Feb. 28, 1967 T. ARONSON 3,306,323

FILLING MACHINE

Filed April 23, 1964 3 Sheets-Sheet 1

FIG. 3

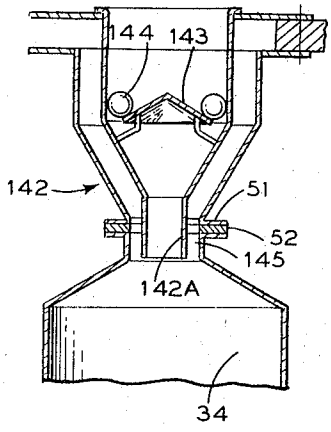


FIG. 4

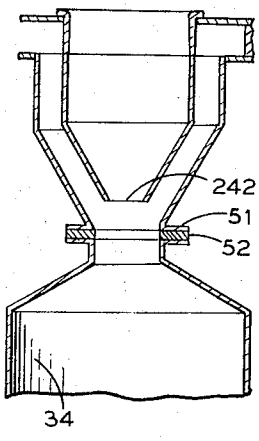


FIG. 1

FIG. 5

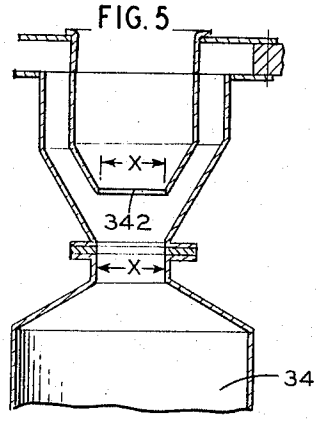
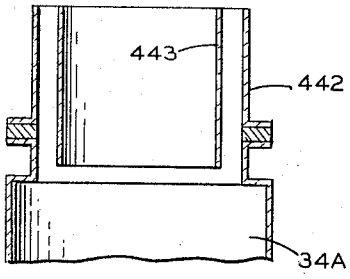


FIG. 6



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FILLING MACHINE

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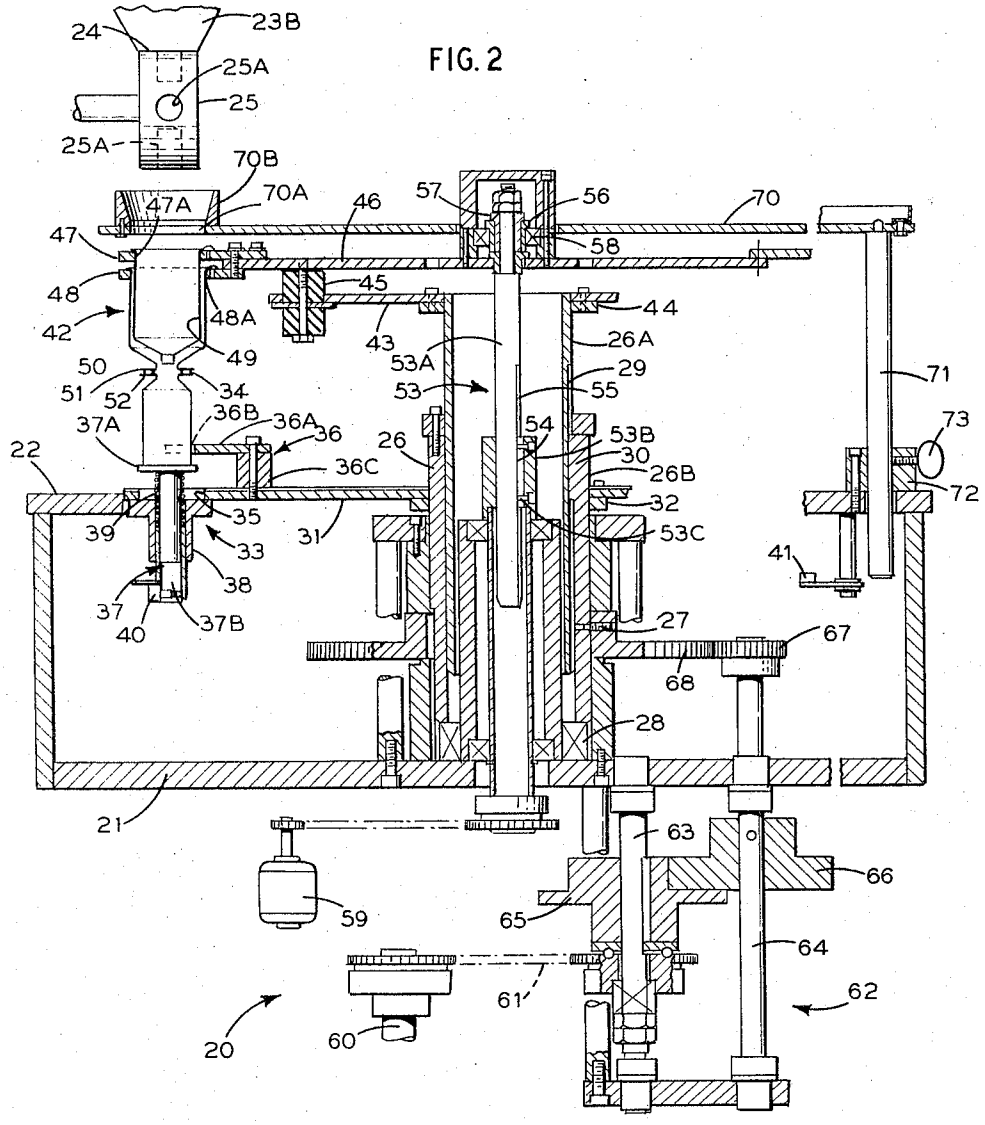
FIG. 2



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FILLING MACHINE

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FIG. 7

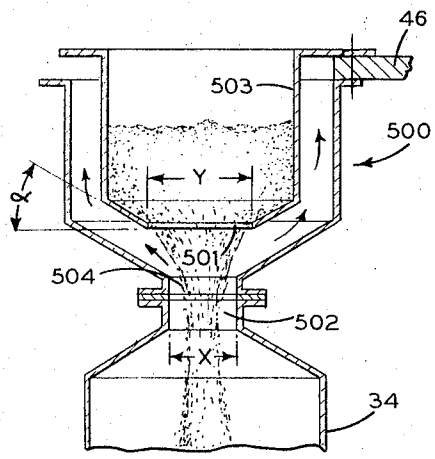


FIG. 8

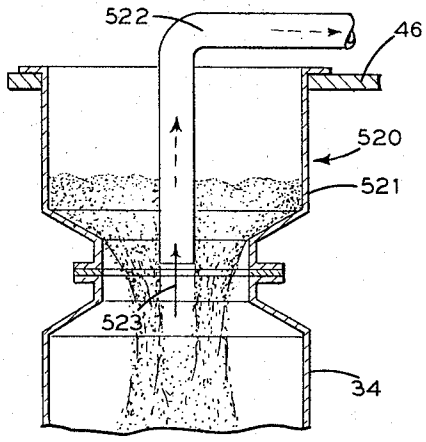


FIG. 10

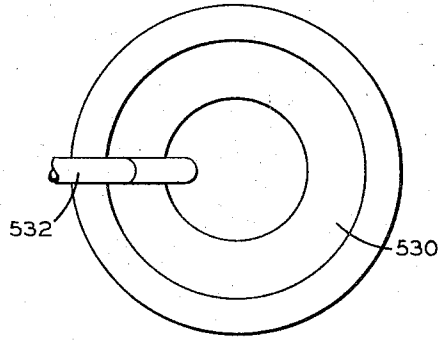


FIG. 12

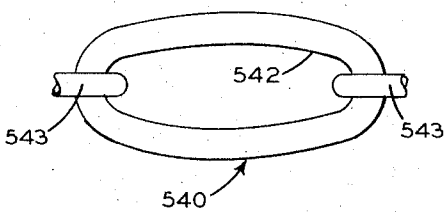


FIG. 9

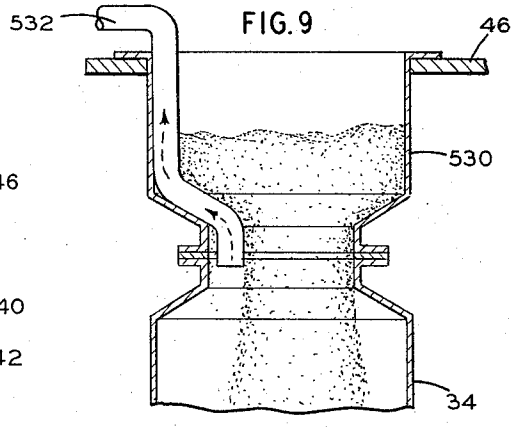
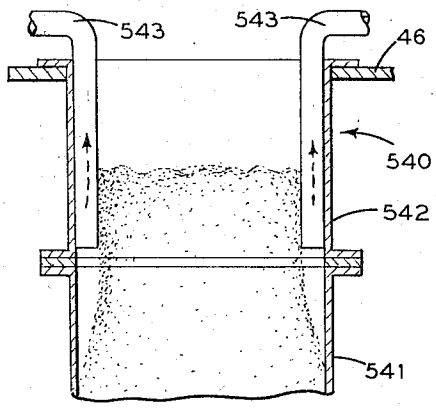


FIG. 11



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3,306,323

Patented Feb. 28, 1967

3,306,323

FILLING MACHINE

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Filed Apr. 23, 1964, Ser. No. 361,935
15 Claims. (Cl. 141—72)

This invention relates in general to a method and apparatus for filling a bottle, vial or container with a fluid or flowable material, and more specifically to a method and apparatus for facilitating the filling of a comparatively large amount of powdered material or the like into a container such as a bottle, vial or the like which is generally formed with a restricted neck opening.

Heretofore, considerable difficulty has been encountered in the filling of a container, such as a bottle or vial having a restricted neck opening, with a comparatively large amount of a powdered material or the like. In the past, an auger was generally used to feed relatively large amounts of powder into a restricted neck container. Such augers would pick up the powdered material, and upon rotation thereof would advance the powder therealong to its point of discharge. However, the inherent in the operation of an auger is the generation of undesirable heat by the powdered material as it is being advanced along the vanes of the auger. The heat thus generated has a deleterious effect on the powder filling operation as it causes corrosion and eventual jamming, all of which results in a loss of speed and poor efficiency. Frequently, the powdered material itself is adversely affected by the heat generated as many powdered products cannot take such heat.

Another troublesome problem encountered in powder filling operations utilizing the known filling techniques, is that of dusting, which is the contamination of the atmosphere in and around the area of the filling operation by the fine or minute particles of powder which tend to become suspended therein. For this reason, workers in and around a powder filling operation are required to wear face masks to avoid breathing of the minute particles of powder thus suspended in the air for obvious health reasons. This condition becomes even more aggravated in the event a highly poisonous powder is being handled, e.g. insecticides and the like.

Therefore, an object of this invention is to overcome the above noted disadvantages and to provide a method and apparatus for filling containers and especially those having restricted neck openings with a comparatively large amount of powdered material in a rapid, efficient and positive manner.

Another object is to provide a powder filling method and apparatus in which containers with restricted neck openings are filled with a comparatively large amount of powder in a manner which assures compacting of the powder within the container so that the same is filled with a desired capacity.

Another object is to provide a powdered filling method and apparatus that will efficiently and rapidly flow a comparatively large amount of powder through restricted opening of the container in a minimum of time and with a minimum of dusting.

Still another object is to provide a powder filling machine in which provision is made for effecting evacuation of the air which is displaced by the powdered material filling the same from within the container to result in compacting of the powder within the container, thereby allowing the same to be filled to a desired capacity.

Still another object is to provide a method and apparatus in which the air displaced from within the container as it is being filled is evacuated to the atmosphere with a minimum of entrained powdered particles.

The foregoing objects and other features and advantages are attained by the method of disposing a funnel means provided with air evacuation means adjacent the mouth opening of a container or vial to be filled with a flowable material. Preferably the mouth of the container or vial to be filled is brought into sealing relationship with the discharged end of the funnel means with the interior of the container placed in open communication with the air evacuation means associated with the funnel means. A comparatively large quantity of powdered material or the like is then placed into the funnel means and the funnel means vibrated, the vibration thereof being imparted to the vial or container connected thereto. The air within the container displaced by the powdered material flowing thereinto is then evacuated to the atmosphere through the air evacuating means. Accordingly, the vibration of the funnel means enhances the flow of the material through the opening of the container, the compacting of the material within the vial, and the evacuating of the air displaced by the powdered material flowing into the container.

One form of the apparatus by which the foregoing method can be automatically performed comprises essentially of a frame having mounted thereon a hopper means for containing a supply of powdered material in bulk form. Operatively associated with the hopper means is a rotating filling head means provided with a plurality of measuring chambers. The arrangement is such that upon rotation of the filling head, the respective measuring chambers are successively rotated relative to the hopper means between a filling and discharging position.

A means is provided for successively conveying a series of containers to be filled through the discharging position of the respective measuring chambers. Interposed between the filling head means and the opening end of the containers, transported by the conveying means, is a funnelling means for receiving the powdered material as the same is discharged from the respective filling head measuring chambers. In accordance with this invention the funnelling means comprise a plurality of connected funnelling stations, each of which are successively moved through the discharging position of the respective filling chambers in synchronization with the containers moving therethrough.

The respective funnelling stations each comprise an inner and outer funnel spatically disposed one within the other. The funnels are arranged so that the respective discharge openings thereof are disposed in alignment with the open end of the containers as the latter are carried by the conveying means. Means are associated with the conveyor means for lifting the respective containers carried thereon into sealing relationship with the reduced mouth opening of the outer funnel of its corresponding funnelling station as the respective containers are about to be moved through the discharging position of the rotating filling head means. Means are also operatively associated with the funnel means for imparting a vibratory movement thereto so as to hasten the flow of the powdered material deposited into the respective funnelling station thereof. The arrangement is such that the air within the container, displaced by the powdered material flowing thereinto, is exhausted through the spacing defined between the respective funnels of the associated funnelling station. Means are also provided for varying the vertical distance between a conveying means and the funnelling means to accommodate varying size bottles or containers.

In other forms of the invention each of the respective funnelling stations may comprise of a single vibratory funnel co-operatively associated with a modified air

evacuation means disposed in open communication with the interior of the container or vial.

A feature of this invention resides in the provision of means for exhausting the air displaced from within the container by the powdered mtaerial being received therein with a minimum of powder entrainment.

Another feature of this invention resides in the provision of concentrically disposed funnel means which are vibrated during a filling operation to enhance both the filling time of the vial and to exhaust from the containers through the spacing formed between the respective funnel means the air displaced by the powdered material discharging thereinto.

Another feature of this invention resides in the provision of an apparatus which can be readily adjusted to accommodate vials or containers of varying sizes or heights.

Another feature of this invention resides in the provision that the method and apparatus is relatively simple and positive in operation.

Another feature resides in the provision that the filling of the restricted neck bottles is attained without the generation of undesirable heat.

Another feature of this invention resides in the provision that the air within the container displaced by the powdered material flowing thereinto is exhausted in a manner which enhances the compacting of the material within the container to insure the placement of a given capacity of the material into a given container.

Still another feature of this invention resides in the provision wherein the air being displaced by the flow of the material flowing into the respective containers is exhausted with a minimum of powdered material becoming entrained therein.

Still another feature of the invention resides in the provision that the vibration of the funnel means imparts a vibration to the container being filled and thereby enhances the compacting of the flowable material within the container.

Other features and advantages will become more readily apparent when considered in view of the drawings and description in which,

FIGURE 1 is a pictorial illustration of the filling machine embodying the instant invention.

FIGURE 2 is a sectional side view of a fragmentary part of the machine of this invention, with parts thereof broken away.

FIGURE 3 is a sectional view to a larger scale illustrating a modified funnel station.

FIGURE 4 is a detailed sectional view similar to that of FIG. 3 but illustrating another slightly modified form of funnel station.

FIGURE 5 is a detailed sectional view taken of still another modified form of funnel station.

FIGURE 6 is a detailed sectional view of still another modified form of funnel station.

FIGURE 7 illustrates a detailed sectional view of yet another modified form of the invention.

FIGURE 8 is a sectional view of still another form of the invention.

FIGURE 9 is a detailed sectional view of still another form of the invention.

FIGURE 10 is a plan view of FIG. 9.

FIGURE 11 is a detail sectional view of still another form of the invention.

FIGURE 12 is a plan view of FIG. 11.

In accordance with this invention, a method in which a vial bottle or container, and one generally provided with a restricted or narrowed neck opening, can be quickly and efficiently filled with a comparatively large amount of fluid or flowable powdered material which comprises the steps of disposing a funnel means provided with air evacuating means into sealing relationship with the mouth opening of a container or vial to be filled with a flowable material so that the air evacuating means is disposed in

open communication with the interior of the container. A comparatively large quantity of powdered material or the like is then placed in the funnel means. The funnel means is then vibrated, the vibration thereof being imparted to the container disposed in sealing relationship therewith. The air displaced by the powdered material flowing into the container is then evacuated to the atmosphere through the air evacuating means. A more specific method comprises the steps of disposing a pair of funnels one within the other so that a space is defined therebetween. The funnels so paired are then placed so that the discharge ends of the outer funnel and the mouth opening of the container to be filled are brought into sealing relationship. A relatively large quantity of bulk powdered material is then positioned in the inner funnel. To expedite the flow of the powdered material through the funnels, the funnels are vibrated, and the vibration thereof is imparted to the container which in turn enhances the compacting of the powder within the container as it is deposited thereinto. Accordingly, the air within the container, which is being displaced by the flow of the powdered material thereinto, is exhausted to the atmosphere through the spacing defined between the inner and outer funnels. As a result of the vibration of the container and the evacuation of the air from the interior of the container, the material deposited into the container is compacted to assure that sufficient room is provided for accepting the desired or maximum capacity of the material which can be placed within the container. Also the evacuation of the air through the spacing between funnels minimizes powder entrainment for the reason that much of the powder reaching the funnel space is vibrated back down into the containers. Upon completion of the filling operation, the container is separated from the discharge opening of the outer funnel and removed therefrom.

While the described method can be manually performed for the singular filling of such containers, it is preferred that the described method or operation be automatically performed at relatively high speed in a rapid continuous or repetitive manner. To attain high speed production with the employment of this method, an apparatus **20** capable of automatically performing a filling operation in accordance with this invention, is illustrated in FIGS. 1 and 2. The apparatus **20** comprises a frame **21** having a top supporting surface **22** with a hopper means **23** connected to the frame so as to be spaced above the supporting surface **22**. The hopper means **23** is defined by a main body portion **23A** having a connected transition section **23B** which terminates in a discharge port **24** through which the powdered material stored in the hopper **23** is dispensed. The hopper **23** is specifically constructed for receiving a relatively large quantity of powdered material, as for example, various talcums, face powders, sugars, explosives, resins, medicinal powders, insecticides and any other like fluent or flowable, finely divided, powdered or granular material.

Operatively associated with the hopper means **23** is a rotating filling head turret means **25** of the type disclosed in U.S. Patent No. 2,540,059. Essentially, the filling head turret means **25** comprises a filling head turret which is rotatably journalled beneath the dispensing port **24** of the hopper means. Accordingly, the peripheral portion of the filling head turret **25** forms a gate for closing the dispensing port **24** of the hopper. Formed in the periphery of the filling head turret **25** are a plurality of filling chambers **25A** each of which is sized for withdrawing a predetermined amount of the powdered material from the hopper **23** as each is successively rotated passed the dispensing port **24**. The respective measuring chambers **25A** are then separately discharged as the filling head turret **25** has been rotated approximately 180° from its filling position.

In the illustrated embodiment of FIGS. 1 and 2, a supporting column **26** is centrally supported on the frame

21. The column 26 comprises an inner and outer tubular section 26A, 26B respectively which are telescopically nested one within the other, and slidably interconnected for relative movement between extended and retracted positions. A suitable set screw 27 or the like is provided to fix the relative positions of the respective column sections 26A, 26B in an adjusted position. In accordance with this invention, the respective sections 26A, 26B of the column are keyed in driving relationship and a suitable bearing 28 is interposed between the base of the column 26 and the frame 21 so as to render the column 26 rotatably journalled thereto. As shown, in FIG. 2, the inner section 26A of the column is provided with a longitudinally extending groove 29 or key way for receiving a complementary key 30 formed on the outer column section, the reason therefor becoming hereinafter more apparent.

A conveying means is provided for successively receiving and transporting a series of containers to be filled successively through the discharging position of the filling head turret 25. In the illustrated embodiment, the conveyor means comprises a turntable 31. The turntable 31 is secured to the outer section 26B of the column 26 by a flange or collar 32 fixed to the column 26. Accordingly, the turntable 31 secured to the column will rotate in unison therewith as will be hereinafter described.

As best seen in FIGS. 1 and 2, the turntable 31 is provided about the outer periphery thereof with a plurality of circumferentially spaced container stations 33, each being adapted to receive and locate a container 34 to be filled thereon. Each container station 33 is defined by an opening 35 formed in the turntable 31 and it is sized to accommodate the bottom of a container 34 or vial to be filled. Guide means 36 are located on the turntable 31 adjacent each of the respective openings 35 formed therein for assuring the positioning of a container 34 in proper alignment with the opening formed therein.

The guide means comprises a positioning plate 36A formed with a suitable notch 36B for receiving a container 34 and it is supported by a block 36C fixed to the table 31. Accordingly the guide plate 36A is fixed above the turntable 31 at each station 33.

Means are provided at each of the container station 33 for supporting the container 34 for vertical movement to effect the raising and lowering of the container thereat during the operating cycle of the filling apparatus as will hereinafter be described. The movable supporting means at each station comprises a piston 37 which is movably mounted in a sleeve 38 fixed in alignment with each of the station opening 35. As shown in FIG. 2, the respective sleeves 38 are suitably connected to the undersurface of the table 31 adjacent each of the station openings. Accordingly, the associated pistons each include a head portion 37A sized to be received in the station opening 35 and a connected stem portion 37B, the latter being slidably received within the bore of the associated sleeve 38 for relative movement thereto. The head portion 37A of the piston, adapted to be received within the opening 35 of each station 33, defines a movable platform or support on which the container 34 is carried during the filling cycle of the apparatus. A spring means 39 disposed about the piston stem 37B is provided to normally bias the head of the piston toward its raised position.

Associated with the stem 37B of each piston 37 is a cam follower or roller 40 which is adapted to engage with a fixed cam 41 connected to the frame so as to extend to the undersurface of the table. The co-action between the fixed cam 41 and the cam follower 40 of the respective pistons 37 is such that through a certain portion of the filling cycle or operation, as will be hereinafter described, the piston 37 is retracted against the bias of its spring 39 so that the head portion 37A thereof is disposed in its lowered position wherein the surface of the piston head 37A is rendered substantially flush with the level of the turntable 31. Accordingly the fixed cam 41 is set at that position of the filling operation or cycle in which the filled containers are to be removed and an emptied container substituted therefor.

In accordance with this invention, the filling of the containers, and in particular containers having a restricted neck opening, which are successively carried through the discharging station of the turret filling head on the turntable, is enhanced by a novel funnelling means 42. The funnelling means 42 is specifically constructed and arranged so as to permit the passage of a comparatively large amount or quantity of powdered material through the restricted opening of the containers in a minimum of time and with a minimum of dusting.

This is attained by a funnelling means 42 which comprises a mounting plate 43 which is secured to the upper end of the inner column section 26A. As shown, the mounting plate 43 is fixed to a collar 44 or flange which is connected to the inner column section 26A. Circumferentially spaced about the periphery of the mounting plate 43 are a plurality of shocks 45 on which there is movably supported a substantially circular shaker plate 46. Connected by suitable fasteners to the outer marginal edge portion of the shaker plate 46 are a pair of spaced ring members 47, 48, one ring 47 being connected to the upper surface of the shaker plate 46 and the other ring 48 being connected to the undersurface of the shaker plate 46. The arrangement is such that the respective rings 47, 48 are concentrically disposed with the outer peripheral portions thereof extended beyond the marginal outer edge of the shaker plate 46. Accordingly each of the respective ring members 47, 48 is provided with a series of aligned openings 47A, 48A the number of openings in each ring member corresponding to the number of container stations 33 on said turntable 31.

Supported in the respective openings 47A, 48A of each ring member 47, 48 is a funnel 49, 50. In the arrangement described, and as apparent in FIG. 2, the funnels 49 carried in the openings of ring member 47 are concentrically disposed within the funnels 50 carried by ring member 48. Accordingly each funnel station, thus defined, comprises an inner and outer funnel 49, 50 which are maintained in co-axially spaced relationship with respect to one another. Each of the funnels at each station is provided with reduced neck openings which are arranged to be co-axially disposed with respect to the restricted neck opening of the containers adapted to be associated therewith.

In accordance with this invention, each of the respective outer funnels 50 of at each of the funnel stations 33 is provided with a means against which the neck or opening of a container associated therewith is urged during a filling operation to define a seal therebetween. As best seen in the respective modification of the individual funnel stations of FIGS. 3 to 6, the end of the respective outer funnels is provided with a circular flange 51 to which there is secured a gasket 52 or seal. Thus as the container 34 associated therewith is to be filled, the operation is such that the respective pistons 37 at each of the container stations 33 will move the container 34 into sealing position with the end of the outer funnel 50.

To facilitate the filling operation a means is provided to impart an orbital vibration to the shaker plate and the funnels 47, 48 carried thereon during a filling cycle of the apparatus. The vibration of the shaker plate 46 is accomplished by means of a drive shaft 53 which is rotatably journalled within the supporting column 26 of the apparatus. As noted in FIG. 2, the drive shaft 53 of the vibrating means includes telescopically connected inner and outer shaft sections 53A, 53B, nested one within the other and connected for movement between extended and retracted position. A cooperating key 54 and key way 55 formed on the respective shaft segments 53A,

53B interconnect the same into driving relationship. A set screw 53C secures shaft sections 53A, 53B in adjusted position. A pair of relatively adjustable complementary eccentrics 56, 57 are journalled to the upper end of the vibrating drive shaft 53. Accordingly, the shaker plate 46 of the funnelling means is rotatably journalled about the eccentrics 56, 57 by a suitable bearing 58. Thus the drive shafts 53 of the vibrator is rotated or driven by a motor 59 or the like, the shaker plate 46 will have imparted thereto an orbital vibrating motion, the amplitude of which can be adjusted by relative adjustment of the respective nested concentrics 56, 57. As a result, whenever the machine is rendered operative, the funnel means 42 connected to the peripheral portion of the shaker plate 46 will tend to vibrate therewith.

The drive means of the apparatus described comprises a suitable power source, e.g. a motor (not shown) for effecting rotation of the main drive shaft 60. The main drive shaft 60 in turn is connected by a flexible or chain drive 61 to a pair of Geneva movement, of which only one is illustrated. The illustrated Geneva movement 62 is designed to effect an intermittent angular rotation of the supporting column 26 and of the turntable 31 and funnelling means 42 carried thereon. Essentially the Geneva movement 62 controlling intermittent angular rotation of the supporting column 26 and the respective turntable 31 and funnelling means 42 carried thereon comprises an input shaft 63 and an output shaft 64 to which the respective cooperating complementary Geneva elements 65, 66 are connected. The respective Geneva elements 65, 66 are designed so that the output shaft 64 has imparted thereto a limited angular rotation dependant upon design ratio of the movement to effect intermittent positioning of the turntable. Connected to the end of the output shaft 64 is a gear 67 which is arranged to mesh with a driven gear 68 fixed to the supporting column 26 to effect the driving thereof accordingly, column section 26A being keyed to section 26B is thus driven therewith.

Not shown is a similar Geneva movement for effecting the rotation of the filling head turret means 25. The arrangement is such that both the turntable 31 and associated funnelling means 42 are intermittently rotated in synchronization with the rotation of the filling head means 25 so that a discharge of the respective filling chambers 25A carried thereon can be effected, each time a funnelling station 42 and its associated container station 33 is moved through the discharging position of the filling head 25.

If desired a covering shield or plate 70 may be supported over the plate 46 of the funnelling means 42.

As shown in FIG. 2, the covering shield 70 comprises a disk which is adjustably supportable on the frame by a series of stanchions 71, of which only one is shown. Accordingly, each stanchion 71 is slidably received in an apertured collar 72 supported on the frame beyond the periphery of the turntable 31. A thumb set screw 73 is provided to fix the elevation of the cover shield 70 in its set position.

As shown the cover shield 70 is provided with an opening 70A and a cooperating collar 70B to define a passageway disposed in alignment respective filling head and funnelling stations at the discharging position of the former. Thus the opening 70A and collar 70B defines a passageway through which the material from the filling chambers 25A is directed to each of the funnelling stations 42 brought into successive alignment therewith.

It will be apparent that the apparatus can be readily adjusted to accommodate variable size containers 34. By loosening set screws 27, 53C and 73, the respective column 26, vibrator drive shaft 53 and shield 70 can be raised or lowered relative to the turntable 31 to accommodate a given container size. With the respective column 26, shaft 53 and shield 70 properly adjusted, the respective set screws 27, 53C and 73 are tightened to maintain the adjusted position thereof.

The operation of the apparatus described is as follows:

When the main power source, e.g. a motor (not shown) is energized to effect rotation of the main drive shaft 60, the latter through the connected Geneva drives effects synchronous intermittent operation of the rotating filling head turret 25, the turntable 31 and associated funnelling means 42. The arrangement is such that the filling head turrets 25 rotates the respective filling chambers 25A thereof successively pass the gate of the hopper 23 to withdraw therefrom successive predetermined amounts of powdered material.

Simultaneously containers or vials 34 to be filled are successively fed onto the respective container stations 33 of the turntable 31. The containers 34 may be manually fed onto each station 33 as the turntable 31 is rotated, or means not shown may be provided to automatically feed the containers 34 to the turntable 31. At that position in the cycle of the turntable at which the containers 34 are placed at the respective container stations 33, the cam follower 40 carried by the piston 37 of such station engages the fixed cam 41 secured to the frame, causing the platform or piston head 37A to be lowered to the plane of the turntable 31. Thus at this point of the cycle, the filled containers 34 may be removed from the turntable 31 and an empty container 34 positioned thereon. The arrangement is such that the engagement of the cam followers 40 and the fixed cam 41 is maintained only over that portion of the cycle sufficient to effect removal and replacement of the containers 34 from the respective container stations 33.

As the turntable 31 advances the respective container stations 33 and container 34 in place thereon toward and through the discharging position of the filling head 25, the cam follower 40 will ride off the fixed cam 41, thereby causing the spring 39 in the respective container station 33 to raise the piston head 37A and containers 34 carried thereon toward the funnelling station 42 associated therewith. Consequently the opening or mouth of the container 34 is placed in sealing position against the gasket 52 carried by the end of the outer funnel 50. As the respective containers 34 are thus passed through the filling station of the apparatus, the rotating filling head 25 timed to the movement of the turntable 31 will successively discharge a fixed quantity of powdered material into each inner funnel 49 of the succeeding funnelling station 42.

Accordingly, to hasten the flow of the powdered material through the restriction of the respective funnel stations 42 and associated container, the shaker plate 46 suppotring the respective funnel stations 42 has imparted thereon an orbital vibratory motion. This is attained by the actuation of the vibrator drive shaft 53 which can be powered either by an independent motor means or else may be connected so as to be driven off the main drive shaft 60. It will thus be apparent that the vibratory motion imparted to the shaker plate 46 and the respective funnel station 42 is transmitted to the respective associated container or vials disposed in sealing relationship therewith during the cycle of operation. The vibration thus imparted to the container enhances the compacting of the powdered material as it flows into the container.

Accordingly, the air in the container which is being displaced by the powder flowing thereinto, is exhausted up through the space defined between the spaced funnels 49, 50. Since the spacing between funnels provides the means for evacuating the air displaced by the powder flowing into container, the compacting of the powder within the container is further enhanced.

An important feature of the invention resides in the provision that entrainment of the powder in the air being evacuated is reduced to a minimum. The lack of powder entrainment appears to be due to the fact that the inlet to the air evacuation space is free from interference with the incoming fluid or powder material, and also because the shape of the evacuating space will cause much of

whatever powder is entrained to filter or distill out before its passage to the atmosphere. Because of the vibration imparted to the funnels, the powder that is distilled or filtered out in the space therebetween is returned to the container.

As the respective funnels **49**, **50** of the succeeding stations have been emptied of their contents upon continued rotation of the turntable, the cam followers **40** of the respective container stations are again brought into engagement with the fixed cam **41** thereby overcoming the bias of the spring **39**, and causing the container **34** carried on piston **37** to be lowered for separating the mouth of the container **34** from the discharge end of the outer funnel **50**. At this point in the cycle, the respective filled containers **34** are removed from their respective container stations **33** and an empty container **34** placed thereon for continuous operation. From the foregoing description, it will be readily apparent that a repetitive filling operation is automatically performed in an efficient, rapid and positive manner.

FIGS. 3 to 6 illustrate slightly modified funnel stations. In the funnel station **142** of FIG. 3, it is to be noted that the reduced neck portion **142A** of the inner funnel is made sufficiently longer so as to extend into the neck or opening of the container **34** being filled. Also a diffusor or baffle means **143** is located within the inner funnel above the restriction thereof. The diffusor or baffle means **143** comprises a plate or screen which is supported so that its peripheral edge is spaced from the walls of the funnel. The function of the diffusor or baffle **143** is to break up any powder lumps or slugs which may be formed as a result of the vacuum action acting on the rotating filling head **25** in effecting withdrawal of the powder from the hopper. If desired, ball elements **144** may be confined within the inner funnel. The ball elements **144** further enhance the breaking of any slugs of powder. When the funnel station **142** is vibrated the balls **144** will have imparted thereto a random shifting movement and thereby break up the lumps or slugs of powder which may exist. By extending the neck **142A** of the inner funnel into the opening of the bottle or container, a positive annular opening **145** is provided between the funnel neck **142A** and the neck of the container through which the displaced air may be exhausted.

In FIG. 4, the opening of the inner funnel **242** is spaced above the opening of the container, and the diameter of the funnel opening is made less than the diameter of the container opening.

In FIG. 5, the opening **342** of the inner funnel similarly located above the opening of the container, but is sized with a diameter which is substantially equal to the diameter of the container opening. By enlarging the discharge opening **342** of the inner funnel more powder is permitted to flow therethrough in less time, to further enhance or expedite the filling operation.

In FIG. 6 a funnel station for use with container **34A** having wide mouth openings is shown. In this form the funnel stations represent cylindrical concentric conduits **442**, **443** of relatively large cross-sectional area. Consequently in this form of the invention, the flow time of powder through the funnel station is reduced to a minimum. Depending on the cross-sectional area of the respective conduits **442**, **443**, the amplitude of vibration can be diminished as required.

FIG. 7 illustrates another modified funnel station **500**. In this form of the invention the opening **501** of the inner funnel is located above the opening **502** of the container **34** and the opening **501** is formed with a diameter Y which is greater than the diameter X of the container **34** opening **502**. Due to the slope of the inner funnel **503** defined by an angle "alpha," the powder will flow in a manner to define an annular space **504** about the stream of powder flowing into the container **34**. Thus the space **504** defined has been found sufficient to permit the evacuation of the air being displaced by the material flowing into the container. Consequently, this construction permits relatively large streams of powder to flow through the restricted opening of the container without impeding the evacuation of the displaced air; and thereby greatly enhance the filling operation.

FIG. 8 illustrates a further modified form of the invention. In this form of the invention, the funnel station **520** comprises a single funnel **521** which is supported on the shaker plate **46**. The means for evacuating the air with this construction comprises a conduit **522** which is centrally disposed with respect to the vibrating funnel **521**. As shown, the inlet end **522A** of the air conduit **522** extends to the opening of the container **34** and is concentrically disposed with respect to the opening of the container. Thus, the powered material disposed within the funnel streams into the container **34** in a substantially annular shaped stream, permitting the displaced air to be evacuated up through the center thereof as indicated by arrow **523**.

FIGS. 9 and 10 illustrate a further modification. In this form, a single funnel **530** is also supported on the shaker plate **46** similar to the arrangement of FIG. 8. However, in this form, the air evacuating tube **531** is positioned contiguous to a wall portion of the funnel **530** as shown. With this arrangement, the air evacuation tube **531** can also be vibrated with the associated funnel. Thus, in this arrangement, the main stream of the powder material flowing into the container **34** is disposed to one side, permitting the air being displaced to be evacuated through the space thus defined. By imparting a vibratory movement to the air conduit **531**, any entrained powder in the evacuating air tube **531** can be filtered or distilled out of the evacuating air and vibrated back into the container as hereinbefore defined.

FIGS. 11 and 12 illustrate a modified funnel station construction **540** that is particularly applicable for use in filling oval shaped containers **541** with talcum powder or the like. In this form of the invention, the funnel device **542** is provided with oval configurations substantially similar to that of the container **541** to be filled. A pair of air evacuating conduits **543** are oppositely disposed in contiguous relationship to the walls of the funnel device **542**; and each is extended so that their respective inlets are disposed adjacent the opening of the container. Thus in operation the powder flows from the funnel device **542** to the container **541** in a main stream which is spaced from the rounded corners of the vial container. The space thus formed provides the passage for the evacuation of the displaced air.

While the instant invention has been described with reference to a method and various apparatuses for performing the same, it will be readily apparent that variations and modifications thereof may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. An apparatus for charging a container with a fluent material comprising,
   (a) funnelling means adapted for receiving a predetermined amount of fluent material,
   (b) said funnelling means including a shaker plate, an inner and outer funnel spaced one from the other connected to said shaker plate and whereby the fluent material is placed in said inner funnel,
   (c) means for positioning the opening of a container in sealing relationship with the opening of said outer funnel,
   (d) means for vibrating said inner funnel whereby the vibration of said inner funnel enhances the flow of fluent material from said inner funnel to the container and whereby the air displaced within the container is exhausted therefrom through the space defined between the respective funnels, said latter means including a drive shaft, a pair of concentric eccentrics mounted on said drive shaft, and means rotatably journalling said shaker plate about said concentric

eccentrics whereby the relative settings of said eccentrics vary the amplitude of vibration imparted to said shaker plate when said drive shaft is actuated.

2. An apparatus for successively filling a container having restricted neck openings with a comparatively large amount of fluent material comprising,

(a) means defining a source of supply for said material,

(b) means for successively withdrawing predetermined amounts of said material,

(c) means for successively moving a line of containers whereby each of said containers are successively brought into position for receiving said predetermined amount of material,

(d) funnelling means interposed between said withdrawing means and said container moving means for directing the fluent material discharged from said withdrawing means to the container,

(e) said funnelling means including a rotatably journalled shaker plate, a series concentrically disposed funnels connected to said plate, drive means for effecting the rotation of said shaker plate and connected funnels, and means synchronizing the rotation of said shaker plate to the movement of said withdrawing means and said container moving means,

(f) means for successively placing the restricted mouth opening of said moving line of container into sealing engagement with the corresponding outer funnel associated therewith and moving in synchronization therewith,

(g) and means for vibrating said funnel means to enhance the flow of material therethrough and whereby the air displaced within said container is exhausted through the spacing between respective concentric funnels.

3. A machine for filling a container having a restricted neck opening with a comparatively large amount of fluent material and for compacting the same thereinto to assure filling of the container with said large amount of material comprising,

(a) a frame,

(b) hopper for containing a supply of said material mounted on said frame,

(c) a rotary filling head mounted on said frame,

(d) said filling head being provided with a plurality of measuring cavities adapted to be moved successively between a filling and discharging position whereby said cavities receive a supply of said material from said hopper in the filling position thereof,

(e) a conveyor means for successively transporting a series of containers under the discharging position of said filling head as each cavity of said head is moved from its filling position to a discharging position,

(f) and a funnelling means moving in synchronization with said filling head for successively receiving and directing the fluent material discharging from the respective measuring chambers to the successive containers moving under said filling head when said head is moved from its filling position to its discharging position,

(g) said funnelling means including a plurality of serially connected pairs of funnels,

(h) each pair of funnels including an inner funnel and a spaced outer funnel,

(i) each of said funnels having reduced mouth openings,

(j) means for successively placing each of said moving containers into sealing relationship with the mouth of its respective outer funnel as the latter moves under said head,

(k) and means for vibrating said funnels for hastening the flow of fluent material received by said funnels to their associated container whereby the air in the container displaced by the material received is exhausted through the spaced defined between funnels.

4. A machine for successively filling a line of moving containers, each having a restricted neck opening with a comparatively large amount of powdered material and for compacting said material thereinto to assure filling of the container with said large amount comprising,

(a) a frame,

(b) hopper for containing a supply of said material mounted on said frame,

(c) a rotary filling head associated with said hopper mounted on said frame,

(d) said filling head having a plurality of measuring cavities adapted to be moved successively between a filling and discharging position, said cavities receiving a measured supply of said material from said hopper in the filling position thereof,

(e) a conveyor means for successively transporting a series of containers under said filling head in synchronization with the rotation of said filling head whereby a container is placed in position to receive the fluent material from said cavity in the discharging position thereof,

(f) and funnelling means moving in synchronization with said containers between said containers and said filling head for receiving and successively directing the fluent material discharging from the respective measuring chambers to the successive containers moving therewith,

(g) said funnelling means including a rotatably journalled shaker plate, a plurality of concentric pairs of funnels connected to said shaker plate,

(h) each pair of funnels including an inner funnel and a spaced outer funnel,

(i) each funnel of said pair having reduced mouth openings,

(j) means for placing the container moving under said rotating head into sealing relationship with the mouth of said outer funnel moving in synchronization therewith,

(k) means for vibrating said shaker plate and funnels connected thereto to hasten the flow of fluent material from the respective pairs of funnels to its associated container and whereby the air in the container displaced thereby is exhausted through the space defined between funnels,

(l) and means for disengaging the container from its funnel means when filled with said material.

5. A machine for automatically filling a line of moving containers having restricted neck openings with a comparatively large amount of powder or pulverized material and for assuring compacting of the same within said container to assure the filling of each container to capacity comprising,

(a) a frame,

(b) a hopper for containing a bulk supply of the powder material,

(c) a filling head means cooperatively associated with said hopper rotatably journalled on said frame,

(d) said filling head means including a plurality of measuring chambers which are adapted to be successively moved between a filling and discharging position as said filling head is rotated,

(e) a conveyor means for transporting a plurality of containers successively beneath the discharging chamber of said head to receive the material discharging from said chambers,

(f) said conveyor means including a turntable rotatably journalled on said frame below said filling head means,

(g) said turntable having a plurality of container stations circumferentially spaced thereabout for receiving said containers,

(h) a funnelling means spaced above said turntable and the containers carried at each station thereof,

(i) said funnelling means including a shaker plate spaced above said turntable,

(j) means for varying the vertical spacing between said turntable and said shaker plate,

(k) a plurality of corresponding funnel stations circumferentially connected about said shaker plate,

(l) each of said funnel stations being coaxialy disposed with respect to a corresponding container station of said conveyor means and adapted to move in synchronization therewith,

(m) each of said funnel stations including an outer funnel terminating in a reduced mouth opening and an inner funnel maintained in spaced relationship to said outer funnel,

(n) means for synchronizing the rotation of said funnel stations and corresponding container stations past the discharging position of said filling head,

(o) means at each said container station for lifting the container thereat to move the same into sealing relationship with the reduced mouth opening of said outer funnel of its corresponding funnel station before the container carried at said station is moved beneath the measuring chamber of said head when said head is in its discharging position,

(p) and means for imparting a vibratory movement to said funnelling means as the same is rotated whereby the vibration thereof hastens the flow of the powder material therethrough to said container moving in sealing relationship to said funnel stations with the air being displaced by the material filling the container being exhausted through the spacing between funnels.

6. An apparatus for successively filling a line of moving containers, each having a neck opening through which a comparatively requisite large amount of fluent material can be placed in the container in a minimum of time comprising,

(a) means defining a source of supply for the fluent material to be filled into said container,

(b) withdrawing means for successively withdrawing predetermined amounts of material from said supply means,

(c) a conveyor means including a plurality of container carrier stations for receiving a container therein whereby said carrier stations and containers thereon are successively moved in line and into position for receiving said predetermined amount of material, said withdrawal means withdrawing the material from said source of supply,

(d) funnelling means interposed between said withdrawal means and said conveyor means for directing the fluent material discharged from said withdrawal means to the containers on said conveyor means,

(e) said funnelling means including a shaker plate and a plurality of funnels connected to said plate, said plurality of funnels being correspondingly disposed with respect to a like number of carrier stations of said conveyor means,

(i) and means operatively associated with the carrier mouth opening adapted to communicate with the mouth opening of the container carried by the carrier stations of said conveyor means,

(g) means operatively associated with each of said funnels for venting the container adapted to be associated therewith during the filling operation,

(h) means for synchronizing the movement of said funnelling means to the movement of said container carrier stations,

(i) and means operatively associated wtih the carrier stations of said conveyor means for lifting the container supported thereon into sealing engagement with the mouth opening of said funnels in the discharging position of said withdrawal means,

(j) and means for imparting a vibrating movement to said shaker plate and connected funnels to enhance the filling of said container with said fluent material.

7. The invention as defined in claim **6** wherein said venting means includes a tubular conduit extending into each of said funnels.

8. The invention as defined in claim **6** and including means operatively connected to said shaker plate to adjust the amplitude of vibration.

9. The invention as defined in claim **6** and including means for adjusting the vertical distance between said conveyor means and said shaker plate to accommodate for variously sized containers.

10. An apparatus for successively filling a line of moving containers, each having a neck opening through which a comparatively requisite large amount of fluent material can be placed in a container in a minimum of time comprising,

(a) means defining a source of supply for the fluent material to be filled into said container,

(b) withdrawing means for successively withdrawing material at a predetermined rate from said supply means,

(c) a conveyor means including a plurality of container carrier stations for receiving a container therein whereby said carrier stations and containers thereon are successively moved in line and into position for receiving said predetermined amount of material, said withdrawal means withdrawing the material from said source of supply,

(d) funneling means interposed between said withdrawal means and said conveyor means for directing the fluent material discharged from said withdrawal means to the containers on said conveyor means,

(e) said funneling means including shaker means and a plurality of connected funnels, said plurality of funnels being correspondingly disposed with respect to a like number of carrier stations of said conveyor means,

(f) each of said funnels terminating in a mouth opening adapted to communicate with the mouth opening of the container carried by the carrier stations of said conveyor means,

(g) means operatively associated with each of said funnels for venting the container adapted to be associated therewith during the filling operation,

(h) means for synchronizing the movement of said funneling means to the movement of said container carrier stations,

(i) and means operatively associated with the carrier stations of said conveyor means for positioning the container into sealing engagement with the mouth opening of the corresponding funnel,

(j) and means for imparting a vibrating movement to said shaker means and connected funnels to enhance the filling of said container with said fluent material.

11. The invention as defined in claim **10** wherein said venting means includes a tubular conduit extending into each of said funnels.

12. The invention as defined in claim **10** and including means operatively connected to said shaker means to adjust the amplitude of vibration.

13. The invention as defined in claim **10** and including means operatively connected to said shaker means to adjust the frequency of vibration.

14. The invention as defined in claim **10** and including means operatively connected to said shaker means to adjust the amplitude of vibration and the frequency of vibration.

15. The invention as defined in claim **10** and including means for adjusting the vertical distance between said conveyor means and said shaker means to accommodate for variously sized containers.

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