

Jan. 1, 1963

O. HÖFLIGER
APPARATUS FOR FILLING AND SEALING THE CARTRIDGES
OF TWO-PIECE CAPSULES AND THE LIKE

3,070,932

Filed Oct. 27, 1959

5 Sheets-Sheet 1

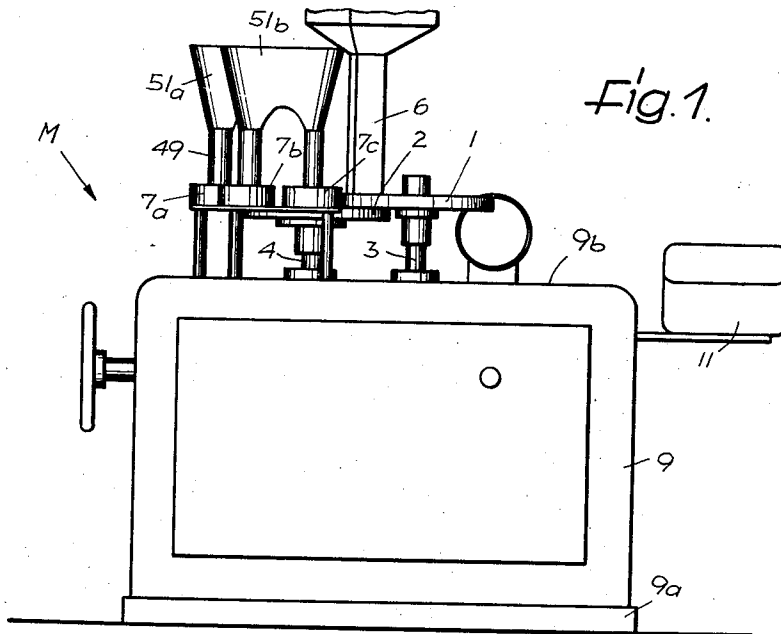
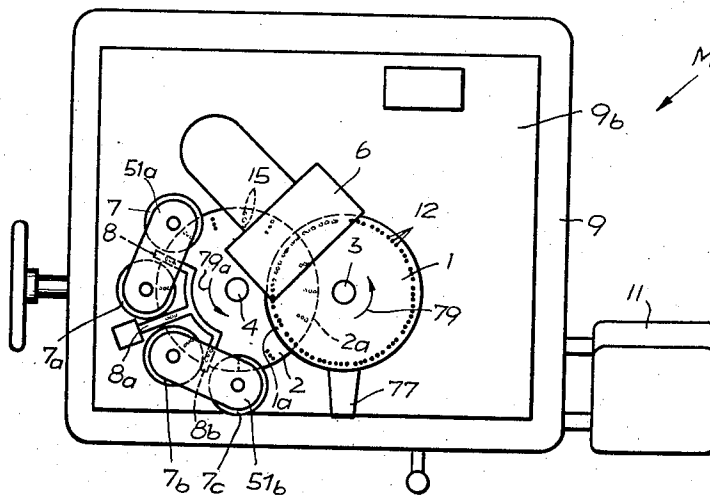


Fig. 2.



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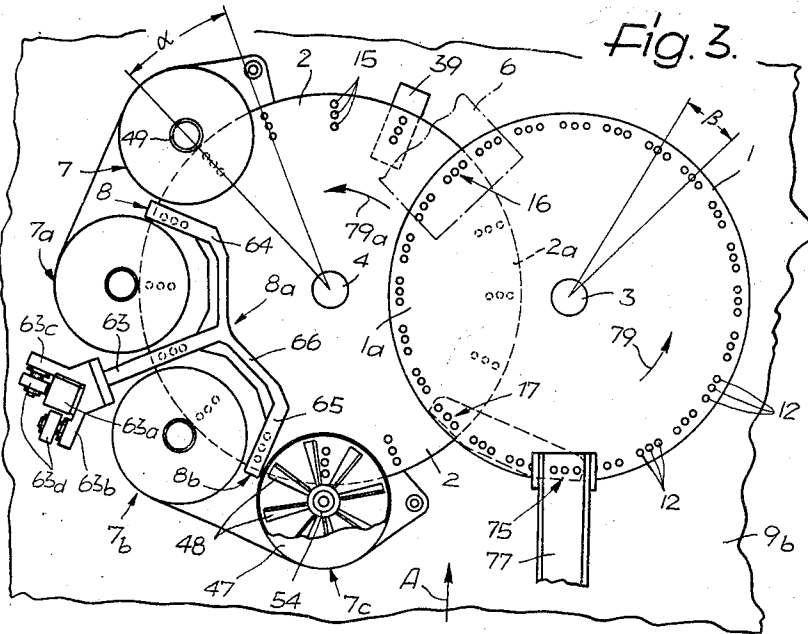
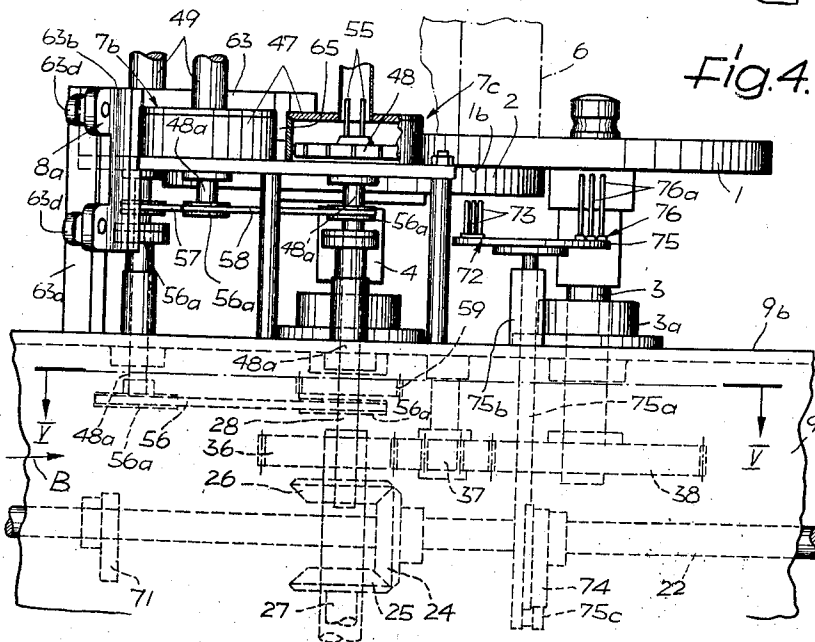
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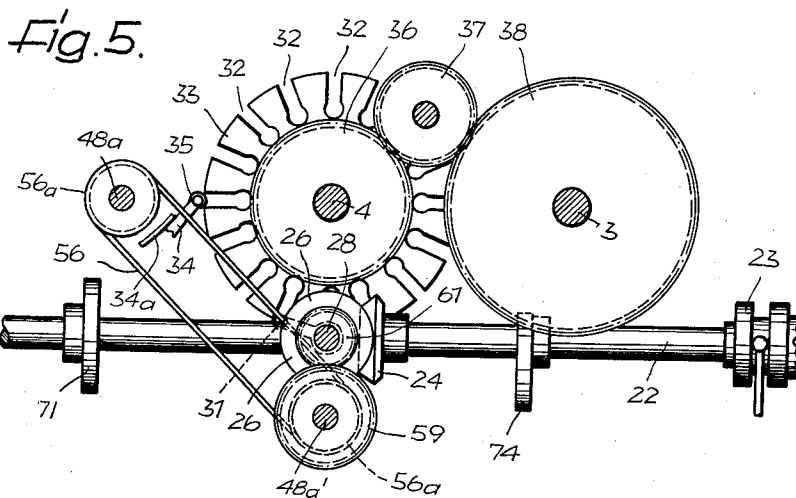
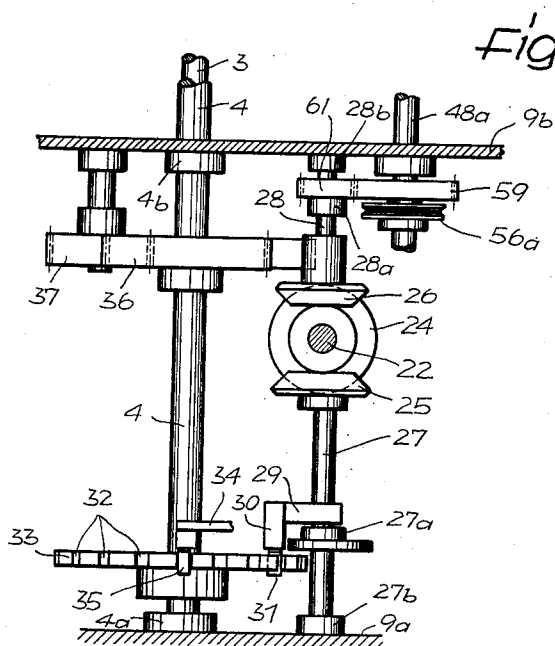
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5 Sheets-Sheet 3



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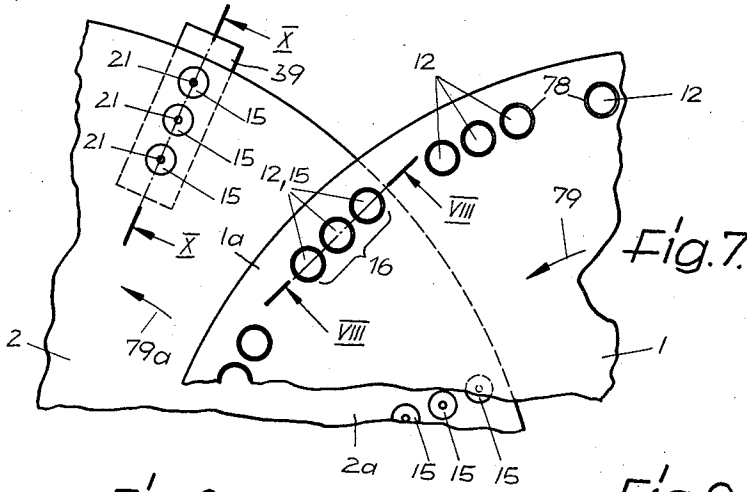


Fig. 8.

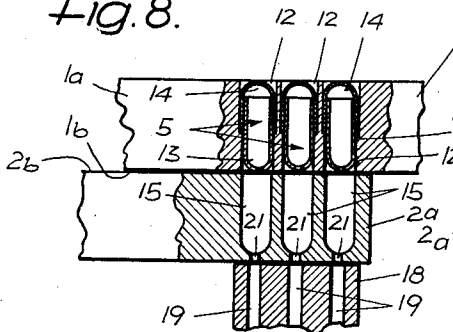


Fig. 9.

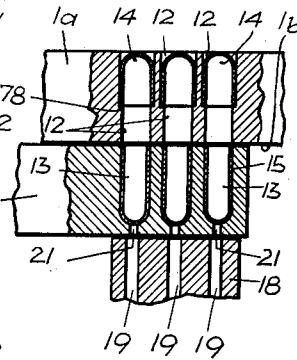
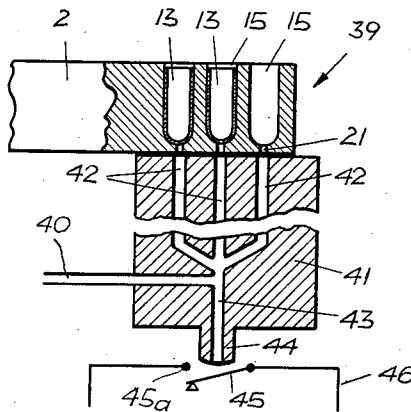


Fig. 10.

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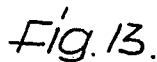
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APPARATUS FOR FILLING AND SEALING THE CARTRIDGES OF TWO-PIECE CAPSULES AND THE LIKE

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18 Claims. (Cl. 53—281)

The present invention relates to an apparatus for continuously filling and sealing the cartridges of two-piece capsules and like receptacles for freely flowing solid particles, such as powdery or granular materials. More particularly, the invention relates to an apparatus which is capable of opening an empty capsule by removing the cap from the cartridge, of filling and preferably compacting requisite quantities of powdery or granular material into each cartridge, and of resealing the filled cartridges by placing the caps thereon, the operation of the apparatus being fully automatic and occurring in a series of rapidly following steps by leading the cartridges along a series of suitably spaced stations.

In presently known apparatus for such purposes, use is made of two discoid members which are mounted on a common vertical shaft, the upper disk being formed with suitable bores for reception of the capsules and the lower disk being formed with bores for reception of the cartridges. A sorting and dispensing device is swingable into a position above the upper disk to deliver empty capsules into the latter's bores, the cartridge of each capsule being thereupon transferred into the aligned bores of the lower disk. After the dispensing device is swung away from the capsule discharging position above the upper disk, the latter is removed from the vertical shaft together with the covers or caps which remain embedded in its bores, whereupon a filling device is swung into operative position above the lower disk to introduce a granular or powdery material into the empty cartridges. The lower disk is continuously rotated while the filling of the cartridges takes place. In order to insure that each cartridge is properly filled during a single revolution of the lower disk, the filling assembly preferably comprises one or more screw or worm conveyors capable of advancing the powdery or granular material at requisite pressures toward and into the open end of each cartridge. When the filling step is completed upon a full revolution of the lower disk, the filling assembly is swung away from the operative position above said lower disk, thus enabling an operator to place the upper disk with the caps in the latter's bores back onto the vertical shaft in such position as to align each bore in the upper disk with a bore in the lower discoid member. In the next step, the filled cartridges are transferred into the bores of the upper disk by means of an ejector mechanism, and the completely assembled capsules consisting of filled cartridges and caps placed over the open ends of the cartridges are finally ejected from the bores of the upper disk.

A serious drawback of such apparatus is in that the operation is not a continuous one because the capsule dispensing and filling operations must be interrupted by repeatedly swinging the respective assemblies either above or away from the discoid members, and also because the upper disk must be removed from and again placed onto the common shaft before and after each material filling step. Thus, a continuous delivery of empty capsules into the bores of the upper disk and a continuous filling of empty cartridges held in the bores of the lower disk if such apparatus is not possible.

An important object of the present invention is to overcome the drawbacks of the just described prior

machine by the provision of an apparatus which is capable of continuously filling, sealing and ejecting two-piece capsules without it being necessary to change the position of the capsule dispensing and cartridge filling assemblies.

Another important object of the invention is to provide an apparatus for continuously filling, sealing and ejecting two-piece capsules which is so constructed that the discoid means for supporting one or both components of the capsules need not be removed at any stage of the operation.

A further object of the invention is to provide an apparatus as outlined hereinabove which is capable of filling the cartridge of each capsule in a series of consecutive steps, and which is also capable of packing or condensing the introduced granular or powdery material in one, two or more stages.

An additional object of the invention is to provide an apparatus for filling, packing, sealing and ejecting the cartridges of two-piece capsules in a series of rapidly following steps and in a fully automatic way by utilizing a single drive mechanism which imparts continuous or intermittent rotary, as well as reciprocatory motion to all movable parts of the apparatus.

A concomitant object of the instant invention is to provide an apparatus of the above outlined characteristics which is so constructed and assembled that any irregularity in the transfer of cartridges brings about immediate shut-down of the operation.

Still another object of the invention is to provide an apparatus for filling two-piece capsules in a continuous operation and in a fully automatic way which is capable of being utilized in connection with powdery as well as granular materials consisting of comparatively small spherical or nearly spherical bodies.

A further object of the present invention is to provide an apparatus as outlined hereinabove which is so constructed as to prevent the formation of air pockets and consequent partial filling of the cartridges.

An ancillary object of the invention is to provide an apparatus for filling the cartridges of two-piece capsules with a granular or powdery substance which is of very compact design; whose parts are readily accessible for inspection, interchange or repair; which requires little supervision during actual operation; which can simultaneously fill a large number of cartridges; and which may be utilized with capsules of many different sizes and designs.

With the above objects in view, the invention resides in the provision of an apparatus which comprises a pair of partially overlapping discoid members mounted on separate preferably vertical shafts which are parallel with each other. The upper disk is formed with a number of bores or grooves, preferably arranged in groups of two, three or more, with the groups extending tangentially relative to the axis about which the upper disk rotates, and the lower disk is formed with a number of bores or recesses, preferably arranged in radially arranged groups of two, three or more. Each set of grooves is brought into vertical alignment with a corresponding number of recesses at two spaced points, hereinafter called transfer stations, during each revolution of the disks. The apparatus further comprises a dispensing and sorting device which may be permanently installed above the upper disk to deliver into each of the latter's grooves an empty capsule consisting of a cartridge and of a cap or cover therefor. Means is provided for rotating the disks in step-by-step fashion whereby each group of grooves comes into alignment with a set of recesses at each transfer station, thus enabling a vacuum generating device to withdraw at the first transfer station all empty cartridges from the superposed grooves into the aligned recesses therebelow

while the caps remain in the grooves of the upper disk. As the empty cartridges are intermittently advanced with the lower disk, they are moved into positions to receive a powdery or granular material from one or more filling assemblies which are permanently installed adjacent to the path of the lower disk between the first and the second transfer stations. It is preferred to provide at least one stuffing or packing assembly adjacent to the path of the lower disk between the two transfer stations, each packing assembly being adjacent to and located past a filling station so as to compact the material already introduced into the cartridges to a desired extent and to thus provide room for introduction of additional material, if desired. When the filled cartridges are advanced to the second transfer station where at least one recess is again aligned with a corresponding number of grooves in the upper disk, a suitable ejector or transfer mechanism returns the filled cartridges into the grooves whereby each cartridge is automatically sealed by its respective cap, and the fully assembled and filled capsules are finally ejected from the grooves of the upper disk to be led to the packaging or sorting station.

Certain other features of the apparatus reside in the provision of means for controlling and indicating that all cartridges were properly transferred into the lower disk at the first transfer station, this control means preferably comprising a suction head operatively connected with the motor which drives the movable components of the apparatus to arrest the same as soon as an empty recess is detected in the lower disk at a point beyond the first transfer station; in the provision of a novel drive which is capable of rotating the shafts of both discoid members at intermittent and fully controlled angular speeds; in the provision of means for actuating certain component parts of the filling, packing and ejecting assemblies in rhythm with the intermittent angular advance of the disks; and in the provision of filling, packing and ejecting assemblies of novel, efficient and very simple design.

Intead of forming the upper disk with a series of tangentially arranged grooves and forming the lower disk with rows of radially arranged recesses, the arrangement of the grooves and of the recesses may be reversed, if desired, and the disks may be driven at different angular speeds which renders it possible to construct the disks in such a way that the number of grooves may either exceed or be less than the number of recesses. The arrangement according to which the recesses in the lower disk are disposed in a number of radial rows is preferred because it renders it possible to mount a large number of alternating filling and packing or compacting assemblies close to each other and adjacent to the non-overlapped portion of the lower disk intermediate the two transfer stations.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following detailed description of a specific embodiment when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic side elevational view of the capsule filling, packing, sealing and ejecting machine;

FIG. 2 is a schematic top plan view of the machine shown in FIG. 1;

FIG. 3 is a greatly enlarged fragmentary view illustrating certain parts of the machine which are shown in FIG. 2;

FIG. 4 is a front elevational view of the assembly shown in FIG. 3, as seen in the direction of arrow A;

FIG. 5 is a horizontal section taken along the line V—V of FIG. 4, as seen in the direction of arrows;

FIG. 6 is an end view of the structure shown in FIG. 4, as seen in the direction of arrow B;

FIG. 7 is a greatly enlarged fragmentary detail view of the assembly illustrated in FIG. 3 showing two overlapping portions of the disks at the first transfer station;

FIG. 8 is a vertical section taken along the line VIII—VIII of FIG. 7, as seen in the direction of arrows, showing a series of capsules in the upper disk before the transfer of their respective cartridges into the recesses formed in the lower disk;

FIG. 9 illustrates the overlapping portion of the upper disk and the overlapped portion of the lower disk in the position of FIG. 8 after the transfer of cartridges into the recesses of the lower disk;

FIG. 10 is a view of a control or arresting system in vertical section taken along the line X—X of FIG. 7, as seen in the direction of arrows;

FIG. 11 is partly elevational and partly sectional view of a filling assembly for the cartridges received in the recesses of the lower disk;

FIG. 12 is partly elevational and partly sectional view of a material compacting assembly; and

FIG. 13 is a vertical section through an ejecting mechanism for transferring loaded cartridges into the grooves of the upper disk.

Referring now in greater detail to the illustrated embodiment, and first to FIGS. 1 and 2, the capsule dispensing, separating, filling, packing, assembling and ejecting machine M comprises a casing or frame 9 which receives various driving, motion transmitting, speed reducing and control assemblies, and also supports a pair of vertical shafts 3, 4 which extend above its cover plate 9b and are rigidly connected with horizontal discoid members 1, 2, respectively. The shafts 3, 4 are spaced from each other in such a way (see FIG. 2) that the disks 1, 2 partially overlap each other. The respective overlapping and overlapped portions 1a, 2a of these disks are immediately adjacent to each other, i.e. the underside 1b of the overlapping disk portion 1a is immediately adjacent to the upper side 2b of the overlapped disk portion 2a. The casing 9 further supports a capsule sorting and dispensing device 6 whose discharge end is adjacent to the upper side 1c of the horizontal disk 1 and which delivers empty capsules, each consisting of a tubular shell or cartridge and a tubular cap, into the grooves or bores 12 formed in the member 1. The machine M further comprises four filling assemblies 7-7c alternating with three material compacting or packing devices 8-8b, all located above the non-overlapped zone of the lower disk 2. Motion is imparted to the disks 1, 2 as well as to certain component parts of the assemblies 7-7c and devices 8-8b by a drive mechanism installed in the casing 9 and controllable by suitable switches and levers mounted on the control panel 11.

As is shown in more detail in FIG. 3, the upper disk 1 is formed with a number of circular vertical bores or grooves 12 which receive the capsules discharged by the dispensing device 6. The grooves 12 are arranged in uniformly spaced groups of three, each set or group of three grooves 12 being disposed in a tangential row, i.e. substantially at right angles to the radius extending from the median groove to the axis of shaft 3 about which the upper disk 1 revolves. FIGS. 8 and 9 show that each capsule 5 comprises a cylindrical shell or cartridge 13 and a cylindrical cover or cap 14 which latter is fitted over the cartridge 13 when the capsules 5 are discharged by the dispensing device 6 in such a way that the cartridges enter first into the respective grooves 12. The lower disk 2 is formed with a large number of vertical recesses or blind bores 15 of such diameters as to slidably receive the cartridges 13 therein. The recesses 15 are disposed in radially aligned groups of three (see FIGS. 3 and 7) and each group is located close to the periphery of the member 2 so as to become aligned with a selected group of grooves 12 when the disks 1, 2 rotate in the directions indicated by the arrows 79 and 79a, respectively. The two transfer stations where a group of grooves is aligned with a

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row of recesses are indicated in FIG. 3 by reference numerals 16 and 17.

It will be readily understood that each group of grooves 12 in the upper disk 1 may consist of either more or less than three grooves, and that the spacing between the individual grooves as well as between the adjacent groups of grooves, too, need not be such as is shown in FIG. 3. The number of individual recesses 15 in each group of recesses in the lower disk 2, of course, preferably corresponds to the number of individual grooves in each group of grooves in the upper disk 1. Moreover, the total number of the groups or rows of grooves 12 in the disk 1 need not correspond to the total number of the rows of recesses 15 in the lower discoid member 2 since the disks may be revolved at such speeds that the formation of two transfer stations is possible as long as the spacing of the grooves in each of their groups corresponds to the spacing of the recesses 15 in each group of recesses formed in the lower disk 2. Finally it will be readily understood that the grooves 15 may be formed in radial rows in which case the groups of recesses 15 are tangential with respect to the periphery of the circle passing through the center of the median recess of each group.

Referring now to FIGS. 7 to 9 which illustrate in greater detail the first transfer station 16, FIG. 7 shows a tangential group of three grooves 12 formed in the momentarily overlapping portion 1a of the upper disk in exact coaxial vertical alignment with a radial group of recesses 15 which latter are formed in the momentarily overlapped portion 2a of the lower disk. FIG. 8 shows three capsules 5, just discharged by the dispensing device 6, in the initial position, i.e. in the respective grooves 12 of the overlapping portion 1a of the upper disk 1. It will be noted that each groove 12 consists of an upper zone and a lower zone, the latter's diameter being somewhat smaller than that of the upper zone so that these zones define therebetween an annular upwardly facing shoulder 78 serving as an abutment or stop for the lower end of a cap 14. Thus, the shoulders 78 prevent the caps 14 from sliding all the way through the respective grooves 12. The diameters of the lower zones in each groove 12 below the respective shoulders 78 correspond to the outer diameters of the cartridges 13, i.e. the diameters of the lower zones of grooves 12 correspond exactly to the diameters of the recesses 15 in the momentarily overlapped portion 2a of the lower disk 2. The lower ends of the recesses 15 communicate with small-diameter vertical bores 21 which, in the position of FIGS. 7 and 8, are aligned and communicate with vertical passages or channels 19 formed in a suction or vacuum head 18, the latter constituting a component part of a non-represented vacuum generating device, such as a fan or the like. The subatmospheric pressures prevailing in the passages 19, in the bores 21 and in the recesses 15 at the first transfer station 16 cause the cartridges 13 of the capsules 5 to descend into the recesses 15, i.e. the cartridges are transferred from the position of FIG. 8 into that shown in FIG. 9. The shoulders 78 prevent the caps 14 from following the downward movement of the cartridges 13. As will be described in greater detail hereinafter, the angular movements of the disks 1 and 2 in the direction of arrows 79, 79a, respectively, occur intermittently in step-by-step fashion, and the disks are held against rotation while the transfer of the cartridges 13 at the first transfer station 16 takes place. It will be noted that the underside 1b of the upper disk 1 and the upper side 2b of the lower disk 2 are machined with sufficient precision and that these sides are in surface-to-surface contact in the zones of overlapping and overlapped disk portions 1a, 2a in order to prevent the entry of air along the adjacent surfaces of the disks while the evacuation of air from the recesses 15 and the transfer of the cartridges 13 into said recesses takes place.

The drive means for intermittently rotating the disks 1, 2 in step-by-step fashion is shown in greater detail in FIGS. 4 to 6. It comprises a constantly revolving hori-

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zontal main drive shaft 22 which may be rotated at requisite speed by a non-represented electric or like motor through a clutch 23 shown at the right-hand end of FIG. 5. The main drive shaft 22 is coaxially connected with and rotates a bevel gear 24 which, in turn, drives a lower bevel gear 25 and an upper bevel gear 26. Bevel gear 25 is coaxially connected with a lower vertical shaft 27 which is rotatably mounted in bearings 27a, 27b, the latter being carried by the base or bottom plate 9a of the machine frame 9. The other bevel gear 26 is coaxially fixed to an upper vertical shaft 28 mounted in bearings 28a, 28b, the latter of which is connected to the underside of the cover plate 9b forming part of the machine frame 9. The lower vertical shaft 27 supports and rotates a radially extending arm 29 having at its free end a downwardly oriented extension 30 which supports a preferably rotatable pawl or roller 31 (see FIGS. 5 and 6). In the position of FIG. 5, the motion transmitting pawl 31 is about to enter into one of the open radial slots 32 formed in a horizontal segment wheel 33, the latter being fixed to that portion of the shaft 4 which extends downwardly through the cover plate 9b and into the frame or casing 9 of the machine M. As is shown in FIG. 6, the shaft 4 of the disk 2 is rotatably mounted in bearings 4a, 4b supported by the casing portions 9a, 9b, respectively. Upon each revolution of the lower vertical shaft 27 and of its arm 29, the roller or pawl 31 causes the segment wheel 33 to perform an angular movement of given magnitude sufficient to turn the lower disk 2 through an angle (see FIG. 3) which corresponds to the angular spacing between the adjacent rows or groups of radially arranged recesses 15. It is assumed that the disk 2 and the segment wheel 33 are intermittently driven in the counterclockwise direction indicated by the arrow 79a. The slotted segment wheel 33 and the pawl or roller 31 constitute a device for transforming continuous circular motion of the shafts 22 and 27 into intermittent or step-by-step rotary motion of the shaft 4 and of the lower disk 2. The segment wheel 33 remotely resembles a Maltese cross.

In order to avoid undesirable acceleration or sluggish advance of the lower disk 2 during intermittent movements thereof, the segment wheel 33 is continuously braked and actually held in arrested position whenever the pawl 31 moves out of a slot 32. The braking device comprises a lever 34 biased toward the periphery of the wheel 33 by a spring 34a and carrying at its free outer end a roller 35 which scans the periphery of the wheel 33 and extends partially into the open end of a slot 32 simultaneously with the movement of pawl 31 out of and away from another slot 32. Thus, whenever the segment wheel 33 is not positively rotated by the arm 29 of the lower vertical shaft 27, the braking and retaining roller 35 holds the disk 2 against rotation by partially extending into one of the slots 32. In this manner, the braking action of the roller 35 insures uniform advance of the shaft 4 and hence of the lower disk 2, thereby holding the same against rotation while the transfer of the cartridges 13 into the recesses 15 at the first transfer station 16 takes place.

The upper disk 1 is rotated in step-by-step fashion by a gear 36 which is mounted on the shaft 4 and meshes with an intermediate or idler gear 37, the latter transmitting rotation to a gear 38 which is coaxially mounted on and fixed to the vertical shaft 3. As is shown in FIG. 4, the shaft 3 is mounted in a bearing 3a carried by the cover plate 9b. The transmission of rotary motion from the shaft 4 to the shaft 3 through the gear train 36-37-38 is such that the upper disk 1 is angularly moved through an angle whenever the shaft 4 rotates the lower disk 2 through the aforementioned angle (see FIG. 3). Upon each stepwise advance of the disks 1 and 2 through the angles, a new group of grooves 12 is moved into vertical alignment with a different row of recesses 15 at the stations 16 and 17.

A control and motion arresting device 39 is mounted adjacent to and is located past the first transfer station 16,

as seen in the direction of the arrow 79a which latter indicates that the disk 2 revolves in anticlockwise direction. The purpose of the control device 39 is to arrest the motor which rotates the main drive shaft 22 whenever a recess 15 remains empty, i.e. whenever the suction head 18 fails to transfer one or more cartridges 13 from the lower zone of a groove 12 into the recess 15 therebelow. This control device 39 is illustrated in greater detail in FIG. 10. It comprises a suction head 41 which is connected to a vacuum generating device, preferably the one which also generates subatmospheric pressures in the channels or passages 19 of the suction head 18 shown in FIGS. 8 and 9. The spaced vertical channels or passages 42 in the head 41 come into alignment with the vertical bores 21 whenever a row of recesses 15 is advanced through the angle from the first transfer station 16 in the direction of the arrow 79a. As described hereinabove, the braking roller 35 then arrests the segment wheel 33 and hence the disks 1 and 2 for a period of time sufficient for the operation of the control device 39. The channels 42 communicate with a vertical channel 43 whose lower end extends into and through a nozzle 44 having its discharge end adjacent to a freely swingable contactor or switch 45 installed in the electric circuit 46 of the non-represented motor which rotates the main drive shaft 22. When each of the recesses 15 in the lower disk 2 receives a shell or cartridge 13, the vacuum generated in the channels 42, 43 by a non-represented fan or like device which is connected to the conduit 40, causes the contactor 45 to move into abutment with the nozzle 44 and with the terminal 45a whereby the circuit 46 is completed and the main shaft 22 is continuously driven to intermittently advance the disks 1, 2 in the manner as described above. Thus, whenever subatmospheric pressures prevail in the channel 43, the contactor 45 is drawn into contact with its terminal 45a to insure continuous operation of the machine by keeping the main drive shaft 22 in motion. However, and as shown in FIG. 10, when one or more recesses 15 should happen to remain empty upon advance of such recesses from the first transfer station 16 in the direction of arrow 79a, normal atmospheric pressures will prevail in the channel 43; therefore, the switch 45 drops by gravity and opens the circuit 46 to arrest the motor of the main drive shaft 22. The operator or attendant of the machine M, noting that the shaft 22 is arrested, will then discover that one or more cartridges 13 remained in their respective grooves 12, e.g. due to excessive friction, and will immediately take remedial action.

While FIG. 3 shows that the dispenser 6 delivers capsules at the first transfer station 16, i.e. into that set of grooves 12 which is in vertical alignment with a radially disposed set of recesses 15 (see FIG. 8), it will be readily understood that the delivery of capsules 5 into the grooves 12 may take place one, two or more steps in advance of the transfer station 16, or that two or more groups of grooves 12 may be filled simultaneously, if desired. When the grooves 12 are filled in advance of the first transfer station 16, this station is utilized only for transferring the cartridges 13 into the respective recesses 15 in the momentarily overlapped portion 2a of the lower disk 2, i.e. only a separation of capsules 5 into two component parts takes place at the station 16.

Referring again to FIG. 3, it will be noted that the angular spacing between the assemblies 7, 8, 7a, 8a, 7b, 8b and 7c, in that order, equals the angles between the adjacent rows of radial recesses 15. The material filling assembly 7 is shown greatly enlarged and in partial section in FIG. 11. It comprises a continuously revolving paddle wheel 48 (see also the filling assembly 7c in FIG. 3) which is surrounded by a stationary cylindrical housing or container 47. The central portion of the container 47 communicates with an upwardly extending filling or inlet tube 49 whose upper end communicates with a hopper 51a, as is shown in FIGS. 1 and 2. These last men-

tioned illustrations show that the hopper 51a may supply the material to be filled into the cartridges 13 to the containers 47 of two adjacent filling assemblies 7 and 7a. The other hopper 51b delivers similar granular or powdery material to the containers 47 of the filling assemblies 7b and 7c. The bottom plate 52 of the cylindrical container 47 shown in FIG. 11 is formed with a segmental cutout 53 which snugly receives a zone of the lower disk 2 with a row of radially aligned recesses 15, each of these recesses containing an empty cartridge 13 whose open upper end is adjacent to the revolving paddles of the wheel 48. The container 47 prevents the granular or powdery material, which drops by gravity through the tube 49, from flowing along the upper side 2b of the lower disk 2, and the paddles of the wheel 48 fill the cartridges 13 up to the level of the disk surface 2b.

In order to avoid clogging of the tube 49 by the material descending from the hopper 51a, the hub 54 of the paddle wheel 48 carries at least one but preferably two or more eccentric axially parallel vertical lugs or studs 55 which extend into the tube 49 and revolve together with the paddle wheel 48 to thus prevent any accumulation of material at the junction of member 49 with the container 47. As may be observed in FIGS. 4 and 5, the downwardly extending vertical shafts 48a of paddle wheels 48 in the containers 47 forming part of filling assemblies 7, 7a and 7b are driven by the endless belts 56, 57 and 58, respectively, and by suitable pulleys indicated by reference numerals 56a. The shaft 48a' associated with the paddle wheel 48 of filling assembly 7c is continuously driven by a gear train comprising a pinion 59 which meshes with a second pinion 61 mounted on the upper vertical shaft 23 which latter, as described hereinbefore, is constantly driven by the main drive shaft 22 through bevel gears 24 and 26. The belts 56-58 are led over pulleys 56a mounted on the shaft 48a' and on the shafts 48a of filling assemblies 7, 7a, 7b, respectively.

The material packing or compacting device 8a is shown in greater detail in FIG. 12. A group of three rams 62 is arranged radially with respect to the lower disk 2 and spaced from each other the same way as the recesses 15 in that portion of the disk 2 which has just been advanced through an angle from the first material filling assembly 7. The rams 62 are vertically reciprocable in a branch or leg 63 forming part of a vertically reciprocable carrier member 66, the latter supporting two additional branches or legs 64 and 65 which form part of packing devices 8, 8b, respectively. As can be observed in FIG. 3, the legs 64, 63 and 65 extend outwardly in the radial direction of the lower disk 2 between the filling assemblies 7-7a, 7a-7b, and 7b-7c, respectively. The lower ends or heads 67 of the rams 62 are located directly above the upper side 2b of the lower disk 2 when the carrier member 66 is in its uppermost position. The rams 62 are yieldably mounted in the leg 63, i.e. they are capable of resisting only a predetermined upwardly directed pressure. This is achieved by forming a cutout 8' in the arm 63 and by drilling vertically aligned sets of bores 69', 69'' for each of the packing members 62. The upper portion of each ram 62 is slidably received in a bore 69'' and carries at its externally threaded upper end above the leg 63 a nut or stop 62a. The lower portion of each ram 62 is formed with a boss 69 which is vertically slidably received in the respective bore 69' and serves as an abutment for the lower end of a helical spring 68 which coaxially surrounds the median portion of the packing or stuffing member 62 in the cutout 8'. The upper ends of resilient members 68 abut against the upper wall of the cutout 8'; thus, each ram 62 is constantly biased in downward direction into a position in which its nut 62a abuts against the upper side of the leg 63. The construction of material packing devices 8 and 8b is analogous.

The carrier member 66 is reciprocable in the directions indicated by the double arrow 81 by means of a cam 71 (see FIG. 4) which is mounted on and rotates with the

main drive shaft 22. However, it is equally possible to provide a separate drive, similar to that comprising the segment wheel 33 and the pawl 31, for intermittently reciprocating the packing devices 8, 8a and 8b by moving the carrier member 66 toward and away from the upper ends of cartridges 13 in recesses 15. As will be readily understood by referring to FIGS. 3 and 4, the carrier 66 is reciprocated indirectly over its branch or leg 63 whose outer end is guided along a vertical column 63a and has a non-represented extension whose lower end scans the periphery of the cam 71 on the horizontal main drive shaft 22. The leg 63 carries a pair of vertical brackets 63b, 63c whose rollers 63d travel along the column 63a.

The second transfer station 17 is adjacent to and located past the last filling assembly 7c, as seen in the direction of the arrow 79a. At this station, the filled cartridges 13 are returned into the grooves 12 in the upper disk 1 by means of an ejector mechanism 72 which is illustrated in FIG. 13. The ejector mechanism 72 comprises three spaced vertical rods 73 mounted on a horizontal plate 75 which is reciprocable by a vertical push rod 75a mounted in a bearing 75b carried by the upper side of the frame cover 9b. The lower end of the push rod 75a extends into the frame 9 and carries a follower roller 75c which scans the periphery of a cam 74 mounted on the main drive shaft 22 (see FIG. 4). When the disk 2 is arrested in a position to hold three filled cartridges 13 directly above the upper ends of ejector rods 73, the cam 74 allows the push rod 75a to move in upward direction and to advance the rods 73 through the respective bores 21 into the recesses 15 whereby the filled cartridges 13 are ejected in upward direction and re-enter the grooves 12 to have their upper ends sealed by the respective caps 14.

As is shown in FIG. 4, the horizontal plate 75 further supports a second set of comparatively longer ejector rods 76a which constitute a second ejector mechanism 76 and are disposed in a group of three in the tangential direction of the upper disk 1 to be aligned with a group of grooves 12 when the member 1 is brought to a halt. The purpose of second ejector rods 76a is to expel a group of filled and sealed capsules 5 from the upper disk 1, the capsules being ejected into a chute 77 (see FIG. 3) which conveys the same to a collecting, storing or packaging station, not shown.

The operation of the machine M is as follows:

As soon as the disks 1, 2 are arrested by the braking roller 35 (see FIG. 5), the dispensing device 6 delivers three empty capsules 5 into the grooves 12 momentarily located at the first transfer station 16. The lower ends of the caps 14 forming part of capsules 5 come into abutment with the shoulders 78 (see FIG. 8). As mentioned hereinbefore, the lower zones of the grooves 12 are of smaller diameter just sufficient to receive the cartridges 13 with a certain amount of friction.

When the disks 1 and 2 are arrested, one group of the latter's recesses 15 is in exact alignment with the vertical channels 19 of the suction or vacuum head 18 at the first transfer station 16. The head 18 withdraws air from the bores 21 and from the recesses 15, and causes the transfer of empty cartridges 13 from the grooves 12 into the recesses 15 while the disks 1 and 2 are still held against rotation by the aforementioned braking roller 35 which then partially enters one of the slots 32 in the segment wheel 33 (see FIG. 5). The shoulders 78 prevent the caps 14 from following the downward movement of the cartridges 13.

As the main drive shaft 22 continues its rotation, the revolving arm 29 moves the roller 31 into another slot 32 and advances the disks 1, 2 through angles respectively, whereby the recesses 15 with empty cartridges 13 therein are transferred by the disk 2 into vertical alignment with the channels 42 of the control means 39 (see FIG. 10). As described in connection with FIG. 10, when each of the grooves 15 momentarily located above the head 41

of the control device 39 contains an empty cartridge 13, the switch 45 remains closed and completes the circuit 46. However, if the suction head 18 failed to transfer one or more cartridges from the grooves 12 into the recesses 15 at the first transfer station 16, atmospheric pressure prevails in the channel 43 and the switch 45 drops away from its terminal 45a to arrest the motor of the main drive shaft 22. The main purpose of the control device 39 is to prevent filling of granular or powdery material into an empty recess 15 at the stations of assemblies 7—7c. The material would fill up the recess to prevent entry of an empty cartridge, or would go to waste by flowing through the bore 21 therebelow.

As the disk 2 continues its intermittent rotation through successive angles in the direction of the arrow 79a, the empty cartridges 13 in grooves 15 are advanced below the first filling assembly 7. The paddle wheel 48 of the assembly 7 fills each cartridge with a powdery or granular material up to the level of the upper disk surface 2b. The material entering the empty cartridges 13 simultaneously expels air therefrom, the evacuation of air from the container 47 of assembly 7 being facilitated by the action of continuously revolving pins 55. Upon further advance of the disk 2 through another angle, the filled cartridges 13 are brought into alignment with the heads 67 forming part of rams 62 in the first material packing or compacting device 8. The cam 71 then causes the carrier member 66 to descend whereby the rams 62 on the leg 64 descend into the cartridges 13 to bring about a preliminary compression of the material therein.

Upon further advance of the disk 2 through an additional angle, the cartridges 13 are moved below the cutout 53 in the container 47 forming part of the second filling assembly 7a. The latter's paddle wheel 48 then refills the cartridges up to the level of the upper disk surface 2b, whereupon the material is again compressed by the rams of the second compacting device 8a. The same procedure is followed at the filling assembly 7b and at the third compacting device 8b. The purpose of the fourth and last filling assembly 7c is to completely fill each cartridge 13 before the cartridges advance to the second transfer station 17. At this station, the first ejector rods 73 are moved in upward direction by the member 75a (see FIG. 4) to eject the filled cartridges from their respective recesses and to introduce the same into the lower zones of the grooves 12 thereabove. As can be observed in FIG. 13, a stop plate 82 adjacent to the upper side 1c of the upper disk 1 prevents ejection of filled and sealed capsules 5 from the member 1 at the second transfer station 17.

Upon further advance of the disk 1 through one or more angles in the direction of the arrow 79, the filled and assembled capsules 5 are brought into alignment with the rods 76a of the second ejector mechanism 76 shown in FIG. 4. These rods eject the capsules into the conveyor or chute 77 which advances the capsules to a packaging or storing station, e.g. directly into suitable containers ready for labelling, storage or shipment.

By providing two or more filling assemblies and a corresponding number of compacting devices, the novel machine may be utilized not only in connection with powdery but also with granular and even spherical substances. In addition, the aforementioned screw or worm conveyor means, presently utilized in conventional capsule filling and assembling machines, may be dispensed with, which is of advantage because the worms deliver the material at considerable pressures resulting in the formation of air pockets and consequent unsatisfactory filling of the cartridges. The rotary studs 55 provide a number of paths for the escape of air from the cartridges, and the groups of compacting rams 62 insure satisfactory compression of powdery, granular or spherical particles in the cartridges 15 to render the formation of air pockets practically impossible.

It will be understood that certain of the elements,

mechanisms and assemblies described above, or two or more together, may also find a useful application in other types of capsule filling and assembling machines differing from the machine which was described hereinabove.

Without further analysis the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of disks mounted for intermittent rotary movements about spaced parallel axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which each in one group of grooves is vertically aligned with each of one group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges into the recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

2. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of disks mounted for intermittent rotary movements about spaced vertical axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, one of the disks being formed with bores arranged in a plurality of tangentially disposed groups and the other disk being formed with bores arranged in a plurality of radial rows, the bores in the overlapping disk being of such shape as to receive the capsules and the bores in the overlapped disk being of such shape as to receive the cartridges, the overlapping portions of said disks defining a first and a second transfer station at which each of one group of bores in one of said disks is vertically aligned with one of a row of bores in the other disk during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the bores of the overlapping disk whereby each bore of said overlapping disk contains an empty capsule at said first transfer station; means located at said first transfer station for moving the cartridges into the bores of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each bore of the overlapped disk at said first transfer station; means for introducing a substance consisting of freely flowing comparatively small solids into each cartridge at at least one point intermediate said transfer stations; and means at second transfer station for returning the filled cartridges from the bores in the overlapped disk into the bores of the overlapping disk.

3. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of disks mounted for

intermittent rotary movements about spaced vertical axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges into the recesses of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each recess of the group of recesses at said first transfer station; means for introducing a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; means at said second transfer station for returning filled cartridges from the recesses into the grooves thereabove; and means for ejecting the capsules from the grooves of the overlapping disk at a point beyond the second transfer station.

4. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of disks mounted for intermittent rotary movements about spaced vertical axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk at said first transfer station; means located at said first transfer station for moving the cartridges into the recesses of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each recess of the group of recesses at said first transfer station; means for introducing a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning filled cartridges from the recesses into the grooves thereabove.

5. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude, said driving means comprising a constantly driven main shaft, an arm driven by said main shaft, a pawl carried by said arm, a segment wheel fixed to one of said vertical shafts and formed with a plurality of radial slots each adapted to receive said pawl whereby the pawl rotates the segment wheel and said one vertical shaft through a given angle during each revolution of the main shaft, and a gear train between said one and the other vertical shaft for rotating the latter through a second given angle when the one vertical shaft rotates; a disk mounted on and connected for rotation to each of said vertical shafts, each of said disks being disposed in a horizontal plane and the distance between the vertical shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of vertical grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of vertical

recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent rotation of said disks while the pawl is moved out of a slot in said segment wheel; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the group of grooves of the overlapping disk into the group of recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning the filled cartridges from the group of recesses into the group of grooves thereabove.

6. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude, said driving means comprising a constantly driven main shaft, means for transforming constant rotary motion of said main shaft into intermittent rotary movements of one of said vertical shafts, and means driven by said one vertical shaft for rotating the other vertical shaft through a second given angle when the one vertical shaft is rotated through a first given angle; a disk mounted on and connected for rotation to each of said vertical shafts, each of said disks being disposed in a horizontal plane and the distance between the vertical shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of vertical grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of vertical recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent rotation of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the group of grooves of the overlapping disk into the group of recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning the filled cartridges from the group of recesses into the group of grooves thereabove.

7. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude, said driving means comprising a constantly driven main shaft, an arm driven by said main shaft, a pawl carried by said arm, a segment wheel fixed to one of said vertical shafts and formed with a plurality of radial slots each adapted to receive said pawl whereby the pawl rotates the segment wheel and said one vertical shaft through a given angle during each revolution of the main shaft, and a gear train between said one and the other vertical shaft for rotating the latter through a second given angle when the one vertical shaft rotates; brake means comprising a spring biased member permanently engaging with said segment wheel and at least partially extending into one of said slots for yieldably holding the segment wheel and said vertical shafts against rotation when the arm moves said pawl out of another of said slots; a disk mounted on and connected for rotation to each of said vertical shafts, each of said disks

being disposed in a horizontal plane and the distance between the vertical shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of vertical grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of vertical recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent rotation of said disks while the pawl is moved out of a slot in said segment wheel; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the groups of grooves of the overlapping disk into the group of recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning the filled cartridges from the group of recesses into the group of grooves thereabove.

8. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude, the angles through which the one of said shafts is advanced by said driving means being different from the angles described by the other shaft; a disk mounted on and connected for rotation with each of said shafts, each of said disks being disposed in a horizontal plane and the distance between the shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges into the recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; and means at said second transfer station for returning the filled cartridges from the group of recesses into the group of grooves thereabove.

9. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude; a disk mounted on and connected for rotation with each of said shafts, each of said disks being disposed in a horizontal plane and the distance between the shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the

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recesses of the overlapped disk; means or filling a substance consisting of comparatively small solid particles into each cartridge at least one point intermediate said transfer stations; a control device located between said first transfer station and said filling means for arresting the intermittent movements of said disks if an empty recess is advanced toward said filling means; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

10. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor which comprises, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude; a disk mounted on and connected for rotation with each of said shafts, each of said disks being disposed in a horizontal plane and the distance between the shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; a control device located between said first transfer station and said filling means for arresting the intermittent movements of said disks if an empty recess is advanced toward said filling means, said control device comprising vacuum generating means including a suction head having at least one first channel communicating with a recess in said overlapped disk at a point intermediate said first transfer station and said filling means during an interval between the intermittent movements of said disks, a second channel communicating with each first channel and having an open end, and an electric circuit for said driving means including a switch adjacent to the open end of said second channel, the switch completing said circuit when each recess communicating with a first channel contains a cartridge and vacuum is generated in said second channel, and the switch opening said circuit to arrest the driving means when a recess communicating with a first channel is empty and substantially atmospheric pressure prevails in said second channel; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

11. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks mounted for intermittent rotary movements about spaced vertical axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping

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disk into the recesses of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each recess of the group of recesses at said first transfer station; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; first ejector means at said second transfer station for returning filled cartridges from the recesses into the grooves thereabove, said first ejector means comprising a plurality of vertically reciprocable rods, one for each recess in a group of recesses, said rods disposed below said overlapped disk and extendable into the group of recesses at said second transfer station for moving filled cartridges upwardly into the grooves thereabove; and second ejector means for ejecting the capsules from the grooves of the overlapping disk at a point beyond the second transfer station, said second ejector means comprising a plurality of vertically reciprocable rods, one for each groove in a group of grooves, said last mentioned rods disposed below the overlapping disk and extendable into the group of grooves thereabove for ejecting the capsules therefrom.

12. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks mounted for intermittent rotary movements about spaced vertical axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each recess of the group of recesses at said first transfer station; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; first ejector means at said second transfer station for returning filled cartridges from the recesses into the grooves thereabove, said first ejector means comprising a plurality of vertically reciprocable rods, one for each recess in a group of recesses, said rods disposed below said overlapped disk and extendable into a group of recesses at said second transfer station for moving filled cartridges upwardly into the grooves thereabove; second ejector means for ejecting the capsules from the grooves of the overlapping disk at a point beyond the second transfer station, said second ejector means comprising a plurality of vertically reciprocable rods, one for each groove in a group of grooves, said last mentioned rods disposed below the overlapping disk and extendable into the group of grooves thereabove for ejecting the capsules therefrom; and means for simultaneously reciprocating the rods of said first and second ejector means.

13. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of vertical shafts; means for intermittently driving said shafts through angles of unchanging magnitude, said driving means comprising a constantly driven main shaft, means for transforming constant rotary motion of said main shaft into intermittent rotary movements of one of said vertical shafts, and means driven by said one vertical shaft for rotating the other vertical shaft through a second given

angle when the one vertical shaft is rotated through a first given angle; a disk mounted on and connected for rotation to each of said vertical shafts, each of said disks being disposed in a horizontal plane and the distance between said vertical shafts being such that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves arranged in a plurality of groups for receiving the capsules and the overlapped disk being formed with a plurality of recesses arranged in a plurality of groups for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at each of which a group of grooves is vertically aligned with a group of recesses during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove of the group of grooves at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the group of grooves of the overlapping disk into the group of recesses of the overlapped disk, said last mentioned means comprising a device for generating vacuum in each recess of the group of recesses at said first transfer station; means for filling a substance consisting of comparatively small solid particles into each cartridge at at least one point intermediate said transfer stations; first ejector means at said second transfer station for returning filled cartridges from the recesses into the grooves thereabove, said first ejector means comprising a plurality of vertically reciprocable rods, one for each recess of a group of recesses, said rods disposed below said overlapped disk and extendable into the recesses of the group of recesses at said second transfer station for moving filled cartridges upwardly into the grooves thereabove; second ejector means for ejecting the capsules from the grooves of the overlapping disk at a point beyond the second transfer station, said second ejector means comprising a plurality of vertically reciprocable rods, one for each groove in a group of grooves, said last mentioned rods disposed below the overlapping disk and extendable into the grooves thereabove for ejecting the capsules therefrom; and means for simultaneously reciprocating the rods of said first and second ejector means, said reciprocating means comprising a plate like member supporting each rod of said first and second ejector means, a cam fixed to said main shaft, a push rod having an end connected to said plate like member and another end, and a follower connected to the other end of said push rod and scanning the periphery of said cam.

14. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks each having an upper side and mounted for intermittent rotary movements about spaced parallel axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk; at least two spaced filling assemblies for introducing a material consisting of comparatively small solid particles into each cartridge at points intermediate said transfer stations, each filling assembly comprising a cylindrical container for receiving the material to be filled into the cartridges and having a cutout for reception of a zone of said overlapped disk, a driven pad-

dle wheel in said container adjacent to the upper side of said overlapped disk for introducing the material into the cartridges received in each recess formed in that zone of the overlapped disk which extends into said cutout, an upwardly extending concentric inlet tube connected to and communicating with said container, a hopper for the material to be filled into the cartridges located above and communicating with said tube, and at least one eccentric stud connected for rotation to said paddle wheel and extending upwardly into said tube for stirring the material descending from the hopper into said container; at least one packing device located between said transfer stations and past at least one of said filling assemblies for compacting the material in said cartridges; the spacing between said filling assemblies and each packing device being such that at least one recess is aligned therewith during the intervals between the intermittent movements of said disks; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

15. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks each having an upper side and mounted for intermittent rotary movements about spaced parallel axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk; at least two spaced filling assemblies for introducing a material consisting of comparatively small solid particles into each cartridge at points intermediate said transfer stations, each filling assembly comprising a cylindrical container for receiving the material to be filled into the cartridges and having a cutout for reception of a zone of said overlapped disk, a driven paddle wheel in said container adjacent to the upper side of said overlapped disk for introducing the material into the cartridges received in each recess formed in that zone of the overlapped disk which extends into said cutout, an upwardly extending concentric inlet tube connected to and communicating with said container, a hopper for the material to be filled into the cartridges located above and communicating with said tube, and at least one eccentric stud connected for rotation to said paddle wheel and extending upwardly into said tube for stirring the material descending from the hopper into said container; at least one packing device located between said transfer stations and past at least one of said filling assemblies for compacting the material in said cartridges, the spacing between said filling assemblies and each packing device being such that at least one recess is aligned therewith during the intervals between the intermittent movements of said disks; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

16. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks mounted for intermittent rotary movements about spaced parallel axes at such distances from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped

disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk; at least two spaced filling assemblies for introducing a material consisting of comparatively small solid particles into each cartridge at points intermediate said transfer stations; at least one packing device located between said transfer stations and past at least one of said filling assemblies for compacting the material in said cartridges, each packing device comprising a supporting leg located above and vertically reciprocable toward and away from the overlapped disk, and at least one ram mounted on said leg and of such configuration as to be extendable into a cartridge therebelow when the supporting leg is moved toward the overlapped disk, the spacing between said filling assemblies and each packing device being such that at least one recess is aligned with each filling assembly and a recess is aligned with each ram of each packing device during each interval between the intermittent movements of said disks; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

17. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks mounted for intermittent rotary movements about spaced parallel axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridge from the grooves of the overlapping disk into the recesses of the overlapped disk; at least two spaced filling assemblies for introducing a material consisting of comparatively small solid particles into each cartridge at points intermediate said transfer stations; at least one packing device located between said transfer stations and past at least one of said filling assemblies for compacting the material in said cartridges, each packing device comprising a supporting leg located above and vertically reciprocable toward and away from said overlapped disk, at least one ram vertically reciprocably mounted in said leg and of such configuration as to be extendable into a cartridge therebelow when the supporting leg is moved toward the overlapped disk, and resilient means mounted in said

leg for constantly biasing each ram in downward direction, the spacing between said filling assemblies and each packing device being such that at least one recess is aligned with each filling assembly and at least one recess is aligned with each ram of each packing device during each interval between the intermittent movements of said disks; and means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove.

18. An apparatus for filling and sealing capsules each consisting of a cartridge and a cover therefor, the apparatus comprising, in combination: a pair of disks mounted for intermittent rotary movements about spaced parallel axes at such distance from each other that a portion of one disk overlaps a portion of the other disk, the overlapping disk being formed with a plurality of grooves for receiving the capsules and the overlapped disk being formed with a plurality of recesses for receiving the cartridges of the capsules, the overlapping portions of said disks defining a first and a second transfer station at which at least one groove is vertically aligned with a recess during the intervals between the intermittent movements of said disks; means for dispensing empty capsules into the grooves of said overlapping disk whereby each groove at said first transfer station contains an empty capsule; means located at said first transfer station for moving the cartridges from the grooves of the overlapping disk into the recesses of the overlapped disk; a plurality of spaced filling assemblies for introducing a material consisting of comparatively small solid particles into each cartridge at points intermediate said transfer stations; a plurality of packing devices each located between a pair of adjacent filling assemblies and each comprising a supporting leg located above and vertically reciprocable toward and away from the overlapped disk, and at least one ram mounted on each leg and of such configuration as to be extendable into a cartridge therebelow for compacting the material therein when the respective leg is moved toward said overlapped disk, a common carrier connected with each of said legs, and means for reciprocating said carrier in rhythm with the intermittent movements of said disks, the spacing between said filling assemblies and said packing devices being such that at least one recess is aligned with each filling assembly and a recess is vertically aligned with each of said rams during each interval between the intermittent movements of said disks; means at said second transfer station for returning the filled cartridges from the recesses into the grooves thereabove; and means located past said second transfer station for ejecting the capsules from the grooves of said overlapping disk.

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