(No Model.) 3 Sheets—Sheet 1.

R. SHOEMAKER, Jr.

PILL COMPRESSING MACHINE.

No. 527,562. Patented Oct. 16, 1894.

FIG. 2.

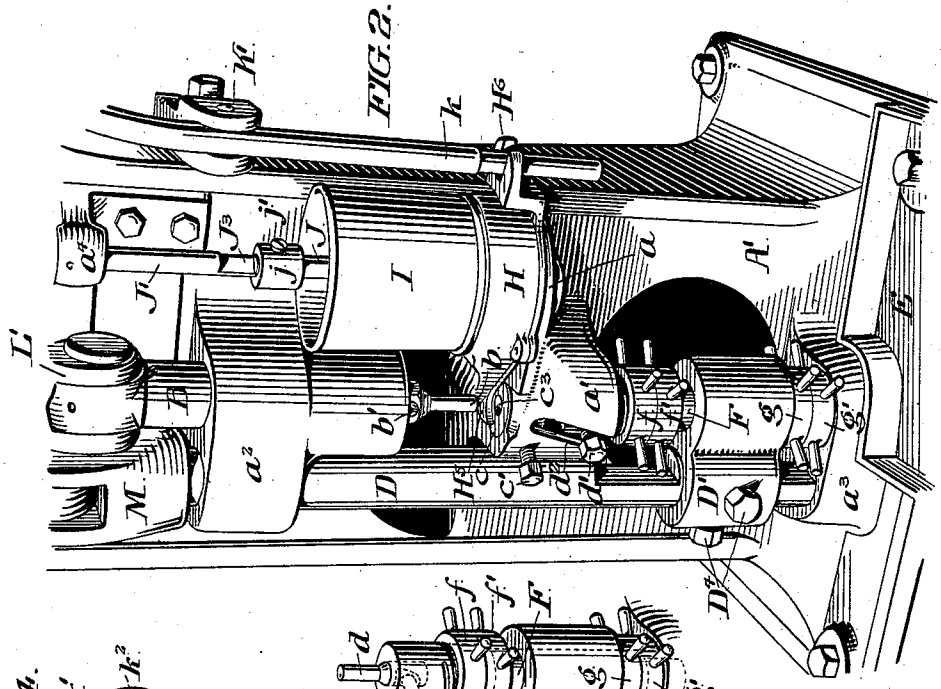


FIG. 4.

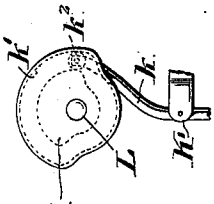


FIG. 3.

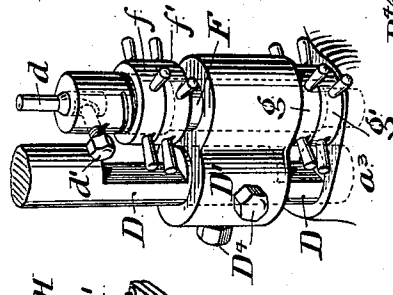
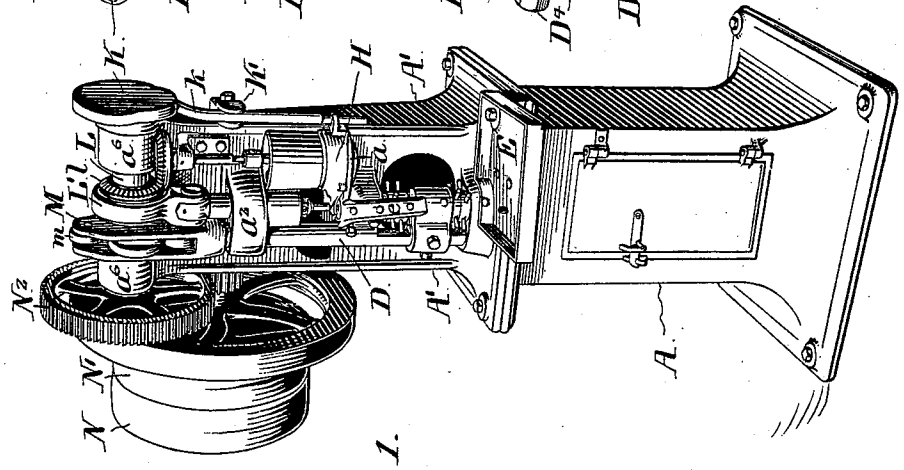


FIG. 1.



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(No Model.) 3 Sheets—Sheet 2.

R. SHOEMAKER, Jr.

PILL COMPRESSING MACHINE.

No. 527,562. Patented Oct. 16, 1894.

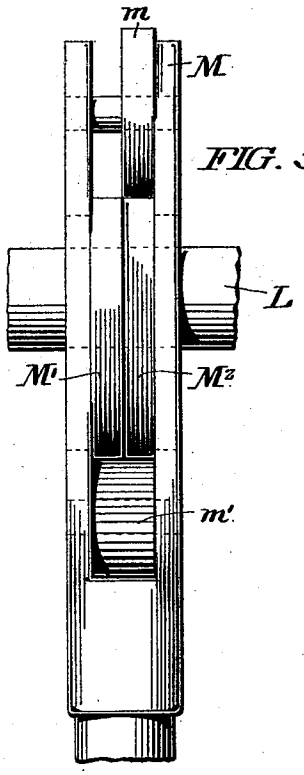


FIG. 5.

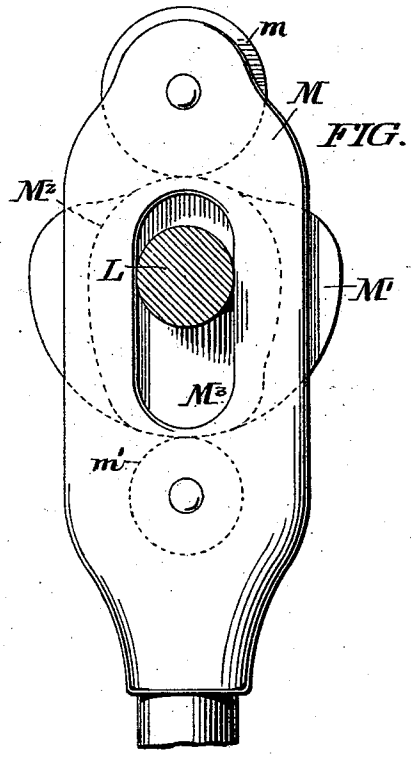


FIG. 6.

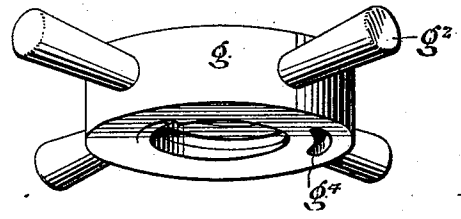


FIG. 7.

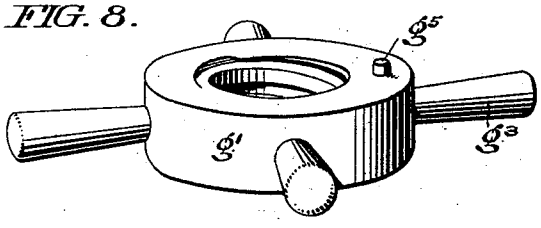
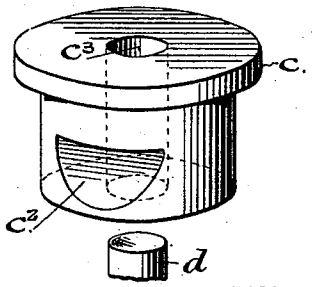


FIG. 8.

FIG. 9.

FIG. 10.



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(No Model.) 3 Sheets—Sheet 3.

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PILL COMPRESSING MACHINE.

No. 527,562. Patented Oct. 16, 1894.

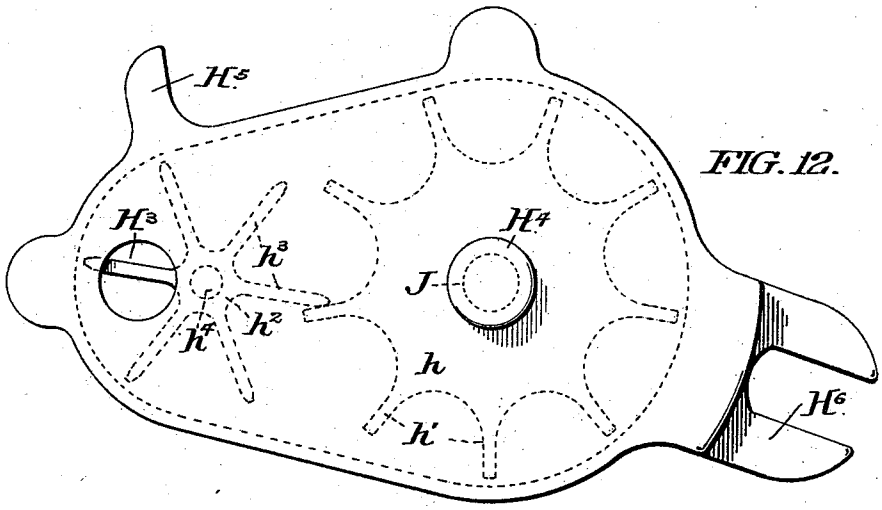
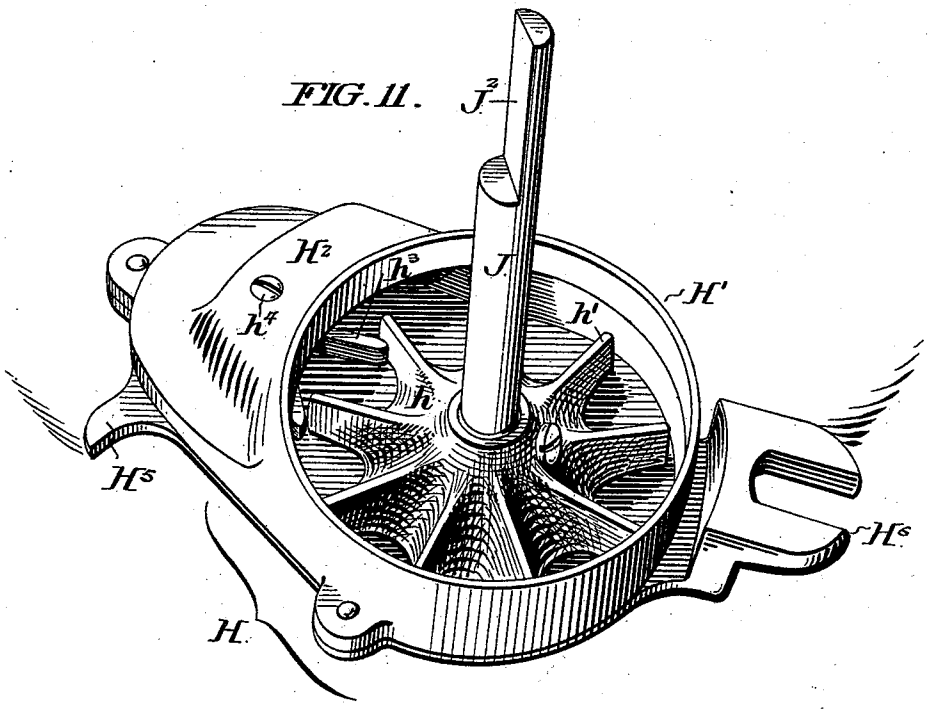


FIG. 12.

FIG. 11.



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UNITED STATES PATENT OFFICE.

ROBERT SHOEMAKER, JR., OF PHILADELPHIA, PENNSYLVANIA.

PILL-COMPRESSING MACHINE.

SPECIFICATION forming part of Letters Patent No. 527,562, dated October 16, 1894.

Application filed December 22, 1892. Serial No. 455,998. (No model.)

To all whom it may concern:

Be it known that I, ROBERT SHOEMAKER, Jr., of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Pill-Compressing Machines, whereof the following is a specification, reference being had to the accompanying drawings.

In said drawings Figure 1 represents, in perspective, the complete machine; Fig. 2 being a partial view, also in perspective, and on an enlarged scale. Fig. 3 is a view of the lower plunger and its actuating rod, showing the details of mechanism for its adjustment. Fig. 4 is a view in side elevation, of the cam for actuating the feed-box. Figs. 5 and 6 are respectively side and front elevations of the cam for actuating the lower plunger. Figs. 7 and 8 are detail views of the adjusting device for said plunger. Fig. 9 is a view of the upper plunger. Fig. 10 is a similar view of the die or mold in which the plungers operate, showing also the head of the lower plunger. Fig. 11 is a top view, in perspective, of the vibrating feed-box, showing the interior thereof, and Fig. 12 is a view of the bottom of said box, the working parts being indicated by dotted lines.

My improvements relate chiefly to the mechanism for operating and adjusting the plungers so as to produce pills or tablets of any desired thickness, and also to the feeding mechanism whereby material is supplied to the plungers; minor features of the invention being directed toward simplifying the construction of the apparatus and facilitating the removal of the parts for cleaning purposes, &c.

Referring to the drawings, A represents a pedestal upon the top of which is mounted the standard, A′, of the machine. About midway of the height of said standard a horizontal table, *a*, is formed therein, a portion of which overhangs or projects forward beyond the face of the said standard, as indicated. Above said table the standard is arched over and continues upward so as to form a solid housing or support for the driving shaft, L, which is mounted across the top thereof in the bearings, a^6, a^6.

The die, *c*, in which the plungers come together to compress the pill, is fitted snugly in a circular recess in the table, *a*, the top of the die being just flush with the upper surface of the table. Said die is held in position by means of a screw, *c′*, which runs through the edge of the table and bears against the inclined surface of a recess, c^2, in the side of the die, (see Fig. 10,) the pressure of the screw of course tending to force the die downward into close contact with the seat.

Above and beneath that portion of the table in which the die, *c*, is mounted, the standard is provided with brackets, a^2, a^3, respectively, having vertical openings in which the rods carrying and actuating the plungers are respectively supported and guided.

The rod, B, carries at its lower end the upper plunger, *b*, whose head, b^3, (see Fig. 9) is provided with an inclined recess, b^2, so that the plunger can be forced by means of the screw, *b′*, into close contact with the rod. Said rod, B, is pivotally attached, at its upper end to the strap, L′, of an eccentric mounted upon the driving shaft, L, whereby the vertical reciprocation of the rod and upper plunger is effected, the range of movement being such as in descending, to thrust the plunger, *b*, down a short distance into the opening, c^3, of the die, *c*, and in rising, to clear the upper face of said die by a distance sufficiently large to admit the approach of the feeding device, which will hereinafter be described.

The actuating rod, D, of the lower plunger is supported and guided, near its upper end, in the bracket, a^2, and at its lower end, in the bracket, a^3, and passes through a horizontally projecting head, D′, detachably secured to it near its lower end, by means of the set screws, D^4. Parallel to the opening through which the rod, D, passes, a second vertical opening is formed through the projecting portion of the head, D′, in which a stem, F, fits snugly, but so as to move freely, said stem being guided at its lower end in the bracket a^3. Portions of the stem above and below the head, D′, are threaded to receive the adjusting nuts, *f*, *f′*, *g*, *g′*, respectively, the details of whose construction are shown in Figs. 7 and 8, the respective pairs being alike.

By referring to the detail views it will be seen that upon the under surface of the nut, *g*, an arc-shaped slot, g^4, is formed to receive a vertical stud or pin, g^5, mounted upon the

upper face of the nut, g'. Thus when the nuts are in such close proximity that the stud engages with the slot, rotation of one nut will will be transmitted to the other, so that they will move together, but independent movement within the limits of the slot, g^4, is also permitted, and thus their faces can be brought closely together to lock one another and prevent slipping. Arms, g^2, g^3, are provided to afford means for rotating the nuts. The construction of the other pair of nuts, f, f', is similar to that just described.

In order to polish the pill and also to prevent it adhering to the die after compression, I give the under plunger which carries the pill out of the die a slightly torsional movement. This may be conveniently accomplished by presenting a stud upon the lower plunger which is made to engage with suitably inclined bearing pieces upon the frame, and to produce the desired result in the present instance in the upper end of the stem, F, the lower plunger, d, is secured by means of a stud in the form of the set screw, d', whose end projects out through a slot between the inclined bearing pieces in the overhanging edge of the table, a. Said plunger is of course arranged in position to enter the cavity, c^3, of the die from below. It will be observed that when the nuts, $f\,f'$, $g\,g'$, are secured in position, leaving the intermediate portion of the rod, F, free to slide vertically for a short distance in the opening of the head, D', the vertical reciprocation of the rod, D, to which said head is attached, will intermittently raise and depress the plunger, d, by striking alternately against the under surface of the nut, f', and upper surface of the nut, g, the range or extent of movement being determined by the position of the upper and lower nuts with relation to the proximate faces of the head, D'. The upper limit of the movement of the plunger, d, is such as to bring its end substantially flush with the top surface of the die, c. Its downward movement is adjusted with relation to the thickness of the pill or tablet to be compressed. The vertical reciprocation of the rod, D, and consequently of the lower plunger is timed, in a manner which will hereinafter be described, with relation to the upper plunger and to the feeding and discharging mechanism, the timing of the rod's movements being produced by means of the double cams shown in detail in Figs. 5 and 6.

Upon the upper end of the rod, D, is mounted a slotted head, M, in the side of which, elongated openings, M^3, are formed to embrace the driving shaft, L, and to permit the vertical movement of the head with relation thereto. In the slot of the head and above and below said openings respectively are mounted the cam rollers, m, m', said rollers being journaled in the sides of the head, and being constructed as shown in Fig. 5, where it will be seen that the roller, m, extends half way across the slot, while the roller, m', may extend as shown entirely across the same. Upon that portion of the driving shaft, L, which is embraced between the sides of the slotted head, M, are rigidly secured the cams, M', M^2, the former of which engages operatively with the roller, m', the other with the roller, m.

The cam surfaces have the configuration indicated in Fig. 6, and are in such relation to one another that the distance between those surfaces, which at any given moment are respectively bearing against the upper and lower rollers, is a constant one. Thus the rod, D, is in positive engagement, not only during its whole movement, but during its periods of rest.

The feeding and discharging devices will now be described. They comprise a feed-box pivotally mounted upon the top of the table, a, and agitating or stirring mechanism within said box. The feed-box, H, is open on top at one end and provided with a vertically projecting cylindrical rim, H', the other end of the box being covered, as indicated at H^2. Concentrically with the cylindrical rim, H', a vertical shaft, J, extends through the bottom of the box, where it is provided with a boss, H^4, which fits snugly, but so as to rotate freely, in an opening in the top of the table, said shaft thus forming a pivot or axis upon which the feed-box can be oscillated, as will hereinafter be described. Said shaft also carries, within the feed-box, an agitator or stirrer, h, having radial arms, h', adapted to rotate in close proximity to the covered end wall of the box and having the surface between said arms inclined or flaring outwardly, as shown in the perspective view of Fig. 11. Said arms engage with the arms, h^3, of a second agitator or stirrer, h^2, rotatably mounted upon an axis, h^4, in the closed or covered end of the feed-box, the ends of said arms, h^3, being arranged to rotate in close proximity to the end wall of that portion of the box. In the bottom of the feed-box, near the closed end and beneath the path traversed by the arms, h^3, is a hole H^3, corresponding in size to the cavity, c^3, of the die, c, and so arranged with reference to the center of oscillation of the feed-box as to register with said cavity; c^3, when the closed end of the feed-box is brought over the die. A laterally projecting finger, H^5, is formed upon the side of the feed-box, H. at a point opposite to the hole, H^3, the position of said finger being such as to sweep across the top of the die, c, during the oscillation of the feed-box. At the end of the feed-box which is farthest from the hole, H^3, a bifurcated arm, H^6, is mounted, which receives the lower end of the lever, k, pivoted at K' to a projection upon the side of the standard and provided at its upper end with a cam roller, k^2, which engages within a slot, k', formed on the inner face of the cam plate, K, mounted upon the end of the shaft L. The oscillation of the lever, k, by means of said cam, will cause the feed-box, H, to oscillate upon the shaft, J, as a center, so as to alternately throw the closed end of the feed-

box over and away from the cavity, c^3, of the die c.

Immediately above the cylindrical rim, H′, of the open end of the feed-box, and fitting closely thereupon is a hopper, I, into which the material to be compressed is fed, said hopper forming in effect an upward prolongation of the cylindrical arm, H′, but being capable of detachment, to permit the removal of the feed-box and stirring mechanism, as will be hereinafter described.

The shaft, J, upon which the feed-box, H, oscillates, and which also carries the stirrer, h, terminates at its upper end in an offset, J^2, as indicated in Fig. 11. Said shaft is coupled by means of a sleeve, j, and set screw, j', to a vertical shaft, J′, provided with a similar offset, J^3, which fits upon and engages with the offset, J^2. The length of the offsets upon these shafts is such as to permit the upward movement of the shaft, J, with relation to the shaft, J′, to an extent sufficient to bring its lower end clear of the bottom of the box. When the shaft, J, is withdrawn in this manner it, together with the stirrer, h, can be lifted out and the feed-box, H, can be removed, so as to permit access to its interior for cleaning, &c.

The compound shaft, J J′, is actuated by means of bevel gears, one of which, l, is mounted upon the driving shaft, L, as indicated in Fig. 1, the other being mounted upon the top of the shaft, J′. A discharge chute, e, is supported upon a projecting bracket, a', extending beyond the table at a point in proximity to the opening, c^3, of the die c, and leads down so as to discharge the pills into a receptacle, E, secured to the base of the standard.

The driving shaft, L, is actuated by means of the gear, N^2, from a pinion whose shaft carries the fast and loose pulleys, N, N′, respectively.

The operation of the device is as follows: The material to be compressed, usually in the form of a dry powder, is fed into the hopper, whence it falls upon the inclined surface of the stirrer, h. The rotation of the latter not only agitates and mixes the material, but throws it radially outward so as to be caught by the arms of the second stirrer, h^2, by which it is carried around over and into the hole, H^3. When the feed-box is in such a position that said hole is immediately over the cavity, c^3, of the die c, the position of the plungers is as follows: The upper plunger, b, is in a raised position, so as to clear the top of the feed-box, while the lower plunger, d, is in its lowest position, so as to permit the desired quantity of material to fall into the cavity, c^3, of the die. The movement of the feed-box having been arrested sufficiently in this position to insure the discharge of enough material to fill the cavity, the return oscillation of the feed-box now takes place, the closed end thereof moving inwardly so as to clear the top of the die, as shown in Figs. 1 and 2. Thereupon the upper plunger, b, descends into the cavity and compresses the material against the lower plunger which rests during the period of compression. The movement of the stud (in the present instance the set screw, d',) in the slot, d^2, between the inclined bearing pieces, gives to the lower plunger a slight rotary movement, which polishes the surface of the pill and prevents adhesion. The upper plunger is then withdrawn and the lower plunger raised so as to eject the pill from the cavity. While the pill is still supported upon the end of the lower plunger the forward movement of the feed-box commences, and the finger, H^5, sweeps across the face of the die and throws the ejected pill or tablet into the chute, e, whence it is discharged into the receptacle, E. During the movement the lower plunger, d, descends so as to permit the entrance of a succeeding charge of material into the die and the series of operations is thereupon repeated.

Having thus described my invention, I claim—

1. The combination with the upper plunger and the die, of the lower plunger, a freely supported stem carrying said lower plunger; a laterally projecting stud arranged upon said stem; bearing pieces inclined at an angle to the direction of vertical movement of said stem and adapted to engage with said stud and actuating mechanism for said stem, substantially as set forth.

2. The combination with the lower plunger stem and the head embracing the same but sliding freely thereon, of a pair of nuts arranged upon the threaded portion of said stem in proximity to the range of movement of the head and actuating devices upon the proximate faces of said nuts whereby a limited range of movement of one nut with relation to the other is permitted, and the combined movement of said nuts beyond said range is effected, substantially as set forth.

3. A machine for compressing pills and the like comprising a die, compressing mechanism in operative relation thereto, a shaft journaled upon the frame of the machine, a feed box loosely fitting about said shaft said box having a discharge orifice adapted to register with the die, stirrers upon said shaft, means for rotating said shaft, and means for reciprocating said feed box about the shaft as a pivot; substantially as described.

4. In combination with complemental mechanism of a machine for compressing pills and the like, a feed box comprising communicating compartments, one of which is a supply compartment while in the other is a discharge orifice for the material to be fed, a stirrer in said supply compartment by which the material is fed into the discharge compartment, and a stirrer in said discharge compartment by which the material is fed to the compressing mechanism; substantially as described.

5. In combination with complemental mechanism of a machine for compressing pills and the like, a feed box comprising a base having a discharge orifice for the material to be fed,

a cover above the portion of said base containing the discharge orifice, the remainder of said box being open at the top to form a supply compartment, a hub with laterally projecting fingers journaled in said closed portion of the feed box and adapted to sweep over the discharge orifice, a stirrer in said supply compartment of the box, the arms of said stirrer engaging with the fingers in the closed portion of the box, and means for rotating said stirrer; substantially as described.

6. The combination with the plunger, the rod in operative connection therewith, the cams M′, M², the surface of each of which is at a constant distance from the diametrically opposite surface of the other, bearings upon said rod each of which constantly engages with one of said cams, and a driving shaft carrying said cams; substantially as described.

7. The combination with the oscillating feed-box and the stirrers arranged therein, of a two-part shaft operatively connected with one of said stirrers and projecting through the bottom of said box to form a center of oscillation therefor, the respective portions of said two-part shaft being capable of longitudinal movement with relation to one another to an extent greater than the projection of said shaft beneath the bottom of said box, whereby the removal of the stirrer from the box is permitted, substantially as set forth.

8. The combination with the lower plunger-carrying stem; the head engaging therewith and the rod carrying said head, of the cams, M′, M², the surface of each of which is at a constant distance from the diametrically opposite surface of the other; cam rollers mounted upon said rod each of which constantly engages with one of said cams, and a driving shaft carrying said cams, substantially as set forth.

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