March 10, 1953 A. W. KATH 2,630,953

CAPSULE FILLING MACHINE

Filed June 8, 1949 6 Sheets-Sheet 1

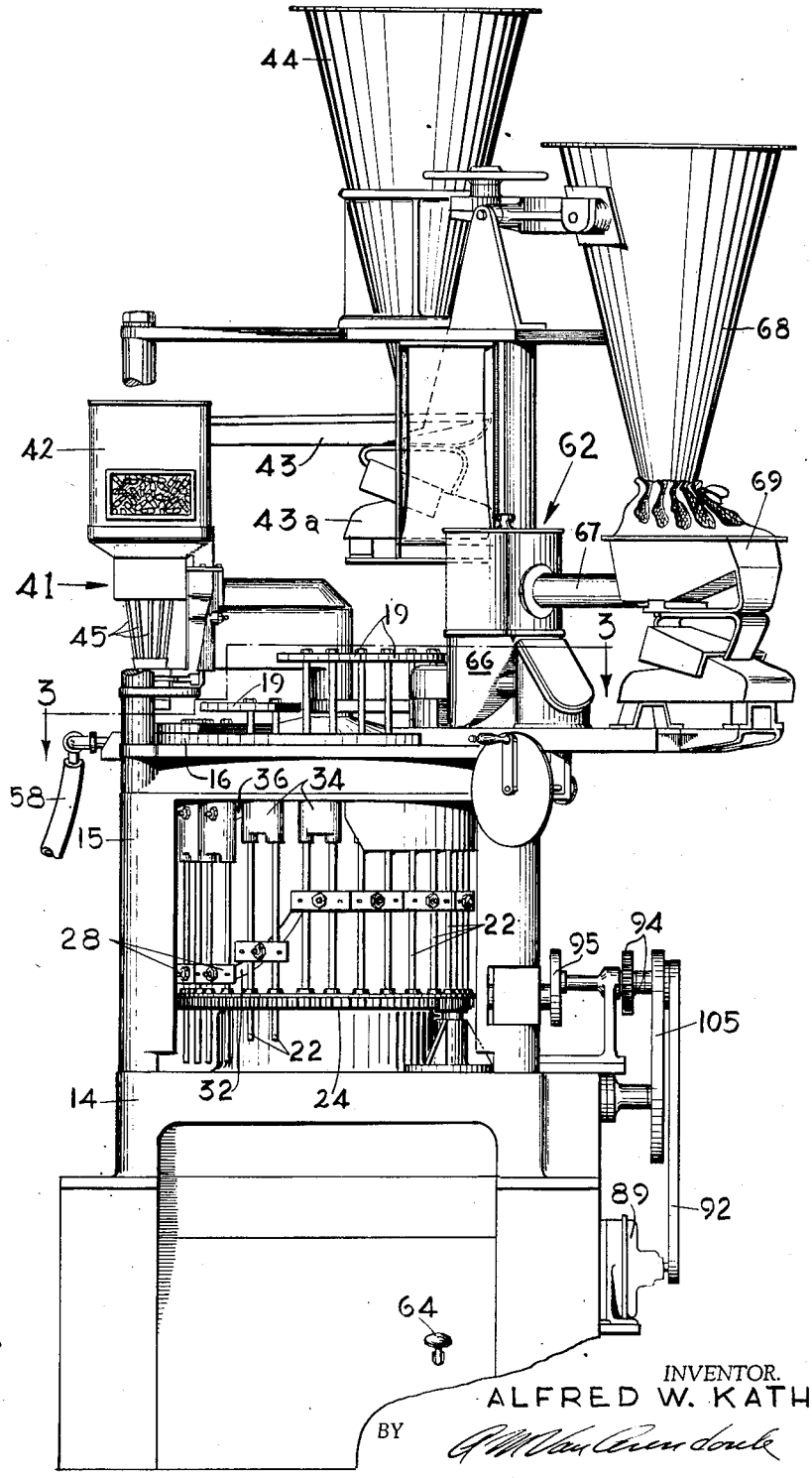


FIG. 1

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CAPSULE FILLING MACHINE

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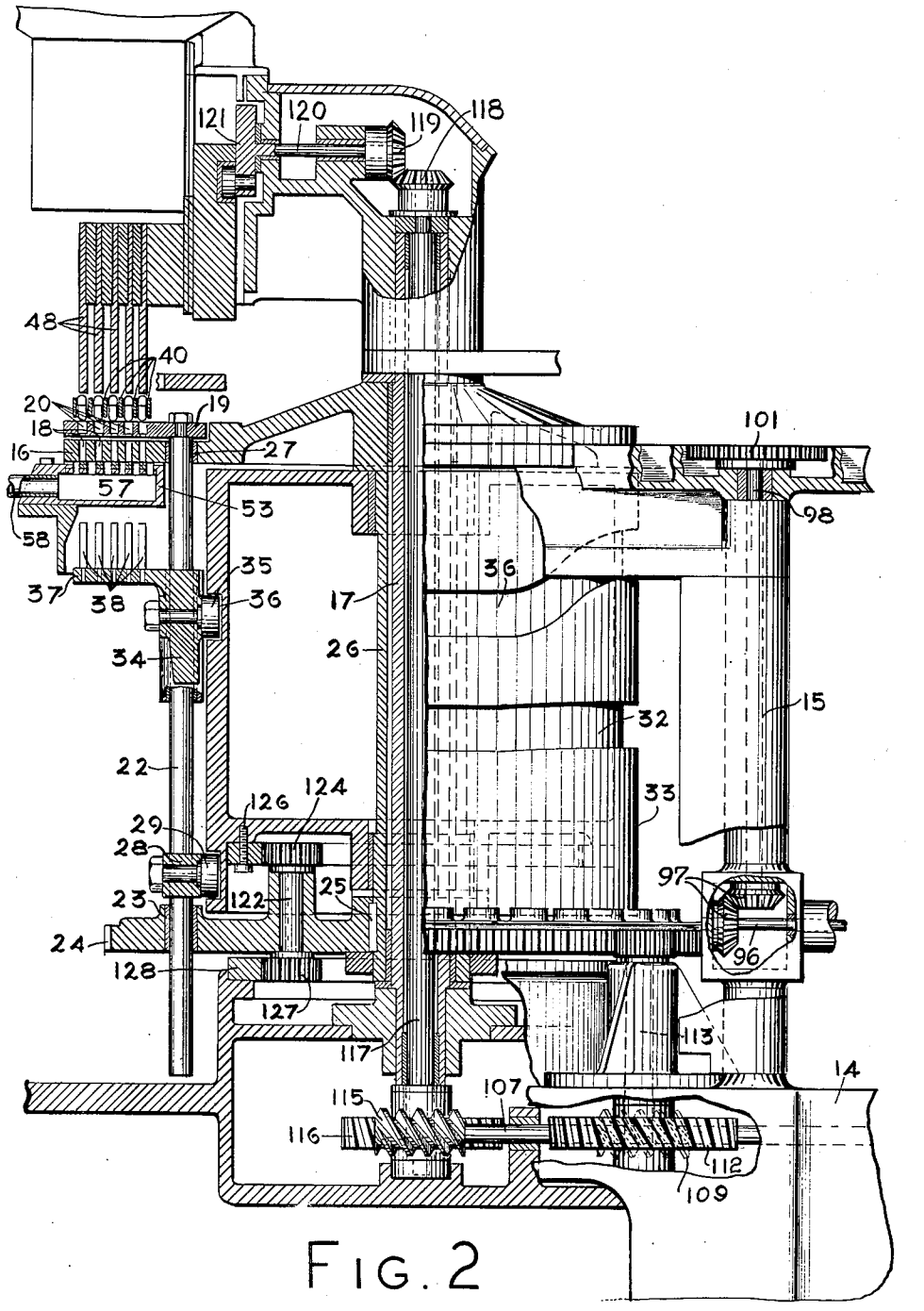


FIG. 2

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CAPSULE FILLING MACHINE

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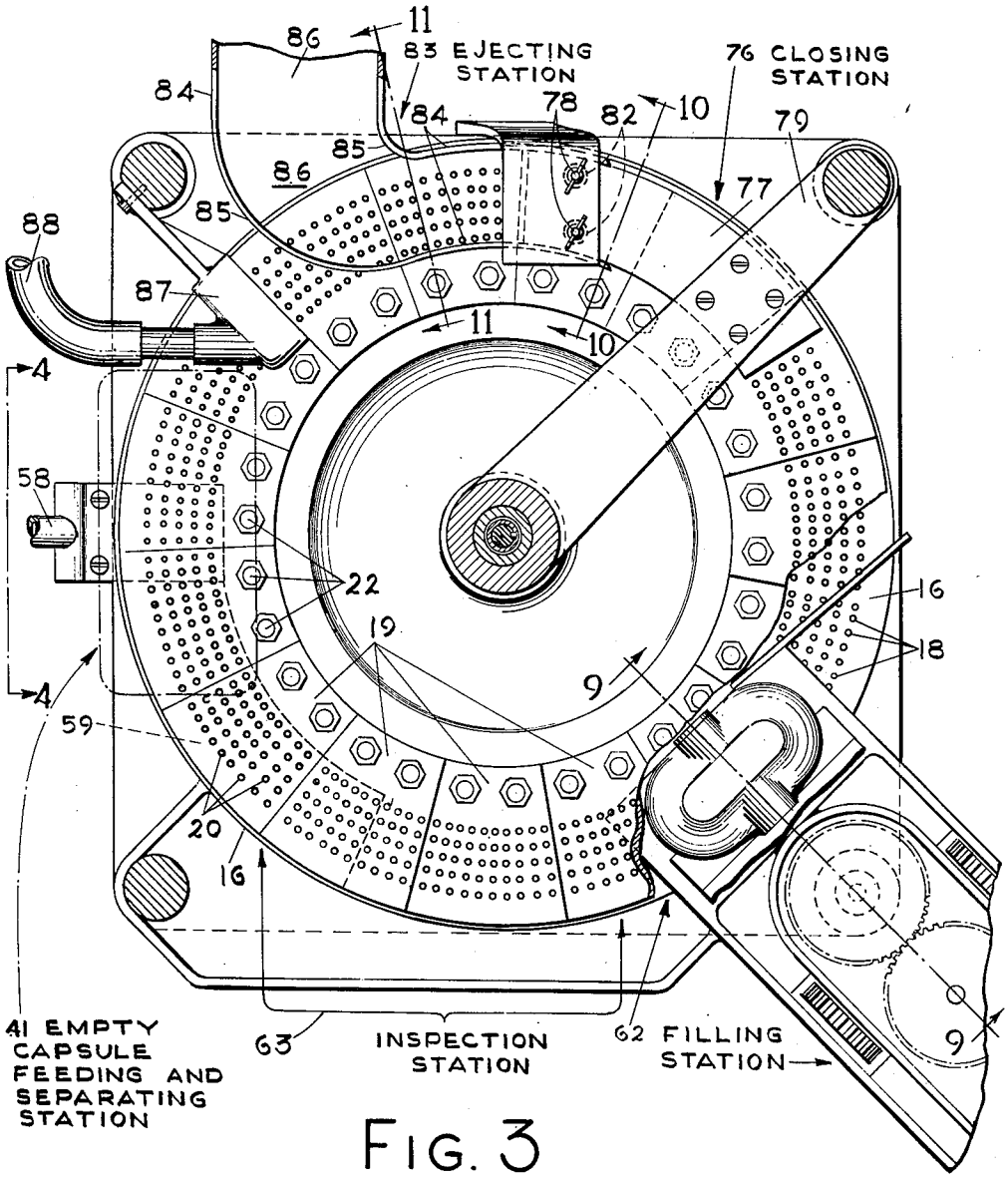


FIG. 3

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CAPSULE FILLING MACHINE

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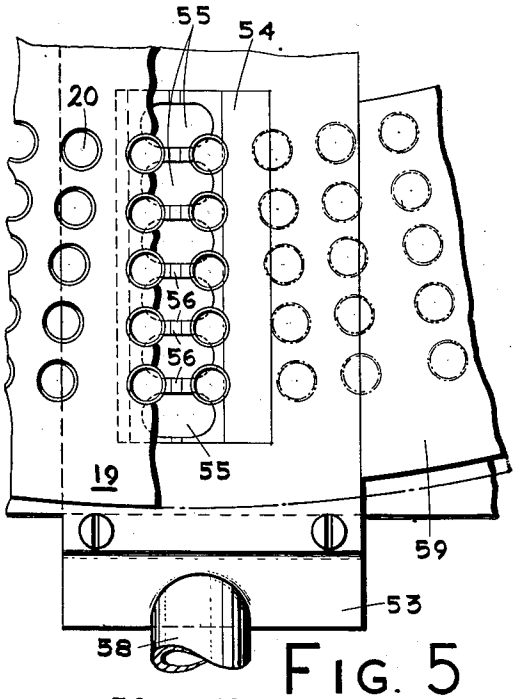


FIG. 5

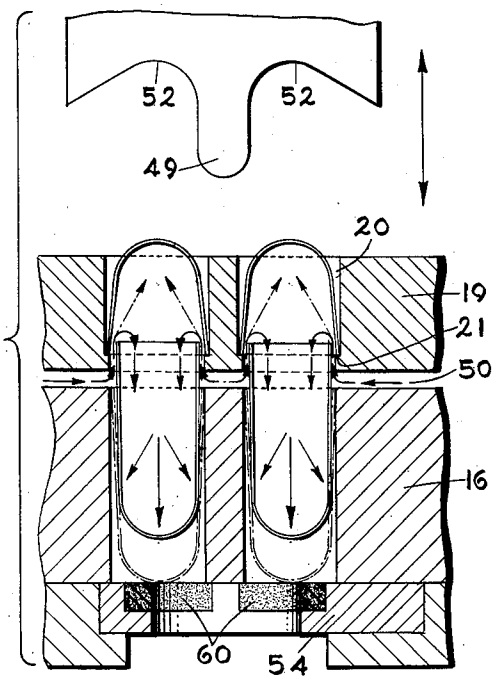


FIG. 7

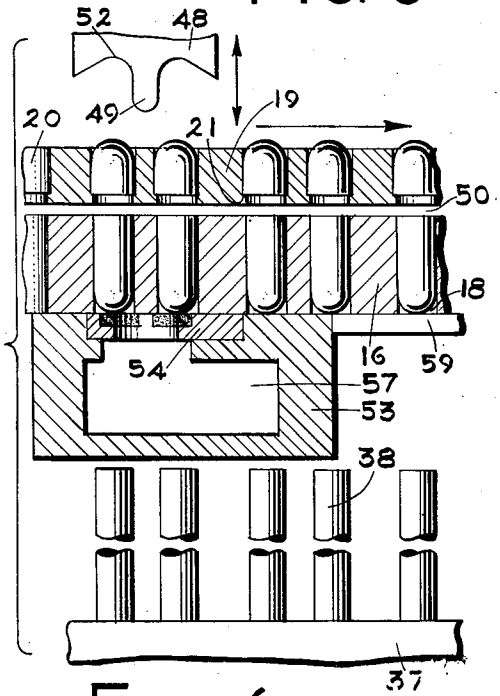


FIG. 6

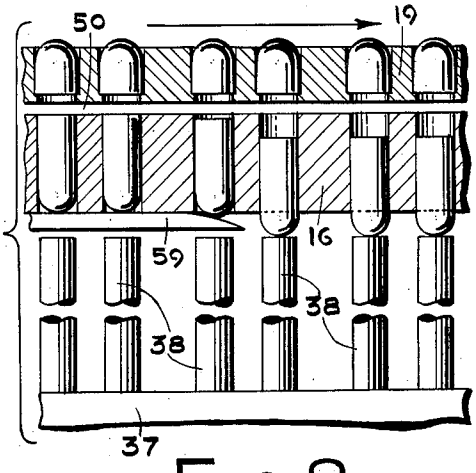


FIG. 8

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CAPSULE FILLING MACHINE

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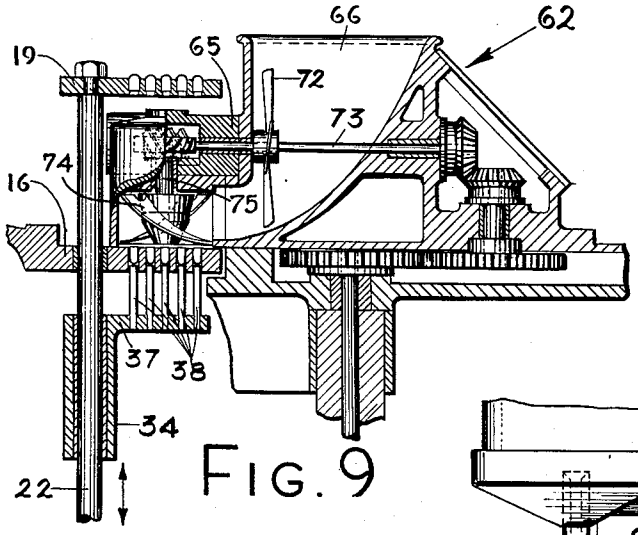


FIG. 9

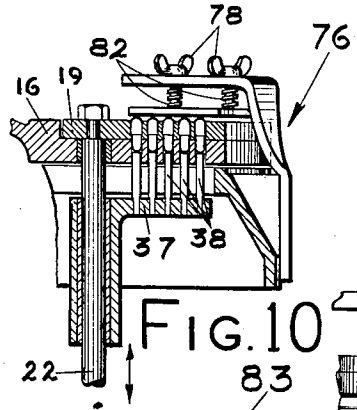


FIG. 10

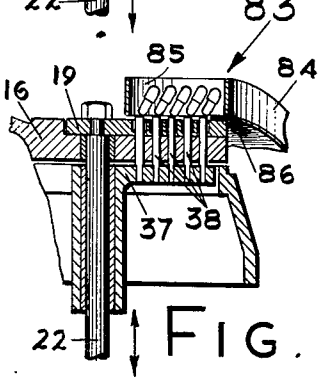


FIG. 11

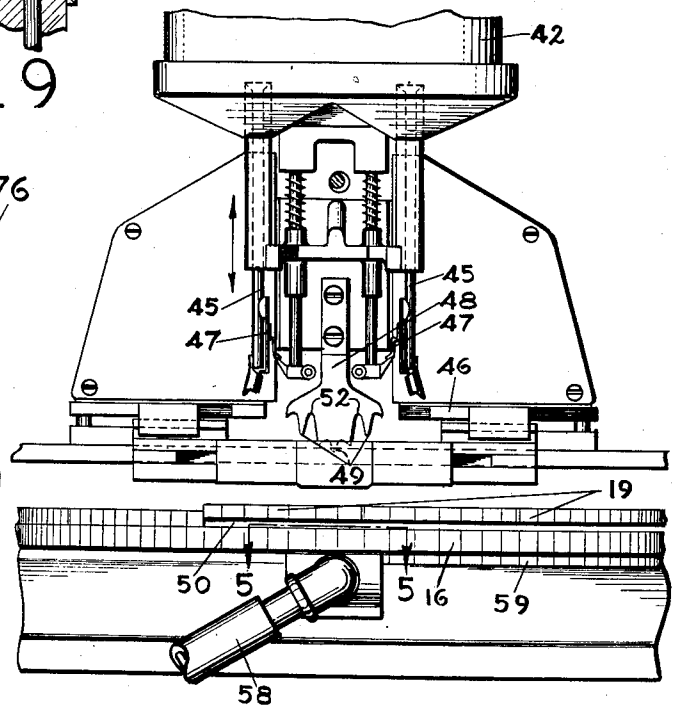


FIG. 4

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CAPSULE FILLING MACHINE

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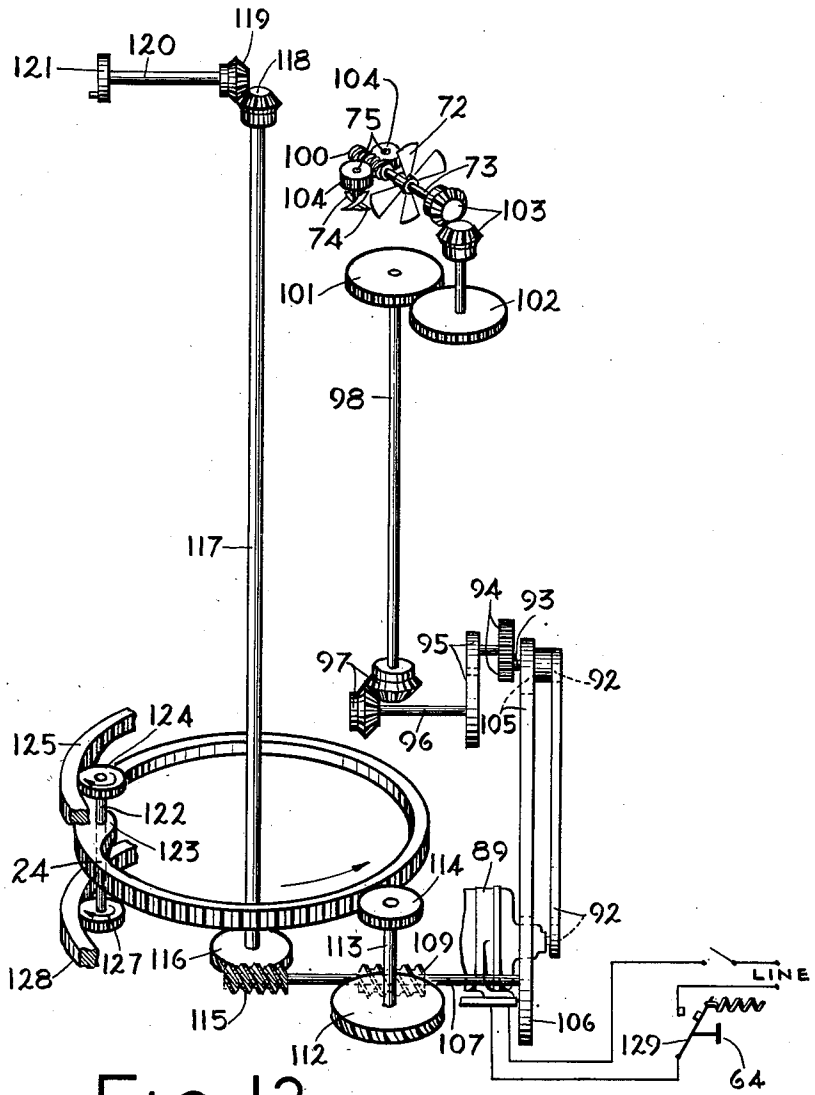


FIG. 12

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Patented Mar. 10, 1953

2,630,953

UNITED STATES PATENT OFFICE

2,630,953

CAPSULE FILLING MACHINE

Alfred W. Kath, Detroit, Mich., assignor to Eli Lilly and Company, Indianapolis, Ind., a corporation of Indiana

Application June 8, 1949, Serial No. 97,889

14 Claims. (Cl. 226—41)

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This invention relates to machines for filling capsules and more particularly to an automatic machine for filling capsules of the telescoping, separable, cap and body type.

A general object of the invention is to provide in a machine of this character a capsule filling mechanism that is free of intermittent movements and that is operable continuously, progressively and smoothly to perform upon multiple groups of capsules all of the required operations of separation, filling, rejoining, and ejection in a facile, expeditious, mass-production manner.

Another object of the invention lies in the simplification in the design, construction and operation of such a machine.

A further object is to provide in a continuously operable capsule filling machine a construction and arrangement which insures against any possibility of shearing capsule parts during the separating operation and which generally tends to eliminate the possibility of the parts becoming jammed in any of the operations.

A still further object is to provide in a machine of this character a construction and mode of operation which affords ample opportunity for visual inspection of the separated cap and body parts and replacement of any defective parts preparatory to their being presented to the filling station.

A further object is to provide an improved arrangement and mode of operation productive of a more positive capsule cap and body separating action at the decapping station.

With these and other incidental objects in view, the invention comprises certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims, and a preferred embodiment of which is hereinafter described with reference to the drawings which accompany and form part of the specification.

In the drawings:

Fig. 1 is a front elevation of the capsule filling machine,

Fig. 2 is an enlarged view of a portion of the machine as shown in Fig. 1, certain parts being broken away, certain other parts being omitted, and still other parts being shown in cross-section for clearness,

Fig. 3 is a plan view of the machine with certain of the superstructure omitted and certain parts being broken away for clearness,

Fig. 4 is a detailed side elevation taken substantially along the line 4—4 of Fig. 3 and showing the capsule uprighting and discharge station,

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Fig. 5 is a detailed plan view taken substantially along line 5—5 of Fig. 4 and showing the capsule cap and body receiving carriers with respect to a vacuum head element of the capsule discharge station,

Figs. 6, 7 and 8 are sectional elevations of the various elements shown in Fig. 5 and particularly illustrate the improved capsule part (cap and body) separating operation,

Figs. 9, 10 and 11 are sectional elevations taken along the lines 9—9, 10—10, and 11—11 of Fig. 3 and show the capsule filling, closing and ejecting stations, respectively, and

Fig. 12 is a diagrammatic view of the machine drive.

Referring to Fig. 1, the machine includes a base 14 supporting an upright frame 15 within the four corners of which are housed substantially all of the driving and operating mechanisms of the machine. A carrier disk 16 (see also Fig. 2) is mounted for rotation in a horizontal plane about a centrally located, vertically disposed, stationary shaft bearing 17. Disk 16 is provided with a series of concentric rows of body receiving apertures 18 (Figs. 3 and 6) which form radially disposed rows with respect to the axis of rotation of the disk.

Mounted above disk 16 is a series of generally sector-shaped plates 19 each of which has a series of cap-receiving apertures 20 arranged in axial alignment with the corresponding body-receiving apertures 18. As clearly shown in Fig. 6, apertures 20 are shouldered as at 21 to provide an arresting stop or seat for the lower ends of the capsule caps. Each sector plate 19 is fixed upon the upper ends of a pair of spaced, parallel, vertically disposed rods 22 (Figs. 1, 2 and 3). Rods 22 are slidably mounted for guided, vertical movement adjacent their lower ends in bushings 23 fixed in a ring gear 24. Ring gear 24 is keyed as at 25 to a depending sleeve 26, the latter being formed integrally with disk 16 and mounted for rotation about shaft 17. Adjacent their upper ends, rods 22 extend through bushings 27 affixed in disk 16. Intermediate their upper and lower ends, each pair of rods is connected together by and has affixed thereto cam followers 28. Each follower 28 is provided with a horizontally disposed, inwardly projecting roller 29 arranged to ride in a cam track 32 provided in a cylindrical drum cam 33 which is maintained stationary within machine frame 15 in a manner later to be described.

By this construction and arrangement, each pair of rods 22 and its associated sector plate 19

are free to be raised or lowered independently by its corresponding roller 29 riding in cam track 32. Also it will be observed that the assembly of rods 22, sleeve 26, disk 16 and ring gear 24 forms a unitary rotating structure including these parts and the sector plates 19 carried by the rods.

Each pair of rods 22 has mounted for free sliding movement thereon above its affixed cam follower 28, an additional cam follower 34 provided with a horizontally disposed, inwardly projecting roller 35 arranged to ride in a cam track 36 provided in drum cam 33 above track 32.

Each follower 34 is provided with a horizontally disposed, generally sector-shaped, outwardly projecting extension 37 in which is mounted a series of upwardly projecting push pins 38, there being one push pin for each pair of companion cap and body receiving apertures 20, 18 in each sector plate 19 and its corresponding segment of disk 16. Each pin 38 is of such diameter as to enter with sliding clearance within the cap and body receiving apertures. It is noted that the guided, vertical, reciprocatory movement which may be imparted to followers 34 is completely independent of the guide, vertical, reciprocatory movement which may be imparted, simultaneously or otherwise, to rods 22.

As the capsule cap-carrying sector plates 19 and their corresponding capsule body-carrying segments of disk 16 are driven in rotation about shaft 17, the plates and their companion segments are as a unit presented, one after another, to the various operation performing stations now to be described.

The first station in the sequence of operations is that at which the empty, assembled capsules are fed into the carriers and decapped. This feeding and decapping station is indicated at 41 in Figs. 1 and 3.

The capsule feeding and decapping mechanism is of the type disclosed in U. S. Patent No. 1,545,777 issued to A. W. Kath et al. July 14, 1925. The feeding mechanism of the present invention, however, is arranged to feed empty, assembled capsules to multiple rows instead of to but a single row of cap and body receiving apertures as disk 16 and sector plates 19 continuously and progressively advance beneath the capsule feeding station. The decapping section is markedly improved as will hereinafter appear.

Briefly, this mechanism comprises a supply hopper 42 for containing the empty, assembled capsules. Hopper 42 is connected by a horizontally disposed chute 43 with an auxiliary supply hopper 44 from which the empty, assembled capsules are fed through chute 43 into hopper 42. A vibratory feed 43*a* of conventional form is associated with chute 43 to maintain a constant flow of capsules from hopper 44 to hopper 42.

As is well known, the empty capsules have a random arrangement in the supply hopper (see window of hopper 42 in Fig. 1) from whence they are fed through a series of vertically disposed guide tubes 45 (Figs. 1 and 4) to a horizontal position on a supporting table 46. Table 46 is provided with a series of longitudinally extending, spaced ribs 40 which form open channels therebetween of a width just sufficient to engage the opposite, lower edges of the caps. During each cycle of the feed mechanism, escapement means indicated at 47 (Fig. 4) is arranged to permit one capsule only to be discharged from each tube 45 and fall into horizontal position in its corresponding channel of table 46 during each downward stroke of a reciprocating head 48. The lower end of head 48 is provided with a series of spaced, depending tongues 49 and associated notches 52.

The elongated channels of table 46 and tongues 49 and notches 52 of head 48 are in alignment with both the concentric and radial rows of apertures 20, 18. During each downward stroke of head 48, tongues 49 and notches 52 cooperate with the ribs 40 of table 46 to tip the capsules cap-up and thrust the thus uprighted capsules downwardly through the channels of supporting table 46 into their corresponding cap and body receiving apertures 20, 18. The details of construction and operation of the above described capsule feeding mechanism is fully disclosed in the previously referred to U. S. Patent No. 1,545,777. In this manner two radial rows of capsule receiving apertures are continuously and progressively supplied with empty, assembled capsules.

The decapping mechanism, as before stated, is similar to that disclosed in the aforementioned patent. This decapping mechanism, however, is improved to insure a more positive decapping action and to effect maintenance of the respective cap and body parts in separated positions following such decapping operation.

Just below and in alignment with a dual, radial row of apertures 20, 18, lying just below and in alignment with tongues 49 and notches 52 of head 48, there is affixed in the machine frame a vacuum block 53 with the upper face of said block in fitted, sliding contact with the lower face of disk 16 as clearly shown in Figs. 6 and 7. Block 53 is provided with an insert 54 having a series of openings 55 (Fig. 5) separated by cross members 56 and communicating with a chamber 57 (Fig. 6) formed interiorly of block 53. Chamber 57 is connected by a tube 58 (Figs. 1, 4 and 5) with a suitable suction source capable of producing a sufficient vacuum within the chamber, openings 55, and apertures 18, 20 to pull the bodies into apertures 18 and thus cause said bodies to be separated from the caps as the latter are arrested in their downward movement by their lower edges engaging with shoulders 21 of their respective receiving apertures 20.

As disk 16 and sector plates 19 are continuously driven in rotation, the sector plates, one after another, pass beneath feeding station 41. As each plate 19 approaches the feeding station, its cam follower 28 and roller 29 are elevated by cam track 32 to a position where the lower surface of the sector plate is raised above the upper surface of disk 16 to provide a space or gap 59 therebetween on the order of $\frac{3}{32}$ of one inch. It has been discovered that by providing gap 59 between the plates and disk, as they pass through the capsule feeding and decapping station, the decapping action is rendered more positive. Also, gap 59 prevents the capsule bodies from being back-pressured into re-engagement with the corresponding gaps from which they were just removed, following the removal of the cap and body parts from over vacuum block 53. This air gap 59, as diagrammatically illustrated in Fig. 7, permits a steady inflow of air, at atmospheric pressure, to enter and be maintained within the interior of the particular capsule caps and bodies both during and following the separating operation. It is believed that this inflow of air into the capsule parts commences substantially concurrently with the withdrawal of the body from the cap, or at least as soon as the body has de-

scended to the position indicated in full lines and before the body arrives at its fully separated position shown in dot-and-dash lines in Fig. 7, it being noted that in the full line position clearance exists between the body and the cap. Hitherto, it frequently happened that certain capsule bodies failed to be separated from their caps and, in other instances, it has been known to happen that even though separation has been completely effected at the separation station, almost immediately after the separated bodies and caps advanced to a position beyond that point over block 53 where the body was removed from the cap, the reduction of air pressure interiorly of the capsule parts caused them to rejoin. Such undesirable rejoining action is attributed to the close contact usually had in prior art structures between the upper surface of the body receiving and the lower surface of the element corresponding to the cap receiving sector plate, such close contact precluding the maintenance of sufficient air pressure interiorly of the capsule parts to maintain them in separated position. In the present invention, provision of air gap 50 overcomes these difficulties.

Referring now to Figs. 5, 6 and 8, it will be observed that the lower ends of the capsule bodies come to rest upon the cross members 56, as shown in dot-and-dash lines in Fig. 7, at that point where these members join the main structure of insert 54. Members 56 serve as stops for arresting the downward movement of the capsule bodies in the decapping operation. The upper faces of insert 54 and block 53, as before stated, lie flush against the lower face of disk 16, a sliding clearance only being provided therebetween. Preferably the upper face of insert 54 is recessed to receive pads 60 (Fig. 7) of pliant material such as rubber, leather, or the like. Pads 60 provide a yielding stop for the bottoms of the capsule bodies and prevent possibility of damage thereto by force of impact incident to their being sucked into home position in apertures 18. As disk 16 and sector plates 19 continue their rotative movement, the bottoms of the capsule bodies slide over the smooth upper surfaces of members 56, insert 54 and block 53 onto the upper surface of a retainer strip 59. Strip 59 is suitably secured to the machine frame and has its upper surface lying flush with the plane of the upper surface of block 53. The strip is indicated in dotted lines in Fig. 3 and extends for a distance equivalent to the width of one or more sector plates 19 beyond feeding station 41.

During the capsule feeding and decapping operation just described, the extension 37 (associated with the sector plate 19 being filled with empty capsules) together with its push pins 38 will have been lowered by cam follower 34 and its roller 35 riding in cam track 36 to a position where the upper ends of the push pins lie beneath the lower surface of block 53. As a given sector 19 together with disk 16 moves from the position shown in Fig. 6 to the position shown in Fig. 8, its associated push pins 38, which at this time lie in close proximity to the under surface of strip 59, serve as bottom rests for the bodies of the capsules as the latter are removed from over strip 59 toward the capsule filling station indicated generally at 62 (Fig. 3).

It will be observed with reference to Fig. 3 that between capsule feeding and decapping station 41 and filling station 62, i. e., in the lower left quadrant of disk 16 as viewed in this figure there is an area indicated by a bracket 63 entitled "inspection station." As the sector plates leave the decapping station and move toward the filling station, track 32 (Figs. 1 and 2) cams the rollers 29 and their followers 28 upwardly a distance sufficient to elevate their associated rods 22 and sector plates 19 from that position shown in the far left of Fig. 1 to the position shown by the two sector plates 19 immediately to the left of filling station 62 of the same figure. This removes the caps a substantial distance away from, but in exact axial alignment with the bodies. Here, the operator may readily visually inspect the condition of the caps contained in each cap carrying sector plate and the bodies contained in each corresponding segment of disk 16 to observe the condition of the parts before they are advanced to the filling station. The ample clearance provided between the under surfaces of plates 19 and the upper surface of disk 16 at this station permits the operator readily to remove and replace defective caps and/or bodies or to correct any untoward conditions found upon inspection. The fact that the cap receiving apertures are constantly maintained in axial alignment with the body receiving apertures constitutes a valuable feature of the invention as it materially aids the operator in making a check for possible defects in parts and for replacing such defective caps and/or bodies before the parts pass to filling station 62.

If the operator should find that a particular sector plate 19 or its corresponding segment of disk 16 should contain more defective parts than could be replaced while said plate and segment continue their advance movement toward filling station 62, the machine may readily be stopped by the operator. This is done by simply releasing a conveniently located foot button 64 (Fig. 1) which is incorporated in the machine drive in a manner to be later explained. Suffice it now to say that upon releasing button 64 the machine will stop. Following the replacement operations, upon depression of the button, sector plates 19 and disk 16 will immediately continue their rotative movement toward filling station 62.

Just prior to the advance of an inspected sector plate 19 and its corresponding companion segment of disk 16 to filling station 62, the extension 37 associated with that plate 19 and the push pins 38 of such extension are elevated by track 36, cam follower 34 and roller 35 a distance sufficient to move the capsule bodies upwardly in apertures 18 to a position where the upper edges of the bodies lie flush with the upper surface of disk 16 or to a position where the upper edges lie just below such surface, the exact distance of upward movement being determined by the dosage amount to be received by the capsules. Such upward movement may be varied by adjusting the position of roller 35 on follower 34, shifting stationary drum cam 33, or lengthening or shortening pins 38 in accordance with the particular requirements.

Referring now particularly to Figs. 1 and 9, sector plates 19 remain in their fully elevated or "inspection station" position during the movement of the sector plates through that quadrant of Fig. 3 embracing filling station 62, so that, as will be seen from Fig. 9, the sector plates will by-pass an inwardly projecting nozzle 65 of a filling-material containing hopper 66 at filling station 62. Nozzle 65 has its lower end resting with just sliding clearance against the upper surface of disk 16, and in communication with hopper 66. Referring now to Fig. 1, hopper 66,

like hopper 42, is connected by a horizontally disposed tube 67 with an auxiliary supply hopper 68 from which the filling material is fed through tube 67 into hopper 66. A vibratory feed 69 of conventional form is used to maintain a constant flow of the filling material from hopper 68 to hopper 66. As shown in Fig. 9, interiorly of hopper 66 there is provided the usual agitator or impeller 72 mounted upon a horizontally disposed shaft 73 that is arranged to be driven in rotation to agitate the filling material forwardly into discharge nozzle 65. Interiorly of nozzle 65 there is provided the usual screw or auger blades 74 affixed to a vertically disposed shaft 75 that is arranged to be driven in rotation to press-feed the filling material into the open, upper ends of the capsule bodies as will be clearly visualized from observation of Fig. 9.

Following the filling operation, as disk 16 and sector plates 19 continue in rotation, roller 29 riding in cam track 32 moves cam follower 28 and rods 22 downwardly an extent sufficient to bring the lower surface of a sector plate into intimate contact with the upper surface of disk 16 as shown in Fig. 10. This downward movement of a sector plate commences immediately upon the plates passing from over nozzle 65 and is completed before the plate and its corresponding segment of disk 16 reaches the capsule rejoining or closing station indicated generally at 76 in Figs. 3 and 10.

Closing station 76 comprises a horizontally disposed, arcuately formed plate 77 (Fig. 3) which is suitably secured upon an arm 79 fixed to the machine frame in superposed relation above the concentric and radial rows of cap-receiving apertures 20. Referring to Fig. 10, it will be seen that plate 77 may be adjusted by screws such as 78 and associated springs 82 to such position that its lower surface yieldingly rests in sliding contact with the upper, domed ends of the capsule caps. As disk 16 and a sector plate 19 advance the capsule parts beneath plate 77, in timed relation, roller 35 and cam track 36 (Fig. 2) very gradually elevate the associated extension 37 and its pins 38 from the position shown in Fig. 9 to the position shown in Fig. 10 whereby the filled capsule bodies will be pressed gradually upwardly into the caps, thus gently but firmly rejoining the filled bodies with the caps. Following this joining operation, the reassembled, filled capsules are advanced by disk 16 and sector plates 19 to the ejecting station 83 now to be described.

Ejecting stations 83 (Figs. 3 and 11) comprises a pair of upright walls 84 which are supported on the machine frame in spaced, parallel relation so as to embrace the radial rows of apertures 20 as sector plates 19, one after another, are advanced to the ejecting station. Walls 84 are curved outwardly as at 85 and are joined by a bottom or base member 86, the leading edge of which lies flush with and conforms to the edge contour of the upper surface of sector plates 19. Thus, there is provided a chute for receiving and directing the assembled, filled capsules. As sector plates 19 and the corresponding segments of disk 16 advance from the closing station to the ejecting station 83, i. e., from the position shown in Fig. 10 to the position shown in Fig. 11, track 36 cams rollers 35, follower 34 and its associated extension 37 together with its pins 38 upwardly a distance sufficient to bring the upper ends of pins 38 slightly above the upper surfaces of their associated sector plates 19. Such upward movement of pins 38 pushes the reassembled, filled capsules upwardly to that position shown in Fig. 11 where the bottoms of their bodies lie slightly above the upper surface of base 86. As a sector plate 19 and its corresponding segment of disk 16 continue in rotation, the capsules are engaged by the leftmost curved wall 85 as viewed in Fig. 3 which serves to brush the capsules outwardly and into horizontal position as shown in Fig. 11 whereupon they slide down base portion 86 into a suitable receptacle (not shown).

A suction head 87 (Fig. 3) may be, and preferably is, mounted in superposed relation above the upper surface of sector plates 19. A tube 88 connects head 87 with the same source of suction (not shown) to which tube 58 of feeding station 41 is connected. The lower face of head 87 preferably lies in intimate, sliding contact with the upper face of the sector plates when they pass beneath the head. Head 87 serves as a vacuum cleaner to remove any residue of powdery or foreign substances from apertures 18, 20.

The mechanism for driving the machine is shown schematically in Fig. 12. It comprises a motor 89 connected by a belt and pulley connection 92 to drive a horizontally disposed shaft 93 which, through gears 94 and belt and pulley connections 95, drives a horizontally disposed shaft 96. Shaft 96 through bevelled gears 97 drives a vertically disposed shaft 98 which is suitably journaled in the machine frame as shown in Fig. 2. The upper end of shaft 98 has affixed thereto a gear 101 meshing with a gear 102 which, through bevelled gears 103, drives horizontally disposed shaft 73 which drives impeller 72 in rotation. The inner end of shaft 73 has secured thereon a worm 100 meshing with worm gears 104 secured to vertically disposed shafts 75 which drive augers 74 in rotation as previously described.

A belt and pulley connection 105 between shaft 93 and a pulley 106 affixed to a horizontally disposed shaft 107 drives the shaft in rotation, said shaft being suitably mounted in bearings in the machine frame as suggested by the illustration in Fig. 2. A worm 109 secured on shaft 107 meshes with a worm gear 112 secured on the lower end of a vertically disposed shaft 113. The upper end of shaft 113 has affixed thereon a pinion 114 meshing with ring gear 24 and in this manner the unitary structure composed of the gear 24, rods 22, disk 16 and sector plates 19 are driven continuously in rotation.

A worm 115 secured on the inner end of shaft 107 meshes with a worm gear 116 affixed on the lower end of a vertically disposed shaft 117 which is journaled for rotation within sleeve bearing 17 as shown in Fig. 2. The upper end of shaft 117 has secured thereto a bevelled gear 118 meshing with a bevelled gear 119 secured on a horizontally disposed shaft 120 suitably journaled for rotation in the machine frame. The inner end of shaft 120 carries a crank 121 that is arranged to impart vertical reciprocation to head 48 for feeding the empty assembled capsules to feeding station 41 as previously described.

As clearly seen in Fig. 12, foot button 64 operates a normally open switch 129 which is wired in series with one side of the line of the electrical circuit of motor 89. Upon depression of foot button 64, the switch is moved to closed position, thus establishing the circuit and starting the motor and the machine. Upon release of the button, the motor stops and the machine discontinues its operations.

The means for maintaining drum cam 33 stationary will now be described. Referring to Figs.

2 and 12, it will be seen that a vertically disposed stub shaft 122 is secured to ring gear 24 in a suitable upwardly projecting bearing 123. The upper end of shaft 122 has affixed thereto a pinion 124 meshing with internal teeth of an annular gear 125 affixed as by bolts 126 to drum cam 33. The lower end of shaft 122 has secured thereto a pinion 127, similar to pinion 124 and similarly meshing with internal teeth of an annular gear 128 which is rigidly secured to the base 14. As ring gear 24 is driven in rotation in a counterclockwise direction to drive disk 16 and sector plates 19 in rotation, pinion 127 being in mesh with stationary annular gear 128 will travel orbitally around bearing 17 and be rotated in a clockwise direction. This imparts clockwise rotation to pinion 124 which in rolling along the teeth of annular gear 125 will cause drum cam 33 to be held stationary at all times.

In its ordinary sense when used in connection with machinery, the term "station" might carry with it an implication that the work passing therethrough came temporarily to rest while the particular operations to be performed at the "station" were carried out. However, the term is herein employed merely as a convenient expression of a situs where particular operations are performed and is not indicative of any delay, interruption or stoppage of the work in any manner whatsoever during the normal course of operation. A salient feature of the present machine is thorough and complete elimination of any and all types of mechanism which might give pause to the continuous and progressive advance of the capsules in a smooth, constant uninterrupted flow throughout the series of operations.

While the form of mechanism herein shown and described is admirably adapted to fulfill the objects primarily stated it is to be understood that it is not intended to confine the invention to the one form of embodiment herein disclosed for it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

What is claimed is:

1. In a capsule filling machine, a rotatable disk carrier having a series of apertures disposed axially thereof for receiving capsule bodies, a plurality of sector plate carriers movably mounted in superposed closely spaced relation circumferentially about said disk carrier, each of said sector plate carriers having a series of apertures aligned with their corresponding body receiving apertures for receiving capsule caps, means for driving said carriers continuously in rotation about a common axis, means for maintaining said cap and body receiving apertures constantly in alignment, and means for axially displacing said carriers one from the other during said rotative movement.

2. In a capsule filling machine; capsule separating means comprising a rotatably mounted plate having shouldered apertures for receiving capsule caps; a rotatably mounted member associated with said plate and having corresponding apertures aligned with said cap receiving apertures for receiving capsule bodies; means for discharging assembled capsules in upright position into said cap receiving apertures; suction means operable to draw said capsules into said apertures, seat said caps on the shoulders of said apertures and withdraw the bodies from the caps into said body apertures; means for driving said plate and member in rotation into cooperative association with said suction means; and means associated with said driving means operable to alignedly and axially displace said plate and member, one from the other, a distance sufficient to cause the suction created by said suction means to be greater in said body receiving apertures than in said cap receiving apertures.

3. In a capsule filling machine; capsule separating means comprising a rotatably mounted plate having shouldered apertures for receiving capsule caps; a rotatably mounted member having corresponding apertures aligned with said cap receiving apertures for receiving capsule bodies; means for discharging assembled capsules in upright position into said cap receiving apertures; suction means operable to draw said capsules into said apertures, seat said caps on the shoulders of said cap apertures and separate the bodies from the caps and deposit said bodies into said body apertures; means for driving said plate and member in rotation into cooperative association with said suction means; and means associated with said rotational driving means operable to alignedly and axially support said plate in such spaced apart relations from said member as the plate and member come into cooperative association with said suction means, that a differential pressure is created between said cap and body receiving apertures whereby atmospheric pressure is maintained interiorly of said capsule cap and body parts during and following said separating operation.

4. In a capsule filling machine, a rotatable disk carrier having a series of apertures disposed axially thereof for receiving capsule bodies, a plurality of sector plate carriers movably mounted in superposed spaced relation circumferentially about said disk carrier, each of said sector plate carriers having a series of apertures aligned with said body receiving apertures contained within a corresponding counterpart segment of said disk carrier for receiving capsule caps, means for driving said carriers in rotation about a common axis, means for maintaining said cap and body receiving apertures constantly in alignment, means for axially displacing said carriers one from the other during said rotative movement, a container for the material with which the capsules are to be filled and having a discharge nozzle disposed in communicating relation with respect to said capsule body receiving apertures, and means for moving said sector plate cap carriers away from said body carrying disk as said cap carriers approach said nozzle whereby said cap carriers by-pass said nozzle as their corresponding counterpart segments of said disk carrier move into and out of filling association with said nozzle.

5. In a capsule filling machine, a rotatable disk having a series of capsule body-carrying apertures, an annular series of sector plates movably supported in closely spaced relation thereto and having a series of complementary capsule cap-carrying apertures axially aligned with said body-carrying apertures, means for driving said cap and body carriers in rotation, means for maintaining said cap and body-carrying apertures in axial alignment during such rotation, means for uprightedly discharging empty capsules into the respective cap and body carrying apertures, suction means effective to separate the caps from the bodies substantially concurrently with the discharge of said assembled capsules into said apertures, said spaced relation between said disk and said sector plates being effective to assist said suction means in effecting the separation

of the caps and bodies, a hopper of filling material communicating with a portion of the apertured surface of the capsule body carrying disk, and means operable during the rotative movement of the cap and body carriers to individually, one after another, move the cap carriers away from the body carriers a distance sufficient to permit the free and easy manipulation, removal or replacement of defective capsule cap parts and to permit discharge of the filling material into said capsule body parts.

6. In a capsule filling machine, a rotatable disk capsule body carrier having series of apertures therein for receiving capsule bodies, an annular series of sector plate capsule cap carriers having a series of apertures therein in alignment with said body receiving apertures for receiving capsule caps, means mounting each of said cap carriers on said body carrier for rotation therewith and independent guided movement toward and away from said body carrier with the respective cap and body receiving apertures constantly maintained in axial alignment, means for driving said carriers continuously in rotation, a filling material hopper having a discharge nozzle in engagement with a portion of said body carrier, said nozzle occupying a plane with respect to said body carrier normally occupied by the cap carriers, and means associated with each of said cap carrier guide means for successively and continuously moving said cap carriers, one after another, out of the plane of said nozzle and thus rendering the openings in the capsule bodies accessible thereto.

7. In a capsule filling machine, a rotatable carrier disk having a series of rows of apertures for receiving capsule bodies, a container of filling material having a discharge opening communicating with a plurality of said apertures, means for driving said carrier in rotation, an annular series of sector plates superposed in closely spaced relation to and circumferentially about said disk, said sector plates each having a series of capsule cap receiving apertures aligned with the body receiving apertures of a corresponding segment of said disk, means supporting said sector plates for simultaneous rotary movement with and axial movement toward and away from said disk with said cap and body apertures being maintained in alignment, means for discharging empty capsule caps and bodies into their respective receiving apertures and disjoining same, and means cooperating with the sector plate supporting means operable to temporarily, axially move the plates from their closely spaced relation to said disk to a position where the capsule cap and body parts may be readily inspected and replaced preparatory to presentation of the open capsule bodies to the discharge opening of said filling material container.

8. In a capsule filling machine, a rotatable carrier disk having a series of rows of apertures for receiving capsule bodies; a container of filling material having a discharge opening communicating with a portion of said apertures; means for driving said carrier in rotation, an annular series of sector plates arranged in closely spaced relation to and circumferentially about said disk, said sector plates each having a series of capsule cap receiving apertures coaxially aligned with the body receiving apertures of a corresponding segment of said disk, means supporting said sector plates for simultaneous rotative movement with and axial movement toward and away from said disk with said cap and body apertures being maintained in alignment, means for discharging empty assembled capsule caps and bodies disjoinedly into their respective receiving apertures while said disk and sector plates are continuously driven in rotation, means cooperating with the sector plate supporting means operable to temporarily axially move the plates from their closely spaced relation to said disk to a position where the capsule cap and body openings may be readily inspected preparatory to presentation of the open capsule bodies to the discharge opening of said filling material container, and operator controlled means for stopping the rotation of said carriers at will when inspection indicates a delay to be necessary for making corrections.

9. In a capsule filling machine, a rotatable carrier disk having a series of apertures disposed axially thereof for receiving capsule bodies, a plurality of sector plate carriers superposed circumferentially about said disk carrier for rotation therewith, each of said sector plate carriers having a series of apertures disposed axially thereof for receiving capsule caps, means for constantly maintaining said cap and body receiving apertures in alignment, said means being effective even while moving said carriers relative to each other, a container of filling material having a discharge opening in registration with a portion of the apertured surface of the body receiving carrier, means for driving said carriers continuously in rotation, and means associated with said aperture alignment maintaining means for temporarily moving the sector plate cap carriers away from the disk carrier to a position where they render the openings in the capsule bodies accessible to the discharge opening of said filling material container and by-pass with clearance said container.

10. In a capsule filling machine, capsule separating means comprising a rotatably mounted plate having shouldered apertures for receiving capsule caps; a rotatably mounted member associated with said plate and having corresponding apertures coaxially aligned with said cap receiving apertures for receiving capsule bodies, means for discharging assembled capsules in upright position in said cap receiving apertures, seat said caps on the shoulders of said cap apertures, separate the bodies from the caps and deposit said bodies into said body apertures; means for driving said plate and member in rotation into cooperative association with said suction means; and means associated with said rotational driving means operable to move said plate in a direction parallel to the axis of rotation of said member and to support said plate in such spaced-apart relation from said member as the plate and member come into cooperative association with said suction means, that a differential pressure is created between said cap and body receiving apertures whereby atmospheric pressure is maintained interiorly of said capsule cap and body parts during and following said separating operation.

11. In a capsule filling machine, a rotatable carrier disk having a series of apertures, each aperture being disposed at normal to the plane of said disk for receiving capsule bodies, a plurality of sector plate carriers mounted circumferentially about said disk carrier for rotation therewith and each having a series of complementary apertures each of which is disposed coaxially with its corresponding body receiving aperture for receiving capsule caps, means for driving said carriers in rotation, means for moving said sector plate carriers away from said disk

carrier in a direction parallel to the axis of rotation of said carriers, and means for maintaining each pair of said complementary cap and body receiving apertures constantly in coaxial alignment during said rotation and said movement of said carriers relative to each other.

12. In a capsule filling machine, a rotatable disk carrier having a series of apertures disposed at normal to the plane of said disk for receiving capsule bodies, a plurality of sector plate carriers movably mounted in superposed spaced relation circumferentially about said disk carrier each having a series of apertures coaxially aligned with a corresponding counterpart segment of said body receiving apertures for receiving capsule caps, means for driving said carriers in rotation about a common axis, means for maintaining said cap and body receiving apertures constantly in coaxial alignment, means for displacing said carriers one from the other in a direction at normal to the plane of said disk carrier during said rotative movement, a container for the material with which the capsules are to be filled and having a discharge orifice disposed in communicating relation with respect to said capsule body receiving apertures, and means for reciprocably moving said sector plate cap carriers away from and toward said body carrying disk carrier in a direction at normal to the plane of said disk carrier and in such timed relation as they approach and leave the location of said container that the cap carriers clear the latter as their corresponding counterpart segments of the disk carrier approach and leave the discharge orifice of said container.

13. In a capsule filling machine, a rotatable carrier disk having a series of rows of apertures for receiving capsule bodies, a container of filling material having a discharge opening communicating with a plurality of said apertures, means for driving said carrier in rotation, an annular series of sector plates superposed in closely spaced relation to and circumferentially about said disk, said sector plates each having a series of capsule cap receiving apertures coaxially aligned with the body receiving apertures of a corresponding segment of said disk, means supporting said sector plates for simultaneous rotary movement with and guided movement in a direction parallel to the axis of rotation toward and away from said disk with said cap and body apertures maintained in coaxial alignment, means for discharging empty capsule caps and bodies into their

respective receiving apertures and disjoining said bodies from said caps, and means cooperating with the sector plate supporting means operable to temporarily move the plates from their closely spaced relation to said disk to a position where the capsule cap and body parts may readily be inspected and replaced preparatory to presentation of the open capsule bodies to the discharge opening of said filling material container.

14. In a capsule filling machine, a rotatable carrier disk having a series of rows of apertures for receiving capsule bodies, a container of filling material having a discharge opening communicating with a portion of said apertures, means for driving said carrier in rotation, an annular series of sector plates arranged in closely spaced relation to and circumferentially about said disk, said sector plates each having a series of capsule cap receiving apertures coaxially aligned with the body receiving apertures of a corresponding segment of said disk, means supporting said sector plates for simultaneous rotative movement with and toward and away from said disk in a direction parallel to the axis of rotation thereof with said cap and body apertures maintained in coaxial alignment, means for discharging empty assembled capsule caps and bodies disjoinedly into their respective receiving apertures while said disk and sector plates are continuously driven in rotation, means cooperating with the sector plate supporting means operable to temporarily move the plates from their closely spaced relation to said disk to a position where the capsule cap and body openings readily may be inspected preparatory to presentation of the open capsule bodies to the discharge opening of said filling material container, and operator controlled means for stopping the rotation of said carriers at will when inspection indicates a delay to be necessary for making corrections.

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