3 Sheets—Sheet 1.

J. H. GILL.

Machine for the Manufacture of Compressed Pills.

No. 215,452. Patented May 20, 1879.

FIG. 1.

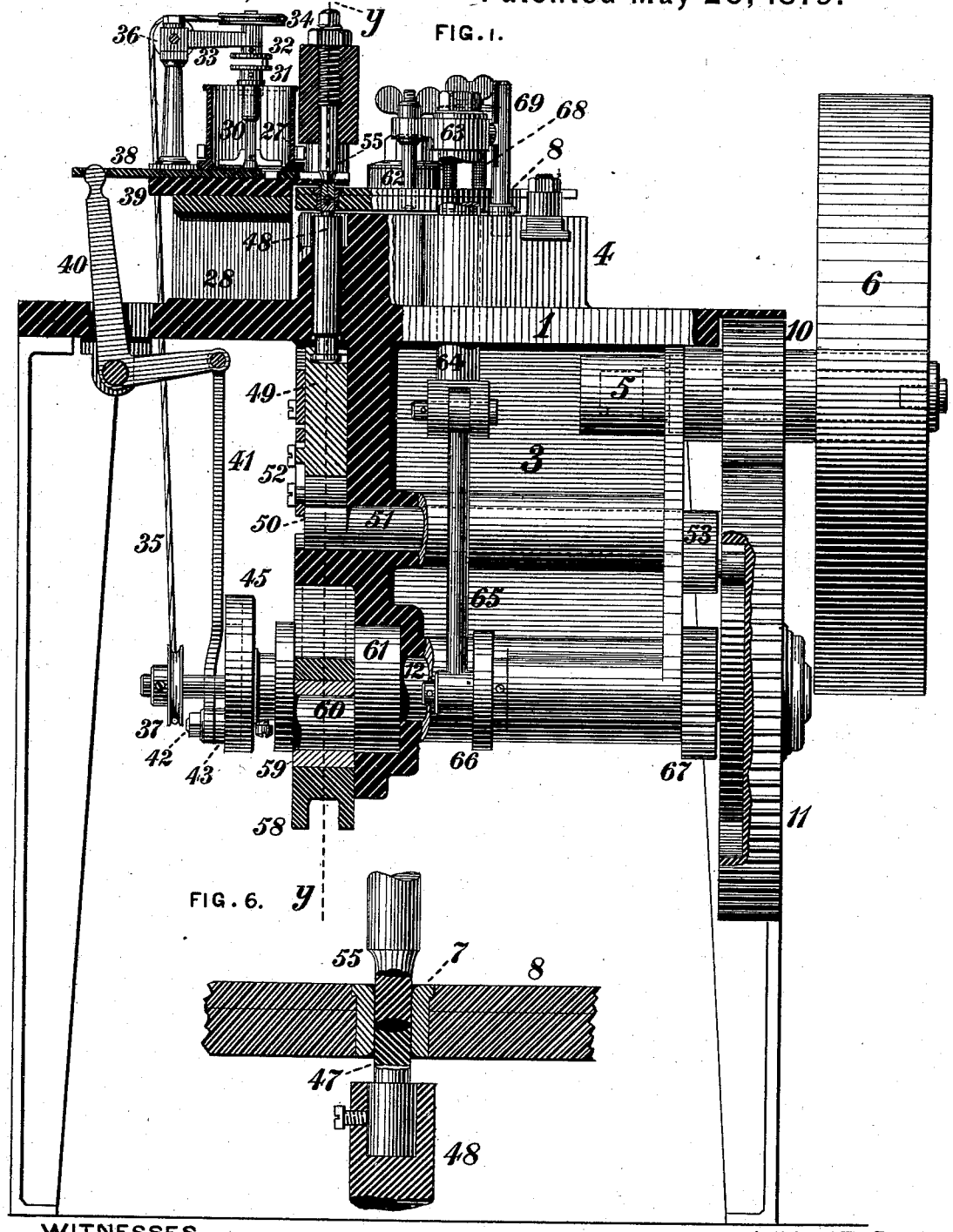

FIG. 6.

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FIG. 2.

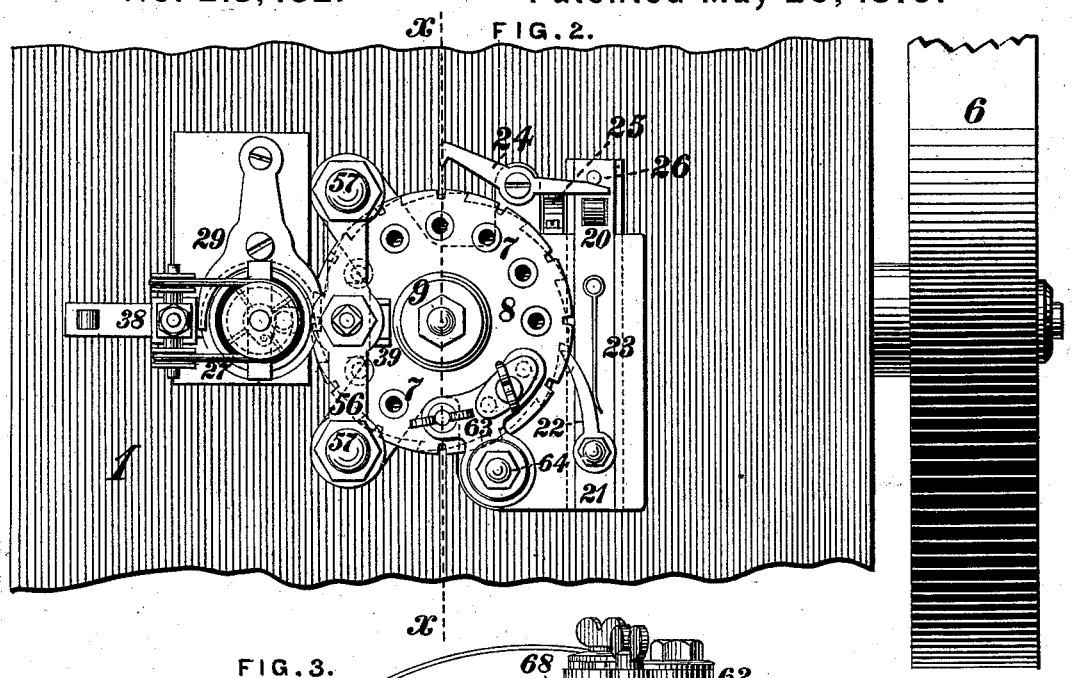

FIG. 3.

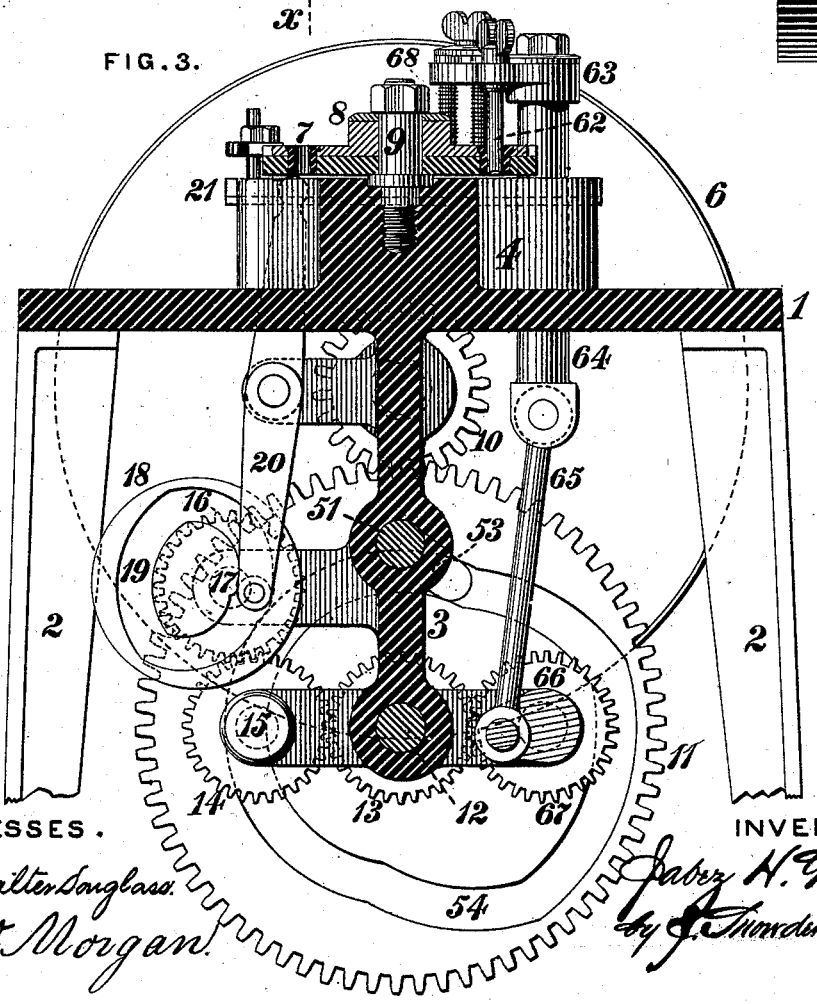

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FIG. 4.

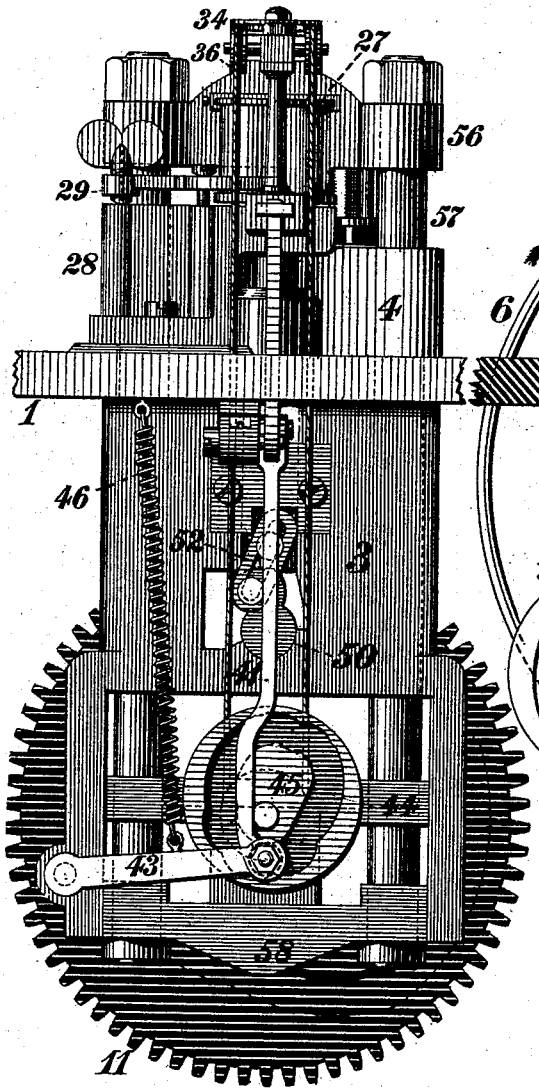
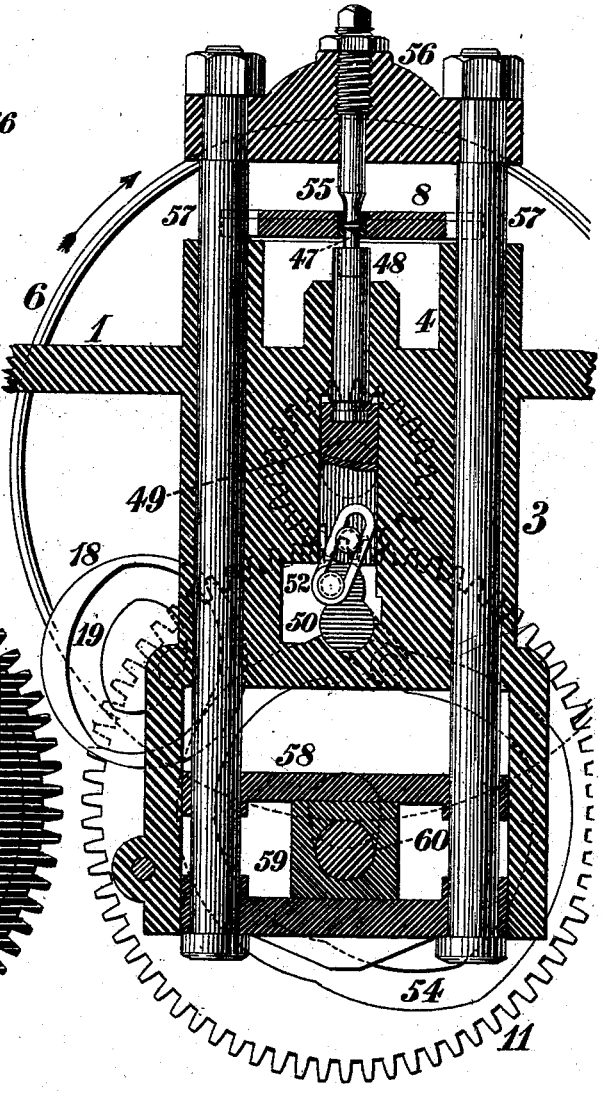


FIG. 5.



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UNITED STATES PATENT OFFICE.

JABEZ H. GILL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO HENRY BOWER, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR THE MANUFACTURE OF COMPRESSED PILLS.

Specification forming part of Letters Patent No. **215,452**, dated May 20, 1879; application filed March 28, 1879.

To all whom it may concern:

Be it known that I, JABEZ H. GILL, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Machines for the Manufacture of Compressed Pills, of which improvements the following is a specification.

My invention relates to machines designed for the formation of pulverized materials into pills by compression between dies or plungers; and its object is to provide, in such form and relation as to constitute a compact, durable, and efficient structure, a connected series of co-operating mechanisms, all actuated from a single driving-shaft, and serving, respectively, to perform the functions of feeding the pulverized material to molds within which it is to be compressed into pills of the required form and dimensions, successively moving said molds into and retaining them in proper position for the application of pressure to their contents, compressing the pulverized material within the molds, ejecting the finished pills therefrom, and cleaning the inner surfaces of the molds, the several operations being automatically and continuously performed in proper relation and sequence.

To this end my improvements consist in certain devices and combinations, including a carrier-disk or mold-wheel provided with a series of molds within which the pills are compacted, and having an intermittent movement of rotation imparted to it, a feed-hopper and feed-slide by which a proper quantity of pulverized material is successively supplied to each of the several molds of the carrier-disk, a reciprocating upper plunger or die, and an intermittently-reciprocating lower die or anvil, between which dies the material in the molds is compressed and solidified into finished pills, mechanism for alternately rotating the carrier-disk for a distance corresponding to the circumferential distance between the centers of two adjacent molds, and holding said carrier-disk stationary during the entrance of the dies into a mold, and a reciprocating ejector and cleaners, which, respectively, eject the finished pills from the molds and clear from the inner surfaces of the molds any particles of the pill ingredients that may adhere thereto, and thereby fit them for receiving a fresh supply. The improvements claimed are hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a side view, partly in section, at the center of the driving-shaft of a machine for manufacturing compressed pills embodying my improvements; Fig. 2, a plan or top view, a portion of the table and driving-pulley being broken away; Fig. 3, a vertical transverse section at the line *x x* of Fig. 2; Fig. 4, an end view from the left-hand side of Fig. 1; Fig. 5, a vertical transverse section at the line *y y* of Fig. 1; and Fig. 6 a vertical section, on an enlarged scale, through one of the molds of the carrier-disk, showing the compressing-dies.

The working parts of the machine are mounted and supported in a substantial metallic frame, consisting of a bed plate or table, 1, resting upon standards 2, and having a downwardly-projecting web or body, 3, and an upper block, 4. A horizontal driving-shaft, 5, is mounted in a bearing in the web 3 beneath the table, and carries a pulley, 6, through which power for the operation of the machine is transmitted from a suitable prime mover, this pulley being also made of proper weight and proportions to serve as a fly-wheel. The pulverized ingredients which are to be formed into pills are subjected to the action of compressive force within cylindrical molds 7, which are arranged in a circular series, and at equal distances apart, around and near the periphery of a carrier-disk or mold-wheel, 8, mounted so as to rotate freely upon a vertical stud, 9, projecting from the upper block, 4, of the frame. The molds 7 are made of hardened steel, and are inserted removably in the carrier-disk, so that molds of different diameters may be substituted when desired; and the carrier-disk 8 is, for convenience of construction, made in two sections, one above the other.

An intermittent movement of rotation is imparted to the carrier-disk in the following manner: The driving-shaft 5 carries a spur-pinion, 10, which meshes with a corresponding gear, 11, on a lower shaft, 12, which may be termed the "pressing-shaft," for the reason that it operates the upper die or pressing-plunger, as hereinafter to be described.

A spur-pinion, 13, on the shaft 12 meshes with a similar pinion, 14, on a short shaft, 15, mounted in a bearing on an arm projecting laterally from the web 3, and the pinion 14 in turn meshes with a pinion, 16, on one end of a shaft, 17, the opposite end of which shaft carries a cam, 18, having an irregularly-formed groove, 19, on one of its sides.

A double-armed lever, 20, is mounted at or near its center in a bearing on an arm projecting from the web 3, and has a roller on its lower end, which fits within the groove 19 of the cam 18. By the rotation of the shaft 17 a vibratory movement is imparted to the lever 20, the extent and character of which are governed by the form of the cam-groove 19. The upper end of the lever 20 fits into a slot in a slide, 21, working in a guide in the upper block, 4, and gives reciprocating movement to the slide 21, corresponding with the movement imparted to the lower end of the lever by the cam-groove.

A pawl, 22, is pivoted to the slide, and engages a series of ratchet-teeth on the lower portion of the periphery of the carrier-disk, its free end being pressed up to and kept in contact with the ratchet-teeth by a spring, 23, by which means an intermittent rotation is imparted to the carrier-disk 8, the latter being moved during the traverse of the slide in one direction a fraction of a revolution, the denominator of which fraction equals the number of molds which it contains, and remaining stationary during the traverse of the slide in the opposite direction.

A double-armed stop-lever or detent, 24, is pivoted to the upper block, 4, adjacent to the carrier-disk, and has a stop upon one of its ends, which engages a series of notches formed upon the periphery of the latter above its ratchet-teeth. A spring, 25, bearing against the opposite arm of the detent, presses its stop end against the periphery of the carrier-disk and into the notches thereon, except during such time as a pin, 26, on the slide 21 bears against the opposite arm of the detent, and releases it from the notch in which it has been engaged. The relation of the pin 26 and pawl 22 to the ratchet-teeth of the carrier-disk and the detent 24 is such that the detent is released from the notch of the carrier-disk just before the pawl engages a ratchet-tooth and commences its traverse with the slide in the direction necessary to move the carrier-disk; and, on the other hand, the detent is caused to engage a notch and hold the carrier-disk stationary coincidently with the termination of the traverse of the slide in the direction stated. During the short period which elapses between the disengagement of the detent and the engagement of the pawl the plungers or dies, to be hereinafter described, are within one of the molds of the carrier-disk, and the accidental displacement of the disk is thus prevented.

The pulverized ingredients from which the pills are to be formed are supplied to a feed-hopper, 27, adjustably secured to a stand, 28, upon the table 1, adjacent to the carrier-disk, and in this instance held in place by a yoke, 29, secured by screws to the stand 28, and having its arms bearing upon an outer lower flange upon the hopper. The bearing of the yoke upon the hopper may be regulated as required, and it may, when desired, be removed, to admit of the removal of the hopper for cleansing or repair. A stirrer, 30, having a series of blades or arms upon its lower end and a crank arm or disk, 31, upon its upper end, is mounted in a bearing or bearings centrally within the hopper 27, and is rotated by a crank arm or disk, 32, on the lower end of a shaft, which is mounted concentrically with the stirrer in a bearing on the end of a removable arm or bracket, 33, above the stand 28.

The crank-pin of the disk 32 fits into a hole in the crank 31 of the stirrer, and by removing the bracket and the shaft which carries the crank 32 the stirrer may be taken out of the hopper when desired. A pulley, 34, is mounted on the upper end of the shaft of the crank 32, and is driven by a belt, 35, passing around idlers 36 on the arm 33 and around a pulley, 37, on the end of the pressing-shaft 12. The material is fed to the molds by a reciprocating agitated feed-slide, 38, working in a trough-shaped guide, 39, beneath the hopper, this guide having an opening of the same diameter as the molds formed near its outer end, and in such position relatively to the carrier-disk as to be, at each stoppage of the disk, concentric with one of the molds thereof. A similar opening is formed in the feed-slide 38, the thickness of which slide, relatively to the diameter of the molds, is such that the opening in the slide will contain exactly the proper amount of material to form a single pill, when the same is packed by the stirrer and by the shaking or agitation of the slide, hereinafter to be described.

A slot or elongated aperture is formed in the bottom of the hopper, below which the feed-slide traverses, and through which the material drops into the opening of the slide. The feed-slide is reciprocated by the vibration of a bell-crank lever, 40, pivoted on a stud or bearing below the table, and having the extremity of its upper arm fitted in a slot in the outer end of the feed-slide, and its lower arm connected to one end of a link or rod, 41, the opposite end of which is connected by a pin, 42, with the free end of a vibrating arm, 43, journaled to a stud on a flange projecting from the web 3 of the frame.

The pin 42 carries a roller, which fits in the groove 44 of a cam, 45, secured upon the pressing-shaft 12, and is held up to the inner surface of said groove by a spring, 46, connected to the arm 43 and to the table 1.

The throw of the roller induced by the form of the cam-groove is such as to give a vibration to the bell-crank 40 sufficient to impart the desired traverse to the feed-slide; and teats or abrupt projections are formed in the cam-groove at points about opposite each other, the

effect of which is to jar or shake the feed-slide at two points in its traverse, the first while it is beneath the opening in the hopper and is receiving material therefrom, this jarring or agitation serving to pack the material in the opening of the feed-slide, and the second when the opening of the feed-slide is immediately above one of the molds of the carrier-disk, this second agitation discharging the contents of the opening into the mold, after which the slide moves backward to the hopper to receive a fresh supply, and leaves the filled mold free for the entrance of the pressing-dies or plungers.

The material thus fed to the mold is compacted therein to the desired form and dimensions by the pressure applied to it by dies operated in the following manner: The lower die or anvil, 47, is secured removably within a recess in the upper end of a cylindrical rod or socket, 48, which is accurately fitted to slide in a guide formed in the table 1 and upper block, 4. The lower end of the socket 48 is fitted in a block, 49, sliding in guides below the socket 48, and the block 49 rests upon a cam-arm, 50, on one end of a horizontal shaft, 51, mounted in a bearing in the web 3 above the pressing-shaft. The block 49 is connected with the cam-arm 50 by a slotted link, 52, so that it may be pushed upward by the direct action of the cam-arm, and drawn downward by the link. When the block 49 is at the extremity of its upward traverse the lower die, the socket in which it is fitted, the block to which the socket is connected, and the cam-arm 50 are all in line vertically, so that pressure applied upon the lower die, or upon material resting thereon, is transmitted directly through these elements to the bearing of the cam-arm upon the frame of the machine. An arm, 53, on the opposite end of the shaft 51 carries a roller fitting a cam-groove, 54, in the spur-gear 11 of the pressing-shaft 12. The form of the cam-groove is such that the movements and intervals of rest of the shaft 51 successively elevate the lower die, 47, and project it into one of the molds of the carrier-disk, cause it to rest stationary therein during the application of pressure by the upper plunger, to be presently described, and withdraw it therefrom at the conclusion of the pressing operation.

The upper plunger or pressing-die, 55, projects downward from and is secured firmly in a cross-head, 56, screwed to the upper ends of two strong presser-rods, 57, fitted to and moving freely in lateral guide-projections formed on the frame-web 3. The plunger 55 is, in the instance shown, secured by a screw and nut and jam-nut, so that it may be readily removed and replaced, or adjusted to form pills of different thicknesses or degrees of consistency, as may be required. A slotted block or lower cross-head, 58, in this case composed of two separate pieces, is secured to the lower ends of the presser-rods 57, and a die-block or box, 59, fits within the cross-head 58. A crank-pin, 60, projecting from a crank or disk, 61, on the presser-shaft, is fitted to the die-block 59, and in the revolution of the presser-shaft communicates vertical reciprocating movement to the lower cross-head, 58, and the attached presser-rods 57, upper cross-head, 56, and plunger 55, the compression of the pill being effected between the upper plunger, 55, and the lower die, 47, during the downward movement of the plunger 55, and the latter being withdrawn from the mold during the upward movement of its cross-head and connections to admit of the partial rotation of the carrier-disk, which brings another mold into position to be filled, and allows subsequent compression to be applied to its contents.

The finished pill is pushed out of the mold at the next interval of rest of the carrier-disk after its formation by an injector, 62, projecting downwardly from an arm, 63, secured upon the upper end of a vertical stem, 64, working in a guide in the upper block, 4, of the frame, and reciprocated by a connecting-rod, 65, journaled at one end to the stem 64, and at the other to a crank arm or disk, 66, on a horizontal shaft, supported in a bearing on the web 3, and rotated by a spur-pinion, 67, meshing with the pinion 13 of the pressing-shaft 12. The finished pill drops from the mold into a suitable box or receptacle placed upon the table 1. Cleaners 68, (one or more,) consisting of steel rods wrapped with some suitable covering material, are secured to the arm 63, which carries the ejector, and serve to remove any foreign matters that may adhere to the inner surfaces of the molds after the pills have been expelled therefrom. A pin on the arm 63 entering a slot in a vertical guide, 69, prevents axial movement of the stem 64, and insures the entrance of the ejector and cleaners into the molds of the carrier-disk in the downward traverse of the stem.

Inasmuch as the operations of ejecting the finished pill and cleaning the molds must, like that of compressing the pill, necessarily be performed only during the intervals of rest of the carrier-disk, it is obvious that the ejector and cleaners might, if preferred, be reciprocated by an arm projecting from the cross-head 56 of the upper plunger instead of by separate driving-gear; but it being desirable to free the pressing mechanism from any side strain, and limit its function to the specific duty of the compression of the pills, which in most cases requires the application of a high degree of pressure to the pulverized material, I deem the separate reciprocation of the ejector and cleaners to be preferable in practice.

In the operation of the machine the several detailed functions of feeding, compressing, ejecting, and cleaning are performed sucessively relatively to each individual mold of the carrier-disk, and are all performed at every interval of rest of the disk, during which period material is supplied to one of the molds, and afterward, in the same interval of rest, compressed therein, a finished pill is expelled

from another mold, and the inner surfaces of two other molds are cleared of foreign matter by the cleaners. The operation is continuous and automatic during the application of power to the driving-pulley, and the measure of rest of the carrier-disk is the period required to fill a mold and compress the material within it.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk, a series of pill-molds therein, and two reciprocating plungers or dies, which, at each interval of rest of the carrier-disk, enter a mold of said carrier-disk to compress pulverized material therein, and are after the compressing operation entirely withdrawn therefrom to admit of the free rotation of the carrier-disk, the combination being and operating substantially as set forth.

2. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk and a series of pill-molds therein, an intermittently-reciprocating lower die or anvil, which successively enters each mold of the carrier-disk, remains stationary therein during the application of pressure to the contents of the mold, and is withdrawn therefrom at the conclusion of the pressing operation, and a reciprocating upper plunger or die, by which pressure is applied to the contents of each mold successively, substantially as set forth.

3. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk and a series of pill-molds therein, a feed-hopper, and a stirrer rotating in the same above an opening in its bottom, and a feed-slide reciprocating beneath the hopper, and having an opening which receives a charge of material therefrom, and conveys the charge to one of the molds of the carrier-disk at each interval of rest thereof, substantially as set forth.

4. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk and a series of pill-molds therein, reciprocating dies or plungers, by which pulverized material is successively compressed in each mold of the carrier-disk, and a reciprocating ejector and cleaner, which respectively eject the finished pill and clean the surface of the mold, substantially as set forth.

5. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk and a series of pill-molds therein, a reciprocating pressing-plunger, and a lower die or anvil, which, during each interval of rest of the carrier-disk, is elevated into and held stationary within a mold of said carrier-disk by a vibrating cam-arm having a bearing upon the frame of the machine and receiving the pressure applied by the pressing-plunger, a wheel having a cam-groove, by which said cam-arm is vibrated, and a slotted link which connects the cam-arm with the lower die or anvil, and withdraws the same from the mold after the pressing operation, substantially as set forth.

6. The combination, in a machine for the manufacture of compressed pills, of a table or bed-plate having a vertical flange or web depending from its lower side, a carrier-disk or mold-wheel which has a series of pill-molds secured within it and is intermittently rotated upon the upper side of the table or bed-plate, a pressing-frame consisting of an upper cross-head carrying a pressing-plunger, and united by presser-rods to a lower slotted cross-head receiving the die or box of a crank-pin, by which said frame is reciprocated, and a lower die or anvil connected to a sliding block which bears upon and is reciprocated by a vibrating cam-arm, the pressing-frame and lower die reciprocating in the same vertical plane, and being guided and supported in the web of the bed-plate, substantially as set forth.

7. The combination, in a machine for the manufacture of compressed pills, of a carrier-disk journaled on and susceptible of free rotation around a central vertical stem or bearing, and having a series of ratchet-teeth and stop-notches formed upon its periphery, a reciprocating slide carrying a pivoted pawl engaging the ratchet-teeth of the carrier-disk, a cam and vibrating lever imparting motion to the slide, and a vibrating detent or stop-lever, which is alternately pressed into a notch of the carrier-disk by a spring, and withdrawn therefrom by a stop-pin on the reciprocating slide, the combination being and operating substantially as set forth.

8. The combination, in a machine for the manufacture of compressed pills, of an intermittently-rotating carrier-disk and a series of pill-molds therein, a feed-hopper, and a reciprocating feed-slide, by which pulverized material is fed to a mold of the carrier-disk at each interval of rest thereof, a reciprocating plunger and lower die or anvil, between which the material fed to the mold is compressed therein at the interval of rest during which said mold is fed, and which are subsequently entirely withdrawn from the mold to permit the free rotation of the carrier-disk, and a reciprocating ejector and cleaner which expel the finished pill and clean the inner surface of the mold, the combination being and operating substantially as set forth.

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