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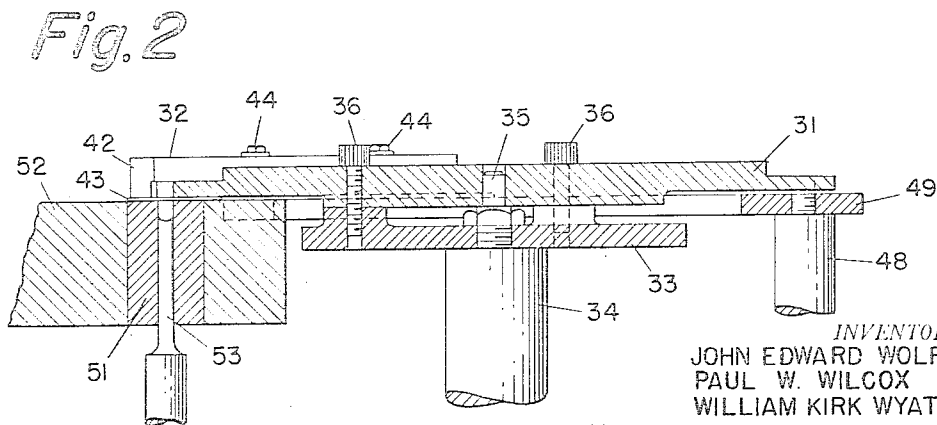
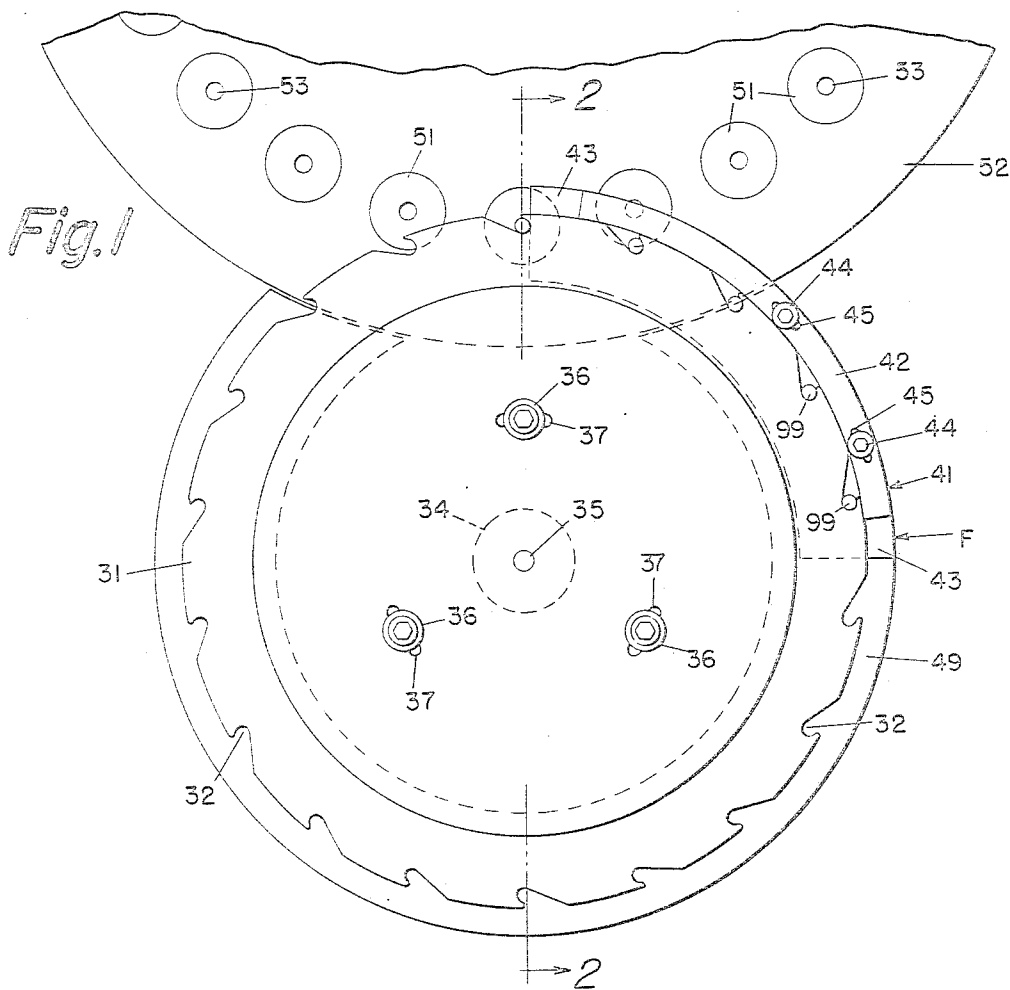
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2,727,473

COATING MECHANISM

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3 Sheets-Sheet 1



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Fig. 3

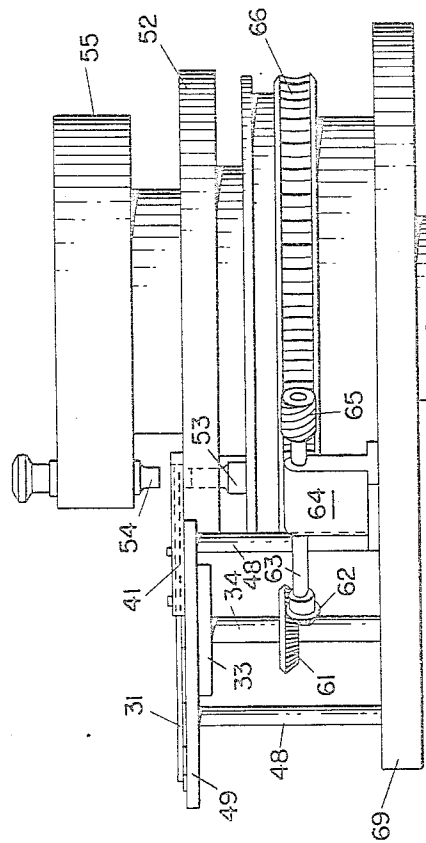
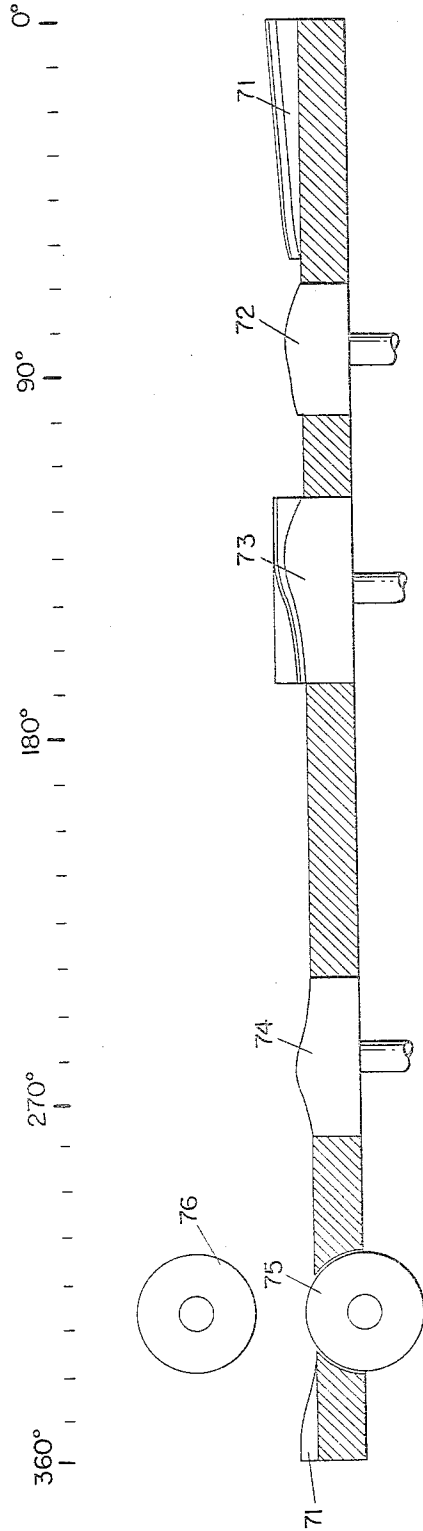


Fig. 4

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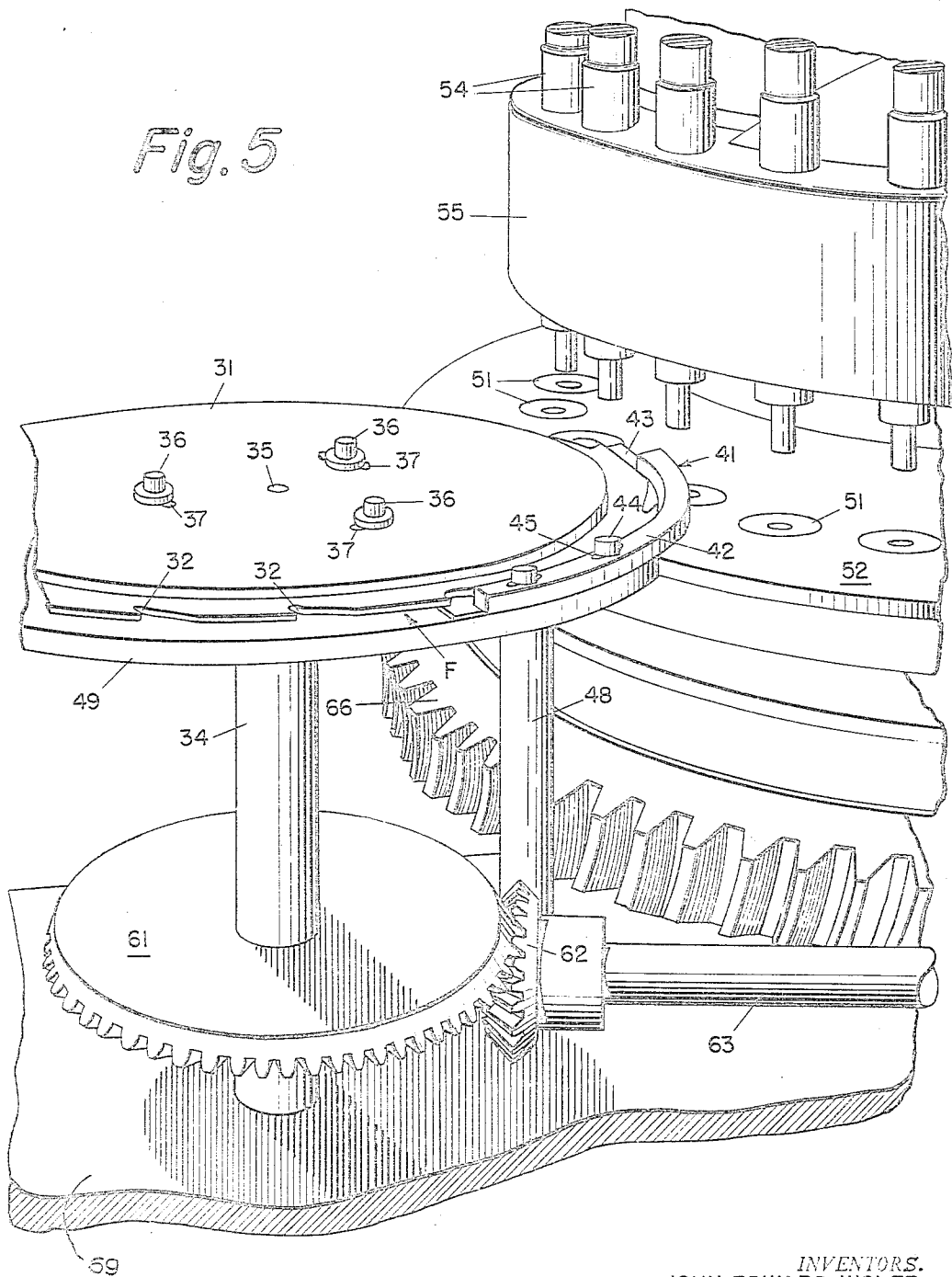
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COATING MECHANISM

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8 Claims. (Cl. 107—1)

This invention concerns itself broadly with a machine for the rapid continuous coating by compression of tablets, pellets, pills and, in general, any core by means of a rotary press. The invention is more particularly concerned with a machine for the rapid continuous coating by compression of medicinal tablets or cores by a rotary press.

Heretofore, devices proposed for the coating of pills and the like by compression have been intermittent in operation in at least one phase of the operation. The obvious limits to speed in intermittent operation and the attendant mechanical difficulties have rendered the search for a rapid continuous method of coating by compression most inviting.

In a process for the rapid continuous coating of tablets by compression there are two major problems requiring solution. One is the exact centering of the core within the die in which it is to be coated and the immediate removal of the core from whatever transfer means is used to carry it to the die without disturbing the positioning of the core within the said die. It is essential to precisely position the core for the reason that in many instances it is desirable, and even necessary, that the coating surrounding the core be of substantially equal thickness throughout. For example, in the enteric coating of medicinal tablets where it is desired to protect the core from the attack of stomach fluids it is essential that the thickness of the enteric coating be substantially the same throughout. Otherwise, the stomach fluids will attack the coating at its thinnest point and thus render ineffective the coating other than at its thinnest point.

Previously, it has been proposed to feed the pellet or tablet to be coated to a die by means of an intermittently operating wheel, notched in its periphery and operating in the plane immediately above that of the rotary bed of the compression machine. Attempts to make the motion of the feed-wheel continuous have been unsuccessful in that as the speed of operation is increased, the positioning of the tablet by previously known means within the compression die becomes erratic and unpredictable. It has been discovered as a feature of this invention that it is possible accurately to position the cores in the compression dies by protecting said core from the action of the upper surface of the rotary bed. This is advantageously accomplished by interposing between the feed-wheel and the upper surface of the rotary bed a thin support plate. This protects the core from the action of the rotary bed at high speeds and enables it to be positioned in the die within the rotary bed unaffected by any forces other than those acting upon it through the feed-wheel.

The core conveniently is positioned in the compression die by placing it atop the bottom coating which fills the die to a level only slightly below the plane of the upper surface of the rotary bed at that point in the process of operation at which the core is deposited. This will more clearly appear from a more detailed description below. Once the core is deposited, it has been discovered as a feature of this invention, that it is advantageously removed from the influence of the feed-wheel in which the

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tablet is pocketed by providing a cam track for the lower punch in the rotary press which causes said punch to be lowered rapidly as the core is deposited. Thus, the punch, the bottom coating, and the positioned core are lowered rapidly and the feed-wheel can pass along without further moving the positioned core.

Thereafter, top coating is added to the die and the entire contents of the die compressed in known manner whereby there is obtained a tablet coated on all surfaces.

The features of this invention and the operation of the mechanism of the invention are more fully set forth in the following description of the mechanism of the invention.

Figure 1 is a plan view of the feed-wheel, the support plate and a portion of the rotary bed.

Figure 2 is a sectional view on the line 2—2 in Figure 1.

Figure 3 is a development of the cam action of the mechanism of the invention.

Figure 4 is a simplified side elevation showing the feed-wheel, the support plate and the rotary bed.

Figure 5 is a perspective view of the feed-wheel, the support plate and a portion of the rotary bed.

The mechanism of the invention includes as its essential features a feed mechanism, a support plate to protect the article to be coated from the action of the rotary bed, cam action to lower rapidly the lower punch just after deposition of the tablet in the die, and means for providing top and bottom coating and for compression.

Referring to Figures 1 and 2, the feed-wheel 31 having in its periphery a plurality of pockets 32, is affixed to the revoluble feed-wheel support element 33, which in turn is affixed by conventional means to the revoluble, vertical shaft 34, or the element 33 can be integral with said shaft. The shaft 34 has a protuberance 35 which acts as a positioning means for the wheel 31 with relation to the support element 33 and shaft 34. The wheel 31 conveniently is affixed to the element 33 by means of hold-down bolts 36. These bolts pierce the wheel 31 through the slots 37 and engage female threads in the member 49. The slots 37 provide means for angularly adjusting the feed-wheel 31 so that the pockets 32 are in proper alignment with the dies 51 in the rotary bed 52.

Also shown in Figures 1 and 2 is the feed support plate 41 which is comprised of the rail portion 42 and sheet portion 43 which can be integral with the rail portion or attached thereto by rivets, welding and the like. The feed support plate 41 is attached to the circular-shaped member 49 by means of the hold-down bolts 44 which pierce the rail portion 42 through the slots 45 and engage female threads in the member 49. The arcuate slots 45 provide means for adjusting the position of the feed support plate 41 relative to the center line between the centers of rotation of the wheel 31 and the rotary bed 52.

The circular-shaped member 49 is supported (as illustrated in Figure 4) by the standards 48 which in turn are supported by a non-rotatable portion 69 of the rotary press. Figure 2 also illustrates the bottom punch 53 within the mold 51.

Figures 4 and 5 are simplified illustrations of the combination of the tablet feed means and the rotary press, including motive means for the feed-wheel. The rotary press includes a rotary bed 52 fitted with the dies 51 which contain the lower punches 53 and are adapted to receive the upper punches 54 at compression. Further, above the compression bed is a rotary head 55 in which the upper punches reciprocate. These upper punches are supported in a track (not shown) in a conventional manner.

The shaft 34 is driven through the bevel gears 61 and 62. The gear 62 is driven by the shaft 63 to which it is attached, and which shaft is supported in a bushing 64

and is driven by the worm gear 65. The gear 65 is powered from the band gear 66 which is part of the rotary press and which is powered in a conventional manner. It will be realized that various gear mechanisms can be utilized as to accomplish the driving of the feed-wheel 31. The essential requirement is that peripheral speed of the centers of the pockets 32 equal that of the dies 51 in the rotary bed 52. The number of pockets 32 in the feed-wheel is such that the circumferential distance between adjacent pockets 32 and adjacent dies 51 is equal.

Additionally, the time period during which the tablet 99 has minimum motion relative to a die 51 in which it is to be deposited can be increased by providing means for reciprocally moving the axis of rotation of the shaft 34 along the line joining the axes of rotation of said shaft and of the rotary bed 52 while the wheel 31 rotates. This reciprocal motion of the shaft 34 gives to the tablet 99 a motion that corresponds essentially with a small arc from the line of centers of dies 51 as the tablet approaches the point of deposition within said die.

This reciprocal motion of the shaft 34 along the line joining the axes of rotation is not essential to obtain good results but is an added refinement.

An adjustment which facilitates operation of the machine and aids in overcoming slight mechanical variations can be included by providing means for adjusting the position of the shaft 34 along the line joining the axes of rotation of said shaft and the rotary bed 52. This allows adjustment so that the lines of centers of the tablets 99 and of the dies 51 are tangent at the line joining the axes of rotation of the shaft 34 and the rotary bed 52. This point is hereinafter referred to as the injection point.

Figure 3 illustrates the cam track 77 in and on which the lower punches 53 travel and the position of the compression wheels on the rotary press. The cam development can be understood by following a lower punch through one revolution of the rotary bed. At 0° in Figure 3 the top portion of lower punch is in the same plane or slightly above the horizontal plane of the upper surface of the rotary compression bed in order to allow the compressed tablet to be stripped off. Then the lower punch moves downward in the cam rail 71 in order to allow bottom fill (coating formulation) to be placed by conventional means in the die cavity. The vertically movable cam 72 is provided to allow variation of the bottom fill by raising the lower punch to the desired level at which time the excess bottom fill is stripped off by known means. Thereafter the bottom punch, supporting the bottom fill in the die cavity, follows the cam track 77 until it reaches the vertically movable cam 73 which serves a two-fold purpose. Cam 73 raises the bottom fill, supported by the lower punch, to a level just slightly below the upper surface of the rotary compression bed in order that it be properly positioned to receive the tablet to be coated. As the tablet to be coated is deposited atop the bottom fill and centered in the die cavity the cam 73, by means of its upper rail, pulls the bottom punch downward to prevent the tablet being further acted upon by the pocket 32 of the feed-wheel 31. This is a feature of the invention.

In its further travel the lower punch follows the cam track until it reaches the vertically movable cam 74. During this travel top fill (coating formulation) is added to the die cavity and the amount retained is adjusted by vertical movement of cam 74. The fill is stripped off at the surface of the rotary bed and the vertical position of the cam 74 governs the amount of top fill remaining within the mold cavity.

The bottom punch, which supports the bottom fill, the tablet to be coated, and the top fill, moves downward off the cam 74 and follows the cam track until it reaches the lower compression wheel 75 which is positioned approximately 180° away from the tablet injection point and immediately below the upper compression wheel 76 which acts on the upper punches. The compression wheels act to bring together the upper and lower punches and to

compress the top and bottom fill around the tablet producing in a single compression operation a tablet coated on all surfaces.

After passing over the lower compression wheel the lower punch, now supporting the coated tablet, drops slightly to allow freeing the coated tablet from the mold and then follows the cam track 77 to the 360°-0° position where the tablet is ejected.

In the foregoing description the important step is the deposition on the bottom fill of the tablet to be coated so that it is centered in the die, and the immediate removal of said tablet from contact with the pocket 32 of the feed-wheel 31. In the mechanism of the invention the deposition of the tablet is accomplished by allowing it to slide or drop slightly from the support plate element 43 onto the bottom fill.

Referring to Figure 1, the tablets are introduced one by one at the point F by known means so that each pocket 32 of the wheel 31 embraces and carries along a single tablet 99. These tablets slide along and over the feed support plate element 43 which is a thin arcuate-shaped sheet-like member. The rail element 42 provides a stiffening effect on the plate element 43 which is preferably as thin as is possible commensurate with wear. Additionally the element 42 prevents possible escape of the tablets from the pockets 32. It is to be noted in Figure 1 that the plate element 43 extends over the rotary bed 52 and supports the tablet approximately until the injection point is reached. This prevents the moving upper surface of the rotary bed 52 from acting on the lower surface of the tablet, which is an important feature of the invention.

It will be observed that support plate 41 can be moved circumferentially with respect to the feed-wheel 31 by loosening the hold-down bolts 44 and moving the plate within the range of the arcuate slots 45. This provides means for adapting the support plate for use with tablets of varying diameter. The adjustment of the support plate 41 with relation to the injection point should be within the range hereinafter described. The end of the support plate element 43 closest to the injection point should be separated from the injection point by a distance at least equal to the radius of the tablet being coated. A maximum distance of separation occurs when the end of the support plate element 43 is positioned so that a tablet 99 no longer will be supported in any part by the element 43 at that point in the cycle at which the point on the tablet nearest the center of the feed-wheel is tangent to the point on the die cavity 51, in which it is to be deposited, farthest from the center of rotation of the rotary bed. The proper position for each size tablet can be determined by examination of the first few coated tablets after adjustment of the support plate. An even coating on the tablets is the criterion. This adjustment, of course, should be made in conjunction with adjustment of the feed-wheel plate 31 in the slots 37 and of the shaft 34 with respect to the axis of the rotary bed 52.

As the tablet 99 passes over the end of the support plate element 43 it slides or drops off said element and is positioned in the cavity in the die 51 atop the bottom fill. Simultaneously the lower punch supporting said fill and tablet is acted on by the cam 73 so as to remove the tablet from further contact with the pocket 32. Theoretically it is desirable that the trailing edge of the tablet 99, that is, the edge engaged by the pocket 32, disengage, due to its being lowered, from said pocket 32 when the center of the tablet is at the ejection point. Thus, it will be observed that the bottom punch is acted on and lowered by the cam 73 slightly before the center of the tablet 99 reaches the injection point.

It is apparent that various size and shape tablets can be coated by variance of the size and/or shape of the punches and dies 51 and of the pockets 32 of the wheel 31 which can be proportioned to the tablet being handled. Also the gear ratio required to power the shaft 34 is de-

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pendent on the size of the wheel 31 relative to the diameter of the line of centers of the rotary bed 52.

It will be realized that F, the point of introducing the tablet into the pockets 32, is not necessarily in the position indicated, but can be placed elsewhere on the periphery of the ring-shaped member 49. Further, it is possible to operate the mechanism of the invention in conjunction with another rotary press producing the tablets to be coated so that the tablets produced by one press can be used as a source of feed to the tablet coating mechanism and the point F can be at some point on the periphery of the ring-shaped member 49 as dictated by convenience.

What is claimed is:

1. In a tablet-coating machine having in combination a horizontally disposed rotary die bed with die pockets therein, means for feeding core tablets into the die pockets, each die pocket being arranged to receive bottom and top coatings for each core tablet, the improvement which comprises a thin metal support plate mounted in adjustable but stationary position above the die bed and below the feed means forming a support for the core tablets and having an edge portion over which the core tablets are slid by the feed means onto the bottom coating in the die pockets as they pass below, said support plate being located so that each die pocket just passes beyond the edge portion as the core feed means slides the core onto the bottom coating material.

2. In a machine for compressing a powdered coating material upon a core, the combination of a generally horizontal rotary bed having circumferentially arranged die pockets therein, a movable top punch and a movable lower punch for each die pocket, actuating means for reciprocating the punches to compress the material in the die pockets, each die pocket being constructed to receive powdered bottom coating material, bottom coating feeding means for depositing coating material successively into the bottom of each die pocket, a generally horizontal core feed wheel mounted over the die pockets in a peripheral position of the rotary bed and rotatable in the opposite direction of the rotary bed, said feed wheel having peripheral pockets for carrying the cores and being rotatable on a shaft so located with respect to the shaft of the rotary bed that the cores are moved into tangency with the die pockets, means for driving both the rotary bed and the core wheel at such speeds that the cores are

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successively moved into coincidence with the die pockets and deposited upon the bottom coating material, top coating feeding means disposed in the direction of movement of the die pockets beyond the point of coincidence for successively delivering coating material upon the core in each die pocket, and a support plate mounted in fixed relation to the machine under a peripheral portion of the core feed wheel and over a peripheral portion of the rotary bed, said plate being interposed between the said peripheral portions and providing a support for the cores carried by the feed wheel and having an edge portion near the point of tangency over which the cores are pushed onto the bottom coating material.

3. A machine according to claim 2 in which the actuating means for reciprocating the lower punches serves to rapidly lower the lower punches as the cores are deposited in the die pockets.

4. A machine according to claim 2 in which the rotary member of the core feeding means is a horizontally rotating wheel having pockets in its periphery spaced from each other by the same distance as the die pockets in the rotary bed.

5. A machine according to claim 2 in which said feed support plate is of thin sheet metal.

6. A machine according to claim 2 in which the support plate is of thin sheet metal and reinforced by an integrally united arcuate rail exterior to and concentric with the feed wheel.

7. A machine according to claim 2 in which the discharge edge of the feed support plate is spaced from a line joining the axes of rotation of the rotary bed and the feed wheel by a distance which is approximately equal to the radius of the core being handled.

8. A machine according to claim 2 in which the lower punch actuating means serves to lower the punch within a 10° rotation to remove the core from the core feeding means.

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