

Dec. 26, 1961

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3,014,240

TABLET PRESS

Filed Dec. 31, 1959

4 Sheets-Sheet 1

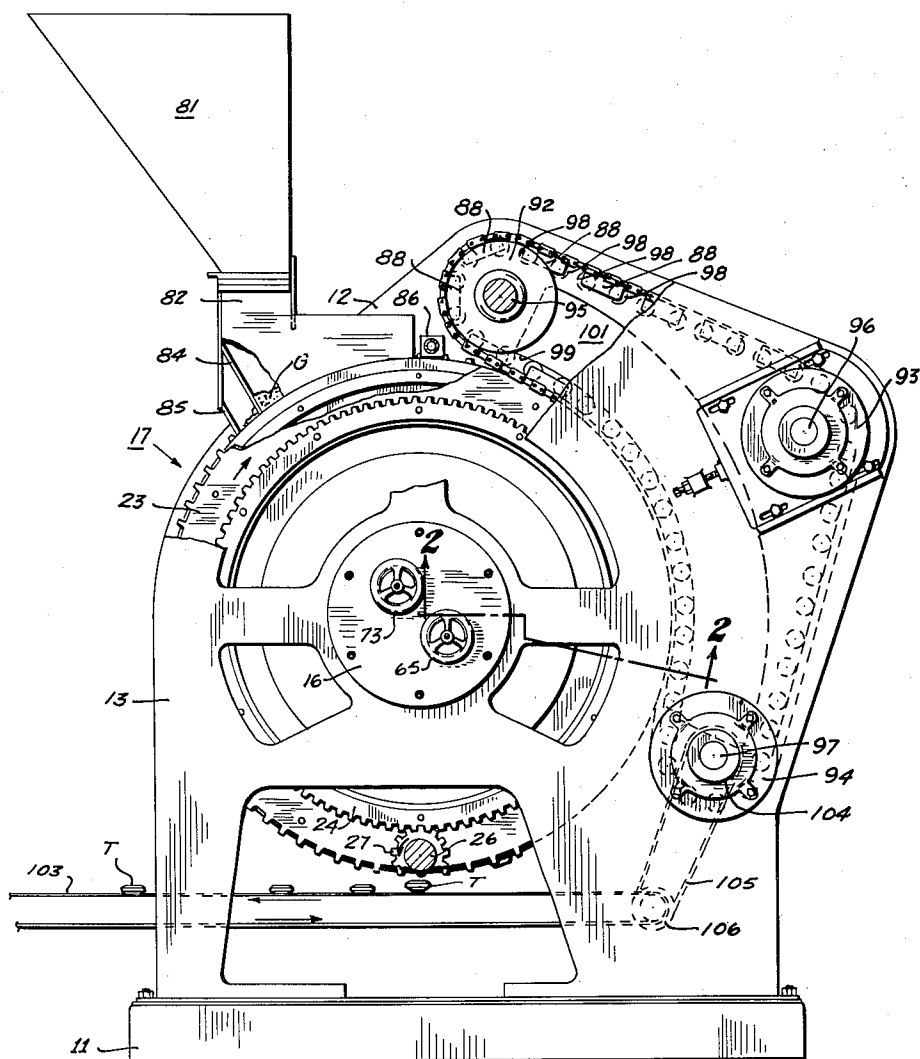


FIG. 1.

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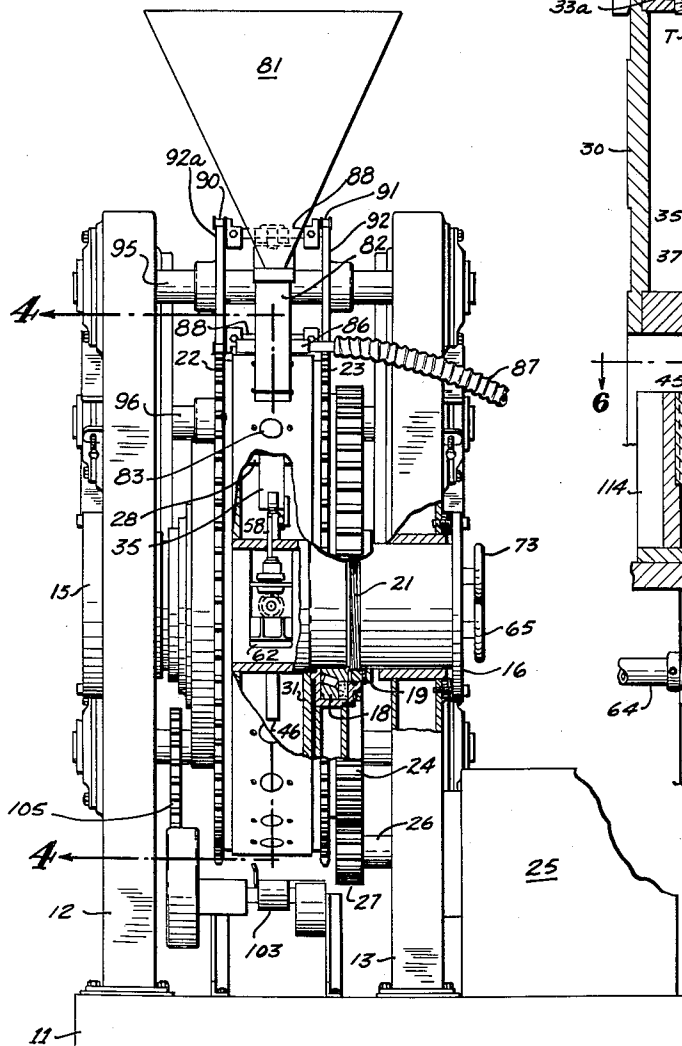


FIG. 3.

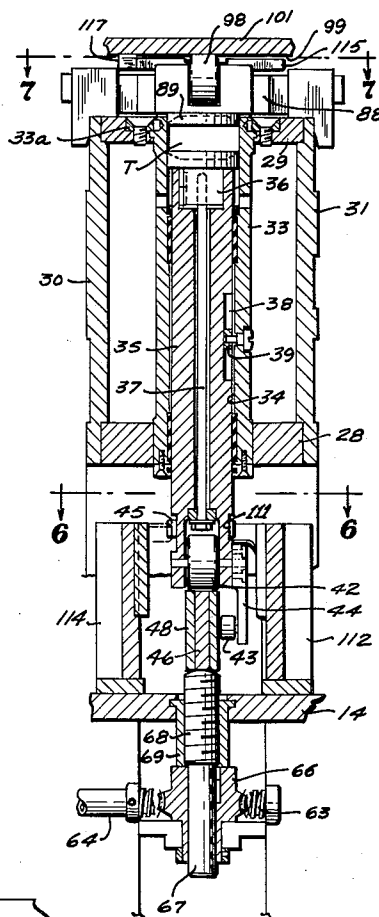


FIG. 2.

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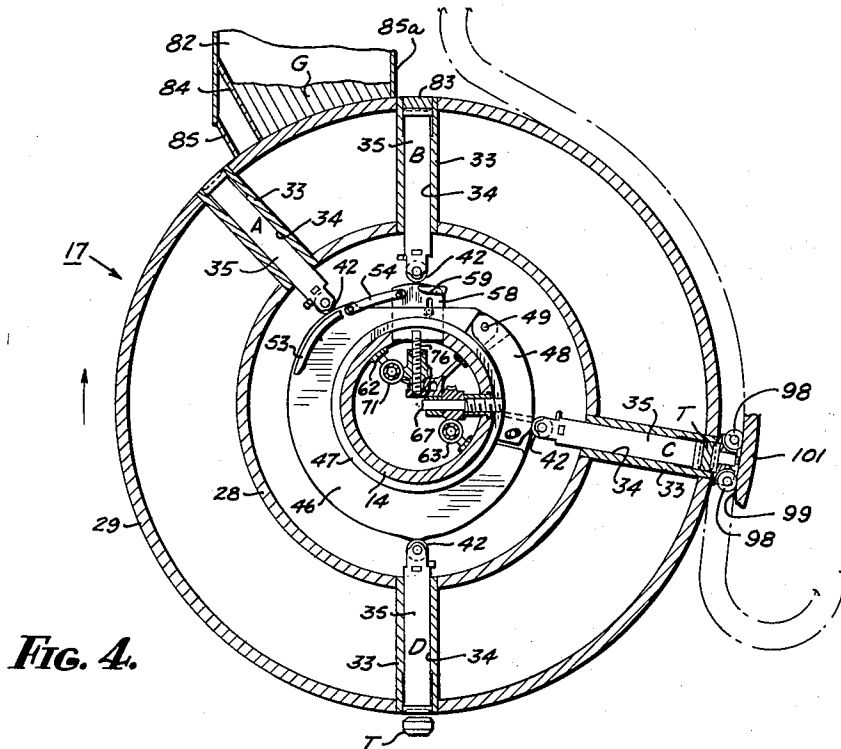


FIG. 4.

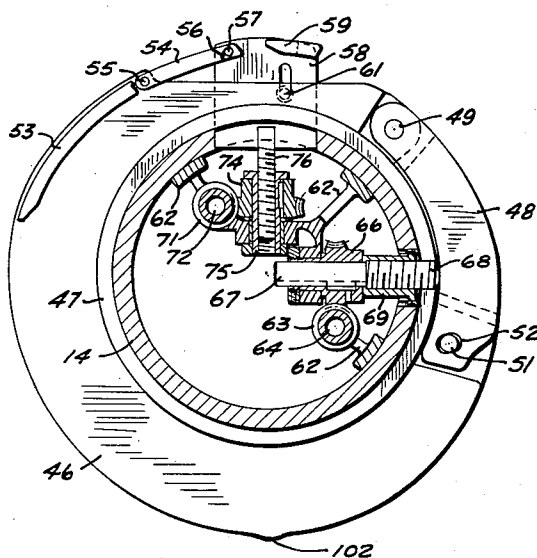


FIG. 5.

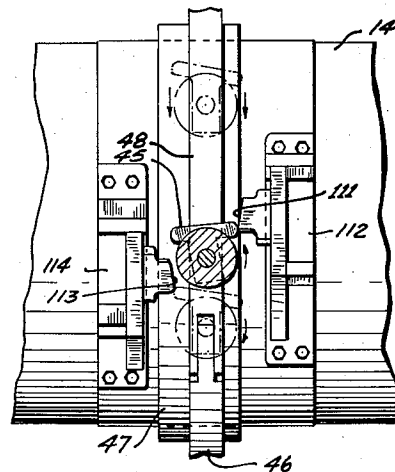


FIG. 6.

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Filed Dec. 31, 1959

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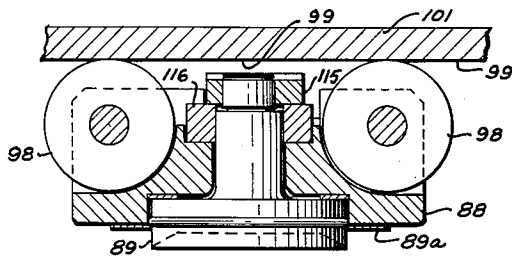


FIG. 8.

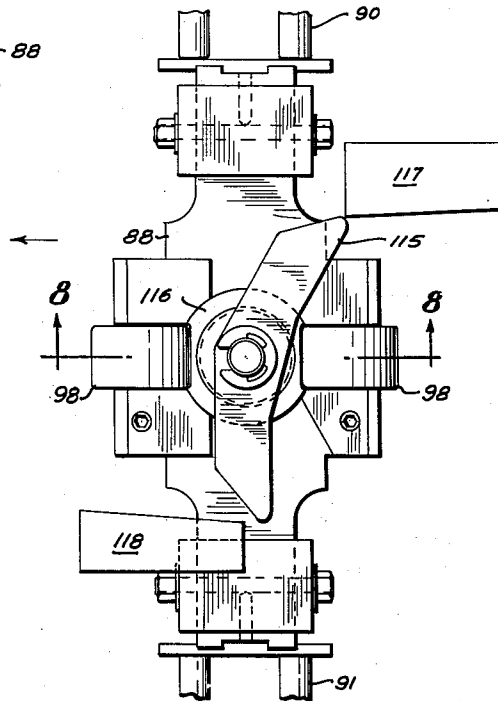


FIG. 7.

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3,014,240

TABLET PRESS

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Filed Dec. 31, 1959, Ser. No. 2,088
8 Claims. (Cl. 18-21)

This invention relates to presses and, more particularly, to a press for manufacturing tablets from powdery and/or granular materials at comparatively low compression pressures.

Several different types of tablet presses are used for briquetting coal and for making medicinal tablets. However, most prior art presses for these purposes are designed to operate at high compression pressures, in the range of twenty thousand pounds per square inch or more, and therefore they are difficult to operate efficiently when compressing powdery or granular materials at substantially lower compression pressures. Presses designed specifically for making medicinal tablets are usually limited to making small tablets, less than one-half inch in diameter, and are difficult, if not impossible, to adapt properly and economically to the manufacture of substantially larger tablets.

A need for the present invention presented itself when a press was sought for making detergent tablets of the character described in the application of Richard P. Laskey, Serial Number 863,173, filed concurrently herewith and assigned to the same assignee as the instant invention. Such presses are not available commercially, and it was soon discovered that present day commercial equipment is not economically suited for conversion to this task. The manufacture of detergent tablets is usually carried out at pressures of 3,000 pounds per square inch or less and the preferred size of the tablets is in the range of about 2" diameter having a thickness of about 1". To meet these requirements efficiently and economically, it became apparent that a new type of press had to be devised. It is to be understood of course, that the invention as herein described is neither limited to the production of detergent tablets nor to the making of tablets of the specific size and at the pressure heretofore indicated. These conditions are merely exemplary and indicate the preferred conditions of manufacture. They are made to give a better understanding of the problem solved by the instant invention.

It is a principal object of this invention to provide a tableting press capable of efficiently and economically producing detergent tablets although the press is suited to the manufacture of other products also.

Another object of this invention is the provision of a press for compressing powdery and/or granular materials into a unified mass at relatively low pressures in the range of three thousand pounds per square inch or less.

Still another object of this invention is the provision of a tablet press of the character described which can be adjusted to vary the size of tablets being produced.

A still further object of this invention is the provision of a tablet press of this character in which adjustable means are provided for controlling the pressure at which the tablets are compressed.

Yet another object of this invention is the provision of a tablet press in which the dies are rotatable so as to prevent sticking and caking of the granular or powdery material to the dies and die cavities.

A further object of this invention is the provision of means in a tablet press for removing the tablets without damaging or abrading the surface of the tablets.

Another object of this invention is a tablet press in which the finished tablets are discharged individually and

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at spaced intervals for ease of handling and further processing.

Still a further object of this invention is the provision of a tablet press in which a large number of radially movable dies are used to obtain high production rates without unduly increasing the physical size of the press or the floor space needed to mount the press.

Briefly stated, in accordance with one embodiment of the invention, the tablet press is composed of a rotating drum with a substantially horizontal axis mounted on a suitable frame and having a plurality of radially movable pistons therein. The ends of the pistons are located inwardly of the outer drum surface in order to provide a plurality of die cavities in the drum periphery. A hopper is provided for gravity filling successive die cavities with powdery or granular material as the drum rotates through the upper portion of its cycle. A plurality of outer dies are mounted on suitable carriages in order to coact with and close the die cavities through the compression portion of the drum rotative cycle. The pistons are moved outwardly to compress the material in the die cavities while the latter are closed by the outer dies. The finished tablets are removed at the bottom of the rotative cycle of the drum due to radial outward movement of the pistons after the outer dies have been withdrawn from the die cavities. Means are provided for rotating the pistons and/or the outer dies to prevent adherence of the tablet material to the pistons, die cavities and outer dies.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is a side elevation, partially broken away, of the entire tablet press, and;

FIGURE 2 is a cross-section taken along the line 2-2 of FIGURE 1 showing one die cavity and the mechanism for rotating the dies, and;

FIGURE 3 is an end elevation, partially broken away, of the entire tablet press, and;

FIGURE 4 is a cross-section taken along the line 4-4 of FIGURE 3 showing the radial pistons at four stations in the compression cycle with relation to the central cam, and;

FIGURE 5 is an enlarged view of the central cam and the mechanism for adjusting same, and;

FIGURE 6 is a view taken along the line 6-6 of FIGURE 2 showing the cams for rotating the radial pistons, and;

FIGURE 7 is a view taken along the line 7-7 of FIGURE 2 showing one outer die carriage and the mechanism for rotating the outer die, and;

FIGURE 8 is a cross-section of the outer die and carriage taken along the line 8-8 of FIGURE 7.

Referring to the drawings and especially to FIGURES 1 and 3, the tablet press is shown mounted on a base plate 11. A frame composed of the members 12 and 13 is mounted on the base plate 11. A hollow non-rotating axle 14, extends between the members 12 and 13 and is held in place by the flanged supports 15 and 16.

A rotatable drum, generally indicated at 17, is supported on two bearings 18 (only one shown) which is held in place by the locknut 19 threaded on the axle 14 as at 21. Large sprockets 22 and 23 are attached to either side of the drum 17 and a drive gear 24 is secured to the side of the sprocket 23. The drum 17 is rotated by the motive power source 25 through the output shaft 26 and drive pinion 27 which engages the drive gear 24. When the press is in operation, the drum 17 is continuously rotated by the motive power source 25.

A better understanding of the structure of the drum 17

can be obtained by referring to FIGURE 4. The drum structure is composed of an inner ring 28, an outer ring 29 and the side plates 30 and 31 (see FIGURE 2). Spaced around the drum are a plurality of radial cylinders 33 having their ends extending through the inner ring 28 and the outer ring 29. Each cylinder 33 is held in place by the member 33a (see FIGURE 2). A radial bore 34 extends through each cylinder 33.

For convenience, FIGURE 4 illustrates cylinders 33 at four stations in the press cycle, as will hereinafter be explained. These stations are marked A, B, C and D. In actual practice, a plurality of equally spaced cylinders 33 are preferably used. In one design a total of 25 equally spaced cylinders 33 has been employed with very good results.

A piston 35 is radially slidable in each of the bores 34. Each piston 35 has a die insert 36 at its outer end attached by means of the elongated rod 37. The pistons are slotted as at 38 and a guide 39 rides in the slot 38 to prevent turning of each piston. However, the slot 38 is wider than the guide 39 to allow some turning which is desirable as will hereinafter be explained. A main cam roller 42 is attached at the inner end of each piston 35. A return cam roller 43 is attached to each piston 35 by the arm 44. A piston rotating member 45 is also attached to each piston.

A central cam is provided for controlling the radial movement of the pistons as they are rotated with the drum as it turns about its axis. The central cam 46 is fastened to the axle 14 by means of the flange 47. As seen in FIGURE 5, an adjustable cam arm 48 is pivoted at 49 to the cam 46. The other end of the cam arm 48 is retained by the pin 51 projecting through the slot 52. The pin 51 is attached to the central cam 46. A stationary return cam 53 projects laterally outwardly from the central cam 46 in order to contact the cam roller 43 and urge the pistons 35 radially inwardly as they enter that portion of the cycle. A return cam link 54 is pivoted at 55 to the central cam 46. The other end of the link 54 is slotted at 56. A pivot pin 57 is secured to the vertically slidable member 58 and projects through the slot 56. A movable return cam 59 is attached to the slidable member 58. The pin 61 which is attached to the central cam 46 maintains alignment of the slidable member 58.

A mechanism is provided whereby the position of the cam arm 48 and the slidable member 58 can be adjusted from an external location on the press. A bracket 62 is mounted on the internal surface of the axle 14. The bracket 62 supports a worm 63 attached to a shaft 64 which extends through the support 16. A hand wheel 65 (FIGURES 1 and 3) is attached to the outer end of the shaft 64. The worm 63 engages a worm gear 66 which is slidably keyed to the shaft 67. The outer end of the shaft 67 is threaded at 68 and engages a threaded sleeve 69 which is attached to the axle 14. Thus, by turning the hand wheel 65, the shaft 67 can be moved inwardly or outwardly through the worm and worm gear combination. Outward movement of the shaft 67 will, of course, cause the cam arm 48 to pivot outwardly about the pivot 49, and; likewise, inward movement of the shaft 67 will allow the arm 48 to pivot inwardly due to the pressure of cam rollers 42 moving over the arm 48.

A worm 71 is attached to the shaft 72 which extends through the flanged support 16 and has a hand wheel 73 (FIGURES 1 and 3) attached thereto. The worm 71 drives a worm gear 74 which is secured to the threaded sleeve 75 which, in turn, is rotatable in the bracket 62. A threaded member 76 engages the sleeve 75 and has its outer end attached to the slidable member 58. Rotation of the hand wheel 73 will result in rotating the sleeve 75 through the worm and worm gear combination. This will result in upward or downward movement of the member 58 depending upon the direction in which the hand wheel 73 is rotated.

Referring now again to FIGURE 4, the granular mate-

rial G to be compressed is supplied to the hopper 81 (FIGURES 1 and 3) from where it flows into the filling chamber 82 which overlies the periphery of the drum 17 at the upper portion of the cycle. The granular material G may be in the form of detergent granules where a detergent tablet is to be manufactured. The granular material flows by gravity into each successive die cavity 83 as it moves under the chamber 82. The die cavity as defined herein is that portion of the bore 34 immediately beyond the face of the die insert 36 when the piston is retracted as at station B in FIGURE 4. A baffle 84 is provided at the filling chamber 82 so that any granular material flowing under the baffle 84 when the drum 17 has been stopped will be retained by the wall 85 rather than be spilled. To provide positive inward movement of the piston 35 to fill each die cavity 83, the return cam roller 43 engages the bottom surface of the return cam 53 as each piston 35 approaches the filling chamber 82. This initiates radial inward movement of each die 35. The dies 35 are gradually drawn inwardly as they pass under the chamber 82 by the return cam 53 and the cam link 55 until the roller 42 strikes the outer surface of the member 58. At that point the piston 35 is moved slightly upwardly so that the lower edge of the wall 85a levels off the granules in the cavity 83. As the cavity 83 passes beyond the wall 85a, the piston 35 is again drawn downwardly by the return cam 59 acting on the roller 43 so that the level of granules in the die cavity 83 is slightly below the outer surface of the drum. Thus, as the pistons 35 move from station A to station B, the die cavities 83 are filled with granular material. It will be appreciated, of course, that the quantity of granules to be compressed can be controlled by upward or downward movement of the member 58 by turning the hand wheel 73. Any excess granular material spilled on the drum surface is removed by the vacuum manifold 86 which is connected by a tube 87 to a conventional vacuum source. The opening in the vacuum manifold 86 is small enough and the vacuum low enough so that none of the granules are drawn out from the die cavities 83.

Means are provided for closing each die cavity 83 to permit radial outward movement of the pistons 35 to compress the granular material. A plurality of carriages 88 each having an outer die 89 attached thereto are affixed to a pair of spaced endless roller chains 90 and 91 (see FIGURES 1, 2, 3, 7 and 8). The plate 89a (FIGURE 7) is provided to prevent granular material from entering the clearance between the periphery of the die 89 and the bore in the carriage 88. The roller chain 91 runs over the sprockets 92, 93 and 94 as shown in FIGURE 1. The sprockets 92, 93 and 94 are fixed on shafts 95, 96 and 97 which are in turn supported by bearings (not shown) mounted in the members 12 and 13. A similar set of sprockets are provided for the roller chain 90 and are also mounted on shafts 95, 96 and 97 but only the sprocket 92a is visible in FIGURE 1 of the drawings. The roller chains 90 and 91 engage the large sprockets 22 and 23 and are driven thereby so that the carriages 88 move in the circuitous path followed by the chains as shown in FIGURE 1. The carriages 88 are spaced so that each of the outer dies 89 will close successive die cavities 83 by engaging the outer end of the bores 34 as the pistons 35 approach the compression portion of the cycle. Each carriage 88 is provided with a pair of rollers 98 which bear against the surface 99 of the support plate 101. The support plate 101 is rigidly attached to the frame between the members 12 and 13. Thus, as the drum 17 is rotated it drives the chains 90 and 91 and the carriages 88 so that each of the die cavities 83 will be closed during the compression portion of the press cycle.

As the pistons 35 move from station B to station C they are moved radially outwardly by the cam arm 48 gradually to compress the granular material until the point of maximum compression is reached at station C. The outward movement of the pistons transforms the

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granular material into a unified mass or solid because the outer dies 89 are constrained by the support plate 101 so that radial outward movement of the pistons 35 decreases the volume of each die cavity 83 until station C is reached. A satisfactory compression pressure is achieved by adjusting the position of the cam arm 48. It will be noted that the compression pressure can be adjusted by turning the hand wheel 65 which results in movement of the arm 48 about the pivot 49. When the arm 48 is pivoted counterclockwise, as viewed in FIGURE 5, the compression pressure is increased. It is decreased, of course, when the arm 48 is pivoted clockwise. It is, therefore, possible to control the quantity of granules being compressed (and thus the weight of the finished tablet) through the hand wheel 73 and the compression pressure (and thus the density of the finished tablet) through the hand wheel 65. An indication of the compression pressure can be obtained by the use of a well known, properly calibrated strain gauge mounted on the support plate 101 at or near the point of maximum compression at station C. Other types of pressure measuring devices can also be used.

As each piston 35 moves from station C to station D, it is moved outwardly by the central cam 46 until the finished tablet T is ejected at the station D. A sudden rise in the cam 46 at station D as at 102 (FIGURE 5) helps to effect removal of the finished tablet T. The finished tablets are removed by the conveyor 103 (FIGURES 1 and 3) which is driven from a sprocket 104 attached to the shaft 97, by a chain 105 and a sprocket 106.

It has been found highly desirable to rotate the pistons 35 and the outer dies 89 in opposite directions in the latter stages of compression until the point of maximum compression at the station C is reached. This has been found very helpful in preventing sticking of the granular material and in obtaining clean removal of the finished tablet from the die cavity 83. As seen in FIGURES 2 and 6, the pistons 35 are rotated in one direction prior to reaching the point of maximum compression at station C by the cam surface 111 engaging the rotating member 45. The cam surface 111 is formed on the bracket 112 which is attached to the axle 14. After going beyond the point of maximum compression, the cam surface 113 acts on the member 45 to return the piston 35 to its previous position and to simultaneously make a sliding break between the finished tablet and the outer surface of the die insert 36 to initiate discharge of the finished tablet. The cam surface 113 is formed on the bracket 114 which is secured to the axle 14.

Similarly, means are provided for rotating the outer dies 89 prior to reaching the point of maximum compression and then returning same. Referring to FIGURES 2, 7 and 8, the rotating mechanism consists of a rotating member 115 secured on the outer end of the die 89. A spacer member 116 is interposed between the rotating member 115 and the carriage 88.

As shown in FIGURES 2 and 7, a cam 117 is secured to support plate 101 to rotate the outer die 89 by engaging the rotating member 115 as the carriage 88 of each outer die 89 approaches the point of maximum compression at station C. This rotation must be opposite to the rotation of the piston 35. The rotating member 115 is reset by the stationary cam 118 attached to the support plate 101. Thus, as the outer die approaches the point of maximum compression at station C, rotation counter to the rotation of its cooperating piston 35 is initiated until the point of maximum compression is reached. The die is then reset for the next rotative cycle and the outer die 89 withdrawn from the die cavity 83 so that the ejection of the finished tablet can commence as the piston 35 moves to station D.

As heretofore described, the tablet press has a single row of pistons 35 and a single central cam 46. It is possible to increase the capacity of the press by any multiple of two or more merely by providing two or more rows of

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pistons 35 in the drum 17 and by providing an equal number of central cams 46 and flights of outer dies 89.

While particular embodiments of the invention have been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed as new is:

1. A detergent tablet press comprising a frame, a drum having a plurality of radial bores and mounted for rotation on said frame, means for rotating said drum, a plurality of pistons mounted for radial movement in the bores of said drum, the ends of said pistons being spaced inwardly from the periphery of said drum thereby forming a plurality of die cavities in the drum, a stationary central cam for controlling the radial movement of said pistons, a plurality of outer dies mounted on carriages, means for moving said carriages with respect to said frame so that the outer dies close each successive die cavity as the drum rotates through the compression portion of its cycle, means for filling the die cavities with a predetermined charge of granular detergent material prior to compression and means for rotating said pistons and said outer dies while compressing the granular material into a tablet.

2. A tablet press comprising the combination of a frame, a drum rotatable on said frame, said drum having a plurality of spaced radial bores, a central stationary cam, a piston mounted for sliding movement in each of said bores, each of said pistons having a cam follower on its inner end bearing against said stationary cam, a second cam mounted centrally of said drum and cooperating with said pistons to control inward movement thereof, the outer end of each piston being spaced inwardly from the periphery of said drum to form a plurality of die cavities, a hopper for gravity filling each die cavity with granular material near the top portion of the drum rotative cycle, a plurality of outer dies mounted on at least one endless chain and driven in synchronism with said drum, said outer dies being spaced to engage the outer ends of successive die cavities and to close same during the compression portion of the press cycle, means for holding said outer dies in engagement with said die cavities during the compression portion of the press cycle and means for rotating said pistons in order to prevent sticking of granular material to said die cavities.

3. A tablet press as claimed in claim 2 in which said central stationary cam is adjustable to control the travel of said pistons thereby adjusting the weight and density of tablets being manufactured.

4. A tablet press as claimed in claim 3 including means for rotating said pistons beyond the compression portion of the press cycle and prior to the discharge of finished tablets for the purpose of initiating discharge of the finished tablets.

5. A tablet press comprising the combination of a frame, a drum rotatable on said frame, said drum having a plurality of radial bores, a piston slidable in each of said bores, a stationary central cam, the inner ends of said pistons being in contact with said central cam so that radial movement of the pistons in the bores is controlled by the cam as the drum rotates, the outer end of each of said pistons being spaced inwardly from the drum periphery so that the outer portion of said bores form a plurality of die cavities, a plurality of outer dies mounted for synchronous movement with said cavities so that the outer dies cover the cavities for a portion of the drum revolution, means for filling said die cavities with granular material prior to the covering of said cavities with said outer dies whereby said granular material is pressed into tablets as said drum rotates through the compression portion of its cycle due to the radial outward movement of said pistons caused by the rise in said central cam and means for ro-

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tating said pistons and said outer dies as they compress the granular material into tablets.

6. A tablet press as claimed in claim 5 including means for adjusting the travel of said pistons.

7. A tablet press comprising the combination of a frame, a drum rotatable on said frame and having a plurality of spaced radial bores, a central adjustable cam mounted in the plane of said radial bores, a plurality of pistons slidable in said bores and having rollers on their inner ends, said rollers bearing against the central cam, the outer ends of said pistons being spaced inwardly from the periphery of said drum so that the outer portion of each bore forms a die cavity, a hopper for gravity filling each die cavity, a plurality of outer dies mounted for movement in an arcuate path to engage said die cavities and to close same during the compression portion of the press cycle, means for holding said outer dies in engage-

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ment with said die cavities during the compression portion of the press cycle and means for rotating said pistons and said outer dies during the compression portion of the press cycle.

8. A tablet press as claimed in claim 7 in which said central adjustable cam comprises a plurality of segments pivoted to each other, there being means to move said segments radially.

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