver 130, thereby holding the entire pin 141 in a position such that the end 145 is entirely retracted out of the hole 146. In this way one of the machines can be made entirely idle and no filling will be accomplished. At the same time the drive of the web on that side of the machine is released as hereinafter described and accordingly no filling on that side of the machine is accomplished.

Referring to Figure 4, the lower web LW and the upper web UW from the rolls 69 and 70, respectively, may be of diverse materials and are either inherently heat sealing or are coated with a suitable heat sealing adhesive placed on the upper surface of the web LW and the lower surface of the web UW, in such a way that when the two webs are brought together and firmly pressed while subjected to some increase in temperature, they will be heat bonded together in moisture tight relationship. The problem of the present invention was to put little piles of the powder to be packaged neatly on the lower web prior to the superposition of the upper web on it and then to heat seal the margins of the two webs around the piles.

To accomplish this the lower web LW from the roll 69 is first passed over guide roll 150 and then over a stationary guide 151 having a smoothly rounded narrow radius nose 152 that is positioned parallel to and closely adjacent the lower termination 153 on the trailing side of the filling horn 120, and also closely adjacent the periphery 131. The lower web LW runs up over the roll 150 and then along the upper surface of the block 151 in the right direction as shown in Figure 4, and thence around the sharp nose 152 of the block 151 and thence into contact with the peripheral surface 131 of the filling drum 130.

Referring to Figures 4 and 7, as well as Figures 9 and 10, it will be observed that the filling drum has an annular recess 154 and a plurality (here the number is eight) radially drilled bores 155. These bores have a minimum radius adjacent the recess 154 and then have a larger radius at 156. At their outer termination, and adjacent the surface 131 of the drum the bore 156 flares out into an almost rectangular opening, with rounded corners, along the surface 158. In the described recess there are positioned plungers generally designated 160 having a shaped outer surface, here illustrated as the dome or convex curve 161. Each of the plungers 160 has a stem 162 which extends into the annular recess 154 and each of the plungers terminates at a conical tip 164. Around the portion of the plunger stem 162 that is within the recess 154 there is a retracting spring 165 that is held in place by the retainer 166. Accordingly, the normal position of each of the plungers 160 in the filling drum 130 is as far in as the head of the plunger will go into the recess 156. The inward travel is, however, controlled by a cam generally designated 168. The cam 168, is illustrated in Figures 4, 7 and to some extent in Figure 17. It has an inner surface 169 that slides in and out upon the surface 170 of the recess **154** in the filling drum **130**. The cam **168** is adjustable for in and out sliding movement and, to a slight extent, in a rotary direction. The cam **168** has an outer terminal flange at **171** and it is attached by means of the hold screws **172—172** to a mounting plate generally designated **174**, the plate in turn having a boss **175** that is mounted on the post **176** by means of the nuts **178**. The entire post **176** is threaded into a suitable boss on the exterior of the frame and gear housing **31** and is therefore a steady support for the plate **174** and hence for the cam **168**. As shown in Figure 17 the plate **174** has arcuate slots **179—179** through which the screws **172** pass. The slots are of sufficient length so as to permit an arcuate adjustment for cam **168** of about 20–30 degrees.

From Figures 4 and 17 it will be observed that the cam has a tapered or conical exterior surface **180**, except at the cam lobe **181**. The cam lobe **181** is relatively short and occupies approximately 20–25 degrees of the 360 degrees of motion around the cam and furthermore the lift of the cam lobe **181** is uniform from the outer end of the conical surface **180** or at its maximum diameter end. Accordingly, the outward push or "lift" occasioned by the tip **164** of the plunger stem riding up upon the cam lobe **181** is the same, regardless of whether the cam **168** is in an "outer" position, such as is shown in Figure 7, or whether it is pushed inwardly.

The inner and outer adjustment of the cam **168** is used to regulate the amount of powder that is taken into the pocket above the plunger **160** and within the surface **158**. When the cam **168** is moved outwardly (and this is accomplished by moving the entire mounting plate **174** outwardly on the stud **176**) the plungers **160** will all be retracted to their innermost position which they occuy except when pushed downwardly at the cam lobe **181** and hence a maximum amount of powder or solid granular material can be taken into the space above the plunger. Where a lesser amount of material is desired, it is only necessary to adjust the plate **174** and the cam **168** inwardly and the lower tips **164** of all the plungers **160** will then ride a little farther up on the conical surface **180**, each being pushed downwardly by the cam lobe **181** as they reach the lower position **160A**, Figure 4.

The cam **168** is mounted so that the cam lobe **181** will produce a downward push of the plungers **160** as each reaches the lowermost position **160A** of Figure 4. It is at this position that the powder or other granular material on top of the plunger is pushed firmly down on the lower web LW. This sharp downward push of the plunger **160** at position **160A** occurs due to the quick lift of the cam lobe **181** and the rotation of the cam **168** afforded by the slots **179** in the mounting plate **174** is such as to permit the downward push to occur at any position from about 10 degrees ahead to about 10 degrees behind the vertical position **160A**.

The web LW as it rides over the nose **152** of the guide block **151** and onto the surface **131** of the filling drum covers the drum from substantially edge to edge and covers each of the pockets **158**, above the plungers **160**, which are by that time entirely filled with the powdered material being packaged. Accordingly, as the plunger reaches the position **160K**, Figure 4, it has already been filled with powder, as will subsequently be described, and as the drum rotates, out from under the trailing tip **153** of the filling horn, the lower web LW is immediately run onto the surface of the drum, thereby holding the powder in place. The powder is maintained in place through the positions **160L** and **160M** by the web LW which remains in place on the periphery **131** of the drum and then as the drum reaches the position **160A**, the downward push of each of the plungers **160** occurs as described and as shown in Figure 6, thereby causing the powdered material to be deposited in neat piles.

The complete sequence of positions is numbered from the discharge position **160A** and thence in a counterclockwise direction, counting through the showings as in Figure 4 and Figures 18 through 23, which latter especially show the sequence of operations preparatory to and during filling of the powder into the pockets above the plungers. Through the positions **160B** and **160C**, Figure 4, the pockets run idle and are uncovered, but as they run under the entering edge **133** of the filling horn, preparation for filling occurs, the apparatus therefore being as follows:

The entering nose of the filling horn **133** is provided with a bore hole at **182**, Figures 9 and 10, terminating at the reduced diameter portion **184**. The bore hole **182** is provided with threads **185** at its upper end which receive the head **186** of a screen block generally designated **188**. The screen block **188** is drilled out at **189** and has a threaded lower end **190** upon which the cap **191** is threaded. The cap **191** serves to hold in place a small disk **192** of screening material, which is preferably of nylon material. The screen block **188** is cross bored at **194** and communicates with the air channel **195**, the air channel **195** itself terminating at the machined surface **196**. Upon the surface **196** there is attached an air control valve assembly generally designated **198**, the same being held onto the surface **196** by suitable cap screws **199**. The air control valve assembly is best shown in Figures 8, 9 and 10 and has upwardly extending frame members **200** which serve to support the journals in which the shaft **201** rotates. The shaft **201** has a spur gear **202** that is driven by another spur gear **204** mounted on shaft **55** previously referred to (see Figures 4 and 16). The shaft **201** carries two cams **205** and **206** that are held in place by set screws. The cam **205** is all of maximum diameter except for one flat as at **205A**, see Figure 9, whereas the cam **206** is all low except for one abruptly rising cam lobe **206A** in Figure 10. See also Figure 9. The frame members **200** have side arms **200A** serving to support the stub shafts **208** and **209** that are held in place by set screws. Upon the stub shaft **209** there is mounted a rocker arm **210** that is held in place on the stub shaft by a ring key **211**. The rocker arm **210** carries at its lower end an atmospheric valve release **212** which is positioned so as to cover the port **214** leading from the antrum **215** in the air control valve assembly **198**. A spring **216** supported at its lower end on the head of screw **218** presses upwardly upon the pad **219** on the rocker arm, therefore normally urging it in the direction of arrow **220**, thus causing the valve **212** to be held tightly against the port **214**, thus preventing the admission of atmospheric air into the antrum **215**. Atmospheric air is admitted only when the cam lobe **206A** on the cam **206** pushes against the roller **221** pivoted on shaft **222** on the upper end of the rocker arm **210**.

Referring to Figure 9, the antrum **215** in the air control valve assembly is provided with another port **224** which communicates through a side passage **225** to the vacuum connection **226**, Figure 8. A vacuum valve stem **228** having the valve **229** at its lower end, controls the opening or closure of the port **224**, the stem being normally pulled outwardly by the action of spring **230** which seats against the spring retainer **231**. The valve stem **228** is pushed inwardly by a rocker arm **232** pivoted on the stub shaft **208**, the rocker being held in place by the ring key **234**. At the upper end of the rocker arm **232** there is a roller **235** which rides on the cam **205**, the cam **205** being so shaped as to apply vacuum over a time period appropriate for the filling operation, as will be now described.

Referring to Figures 18 through 23, in these figures there is shown only a fragmentary part of the filling horn **120** and the atmospheric valve **212** and the vacuum valve **229** are shown schematically. It will be understood that these valves are operated by the mechanisms shown especially in Figures 8, 9 and 10 in timed sequence so as to produce the pressure conditions within the antrum 215 and hence above the plungers 160 to be described. In Figure 4 the plunger has reached a position 160C and just begins to run under the entering nose 133 of the filling horn 120. As the plunger reaches the position 160D shown in Figure 18, the leading edge of the wall 158 of the cavity just uncovers the bore opening 184 below the screen block 188. At this time the atmospheric valve 212 is closed and the vacuum valve 229 is open and accordingly air is drawn out of the pocket above the plunger 160 through the aperture 184 and thence through the nylon screen 192, as indicated by the arrow 237. The flow of air being evacuated continues out through the port 195, antrum 215 and through the vacuum valve 229 to the vacuum line 226. The vacuum continues to be drawn until the chamber above the plunger has the air pressure therein substantially reduced, whereupon as the plunger reaches the position in Figure 19, viz. position 160E, the vacuum valve 229 is closed and the atmospheric valve 212 is abruptly opened by the sharply rising cam surface 206A on the cam 206, see Figure 9. Atmospheric air accordingly rushes in via arrows 236—236 and impinges against the nylon screen 192, thus blasting out through the surface openings in the screen, as indicated by the plurality of arrows 238, thus causing any powder which may have adhered to the screen to be "dusted off." The in-rush of air, however, is limited since the size of the cavity above the plunger 160 is small and once the pressure conditions are re-established, the atmospheric valve 212 is closed and vacuum valve 229 is also closed. This condition is shown in Figure 20, viz. position 160F. Then as the leading edge 158A of the cavity above the plunger 160G, Figure 21, proceeds due to the rotation of the filling drum in the direction of the arrow shown, and before that edge 158A reaches the entering wall 126 of the rectangular filling opening 125, the vacuum valve 229 is again opened, the atmospheric valve 212 meanwhile remaining closed. Accordingly, air is exhausted from the space above the plungers 160G, Figure 21, via arrows 239—239. As rotation proceeds to position 160H, shown in Figure 22, the leading edge 158A has proceeded beyond the entering wall 126 of the rectangular opening 125 in the filling horn 120. In operation the hopper 71 and the column composed of nipple 73, tubular member 96 and spout 101, leading down to the downwardly converging surface 121 of the filling horn, are all filled with the powdered material which is to be packaged and accordingly a solid column of powdered material stands above each pocket 158, Figure 7, as they are exposed to rectangular opening 125, Figure 22. In addition, the gentle rotation of the agitator 103 prevents any bridging and the column of material moves downwardly in a slow direction. Referring to Figures 21 and 22, the pocket above each of the plungers 160 as at position 160G, is evacuated and as the wall 158A moves to the position shown in Figure 22, the flow of solid material downwardly in the direction of arrow 240 is accomplished. A little air may enter with the material, but this is only the amount that adheres to the material particles, and there may actually be a little pocket formed in the downwardly flowing column of powder as at 241, Figure 22. The tendency of the powder to move beyond the pockets above the plungers 160 is prevented in part by two factors: First, the amount of air capable of bearing the material is limited, due to the fact that the entire mechanism is sealed due to the downwardly flowing column of powder. Any slight air that is carried into the pocket with the material as it falls is exhausted through the vacuum valve but the powdered material is prevented from moving through into the vacuum system by the nylon screen 192.

The filling operation continues through the position shown at 160I and the vacuum valve closes, thereupon moving from the position 160I to the position 160J the pocket is entirely full and the amount of material residing in the pocket above the plunger 160 is determined by the position of the plunger, which is in turn determined by the inward and outward adjustment of the cam 168, Figure 7. This measured quantity of material is scraped off with the pocket full, as the pocket passes under the wall 128 of the filling horn 120, Figure 4, and is carried through the position 160K, Figure 4, and is then held in the positions 160L and 160M due to the lower web LW as previously described. Beneath the filling drum 130, and extending from it to the right, as shown in Figure 4, there is a table 242 which is vertically adjustable by means of the brackets 244—244 held in place by cap screws 245—245, attached to the transmission housing 31, see Figures 4 and 7. The table is adjusted so that as the plungers in position 160A force the powdered material downwardly, they also force the lower web LW into contact with the table 242, as shown in Figure 6, and then as the web LW moves to the right, Figures 4, 5 and 6, the piles of powdered material are carried therealong. As they move along the upper web UW which is fed from the roll 70 carried by the bracket 246, Figure 4, travels over the guide rollers 248, 249 and 250. The guide roller 250 is carried upon the adjustable bracket 251 held by the screw 252 so that the position of the roller 250 can be varied up and down and backward and forward, thereby allowing the slant of the downward travel of the upper web in portion 254 to be made abrupt or gradual as desired. The upper web UW is thus brought down upon the piles P1, P2 and P3 of powdered material already deposited at spaced intervals on the lower web and the composite then travels to the sealing rollers shown generally between the lines 64 and 65, Figure 4.

The sealing rollers are best shown in Figures 4 and 11. In Figure 4 it will be noted that the upper sealing roller generally designated 258 and the lower sealing roller generally designated 259 have at either edge thereof a continuous periphery as at 258A and 258B, Figure 11, for the upper sealing roller and 259A and 259B at either edge of the lower sealing roller. These edges are actually separable side plates and between them there is clamped a central portion 258C for the upper roller and 259C for the lower roller, these portions having webs 258D and 259D for the upper and lower rollers, respectively, of the same radial dimension and curvature as the outer portions 258A, 258B and 259A and 259B, respectively. Between the webs, however, there are pockets as pockets 258E for the upper roller and pockets 259E for the lower roller, these pockets being of any arcuate length desired, depending upon the size of the package that is being made. Accordingly, it will be understood that the central part 258C of the upper roller and 259C of the lower roller may be divided into any desired number of pockets with webs in between. Six such pockets are shown for each of the rollers in Figures 4 and 11, but this is merely exemplary. The upper roller assembly 258 is carried on the shaft 50 driven as previously described. The outer protruding end of the shaft being provided with a keyed on gear 260. The gear 260 meshes and drives a mating gear 261 as will be described, so that the two gears and the rollers that they carry revolve in unison, so as to bring the webs 258D and 259D into contact with each other as the sealing rollers 258 and 259, respectively, revolve. It may be stated that each of the rollers 258 and 259 are arranged to be heated internally so as to provide for the sealing of the upper web and lower web by heat sealing methods. The heating of the rollers is accomplished as follows:

The inner edge plate 258A of the upper roller is machined at 262 to fit a corresponding recess 264, thereby holding the peripheral track 258A of the upper roller concentric with the axis of shaft 50. However, a space is provided at 265 which is filled with insulation which to some extent prevents the passage of heat from the heated roller 258 to the gear 260 and hence to the transmission

31. A heat insulation bushing **266** is also provided and a heat insulating plate **267** is provided, these being held in place by a metal plate **268** that is in turn held in place by the screws **269** to the gear **260**. The member **258C** of the heated roller is recessed at **270** to receive a heating element **271** and it is held together by a plurality of screws **272** which pass through the gear **260** and through the edge of plate **258A** and unto the member **258C**. The member **258C** thus holds the heater element **271** firmly clamped in place against the inside surface of plate **258A**. The edge of the heating element is meanwhile firmly clamped in the recess **270** in the central portion **258C** of the roller and heats **258C**. The central portion **258C** is provided with a second recess **275** in which an outer heating element **276** is positioned, the latter being held in place by the outer track plate **258B** that is in turn clamped to the central portion **258C** of the roller by means of a plurality of screws **278**. Centrally in the plate **276** there is provided a nipple **279** that is held in place by the screws **280**. The nipple **279** serves as a mounting for an electrical insulator **281** upon which the slip rings **282** and **284** are mounted. The insulating member **281** is held in place and from rotating on the nipple **279** by means of the keying screw **283**. Upon the crankcase **31** there is a bracket **285** which extends out and serves as a mounting for a brush holder **286** which carries two brushes **288** and **289** contacting the slip rings **282** and **284**, respectively. A covering bell **290** serves to protect the brush holders.

Upon the central portion **258C** of the upper roller assembly there is a thermostat mounting pad **291** held in place by a screw **292**. This pad serves as a base upon which a thermostat generally designated **294** is attached by suitable screws. The thermostat, which may be of any suitable type, is preferably provided with an adjusting screw **295** and in one of the pockets **258E** aligned with this adjusting screw, there is a hole **296**, see Figure 4, through which a slender screw driver may be inserted for turning the adjusting screw **295**, thereby allowing regulation of the temperature of the roller **258**. The wires from the slip rings **282** and **284** are carried out through the hole and nipple **279** and the two heating elements **271** and **276** are wired in series with each other and with the thermostat **294**, as shown by the wiring diagram in Figure 24. They may be wired in parallel, if desired, but in order to reduce the load carried by the thermostat contacts, series wiring is preferred.

The entire lower roller assembly **259** is carried upon a shaft generally designated **298** which has stub outer ends journalled in the moutning arm generally designated **299**. The arm **299** is pivoted on the pin **300** attached to an ear **301** in the crankcase and frame housing **31**. The arm **299** is divided at **303**, the right end, as shown in Figure 4, being held to the knuckle **302** by the bolt **304**. By inserting shims at the break **303**, and then pulling up the through bolt **304**, the position of the center of shaft **298** can be moved from the left to the right or vice versa as shown in Figure 4, thus allowing precise alignment of the web **259D** with the webs **258D** of the upper roller.

The arm **299** extends to the right as shown in Figure 4 and has a recess at **305** which receives the upper end of the spring **306**, the lower end of which is mounted in supports **308**. By loosening lock nut **307*b*** and then moving the screws **307*a*** up or down the bottom position of the spring **306** can be adjusted and the force on arm **299** can thereby be varied, in that way allowing adjustment of the pressure of the roll **259** against the roll **258**.

Referring to Figure 11, the construction of the roll **259** while generally the same as **258** is somewhat simplified in that the transmission of heat to the gear housing was not a problem. Thus, the gear **261** is attached by the screws **309** directly to a flange **310** machined on the shaft **298**. The flange **310** thins out and forms a tracking edge **259A** of the lower roller. The central member **259C** of the lower roller is likewise recessed to receive the heating elements **311** and **312**. The central element **259C** is attached to the portion **259A** by the screws **314** and the outer plate **259B** is in turn attached to the central portion **259C** by the screws **315**. The outer tracking plate **259A** has a central stub shaft portion **316**, upon which there is concentrically mounted nipple **318** which is held in place by suitable screws. The nipple serves as a mounting for the electrical insulation **319** upon which the slip rings **320** and **321** are carried. The insulation **319** is likewise held in place and prevented from turning by the keying screw **323**. A brush holder **322** is mounted by the screw **326** against the bracket **328** which is in turn held on the arm **229** and two brushes are mounted in the brush holders, one of which is shown at **324**. A covering bell **325** serves to protect these portions of the mechanism. Suitable lubrication fittings are provided for each of the ends of the shaft **298** and **316**. The two heating elements **311** and **312** are served by lead wires from the slip rings **320** and **321** which enter through the central bore and the nipple **318**. The two heating elements being connected in series and in series with the thermostat **329** which is mounted in the same manner as described with reference to roller **258**. The thermostat is also made adjustable by locating an aperture so that the thermostat adjusting screw **330** can be reached with a long thin screw driver.

The rollers are accordingly electrically heated to a desired temperature, and as they rotate the track **259A** runs in a position to exert pressure against the track **258A** and the track **259B** runs in a position to exert pressure against the track **258B**. At the same time the webs **259D** likewise exert pressure against the webs **258D**. Since the apparatus is gear driven from the same transmission as operates the feeding mechanism, the piles of powdered material laid down upon the lower web LW and already covered by the upper web UW arrive at the sealing rollers in such position that the intermediate webs **259D** and **258D** come in the space between the piles P1, P2 and P3 and one pile is sealed off from the other transversely across the web, and both edges of the composite web are also sealed, all in one operation. The heat and the pressure may be adjusted as described.

The pull of the continuous composite produced at the sealing rolls, is provided by the pull drive between the lines **65** and **66** of Figure 4. The pull drive is best illustrated in Figures 4, 12 and 13. The drive is provided by a metal upper roller generally designated **332** and a cooperating rubber tired lower roller generally designated **333**, the lower roller being so mounted as to be urged upwardly into resilient contact with the upper roller. The upper roller **332** has two edges **332A** and **332B** and the whole roller is keyed on the extending end of shaft **54** extending out of the transmission housing **31** and driven as previously described. A key at **334** allows positive drive, the key being held in place by the set screw **335**. Roller **332** accordingly presents two spaced tracks **332A** and **332B** which are positioned just far enough apart so as to track upon the portion of the composite package that is sealed by the sealing tracks **258A** and **258B** and the corresponding sealing tracks **259A** and **259B** of the upper and lower sealing rollers, respectively, previously described. Upon the upper pull roller **332** there is mounted a drive gear **336** held in place by screws **338**, this gear meshing with corresponding gear **339** of the lower roller assembly **333**. The gear **339** is held onto a central hub **340** by means of the screws **341—341** and the hub **340** is provided with bushings at **342—342** so that it may turn freely upon the stationary shaft **344** that is held in the bifurcated ends **345** of the mounting arm **346**, this arm being pivoted upon the pin **348** that is in turn carried by the ears **349** extending downwardly from the frame and transmission housing **31**. The arm **346** is provided with a recess **350** which receives the upper end of the spring **351**, the lower end of which is carried by a bracket **352** upon which the spring 351 is adjustably mounted in the manner described for spring 306 of arm 305. By adjusting the spring 351 up and down the force of the roller 333 against the roller 332 may be varied.

Upon the exterior surface of the hub 340 there is vulcanized a rubber spool generally designated 354 having the tracking surfaces 354A and 354B spaced apart so as to be aligned for rolling contact with the edges 332A and 332B of the upper roller 332. A strong rolling resilient contact is therefore provided by the roller 332 against only the tracking surfaces 332A and 332B. Both the rubber spool 354 and the roller 332 are carved out as at 332C and 354C so as to allow ample space for the packet of powdered material to be passed through the pulling rollers without any engagement of the rollers on the packet bulges.

The same bracket 352 which carries the springs 351 has an upwardly extending perch 356, Figures 12 and 13, upon which the trunnion pin 357 is rotatably mounted. The trunnion is held from shifting endwise by a ring key 358 and by the turning handle 359. Upon the trunnion shaft 257 there is pinned a cam lobe 360, and by rotating the shaft, by means of handle 359, the cam lobe can be brought into contact with the upper surface 361 of the arm 346 so as to force it downwardly and thus move the lower roller 333 away from the upper roller 332, for threading, disengaging jams, etc. A similar rotatable cam lobe 331 is provided for the mounting arm 229. By rotating the cam lobe 331 until it is brought into contact with the upper surface of the mounting arm 299, the mounting arm may be pivoted in a clockwise direction about the pin 300, thus moving the lower roller 259 away from the upper roller 258 for facilitating threading, breaking jams, etc.

On the inner surface of the gear 336 of roller 332, Figure 12, there is a pin 363 which is positioned so as to engage a lever 362 of the counter mechanism 364, the lever being normally biased in the direction of arrow 365 by the spring 366. Between the sealing rollers 258—259 and the drive rollers 332—333, there is provided a continuation of the table 242 as at 368, this likewise being mounted so as to be vertically adjustable, and between the drive rollers 332—333 and the cut-off mechanism between the lines 66 and 67 a further continuation of such table is provided at 369, this likewise being made so as to be vertically adjustable. The package composite in the continuous strip is accordingly supported throughout its entire travel from left to right as shown in Figure 4.

Between the positions 66 and 67 there is provided a cut-off comprising a stationary cut-off knife assembly generally designated 370 and a rotary cut-off knife generally designated 371. These are best shown in Figures 4, 14 and 15. The stationary knife assembly 370 includes a bracket portion 372 that is attached to the crankcase and frame member 31 by screws 374. This bracket has a slanting upper surface 375 upon which the stationary knife 376 is mounted. The knife 376 is held in place by screws 378 passing through slots 379 in the knife. The knife is adjustable back and forth in the direction of arrow 380 by means of the adjusting screw 381 and it may thus be brought closer or may be moved farther away from the rotary cutting knife generally designated 371. The knife 376 is made double edged and can be re-used merely by reversing it. Of course, it can frequently be sharpened as it gets dull.

The rotary knife includes a hub 392 which carries two rotary knife blades. The manner in which they are carried is illustrated in Figures 14 and 15. Thus, upon the extending end of shaft 60, Figure 16, there is a reduced portion 60A which presents a shoulder at 60B. A sleeve 385 is mounted upon the reduced end 60, the sleeve being held on by an end plate 386 held in place by the screw 388. The sleeve is made to take a key 389 so that it rotates firmly with the shaft 60. At the outer end of the sleeve there is provided a flange 390 having arcuate slots 391—391. Behind the flange there is mounted the knife holder 392 which has two flats 394—394, upon which the knife blades 395—395 are mounted and held in place by the screws 396. The knife holder also has the webs 398 through which pass the adjusting screws 399 by means of which the pitch diameter of the knife blades 395 may be uniformly and accurately adjusted. The blades 395 are adjusted so that they cooperate with the stationary blades 376 to produce a shearing action and as observed in Figure 4, the position of the blades is such that they are aligned with the path of travel of the web of already sealed packets of powder. Thus, as shown in Figure 6, the web with the powder between the upper foil UW and the lower foil LW as at positions P4, P5 and P6, approaches and is pulled along by the pull rolls 332 and 333. The strip then travels along as at P7 and P8 and P9 until they come into the position of the cooperating knives at 370 and 371. The rotation of the knife 371 being driven from the transmission housing is adjusted so that the cuts occur between the successive packets and thus when the packets are severed as at P10 the powder is contained within the severed portions of the lower web LW and the upper web UW, the two webs being completely sealed entirely around the packet portion. The severed packets slide down the chute 68.

Referring to Figure 24 power is supplied usually over 220-volt lines L1 and L2. A switch 401 is provided from lines L1 and L2 to the motor 40 over suitable circuits for controlling the operation of the motor. Power is preferably brought into a junction box 402, Figure 1, upon which the switches for the various auxiliaries are mounted. From the junction box 402 a circuit extends from line L2 through the line 404 to the brush 288 and thence through slip ring 282 and line 405 through heater unit 276, line 406, heater unit 271, line 408, thermostat 294, line 409 and thence to slip ring 284, through brush 289 and line 410 through switch 411 to line L1.

Similarily, a circuit extends from line L2 through line 412 to brush 324, slip ring 320, line 414, through heater element 311, line 415, heater element 312 and line 416, through thermostat 329 and line 417 to slip ring 321 and thence through a brush and line 418, through junction 424 and switch 411 to line L1. A circuit also extends from junction 424, through pilot light 425 to circuit L2. Accordingly, when the switch 411 is closed, parallel circuits are established through the pilot light 425 and through the circuits of heater elements 311 and 312.

A circuit also extends from line 420, through the heater elements 122 in the filling horn and then through a thermostat 421, which is thermally connected to the filling horn, and thence through line 422, junction 428 and switch 423 to line L1. A circuit also extends from the junction 428 and pilot light 429 to line L2 and accordingly when switch 423 is closed the pilot light 429 will be illuminated, thus indicating that the operation of the heaters 122 in the filling horn 120.

Referring to Figure 1, if the place in which the apparatus is used does not afford a separate vacuum supply, this may easily be provided by means of a vacuum pump generally designated 430 which is operated by a self-contained motor, or separate motor, which will then be served by a suitable power line not illustrated from the switch box 402. Where such a self-contained vacuum pump is used, a pipe connection is made at 431 to the collector 432 which is interposed between the vacuum line 434 and 431 so as to remove any trace of powder which might be drawn through the vacuum line toward the pump 430. The amount of such powder which might be drawn over is too small to be economically important, but it might interefere with the operation of the pump if it got into it. Therefore, an efficient collector is used at this stage of the apparatus. The vacuum line 434 extends to the vacuum connection 226, see Figure 8.

It will be observed that in Figure 8 gear 204 mounted upon the shaft 55 of the transmission 31 not only drives the gear 202 for operating the cams 205 and 206 of the atmospheric and vacuum valving arrangement, but the shaft 201 is coupled by means of the coupling 435 to the central shaft 436 having a sprocket 438 thereon. This sprocket serves to drive the chain 90 by means of which the agitator mechanism in the filling spout is slowly rotated.

It will be understood from the foregoing that either the right or left packager may be operated singly or both may be operated at the same time. While a double packaging unit with right and left packagers has been herein illustrated, it will be understood that it is within the purview of the invention to have only a single packager.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments herein.

What I claim is:

1. In an apparatus for the production of sealed packages of accurately measured small quantities of finely divided solid materials comprising a table supported in a substantially horizontal position, a plurality of stations along said table including a filling station, a sealing station, a pulling station, and a severing and discharge station, said receiving station including a material holder for said finely divided solid material, said material holder including a columnar space therethrough for holding said material as a solid column therein and a bottom having a partial cylindrical under surface, said surface having an opening therein aligned with said columnar space for the discharge of the solid material therethrough, a wheel having a cylindrical rim surface of a diameter such that it has a sealed running fit against the partial cylindrical bottom surface of said material holder, means mounting the wheel for rotation of said rim in contact with said partial cylindrical surface, said partial cylindrical bottom surface having an entering edge where the rim of the wheel engages said surface as it rotates thereagainst and a trailing edge away from which the rim of the wheel rotates as it leaves said surface, a port in the surface of said entering edge having gaseous fluid control means connected thereto for controlling a gaseous fluid to produce a condition of evacuation in said port as the pocket reaches said port and continues its motion towards said material discharge opening in said partial cylindrical bottom surface, a guide closely adjacent said trailing edge for guiding a continuous strip of package forming sealing material against the rim of said wheel for movement downwardly in contact with the rim of said wheel to a lowermost position closely adjacent said table, said strip being thereafter moved along said table past said sealing station through said pulling station at which a pair of rolls engage the edges of the strip for pulling it along said table, said wheel at the receiving station having a plurality of radial pockets in said rim, a plunger positioned in each of said pockets and means on said wheel for normally retracting said plungers, cam means mounted in proximity with said wheel and having a cam lobe thereon positioned so as to contact said plungers and move them radially outwardly when each of the pockets and the plunger therein reaches a lowermost position directed downwardly toward said table, means between the receiving and sealing stations for feeding a superimposed continuous strip of package forming sealable material upon the first strip as it moves to said sealing station, said sealing station including cooperating pressure rollers engageable with the bottom and top of said composite composed of the two strips, said rollers being formed so as to provide continuous pressure along the edges of said composite formed of two strips and for applying pressure upon areas extending transversely across said strip at spaced intervals therealong, and means along said table at said severing station for severing the composite sealed strip after it has been pulled therealong, said severing means being timed for severing the strips only in said sealed transverse areas.

2. The apparatus of claim 1 further characterized in that the fluid pressure control means in the port in the surface of the entering edge of the partial cylindrical bottom surface of the material holder is adapted for producing in said port a condition of evacuation as each pocket in the wheel reaches said port, then relieving said condition of evacuation therein and thereafter producing a condition of re-evacuation as the pocket leaves said port and reaches the material discharge opening of said material holder.

3. The apparatus of claim 2 further characterized in that a fine screen is concentrically placed over said port closely adjacent the rim of said wheel.

4. An apparatus for the production of sealed packages of accurately measured small quantities of finely divided solid materials comprising a material holder for finely divided material having a substantially vertical space therein for holding said material for columnar flow downwardly therethrough, said material holder having a partial cylindrical bottom surface through which there is provided a port at the bottom of said material holding space, said partial cylindrical bottom surface having an entering edge and a trailing edge, a material receiving wheel having a smooth rim of a diameter such that it revolves in contacting relation with said partial cylindrical bottom surface of the material holder, a plurality of evenly spaced cylindrical radial pockets in said wheel, each of said pockets forming a port in the rim of said wheel, a plunger in each of said pockets having an integral stem, said wheel being recessed so as to expose said stem, means on each of said stems for retracting each plunger to a bottom position in each pocket, cam means contacting said stem for normally holding them at a given position in said pockets, said cam being provided with a cam lobe at one position for moving the plungers radially outwardly from said cam lobe.

5. The apparatus of claim 4 further characterized in that said cam is concentrically mounted for movement relative to said wheel and shaped conically so as to provide uniform movement of all plungers outwardly or inwardly as the cam is moved for varying the retracted position of all plungers in said pockets.

6. An apparatus for the production of sealed packages of accurately measured small quantities of finely divided solid materials comprising a material holder for holding said material as a solid vertical column, said holder having a bottom member including a partial cylindrical surface opening generally downwardly, a port in said surface at the bottom of said material holder for the delivery therefrom of said material, said material holder including a cylindrical sleeve forming a part of the wall thereof, means for rotating said sleeve and an agitator extending from said sleeve into said material closely adjacent said port for agitating the material in said holder as it is delivered from said port.

7. The apparatus of claim 6 further characterized in that said sleeve is sealed with reference to adjacent portions of the holder to prevent the excessive entrance of air into said holder.

8. An apparatus for the production of sealed packages of accurately measured small quantities of finely divided solid materials comprising a transmission case forming the frame of said apparatus, a drive shaft in said transmission case, a plurality of driven shafts extending through said case substantially horizontally and protruding at either side thereof, each of said driven shafts being geared to said transmission shaft for rotation at uniform speeds, a pair of means according to claim 13 mounted on opposite sides of said transmission case for feeding a

continuous strip of package forming sealable material along a table and for feeding and depositing spaced piles of finely divided solid material on said strip, a pair of means for superimposing a second strip of package forming material upon the first over said spaced piles of solid material and a pair of sealing rollers along each table for sealing each superimposed pair of strips moving therealong and for pulling said superimposed strips therealong, a pair of cutting means in sequence after the sealing rollers for severing the sealed superimposed strips into packages, said pairs of feeding, sealing and pulling means, and said cutting means being operated in timed relation by the transverse shafts through said transmission case.

9. The apparatus of claim 8 being further characterized in that disconnect clutches are provided for the feeding and pulling means along each table for selectively interrupting the operations along each table.

10. A device for accurately measuring and delivering onto a foil relatively small compact piles of powdered material comprising a delivery head having a partial cylindrical bottom surface, a port in an uppermost portion of said partial cylindrical surface connected with a feed hopper opening downwardly onto said port, a delivery wheel having its rim machined to fit accurately and to run in relatively gas-tight contact with said partial cylindrical bottom surface, means mounting said wheel for rotation with its rim in contact with said partial cylindrical surface, a plurality of spaced radial cylinders in said wheel opening onto said rim surface, a piston in each of said cylinders and forming a bottom therefor, rod means connected to each of said pistons for moving them and means for retracting each of said pistons radially inwardly into said cylinder, means for feeding a foil onto said rim as it runs out of contact with said partial cylindrical surface and downwardly, and for carrying said foil thence horizontally, a camming device in said wheel having a generally conical surface, said camming device being mounted substantially concentrically with the wheel in a position for each of said rods to ride thereagainst, said camming device being adjustably movable axially with respect to said wheel for varying the radially inwardly retracted position of said rods and hence the pistons attached thereto and a cam on said conical surface for pushing the rods and the pistons attached thereto radially outwardly, said cam being adjustable about the axis of said wheel for adjusting the exact position within a range of radial downward positions in which said rods and pistons attached thereto are pushed radially outwardly toward the wheel rim.

11. The apparatus as specified in claim 10 being further characterized in that the recesses in the wheel rim are chamfered adjacent the rim surface of the wheel.

12. The apparatus as described in claim 10 further characterized in that a second port is provided in said partial cylindrical bottom surface in advance from said delivery port with respect to the direction of rotation of said wheel, a vacuum source communicating with said second port, valve means connected to said port for varying the pressure therein from a condition of vacuum to a higher pressure, said valve means being operated in timed relation with respect to the movement of each of said radial cylinders past said second port for initially applying a vacuum to said recess as it reaches said port and then permitting the pressure to rise therein and thereafter again applying a vacuum as said recess reaches said delivery port.

13. An apparatus for the production of sealed packages of accurately measured small quantities of finely divided solid materials comprising a material holder for said finely divided material having a filling opening at the top and a discharge opening at the bottom, said material holder being positioned so that solid material there-

in is retained as a column for downward flow therethrough to said discharge opening, a material receiver for receiving finely divided solid material therein having a continuous surface movable in sealing relation against the bottom of said holder, said material receiver having a plurality of spaced pockets therein, plunger means for each of said pockets movable therewith and forming an end for each pocket, against which the finely divided solid material may repose, said pockets being disposed in said material receiver so as to be brought into registry with the delivery opening of the material holder as the material receiver moves relative to the material holder, means for feeding a continuous strip of package forming sealable material into registry with the continuous surface of said material receiver as it moves away from the bottom of said material holder for retaining the finely divided material therein as the material receiver moves, said material receiver being mounted for movement of said pockets to a downwardly directed position, each of said plungers in said pockets being movable therein and means for moving the plungers in said pockets to discharge the material therefrom as each pocket reaches said downwardly directed position and for discharging the finely divided material in a series of compact spaced piles on said continuous strip and means for thereafter retracting said plungers, said means for moving the plungers in said pockets comprising a tapered, generally conical cam concentric with said material receiver and adjustable mounting means for holding the cam, said cam being shaped so that when it is moved in one direction axially all of the plungers will be moved inwardly or outwardly simultaneously for adjusting the datum position of said plungers and said cam being being shaped to move the plungers outwardly at one position.

14. A substantially horizontal table, means for delivering on said table a continuous strip of sealable package forming material, means according to claim 13 for delivering onto said strip spaced and compacted piles of accurately measured powdered material, the terminal edges of said piles being spaced from the edges of the strip and spaced along the strip, means for applying over said strip and piles a second similar strip of sealable package forming material, a pair of rolls one situated below the strip and the other above the strip geared so as to run together in contact and to apply pressure to the upper and lower faces of said strip along the edges thereof and transversely at spaced intervals between said piles of material for sealing the two strips together along their edges and between said piles, said rollers being internally heated and a stationary and cooperating rotary cutter along said table for severing the sealed strips along the transverse seal as the strip moves therebetween, said rotary cutter being geared for movement in synchronism with said heating rollers.

15. An apparatus of the type set forth in claim 14 further characterized in that means is provided within each of said sealing rollers for electrically heating the same internally and for adjustably restraining at least one of said rollers in a position so that they do not contact the strips.

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