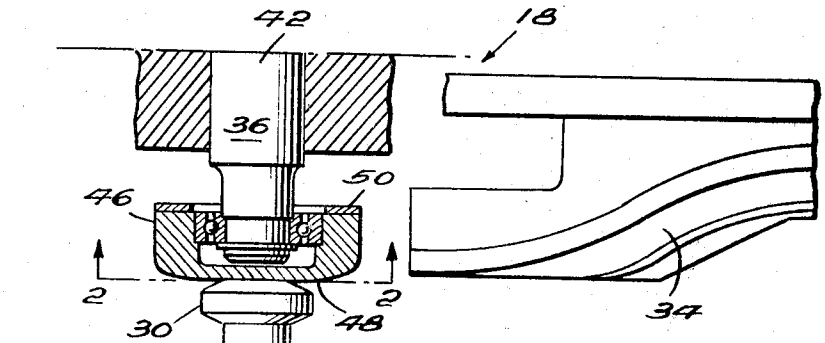
Dec. 1, 1970 W. H. HAMILTON 3,545,007

TABLET MAKING MACHINE

Filed May 1, 1969

Fig. 1.



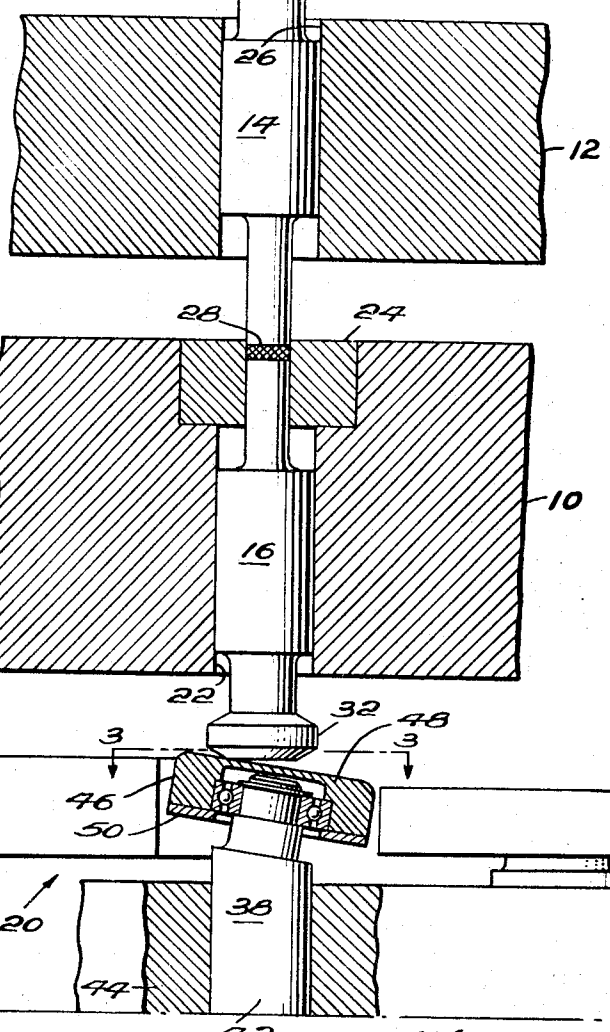
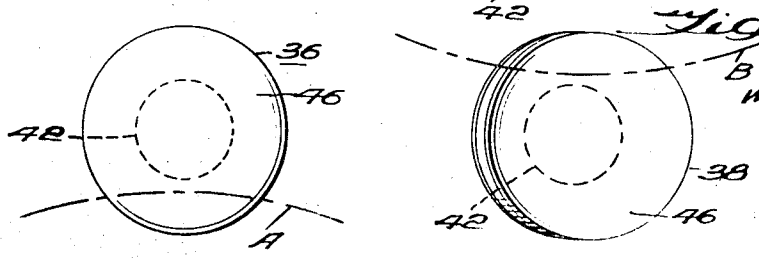


Fig. 2.

Fig. 3.



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3,545,007

TABLET MAKING MACHINE

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Int. Cl. B30b 11/10
U.S. Cl. 107—17 10 Claims

ABSTRACT OF THE DISCLOSURE

The punches of a rotary tabletting machine are guided at least in part by a cam roll which pivots on an axis extending in the same general direction as the rotational axis of the die table. The end surface of the cam roll that is normal to its pivotal axis engages the punch heads.

This invention relates to rotary tabletting presses, more particularly, the invention relates to an improved cam structure for guiding the movements of tablet-forming punches contacted thereby.

Conventional tablet making machines comprise a rotary die table in which is formed an annular series of die cavities. Above and below the die table an annular series of upper and lower punches are carried for rotation with the die table, there being one upper punch and one lower punch associated witn each die cavity. The heads of the punches may be guided by stationary camming surfaces to control their reciprocating movements, into and out of the die cavity, as the die table turns through filling, compression, and ejection stations.

It is already known that wearing contact of the punch head on the camming surfaces can be substantially reduced by providing rolling contact between these engaging surfaces. In this connection, U.S. Pat. No. 3,408,963, granted Nov. 5, 1968, is cited; and the disclosure thereof is incorporated by reference herein for tne sake of brevity. Apparatus of the type disclosed in the cited patent and the other patents referred to in the cited patent may be improved by incorporating the improved cam structure of the present invention. It is to be noted, however, that the rolling contact heretofore provided has been limited to camming rolls mounted for free rotation about a horizontal axis in machines having a die table mounted for rotation about a vertical axis. Such prior arrangements effect very brief camming contact between the flat surface of the punch head and the cylindrical surface of the camming roll.

When it is desired to provide dwell time at a portion of the cam track used to effect a gradual movement of the punch into the die cavity, it has been necessary to revert to a conventional stationary surface providing no rolling contact with the punch head. As a result, such location on the cam track experiences the greatest wear and requires frequent replacement.

According to the present invention, a roller pivotally mounted for free rotation about an upright axis may be installed at such locations on the cam track, wtih an off-center portion of its circular end face rather than its cylindrical edge face being positioned for engagement with the punch head. Thus arranged, the punch head inflicts appreciably less frictional wear on the margin of the circular end face of the roller than it would cause to a totally stationary cam surface. In addition, since the end surface of the improved cam roll may be flat or preferably slightly rounded, the desired dwell time is obtainable at a critical location.

The increased dwell time provided by the present invention, as compared with a cylindrical cam roll surface, accomplishes improved results, as evidenced by the better

tablet produced by the apparatus. Tablets that are produced with increased dwell time during compression are aerated more thoroughly. The fine particles of tablet material are better oriented in the die cavity, and they are compressed more gradually under reduced pressure. Consequently, the resultant tablets are free of cracks and laminations, and the reduced stress on the mechanical forming parts extends their useful life, even at higher operational speeds.

The invention may be better understood with reference to the drawings, in which:

FIG. 1 is a vertical sectional view taken through a portion of a tabletting machine embodying the invention, with portions shown in elevation;

FIG. 2 is a view looking in the direction of the arrows 2—2 of FIG. 1 at the surface of a camming roll; and

FIG. 3 is a view similar to FIG. 2, but looking in the direction of the arrows 3—3 of FIG. 1.

In FIG. 1 the die table is designated by the numeral **10**, it being understood that it is mounted for rotation about a vertical axis together with a carrier **12** for upper punches, one of which is illustrated and designated by the numeral **14**. Lower punch **16** is representative of the annular series of like punches carried by the die table **10**.

Upper and lower cam structures **18** and **20** are stationarily mounted above the carrier **12** and below the table **10**, respectively, for guiding the movements of their associated punches in vertical direction.

Each lower punch **16** is slidably received in a vertical bore **22** for reciprocating movement in vertical direction. The upper end or tip of the lower punch **16** projects upwardly into a die cavity of a die **24**, the latter being held in a counterbore aligned with the bore **22**. The upper surface of die **24** is flush with the top of the die table **10**.

Similarly, the upper punch **14** is slidably received in a vertical bore **26** in the carrier **12** aligned with the bore **22**. The lower end or tip of the reciprocating upper punch **14** is movable into and out of the mouth of die **24** for closing and opening the die cavity, respectively.

The upper and lower punches **14** and **16** coact with the die **24** for receiving in the die cavity a charge of material to be compacted into a tablet, also for compressing the charge, and ejecting the tablet **28** formed between their tips. The vertical movements of the upper punch **14** are controlled by guiding the motions of its integral punch head **30** with the upper cam structure **18**. In like manner, the vertical movements of the lower punch are controlled by guiding the motions of its integral punch head **32** with the lower cam structure **20**. The upper and lower punches **14** and **16** travel in an arcuate path about the vertical axis of rotation of the die table **10**, their respective paths being shown by phantom line A in FIG. 2 and by phantom line B in FIG. 3.

FIG. 1 illustrates the positions of parts during final compression of a table **28**. In this position the upper punch **14** has been guided by its head **30** with a stationary punch lowering track **34** into sliding engagement with upper cam roll **36**. Simultaneously, the head of lower punch **16** is sliding engagement with lower cam roll **38** after guidance by a stationary weight adjusting cam **40**.

The cam rolls **36** and **38** are of similar construction, being generally mushroom shaped parts, each with a shaft **42** received in the bore of a supporting element **44**. Like reference numerals are employed to designate correspondingly similar parts of the cam rolls **36** and **38**. Each cam roll has a roller **46** with a broad end surface **48** and which is pivotally mounted on its shaft **42** by ball or roller bearings **50**.

All parts of the apparatus thus far described are made of metal material suitable for the function they perform.

According to the invention sliding friction between the head **30** of upper punch **14** and the upper cam structure

is reduced considerably by guiding this punch head 30 with a roller 46 pivotally mounted on a shaft 42 with a vertical rotational axis during compression of a tablet 28. Punch 14 travels arcuate path A across the rounded, broad, end surface 48 at the marginal portion thereof. The frictional contact between the moving punch head 30 and the end surface 48 of roller 46 applies an unbalanced force to the roller 46 which causes it to rotate freely on its bearing 50, thereby minimizing wear of the surface 48. If the surface 48 were immovable, as are the stationary cam parts of the prior art, there would be undesirable wear on this surface. For this reason, path A of the punch 14 is directed away from rotational center of the roller 46.

It is readily apparent that the arrangement of cam roll 38 with respect to lower punch 16 is basically similar to its upper counterpart, the path B of punch 16 being along the margin of its roller 46 on surface 48 and displaced from the rotational axis of its pivot shaft 42. Instead of being mounted for pivotal movement on a vertical axis, roller 46 of cam roll 38 is pivotally mounted on its shaft 42 for movement about an axis inclined to the vertical on the order of 8 to 10 degrees. The angular inclination can be substantially more or less than in this illustration, however. With such an angularly inclined pivot shaft, the broad flat surface 48 of the lower cam roll 38 is inclined a like amount to the horizontal, thereby providing a gentle incline for the punch head 32 which guides the lower punch 16 further into the die cavity for completing compression of the tablet 28 with minimum scuffing of the cam and follower surfaces here involved. The cam roll 38 is disposed in bridging position between adjacent stationary cam surfaces along path B.

It is to be understood that the invention is not limited to any particular location in a tabletting machine, even though it has been shown applied to a final compression station. A cam roll of the type disclosed herein can be used for such other camming functions as ejection, precompression and the like. Although the invention has been shown and described with the shaft 42 mounted on a fixed supporting element 44 it lends itself to mounting on vertically adjustable supporting elements either independently or, for example, in the manner of the prior art cam disclosed in the patent previously cited herein.

Broadly stated the roller 46 of the present invention is mounted for pivotal movement about an axis extending in the same general direction as the axis of the table 10; and the roller axis extends through the end surface 48 thereof that is engageable with a punch, the roller axis being substantially normal to the end surface.

What is claimed is:

1. In a tabletting machine, including a die table mounted for rotation about an axis, a die in said die table, at least one punch carried by said die table in an arcuate path about said axis, said punch being movable inwardly and outwardly of said die in a generally axial direction, and cam structure for guiding the movements of said punch in axial direction by contact therewith during relative motion therebetween along said path, that improvement in said cam structure comprising a cam roll mounted for pivotal movement on an axis extending in the same general direction as the rotational axis of said die table, said cam roll including a roller having a broad end surface substantially normal to the pivotal axis of said roll.

2. A tabletting machine as in claim 1 in which said end surface of said roller is engageable along the marginal portions thereof with said punch.

3. A tabletting machine as in claim 1 in which said end surface is rounded.

4. A tabletting machine as in claim 1 in which said end surface is flat.

5. A tabletting machine as in claim 1 in which the pivotal axis of said roller is parallel to the rotational axis of said die table.

6. A tabletting machine as in claim 1 in which the pivotal axis of said roller is at an angular inclination to the rotational axis of said die table corresponding to the angle of incline presented by said end surface to said punch.

7. A tabletting machine as in claim 1 in which said cam roll has a shaft and roller bearings between said roller and said shaft.

8. A tabletting machine as in claim 1 in which a second punch is provided for coaction with the first mentioned punch, and a second cam roll for guiding the second punch, the pivotal axis of said first cam roll being parallel to the rotational axis of said die table, and the pivotal axis of said second cam roll being at an angular inclination to the rotational axis of said die table.

9. A tabletting machine as in claim 6 in which the inclined surface presented by said end surface is disposed in bridging position between adjacent stationary cam surfaces of said cam structure.

10. A tabletting machine as in claim 1 in which the rotational axis of said die table is vertically disposed, and in which said cam roll is vertically adjustable for selectively positioning the end surface of said roller.

References Cited

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2,166,192	7/1939	Whittemore	107—17
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HENRY S. JAUDON, Primary Examiner

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,545,007 Dated December 1, 1970

Inventor(s) William H. Hamilton

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 1, line 29, "witn" should be -- with --,
line 39, "tne" should be -- the --.

In column 2, line 3, "aerated" should be -- deaerated --,
line 55, "table" should be -- tablet --,
line 59, after "is" insert -- in --.

SIGNED AND
SEALED
FEB 9 1971

FEB. 9, 1971

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents