March 29, 1966 S. E. HARRIS ET AL 3,242,638

APPARATUS FOR CAPSULE FILLING

Filed Dec. 4, 1962 9 Sheets-Sheet 1

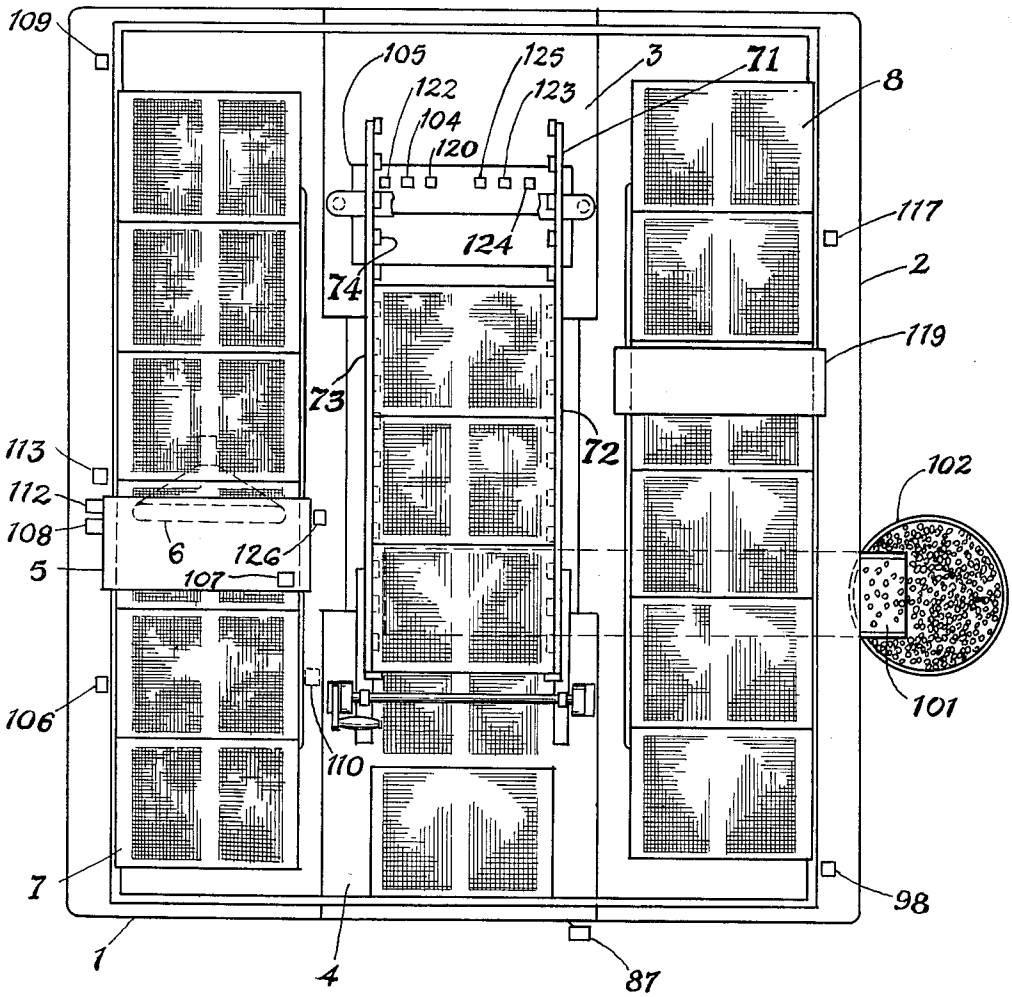


Fig 1

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APPARATUS FOR CAPSULE FILLING

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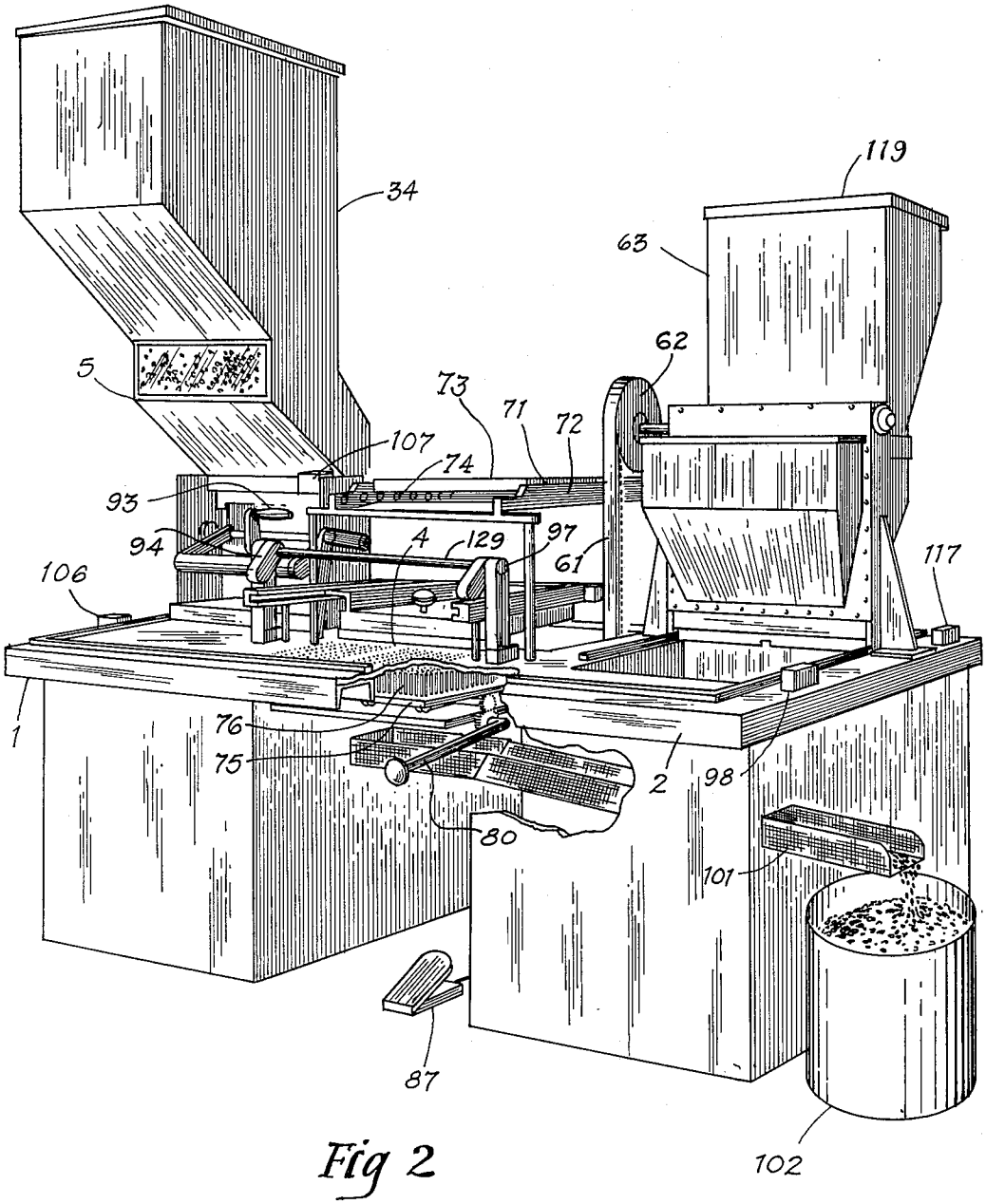


Fig 2

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APPARATUS FOR CAPSULE FILLING

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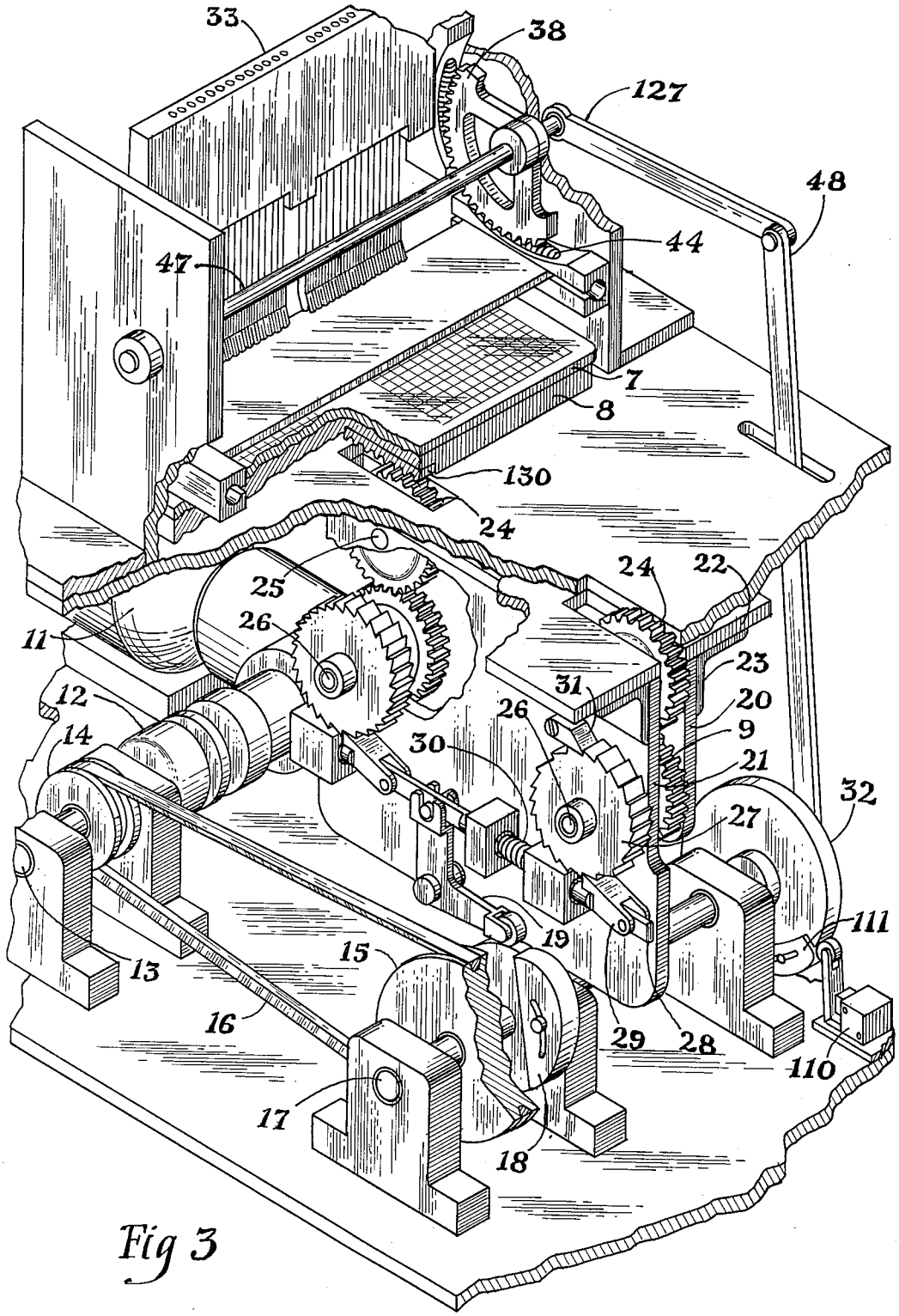


Fig 3

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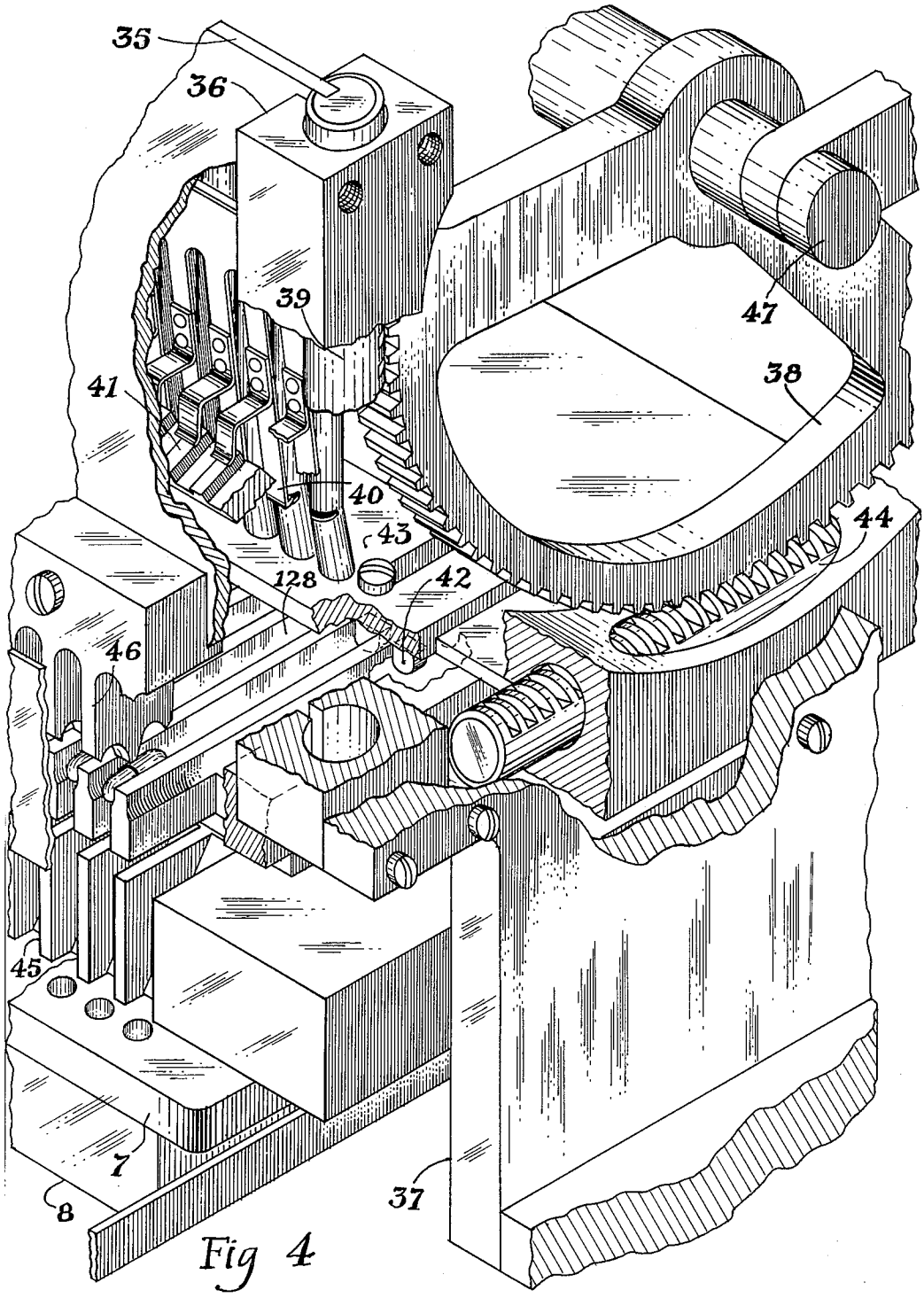


Fig 4

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APPARATUS FOR CAPSULE FILLING

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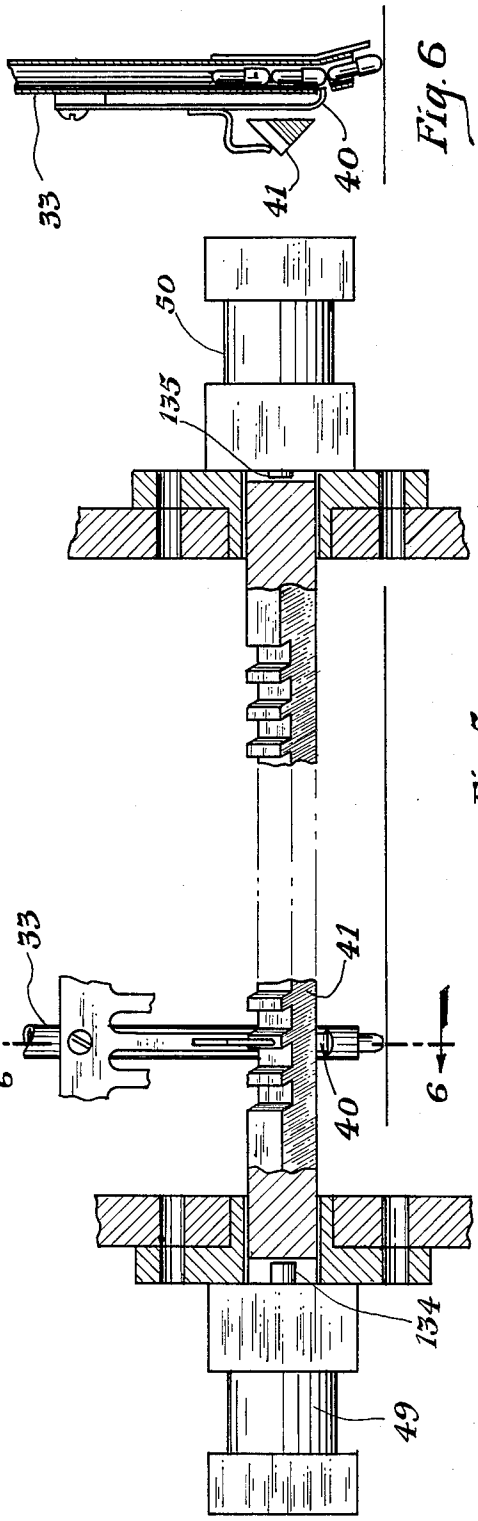


Fig. 5

Fig. 6

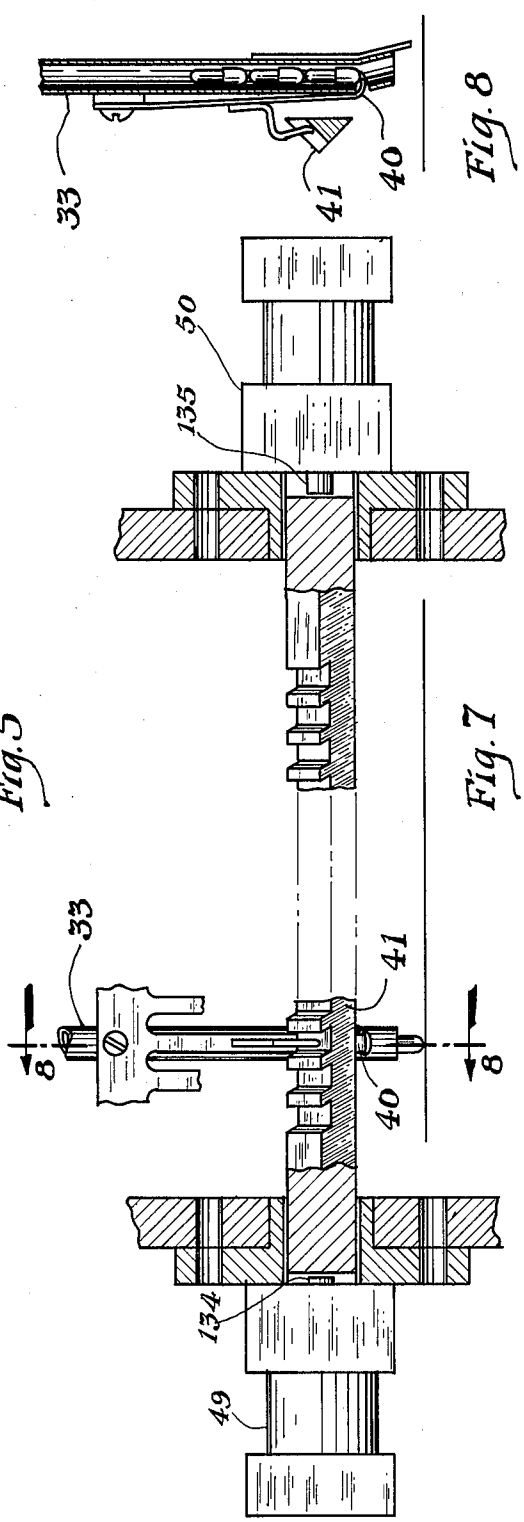


Fig. 7

Fig. 8

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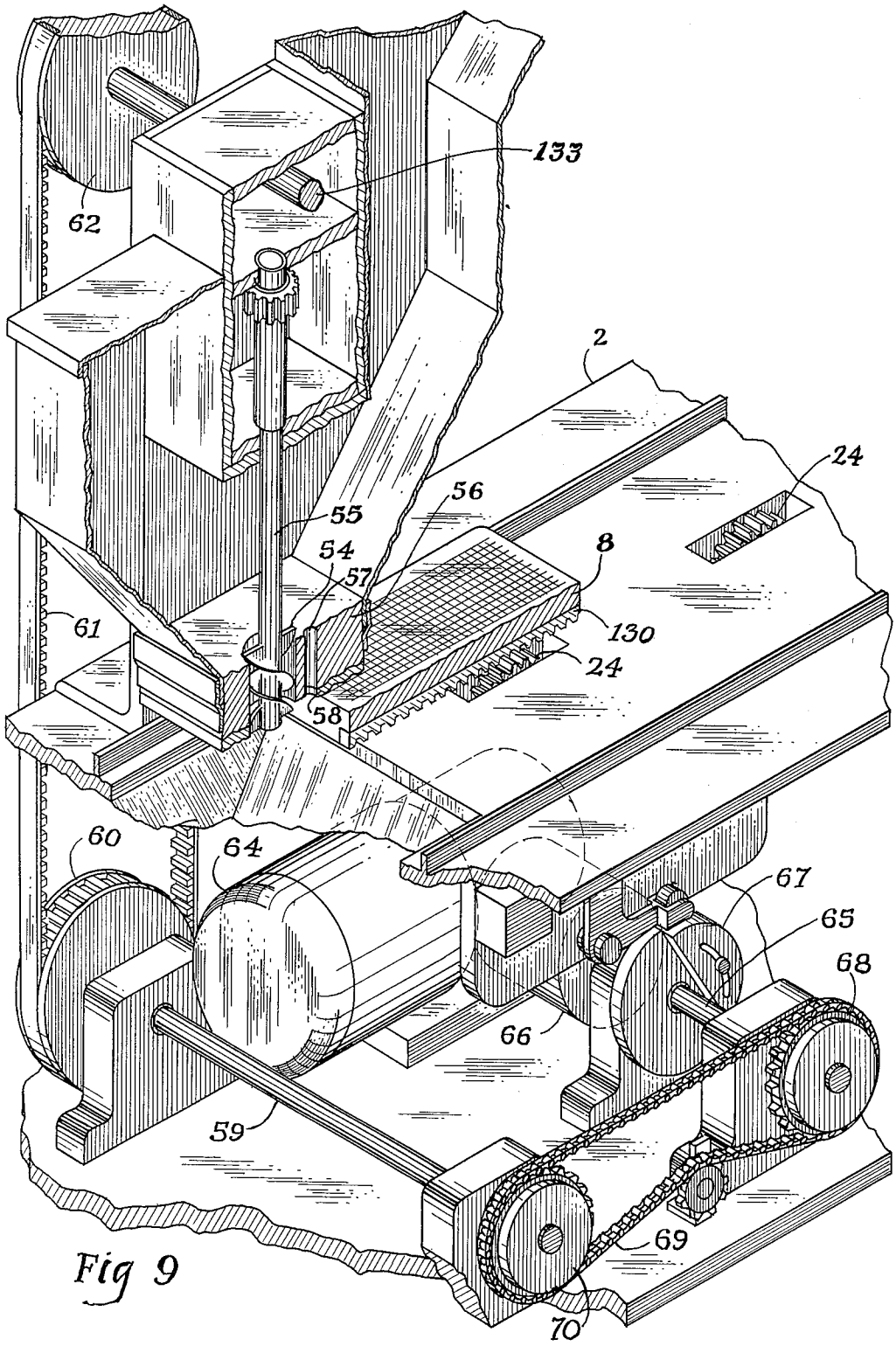


Fig 9

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APPARATUS FOR CAPSULE FILLING

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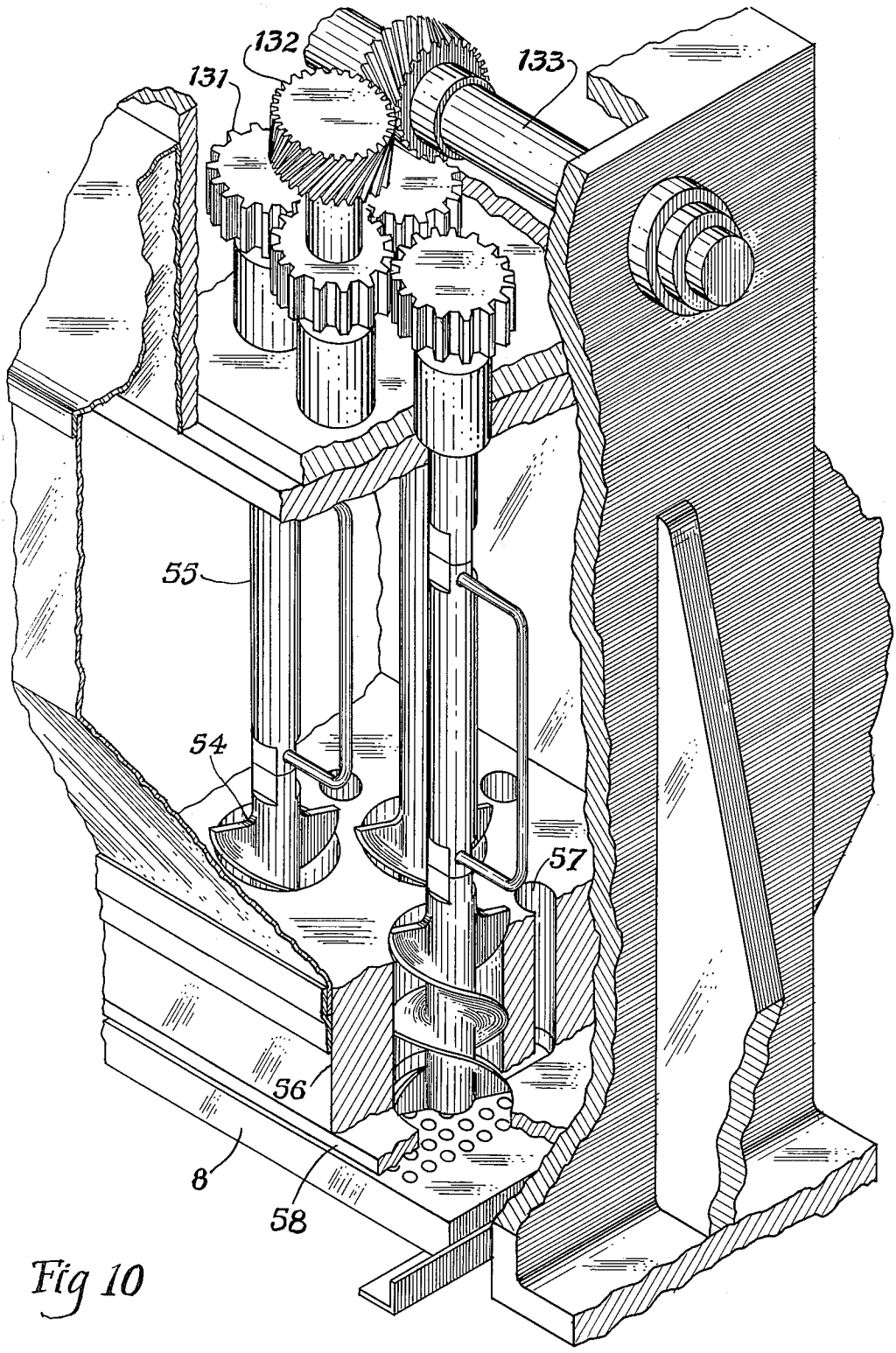


Fig 10

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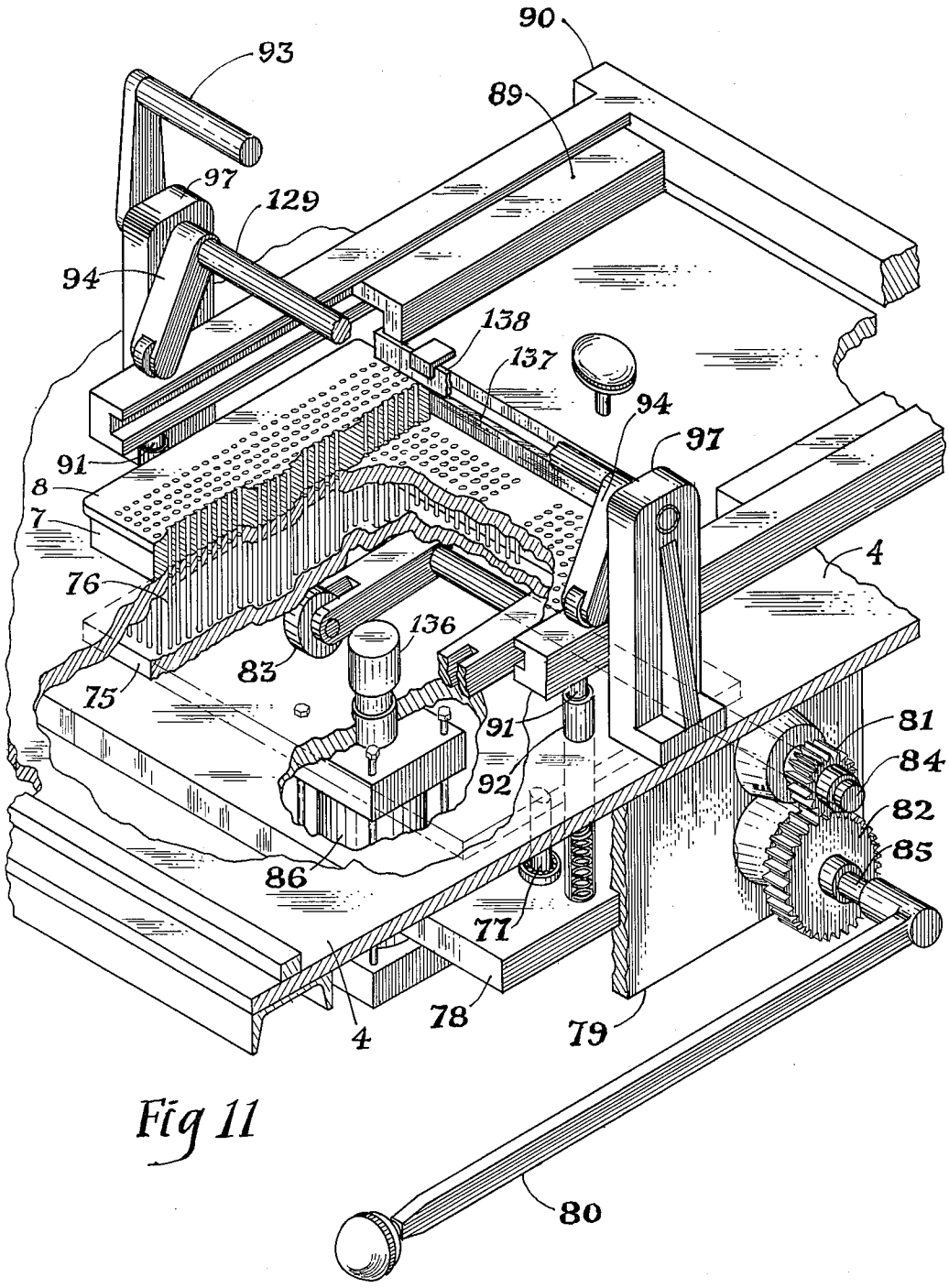


Fig 11

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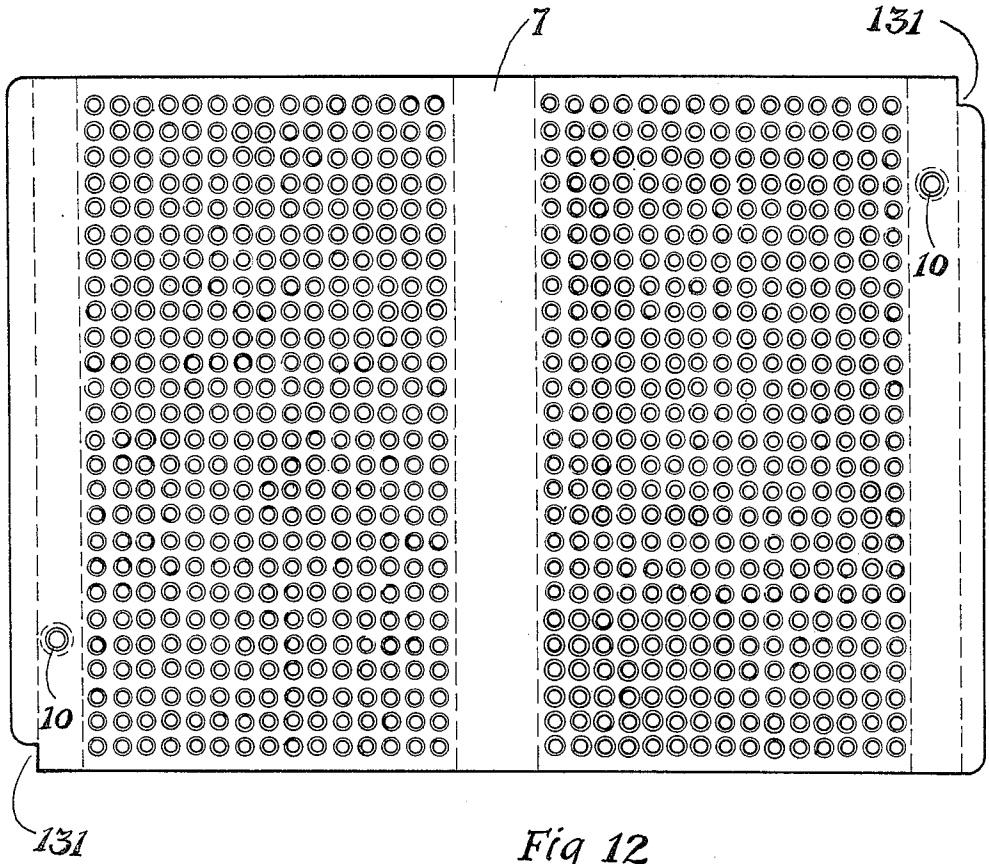


Fig 12

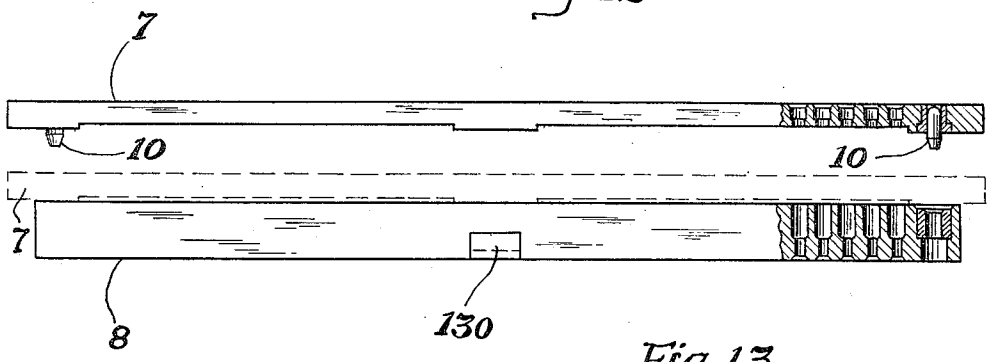


Fig 13

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3,242,638

APPARATUS FOR CAPSULE FILLING

Sidney Ernest Harris, Wayne, Henry James Mianecki, Nutley, and William George Rausch, Verona, N.J., assignors to Hoffmann-La Roche Inc., Nutley, N.J., a corporation of New Jersey

Filed Dec. 4, 1962, Ser. No. 242,120
4 Claims. (Cl. 53—281)

This invention relates, in general, to a method and to an apparatus for filling capsules. More particularly, it relates to an improved and substantially mechanized method for filling capsules and to the apparatus used in accomplishing this.

It is an object of this invention to provide an economical and practical method for filling hard-shell capsules. It is a more particular object of the invention to provide apparatus suitable for use in carrying out such method.

In general, the objects of this invention are accomplished by the provision of means for feeding empty capsules into a plurality of openings in plates designed to receive same, means for separating the capsule caps from the capsule bodies, means for depositing powder in said capsule bodies, means for reassembling the capsule caps with the filled capsule bodies and means for collecting the filled capsules, together with means for conveying a plurality of said plates continuously through the capsule feeding means and through the powder depositing means.

Referring now to the drawings, wherein like reference characters designate corresponding parts through all views:

FIGURE 1 is a top plan view of the various components comprising the capsule filling apparatus.

FIGURE 2 is a perspective view of the apparatus.

FIGURE 3 is a detailed perspective view of the driving assembly for the capsule orientating and inserting mechanism and of the index drive for the apparatus.

FIGURE 4 is a detailed perspective view of the capsule orientating and inserting mechanism.

FIGURE 5 is a perspective view of a particular portion of the capsule inserting and orientating mechanism which shows the position of gates and gate lifters in capsule feeding position.

FIGURE 6 is a sectional view taken along the line 6—6 of FIGURE 5.

FIGURE 7 is a perspective view of the same portion of the capsule inserting and orientating mechanism depicted in FIGURE 5 showing, however, the gates and gate lifters in the "no capsule" release position.

FIGURE 8 is a sectional view taken along the line 8—8 of FIGURE 7.

FIGURE 9 is a detailed perspective view of the driving assembly for the powder depositing means.

FIGURE 10 is a detailed perspective view of the powder depositing means.

FIGURE 11 is a detailed perspective view of the capsule reassembly and ejection mechanism.

FIGURE 12 is a top plan view of the double plate assembly.

FIGURE 13 is a sectional view of the double plate assembly.

In the practice of the present invention, a plurality of specially designed capsule carrier double plate assemblies is first provided. In general, a single double plate assembly consists of an upper plate and a lower plate, each of which is substantially rectangular in shape. The upper plate is designed so that it can be detachably mounted on the lower plate. These plates, that is, both the upper plate and the lower plate, contain an identical pattern of holes, each hole being of a size suitable for receiving a capsule. In carrying out the invention, a plurality of

individual double plate assemblies are conveyed, one after another, along a platform having positioned thereon a means for inserting capsules in the holes in said plates; capsules are caused to be inserted, by appropriate means, into the holes in the double plate assembly; the capsule bodies are separated, by appropriate means, from the capsule caps while the capsules are positioned in said assembly and while the said assembly is being conveyed along said platform; the upper plate, in which the capsule caps are retained, is separated from the lower plate which contains the capsule bodies; the lower plate is conveyed along a second platform beneath an appropriate means for filling the capsule bodies therein with powder; and, subsequently, the lower plate, which contains the filled capsule bodies, is moved to the reassembly area; the upper plate, which upon detachment from the lower plate was conveyed by appropriate means directly to the reassembly area, is thereafter remounted on the lower plate; the capsules are then reassembled within the double plate assembly; and, thereafter, the capsules, which are now filled and closed tightly, are ejected from the double plate assembly and collected.

The apparatus includes also means, suitably positioned on the first platform, for instituting the automatic conveyance of the double plate assemblies along said platform. The apparatus includes separate means also for automatically initiating the feed of the capsules from the capsule orientating and inserting means when a double plate assembly is in position to receive capsules.

The apparatus includes also means, suitably positioned on the first platform, for stopping the feed of capsules for one cycle as the junction line of adjacent double plate assemblies is positioned beneath the capsule feeding means and, additionally, means for reinstituting the feed of capsules when the holes in the next succeeding double plate assembly are in position to receive capsules. Moreover, the apparatus includes means, suitably positioned near the end of said first platform, for stopping the feed of the capsules and for stopping the movement of the double plate assemblies along said first platform when the first in line double plate assembly reaches and, by contact therewith, activates said means. Upon deactivation of said stopping means by removal of said first in line double plate assembly from contact therewith, movement of the succeeding double plate assemblies along said first platform is reinstituted, and the feeding of capsules to said double plate assemblies is resumed.

The apparatus includes also means, suitably positioned near the end of the said second platform, for stopping the movement of the lower plates along said second platform, and for stopping the deposit of powder on said lower plates, when the first in line lower plate reaches and, by contact therewith, activates said means. Upon deactivation of said stopping means, by removal of the first in line lower plate from contact therewith, movement of the lower plates and powder feed is resumed.

FIGURE 1 shows platform 1 and platform 2 which are connected at one end by transfer bridge 3 and at the other end by bridge 4. Bridge 4 is formed by the platform on which a hereinafter described reassembly and ejection mechanism is positioned. Located on a shelf below platform 1 is the drive for capsule orientating and inserting mechanism 5. Located on a shelf below platform 2 is the drive for powder depositing means 119. Index mechanisms, one of which propels the carrier double plate assemblies intermittently along the surface of platform 1 and the other of which propels lower capsule carrier plates 8 intermittently along the surface of platform 2, between suitable guide rails, are attached to the underside of platforms 1 and 2, respectively. Attached also to the underside of platform 1, beneath orientating and inserting mechanism 5, is vacuum manifold 6 and

seal. Capsule orientating and inserting mechanism **5** and powder depositing means **119** are mounted on platforms **1** and **2**, respectively.

FIGURE 2 shows, in a perspective view, capsule orientating and inserting mechanism **5** mounted on platform **1** and powder depositing means **119** mounted on platform **2**. Additionally, it shows upper plate return conveyor **71** mounted above and between platforms **1** and **2**. Bridge **4** which is formed by the reassembly and ejection mechanism is also shown in FIGURE 2.

The capsule carrier plates which are used in the practice of this invention are constructed out of a suitable metal. They can, for example, be made of a magnesium-aluminum alloy. The double plate assembly consists of upper plate **7** with counterbored holes (see FIGURE 12) positioned on top of lower plate **8** (see FIGURE 13). Each plate contains the same number, and an identical pattern and alignment, of holes. The plates used in the preferred embodiment of the invention have bored therein 780 holes, arranged as 26 rows containing 30 holes each. When plate **7** is mounted on lower plate **8**, the holes which are bored therein are in precise alignment with the holes in plate **8**. Proper alignment of the holes in the upper and lower plates is assured by positioning of locating pins **10** which project from upper plate **7** into openings bored in plate **8** for the reception thereof. The dimensions and the shape of the capsule-receiving holes in plate **7** are such that, when the capsule bodies are caused to separate from the capsule caps in the manner hereinafter indicated, the cap of the capsule is retained in the counterbore. The capsule-receiving holes in plate **8** are of such dimension and shape that, when the capsule bodies are caused to separate from the capsule caps in the manner hereinafter indicated, the capsule bodies are retained therein. On the bottom surface of each lower plate **8** is rack **130** which engages rotatable plate gear **24** (FIGURE 3) of the indexing system. Rotation of plate gear **24** while engaged with rack **130** drives the double plate assembly forward.

In carrying out the invention, upper plate **7** is mounted on top of lower plate **8** to provide the double plate assembly. This double plate assembly is placed on platform **1** and by engagement of rack **130** with plate gear **24** it is intermittently conveyed along platform **1** beneath the capsule slides of capsule orientating and inserting mechanism **5**. Referring now particularly to FIGURE 3, gear head motor **11**, with an output shaft speed of for example about 116 r.p.m., drives directly clutch-brake combination **12** mounted on shaft **13** and, through sheaves **14** and **15** and belt **16**, countershaft **17** at about 80 r.p.m. Fastened to countershaft **17** is cam **18** which, through crank **19**, produces intermittent forward motion of the capsule plates.

Again referring to FIGURE 3, in the index drive, a series of identical gear and ratchet mechanisms move the capsule plates. Side plates **20** and **21** are attached to mounting plate **22** by means of angle bracket **23**. Plate gears **24**, which engage rack **130** of lower plate **8**, and driving gears **9** are mounted between side plates **20** and **21** on small shafts **25** and **26**. Plate gear **24** rotates freely on shaft **25** and is driven by driving gear **9** which is keyed to shaft **26**. Also keyed to shaft **26** is ratchet **27**. The dimensions of ratchet **27** are such that each tooth causes the gears to move so as to drive the capsule plate forward exactly the distance between two succeeding rows of holes in the capsule plates. Ratchet **27** is driven by ratchet drive shaft **28** through driving pawls **29**. Ratchet drive shaft **28** in turn is driven by driving crank **19** operated by indexing cam **18**. The lift of cam **18** is arranged to move ratchet drive shaft **28** forward through ½ inch and it is installed so that, at its farthest point of forward motion, it positions the holes in the capsule plates in place below the capsule slides **45** of capsule orientating and inserting mechanism **5**. Spring **30** returns the ratchet drive shaft **28** and pawls **29** into position for the next cycle. Back lash is prevented by latching pawls **31**.

One such indexing apparatus is attached to the frame of platform **1** in proper relationship to the driving assembly and to the capsule inserting mechanism. Another such indexing system is attached to the frame of platform **2** in proper relation to the capsule filling mechanism and to the driving assembly therefor.

Referring once again to FIGURE 3, which depicts the means employed to feed empty capsules int the double plate assembly, attached to countershaft **17** is eccentric **32** which, through connecting rod **48** and lever arm **127**, operates sector gears **38** of capsule orientating and inserting mechanism **5**. Orientating and inserting mechanism **5** is designed to arrange the capsules so that their bodies are pointing downward and to release the orientated capsules in such a manner that, row by row, one capsule falls into each of the holes in the double plate assembly. Orientating and inserting mechanism **5** consists of magazine **33** which serves to pick up capsules at random from hopper **34** (see FIGURE 2) and to transfer them to the orientating and inserting area. Referring now to FIGURE 4, magazine **33** (see FIGURE 3) is fastened to vertical guide plate **35** which moves between vertical plate guides **36** attached to side bracket **37**. Reciprocal vertical motion of the magazine is accomplished through sector gear **38** and magazine rack **39**. Capsules are retained in the lower portion of magazine **33** by gate **40** until released by the automatic operation of gate lifter **41**. This operation will be described in more detail hereinafter. Operation of gate lifter **41** occurs when magazine **33** reaches the lowest point in its travel. Spacing of magazine **33** above capsule raceway **128** is such that only one capsule can be released from each tube of the magazine at each cycle. After release of the capsules onto raceway **128**, the capsules are moved forward by push blade **42** attached to push-plate **43**. Forward motion of push-plate **43** is caused by action of sector gear **38**, operating on push-plate rack **44**. The capsules are pushed forward on raceway **128** until they reach a position immediately above capsule slide **45**. Raceway **128** is differentially machined so that when rectifier block **46** descends, all of the capsules are caused to be orientated with their bodies pointing down. The descent of rectifier block **46** forces the orientated capsules through the slots of the raceway **128** into the capsule slide **45**. From capsule slide **45**, the capsules fall into the holes of the double plate assembly.

The entry of the capsules into the double plate assembly is assisted, and separation of capsule caps from the capsule bodies is accomplished by applying a moderate vacuum from beneath the holes in the carrier plate assembly through manifold **6** (FIGURE 1). The vacuum is created by a suitable vacuum pump and it is transmitted from the pump to the manifold by means of a hose. At the junction of adjacent sets of carrier plate assemblies, no holes are present to receive capsules. Normally open microswitch **113** (see FIGURE 1), which is held closed by contact with the edge of upper plate **7**, opens when it engages with indentation **131** (see FIGURE 12) suitably positioned on the edge of plate **7**. Referring to FIGURES 5 and 6, piston **134**, operating through air cylinder **49** moves gate lifters **41** sideways a sufficient distance to align the outwardly projecting portions of gate lifters **41** with gates **40**. Such alignment, which occurs when microswitch **113** is held in closed position by plate **7**, permits capsules to be released into the double plate assembly. Referring now to FIGURES 7 and 8, as the junction line of adjacent carrier plate assemblies passes under the orientating and inserting mechanism, switch **113** is opened and piston **135** operating through air cylinder **50** which, in turn, operates through a three way solenoid valve moves gate lifters **41** sideways a sufficient distance to align the notches in gate lifters **41** with gates **40**. When so aligned, gates

40 will not open and, hence, no capsules will be released into raceway 128. The electrical control circuit is arranged so that any interruption of the indexing control circuit moves the gate lifter to the "no delivery" position.

Referring now to FIGURE 9, the powder depositing apparatus consists of a series of augers 54, preferably six in number, mounted on shaft 55 in block 56. Augers 54 are spaced so as to supply a quantity of powder to an area sufficient to cover the pattern of holes in the capsule carrier plate 8. A set of relief holes 57 serves to recirculate excess powder which may be forced down by augers 54 upon plate 8. The seal between the bottom of block 56 and capsule plate 8 is provided by accurately ground steel plate 58 which is fastened to the block 56. Referring now to FIGURE 10, augers 54 are driven by suitable gears 131 and 132 with motive power to gear shaft 133 being obtained from countershaft 59 through sheave 60, belt 61 and sheave 62 as shown in FIGURE 9. A suitable hopper 63 (see FIGURE 2) is mounted on top of the capsule filling mechanism. Augers 54 are driven by the indexing motor and, hence, operation of the augers stops whenever indexing of plates ceases. The plate which is receiving powder is pushed forward by forward movement of the plate which follows.

On the powder depositing side of the apparatus, drive is provided in the following manner. Referring again to FIGURE 9, gear head motor 64 drives shaft 65 through clutch 66 at about 87½ r.p.m. Fastened to shaft 65 is indexing cam 67 which, through an index drive, operates in the same manner as the index drive on the capsule inserting side and which has been previously described, to produce an intermittent forward motion of the lower capsule plates 8. Also attached to shaft 65 is sprocket 68 which, through chain 69 and sprocket 70, drives countershaft 59. Countershaft 59 drives gears 131 and 132 (see FIGURE 10) through gear shaft 133, sheave 60, belt 61 and sheave 62. Gears 131 and 132, in turn, drive augers 54 to deposit powder on the lower plates as they are conveyed along platform 2.

Indexing cam 67 operates at a constant rate. The plates are, therefore, moved through the apparatus intermittently but at a constant rate which is predetermined by the output shaft speed of motor 11. The speed of the capsule filler, relative to the rate of indexing of the plates, however, may be varied to accommodate powders of different densities and capsules of different sizes by changing the ratio of sprockets 68 and 70. A system of electrical controls stops the index drive and powder supply when no plates are properly positioned to receive powder or when the entire platform is filled with plates. These electrical controls will be more fully described hereinafter.

Referring now once again to FIGURE 1 and upper plate return conveyor 71 shown therein, this consists of a series of rollers 74 attached to parallel bars 72 and 73, suitably spaced to receive and to carry upper plates 7. Conveyor 71 is mounted parallel to, and above the space which separates, platforms 1 and 2. The conveyor originates in close proximity to bridge 3 and it terminates near bridge 4 formed by the reassembly and ejection mechanism. The conveyor is inclined on a slightly downward angle from bridge 3 to bridge 4 to facilitate the passage of upper plates 7 from bridge 3 to the reassembly area. The conveyor is positioned at such a height and such a distance from bridge 3, that an operator positioned at bridge 3 can easily place the upper plates thereon. Moreover, the conveyor is positioned at such a height and such a distance from bridge 4 that an operator positioned at the reassembly and ejection mechanism can easily remove the upper plates therefrom. A thin sheet of Lucite, stainless steel, etc. can be fastened, if desired, beneath the whole length of return conveyor 71 to prevent updrafts of air from blowing the lightweight capsule caps out of the holes in the plates. As indicated heretofore, conveyor 71 serves as the means by which the capsule caps—containing upper plate, after detachment from the capsule bodies—containing lower plate, is transported from bridge 3 to the reassembly and ejection area at bridge 4.

The capsules are reassembled and ejected from the plates by a mechanism consisting of a pinplate assembly and a hold-down and ejection assembly. Referring now to FIGURE 11, pinplate assembly consists of plate 75 bearing reassembly pins 76 which are mounted in a pattern corresponding exactly to the pattern of holes in the capsule carrier plates 7 and 8. Plate 75 is mounted on parallel shafts 77 guided by ball bushings mounted in a spacer plate 78 attached to side bracket 79 fastened beneath bridge 4. Plate 75 is mounted so that, in its lowest position, the tips of the pins protrude into the holes bored in the surface of bridge 4. Lever 80, acting through gears 81 and 82 and lifting cam 83 mounted on shafts 84 and 85, serves to raise the pins. An upward thrust of piston 136 of air cylinder 86, which cylinder is mounted on spacer plate 78 and is activated by air valve and foot switch 87 (FIGURE 2), serves, in a manner described hereinafter, to tightly reassemble the capsules.

Referring again to FIGURE 11, the hold down and ejection assembly consists of a metal plate 89, preferably, but not necessarily, an aluminum plate, which moves horizontally in guide frame 90. Guide frame 90 is fastened to parallel shafts 91 which move vertically in guide frame shaft sleeves 92 responding to action of handle 93 and cam 94 fastened to cross shaft 129. Shaft 129 is supported by bearing brackets 97.

The reassembly and ejection mechanism operates in the following manner. When lower plate 8 reaches limit switch 98 (FIGURE 1) on platform 2, it is drawn manually to the reassembly area on bridge 4. Upper plate 7, which was separated manually from lower plate 8 at bridge 3 is removed manually from upper plate return conveyor 71, positioned properly on top of lower plate 8 by means of locating pins 10 (see FIGURE 13) and the double plate assembly is pushed into position above reassembly pins 76. Referring to FIGURE 11, exact positioning of the double plate assembly above reassembly pins 76 is assisted by guide frame shaft sleeve 92 and backing bar 137. Holddown plate 89 is then drawn forward in guide frame 90 to a position above the double plate assembly and, by handle 93 and cam 94, it is lowered firmly into contact with the upper plate 7. Lever 80 is then depressed to raise plate 75 until pins 76 reassemble the capsules within the plate. Momentary operation of air cylinder 86 by closing foot switch 87 causes an upward thrust of piston 136 against plate 75. This serves to reassemble the capsules tightly by forcing them into contact with holddown plate 89. Opening of foot switch 87 causes piston 136 to separate from plate 75, downward movement of piston 136 being brought about by a spring contained within the cylinder. Handle 93 is released to raise holddown plate 89. This same movement causes scrape off fence 138 to descend and enclose the surface of the capsule plate. Additional downward pressure on lever 80 raises pin plate 75 to its highest position and forces the reassembled capsules out of the holes. With lever 80 still fully depressed, holddown plate 89 is pushed horizontally backwards in guide frame 90 causing scrape off fence 138 to push the capsules into a discharging chute 101 leading to container 102 (see FIGURES 1 and 2) placed beside the machine. Pins 76 are then withdrawn by raising lever 80.

In carrying out this invention, it is preferable to provide a motor for each side of the system. Although it is possible to use a single motor with a long cross shaft, the use of two separate motors is preferable since this enables either side to continue to operate even though the other stops. It is convenient, although not essential, to use compact gear head motors to deliver an output shaft speed

of about 85 r.p.m. In the alternative, one may use a conventional 1750 r.p.m. motor and obtain the requisite operating speed by auxiliary belts, chains or gears. The motor starters are located in a control cabinet and they are activated by magnetic switches located in a suitable console mounted on bridge 3. The motors run continuously. Starting and stopping of the various parts of the machine is accomplished by an electrical clutch-brake system for the capsule inserting side and a plain electrical clutch, without brake, for the powder filling side.

In the preferred indexing system, combination clutch and brake 12 engages the clutch or the brake, depending upon which of the contacts of a suitably positioned relay are open or closed. The coil of such relay is energized by a source of 12 volt A.C. through manual switch 104 on console panel 105. In the circuit are microswitch 106, wired normally open, located in such position that lower capsule carrier plate 8, engaged with plate gear 24, holds it closed. Indexing of the plates ceases when no plate is in position to hold microswitch 106 closed. Manual switch 108, which is normally turned to closed during operations, is mounted on the side bracket of orientating and inserting mechanism 5 to permit disabling the circuit temporarily for adjustment. Microswitch 109, is wired normally closed and it is located near the end of platform 1 near transfer bridge 3. Any plate which is not moved manually onto transfer bridge 3 opens switch 109 and stops the operation of capsule orientating and inserting mechanism 5. Operation resumes when switch 109 is closed by removal of such plate from contact therewith, for example, when the plate is moved onto transfer bridge 3. Normally closed microswitch 110, wired in parallel with switches 106 and 109, is mounted near eccentric 32 (FIGURE 3) which drives capsule orientating and inserting mechanism 5. Switch 110 is opened by cam 111 attached to eccentric 32. When magazine 33 is at the highest point of its excursion, switches 106, 108 and 109 are all closed; and, hence, the opening of switch 110 will have no effect. However, if any one of those switches are open, the current which controls the clutch-brake combination 12 will continue through the parallel circuit of switch 110 until interrupted when cam 111 opens switch 110. By this means, capsule orientating and inserting mechanism 5 will always stop when the magazine 33 is at the highest point of its travel. This facilitates the clearing of any blockage that may occur in the magazine tubes due to defective or broken capsules. Also in parallel with part of this circuit is a relay, controlled by manual switch 112 on the side bracket of capsule orientating and inserting mechanism 5, and microswitch 113. Microswitch 113 is normally open and is closed by the edge of upper capsule carrier plate 7 passing under capsule orientating and inserting mechanism 5. While closed, the circuit opens a solenoid valve to activate air cylinder 49 which, by means of piston 134, holds gate lifter 41 in position to release capsules (see FIGURES 5 and 6). As indicated heretofore, indentation 131 in upper capsule carrier plate 7 allows switch 113 to open for one cycle when no capsules are required. Through a relay, a solenoid valve, air cylinder 50 and piston 135, the opening of switch 113 causes gate lifter 41 to move so that no capsule will be released during that cycle. Additionally, this portion of the circuit is so wired that no current is received when any of the switches 106, 107, 108 and 109 are open, so that gate lifter 41 moves to the no capsule position (see FIGURES 7 and 8) whenever the operation of the index drive is interrupted.

The index drive on the capsule filling side operates in the following manner. Clutch 66 (FIGURE 9) engages through the action of a relay and switches 117 and 98. Switch 117 is normally open and it is held closed by capsule carrier plate 8 passing over index drive plate gear 24. Switch 98 is normally closed. It opens, however, and, hence, stops the operation when a plate, which reaches the end of platform 2, is not removed therefrom.

The reassembly system operates through switch 120 on control console 105 and foot switch 87. A 12 volt A.C. is supplied to a solenoid valve to control compressed air to air cylinder 86 which closes the capsules during the reassembly operation.

Control console 105 contains index drive switch 104, motor switch 122, each for the capsule orientating and inserting side of the system, index drive switch 123 and motor switch 124, each for the powder filling side of the system, and reassembly switch 120. Additionally, control console 105 may contain manual switch 125. Through manual switch 125 and micro-switch 126, a pulse of 12 volt A.C. can be fed to a batch counter to record the passage of a capsule plate by switch 126. The batch counter may conveniently be mounted on console 105.

Basically, the present capsule filling system operates in the following manner. Carrier plate 7 is positioned on top of carrier plate 8 to provide the double carrier plate assembly. A plurality of such double plate assemblies are placed, one after another on, and conveyed along, platform 1 and passed beneath orientating and inserting mechanism 5. Unless otherwise halted, indexing of the plates along platform 1 will continue so long as there is a plate in contact with switch 106. Capsules from hopper 34 are picked up at random by magazine 33 and transferred to raceway 128 and capsule slides 45. From capsule slides 45, one capsule is dropped into each of the holes in the double plate assembly, one row at a time. Vacuum, applied beneath the holes in the double plate assembly through manifold 6, facilitates entry of the capsules into the holes of the double plate assembly and causes the capsule bodies to separate from the capsule caps. When the first in line double plate assembly approaches the end of platform 1, it is moved manually to transfer bridge 3. If such assembly is not removed from platform 1 by the time it reaches switch 109, indexing of the plates and feeding of the capsules ceases. On bridge 3, carrier plate 7 is separated from carrier plate 8. Plate 8, containing the capsule bodies, is placed on, and conveyed along, platform 2 beneath the mechanism which deposits powder thereon. Plate 7, containing the capsule caps, is placed upon upper plate return conveyor 71 and allowed to be moved, by gravity, toward bridge 4 formed by the reassembly and ejector mechanism. From hopper 63, by means of augers 54, powder is released onto plate 8 in such a manner as to fill the capsule bodies carried therein. When plate 8 approaches the end of platform 2, it is moved manually into place in the reassembly and ejector mechanism. If plate 8 is not removed from platform 2 by the time it reaches switch 98, indexing of the plates, and feeding of the powder ceases. Plate 7, containing the capsule caps, is repositioned on top of plate 8 and, by the action of the reassembly and ejector mechanism, the capsules are reassembled in, and, subsequently, ejected from the double plate assembly and transferred, by gravity, through discharge chute 101 to container 102.

The present invention is of significant importance for several reasons. Basically, the invention is of prime importance since it provides an apparatus and a method for filling capsules which is largely mechanized. Its use, therefore, brings about substantial economies. Moreover, due to its compactness, the apparatus can be utilized in establishments where available floor space is at a minimum. Furthermore, by minor changes in certain of its component parts, the system can easily be adapted to accommodate capsules of different sizes and/or powders of different densities. Additionally, while the apparatus is primarily useful as a means for inserting powders into capsules, it can be used also to incorporate granules and tablets therein. Modifications necessary to effectuate such embodiments of the invention will be readily apparent to those skilled in the art.

We claim:

1. An apparatus for filling capsules comprising a double plate assembly, said assembly consisting of two substantially rectangular shaped plates, one of which is detachably mounted on top of the other, each of the plates in said double plate assembly having an identical pattern of holes therein for the reception of capsules, said plates having means to insure that, when the upper plate is positioned on top of the lower plate, the holes in one plate are aligned with the holes in the other, means, suitably positioned on a platform therefor, for inserting capsules, row by row, into the holes in said double plate assembly, rotatable plate gears suitably positioned on, and protruding through the surface of, said platform which engage with a rack set into the bottom surface of said lower plates, and means for driving said plate gears so as to produce intermittent forward motion of a plurality of double plate assemblies along said platform and through said capsule inserting means, a vacuum means for separating the capsule bodies from the capsule caps as each double plate assembly is moved along said platform whereby the said capsule bodies are retained in said lower plate and said capsule caps are retained in said upper plate, means, suitably positioned on a platform therefor, for depositing powder onto a detached lower plate to fill the capsule bodies positioned therein, rotatable plate gears suitably positioned on, and protruding through the surface of, said second platform which engage with a rack set into the bottom surface of said lower plates, and means for driving said plate gears so as to produce intermittent forward motion of a plurality of lower plates along said platform and through said powder depositing means, means for reassembling said capsules in said double plate assembly while the capsule caps are positioned in the upper plate and the capsule bodies are positioned in the lower plate, said means comprising a moveable plate, bearing pins in a pattern corresponding to the pattern of holes in the double plate assembly, a hold-down plate for positioning on the upper surface of the upper plate of the double plate assembly and means for raising said moveable plate to close said capsules by forcing same against the hold down plate and means for ejecting the closed capsules from the double plate assembly.

2. An apparatus for filling capsules comprising a double plate assembly, said assembly consisting of two rectangular shaped plates, one of which is detachably mounted on top of the other, each of the plates in said double plate assembly having an identical pattern of holes therein for the reception of capsules, said plates having means to insure that, when the upper plate is positioned on top of the lower plate, the holes in one plate are aligned with the holes in the other, means, suitably positioned on a platform therefor, for inserting capsules, row by row, into the holes in said double plate assembly, means, suitably positioned on said platform, to provide a vacuum from beneath the surface of said platform to separate the capsule bodies from the capsule caps whereby the capsule bodies are retained in the lower plate and the capsule caps are retained in the upper plate, rotatable plate gears, suitably positioned on said platform, which engage with a rack set into the bottom surface of said lower plates, and means for driving said plate gears to produce intermittent forward motion of a plurality of double plate assemblies along said platform, through said capsule inserting means and over said vacuum means, means, suitably positioned on said platform, for stopping the feed of capsules from the capsule inserting means for one cycle when the junction line of adjacent double plate assemblies is positioned beneath the capsule inserting means, means for reinstituting capsule feed when the holes in the next succeeding double plate assembly are in position to receive capsules, means, suitably positioned on a platform therefor, for depositing powder onto a detached lower plate to fill the capsule bodies positioned therein, rotatable plate gears, suitably positioned on said platform, which engage with a rack set into the surface of each lower plate to produce intermittent forward motion of a plurality of lower plates along said platform and through said powder depositing means, and means for driving said plate gears, means for reassembling said capsules while positioned in, and for ejecting said closed capsules from, said double plate assembly, said reassembling means comprising a moveable plate bearing pins in a pattern corresponding to the pattern of holes in the double plate assembly, a holddown plate for positioning in contact with the upper surface of the upper plate of the double plate assembly, means for raising said moveable pin-bearing plate to close said capsules by forcing same against the holddown plate and means for ejecting the closed capsules from the double plate assembly.

3. An apparatus for filling capsules comprising a double plate assembly, said assembly consisting of two substantially rectangular shaped plates, one of which is detachably mounted on top of the other, each of the plates in said double plate assembly having an identical pattern of holes therein for the reception of capsules, said plates having means to insure that, when the upper plate is positioned on top of the lower plate, the holes in one plate are aligned with the holes in the other, means, suitably positioned on a platform therefor, for inserting capsules, row by row, into the holes in said double plate assembly and means for driving said capsule inserting mechanism, means suitably positioned on said platform to provide a vacuum from beneath the surface of said platform to pull the capsule bodies downwardly to disengage same from the capsule caps whereby the capsule bodies are retained in the lower plate and the capsule caps are retained in the upper plate, rotatable plate gears, suitably positioned on said platform, which engages a rack set into the bottom surface of each lower plate and means for driving said plate gears to produce intermittent forward motion of a plurality of double plate assemblies along said platform through said capsule inserting means and over said vacuum means, means, suitably positioned on said platform for stopping the feed of capsules from the capsule inserting means for one cycle when the junction line of adjacent double plate assemblies is positioned beneath the capsule inserting means, means for reinstituting capsule feed when the first row of holes in the next succeeding double plate assembly are in position to receive capsules, means suitably positioned near the end of said platform, for both stopping the movement of said double plate assemblies along said platform and stopping the feed of capsules when the first in line double plate assembly reaches and, by contact therewith, activates such means, means for reinstituting the feed of capsules when the first in line double plate assembly is removed from said platform, means, suitably positioned on a platform therefor, for depositing powder on a detached lower plate to fill the capsule bodies positioned therein and means for driving said powder depositing mechanism, rotatable plate gears suitably positioned on said platform which engage with a rack set into the bottom surface of each lower plate and means for driving said plate gears to produce intermittent forward motion of a plurality of lower plates along said platform and through said powder depositing means, means, suitably positioned near the end of said platform, for both stopping the movement of said lower plates along said platform when the plate first in line reaches and, by contact therewith, activates such means, and stopping the feed of powder when plate movement ceases, means for reinstituting both the feed of powder to said plates and the movement of said plates along said platform when the plate first in line is removed from contact which said stopping means, means for reassembling said capsules while positioned in, and for ejecting said closed capsules from, said double plate assembly, said reassembling and ejecting means comprising a moveable plate, bearing pins

in a pattern corresponding to the pattern of holes in the double plate assembly, a hold down plate for positioning on the upper surface of the upper plate of the double plate assembly, means for raising said moveable pin-bearing plate to close said capsules by forcing same against the holddown plate, means for removing the holddown plate from contact with said upper plate and for raising the pin-bearing plate to a higher position to eject the closed capsules form the double plate assembly and means for sweeping said closed capsules from the surface of the upper plate of double plate assembly into a suitable receptacle.

4. An apparatus for filling capsules which comprises a double plate assembly having holes therein suitable for receiving and retaining capsules, a first platform having suitably positioned thereon a means for inserting capsules into the holes in said double plate assembly and means for driving said capsule inserting mechanism and a vacuum means for separating the capsule bodies from the capsule caps while the capsules are positioned in said double plate assembly, a second platform, disposed in parallel alignment to said first platform, said first platform and said second platform being connected at one end by a transfer bridge and at the other by a third platform having means positioned thereon for the reassembly of said capsules, said second platform having means thereon for filling capsule bodies with powder and means for driving said filling mechanism, said transfer bridge and said third platform being connected by a roller-type conveyor which is positioned between, and elevated above, said first and second platform, said roller conveyor inclining slightly at a downward angle toward said third platform so as to permit the upper plates of double plate assemblies to move by gravity from the transfer bridge to a location adjacent to and slightly above said third platform, the double plate assembly of said apparatus, consisting of two substantially rectangular shaped plates, one of which is detachably mounted on top of the other, each of the plates in said double plate assembly having an identical pattern of holes therein for the reception of capsules, said plates having means to insure that, when the upper plate is positioned on top of the lower plate, the holes in one plate are aligned with the holes in the other, said capsule inserting means on said first platform being such as to insert capsules in said double plate assembly, row by row, said first platform having suitably positioned thereon rotatable plate gears protruding the surface of said platform which engage a rack set into the bottom surface of each lower plate and means for driving said plate gears to produce intermittent forward motion of a plurality of double plate assemblies along said first platform through said capasule inserting means and over said vacuum means, said first platform containing also means for stopping the feed of capsules from the capsule inserting means when the junction line of adjacent double plate assemblies is positioned beneath the capsule inserting means and means for reinstituting capsule feed when the first row of holes in the next succeeding double plate assembly is in position to receive capsules, said first platform having also means, suitably positioned near the end thereof, for stopping the feed of capsules from the capsule inserting means when the first in the line double plate assembly reaches and, by contact therewith, activates such means, and means for reinstituting the feed of capsules when the first in line double plate assembly is removed from contact with said stopping means, said second platform having positioned thereon rotatable plate gears protruding the surface of said platform which engage a rack set into the bottom surface of each lower plate and means for driving said plate gears to produce intermittent forward motion of a plurality of lower plates along said second platform and through said powder depositing means, means suitably positioned near the end of said second platform both for stopping the movement of said lower plates along said second platform when the plate first in line reaches and, by contact therewith, activates such means and for stopping the feed of powder when plate movement ceases, means for reinstituting the feed of powder to said plates and for reinstituting the movement of said plates along said second platform when the plate first in line is removed from contact with said stopping means, said third platform having means for reassembling said capsules while positioned in said double plate assembly and for ejecting same from said double plate assembly, said reassembling and ejecting means comprising a moveable plate bearing pins in a pattern corresponding to the pattern of holes in the double plate assembly, a hold down plate for positioning on the upper surface of the upper plate of the double plate assembly, means for raising said pin-bearing plate to close said capsules by forcing same against the hold down plate, means for removing the hold down plate from contact with said upper plate and for raising said pins to a higher position to eject the closed capsules from the double plate assembly and means for sweeping said closed capsules from the surface of the upper plate of the double plate assembly into a suitable receptacle.

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