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TABLET COMPRESSING MACHINE

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4 Sheets-Sheet 1

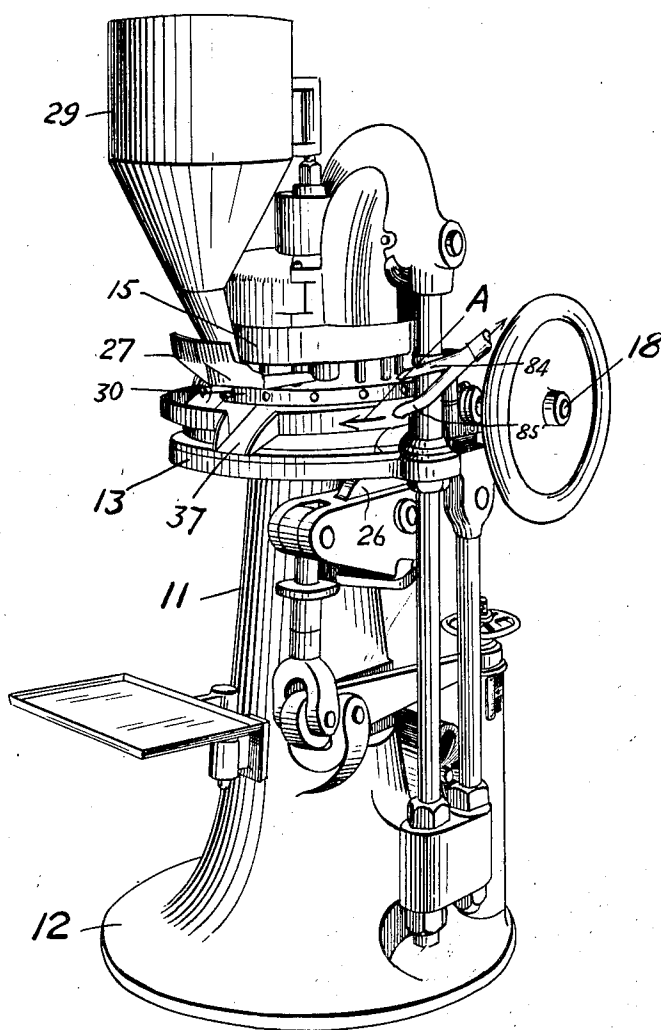


FIG. 1.

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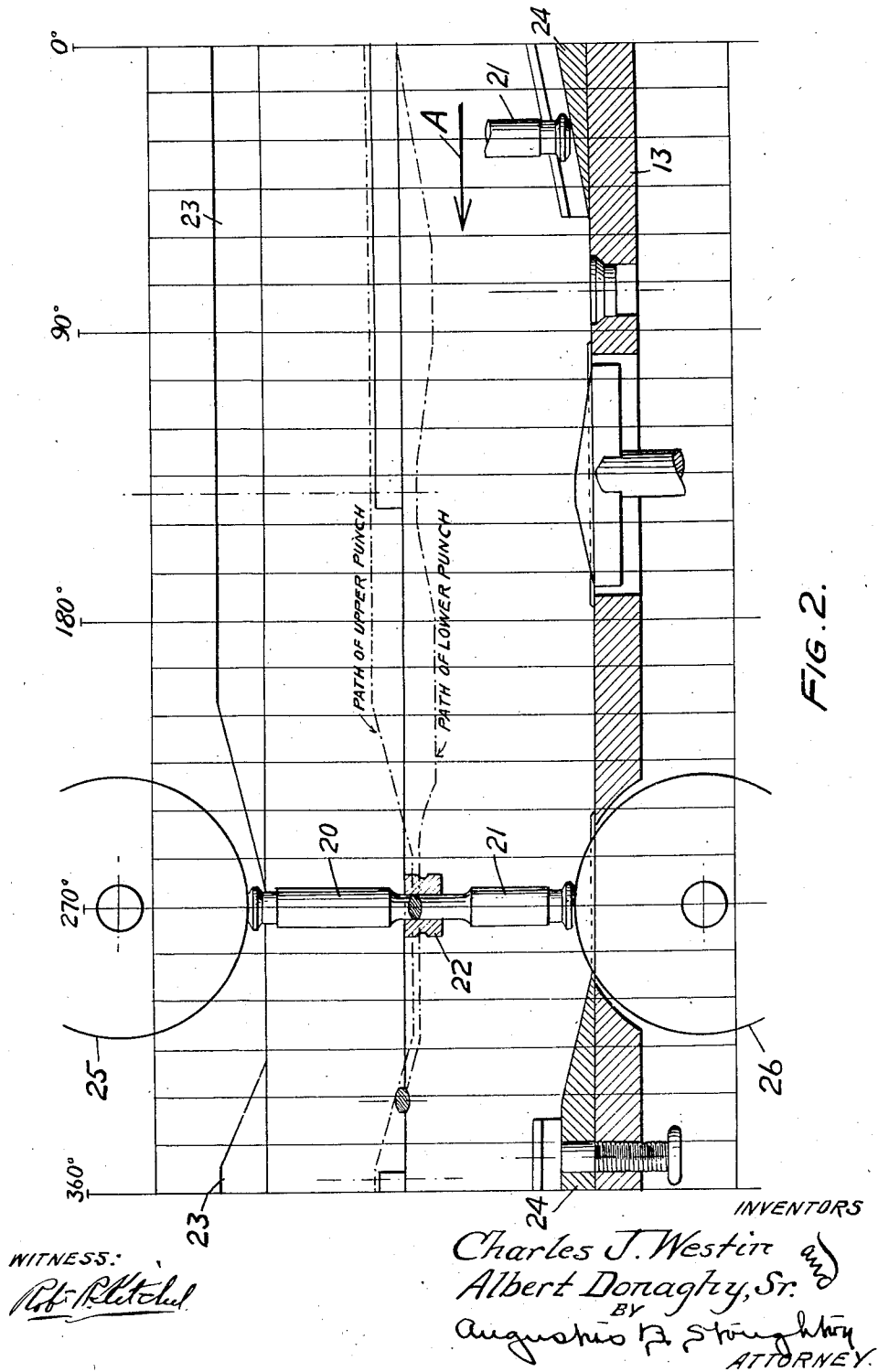
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4 Sheets-Sheet 3

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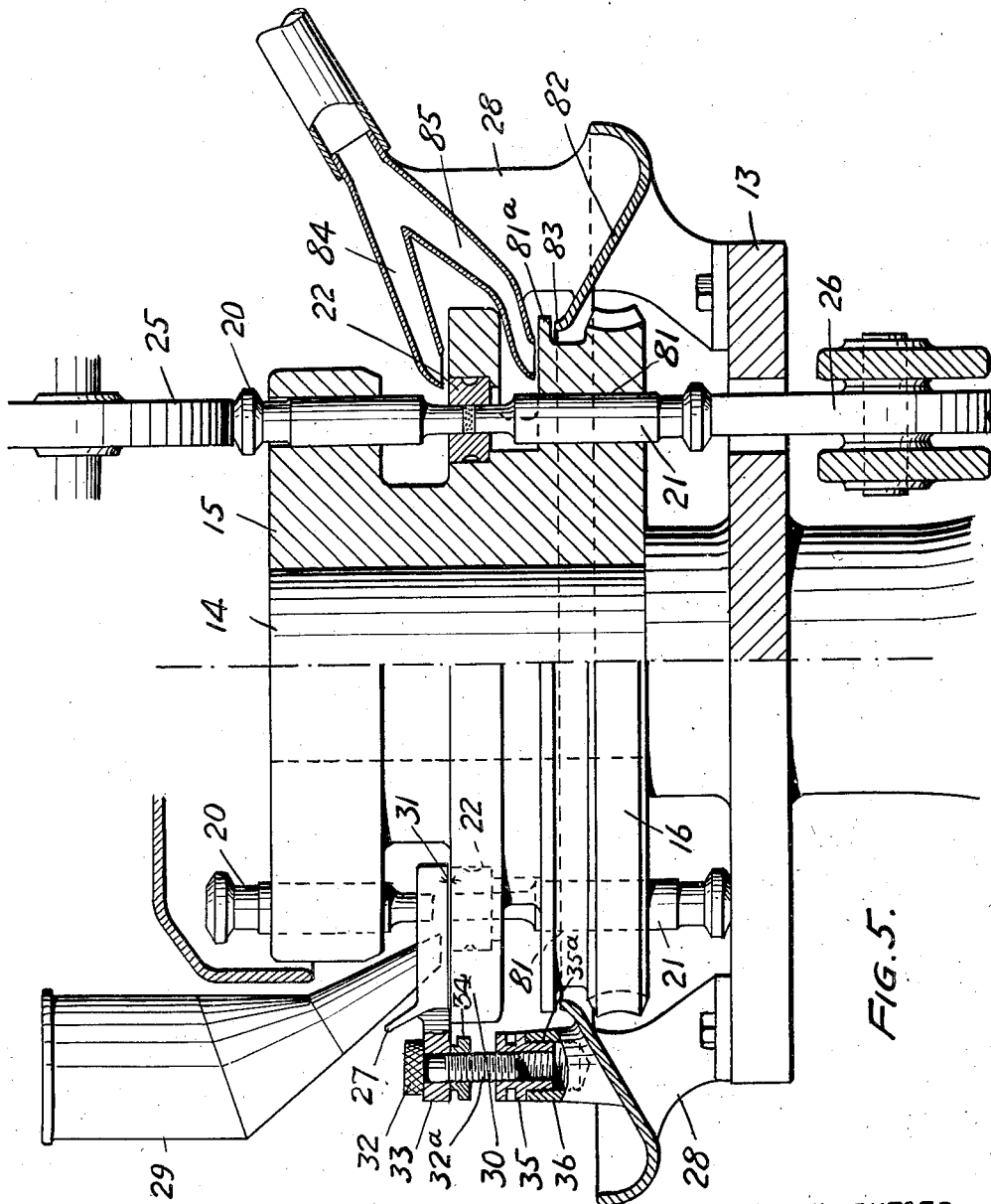
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TABLET COMPRESSING MACHINE

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UNITED STATES PATENT OFFICE

2,043,086

TABLET COMPRESSING MACHINE

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6 Claims. (Cl. 107—17)

The present invention relates to tablet-compressing machines which may be of the rotary type, and pertains particularly to new and useful improvements in the principles of construction which result in economy of manufacture, greater convenience and efficiency of operation, and which materially increase the production rate of the machine.

Features of our invention are new and improved means for holding and adjusting the powder feed frame or grid; new and improved means for adjusting the mold-fill or weight-adjuster; new and improved means and methods for the prevention of dirt around the machine and for dust removal, or for both; and other features relating to details of economies of construction and operation which will definitely appear from the description to follow.

In the drawings:

Fig. 1 is a perspective view of our device with housing 28 omitted;

Fig. 2 is a diagrammatic and schematic development showing parts of the machine and the way in which they operate, with parts shown in cross-section;

Fig. 3 is a plan view of the grid, indicating the adjacent parts of the machine;

Fig. 4 is a side view of the grid and the mold-fill or weight-adjuster cam, with parts in vertical cross-section; and

Fig. 5 is a view in side elevation of the upper part of our machine, with parts in vertical cross-section.

In that embodiment of our invention chosen for illustration in the drawings, there is shown a machine of this general type consisting of a frame 11 provided with a base 12, a stationary table 13 with a central spindle 14 (Fig. 5) on which a rotating mold table or head is mounted. The head 15 is rotated in the direction indicated in Figs. 1 and 2 by the arrow A, as, for example, by a worm-gear 16 (Fig. 5) attached to head 15 and co-operating with a worm (not shown) mounted on shaft 18, which is driven from any convenient source of power. As is best seen in Fig. 5, the head 15 is of such construction that a number of rings or annular disks are superimposed with smaller rings or necks in between, forming a structure of several stories and of diameters to suit the co-acting mechanism. A plurality of apertures are spaced around the head and cut clear through the several stories, to form bearings and seats for the plurality of upper punches 20, lower punches 21 and molds 22. The punches are caused to co-operate with

the mold 22 through cam tracks (best seen in Fig. 2); 23 for the upper, 24 for the lower; or through the upper compressing roll 25 and lower roll 26.

Fig. 2 shows step-by-step in sequence the functions of each set of punches for a complete revolution of 360° of the head 15. The degrees marked along the top are arbitrarily chosen and merely serve the purpose of showing the synchronized action of the parts. At the 0° line, the lower punch 21 starts down, opening the mold cell and the powder flows in, completing the filling at about 95°, where the punch again rises, lifting some of the powder out of the mold, the excess being scraped off at 140°. From this point the lower punch may travel straight or be lowered as the case may be, until it strikes the roller 26 at the same time, or approximately so, that the upper punch 20 strikes the roller 25 and the powder is compressed into a tablet at 270°. At the 330° line, the tablet has been lifted out of the mold and rides off the mold table 30 onto the discharge chute 37 (Fig. 3) at about 350°.

Referring to Figs. 3 and 5, a feed frame or grid 27 is mounted on housing 28. Grid 27 is stationary in respect to the rotating head 15 and the mold-table 30 thereon but extends in over the mold-table, so that the mold table forms the bottom of the grid and, as the head rotates, new molds are successively presented under the grid for filling. Grid 27 consists of a labyrinthian structure formed by walls 127, having openings 128 therein alternately spaced on opposite sides of the center line of molds 22. At its offtake end, or rear end in the direction of rotation of table 15, grid 27 carries a scraper 129, which projects through a slot in the outer wall of grid 27, and which is pressed by a spring 130 into contact with the surface of mold table 30.

Grid 27 receives the material from hopper 29 and, because of its labyrinth-like construction (Fig. 3) and the co-operating effects between the labyrinth and the rotation of the mold-table 30 underneath, the material moves back-and-forth over the molds 22, and, as the punch 21 recedes down from the ejecting position opening the mold-cell to its full capacity, the material flows into this cell and fills it. The grid always maintains a surplus amount of material (indicated at B in Fig. 4) above the mold and the action of punch 21 is such that the mold-cell will receive more material than is needed for the tablet to be compressed but the surplus in the grid, together with the excess powder placed in the grid, is scraped off by scraper 129 as the punch 21

is lifted to form a cell of the proper size at the weight adjusting station, Fig. 5, or at 140° of Fig. 2.

It will be noticed in Figs. 3 and 5 that the feed frame or grid 27 is spaced slightly above the mold-table 30 by the adjustable bolts 32. This space 31 varies in width with different kinds of material and different granulations and must, therefore, be adjustable in respect to the mold-table 30, while at the same time rigidly fixed when once properly set. It is also desirable to have the supporting means so arranged that the grid 27 may quickly be removed from the machine or detached from the support 36 on housing 28 without disturbing the adjustment. This can readily be done with the arrangement of parts as shown. Heretofore, using a plain stud or screw rigidly attached to lug 36 on housing 28, it would cause a very undesirable mess and a lot of wasted material when opening or removing housing 28 in order to get in to gear 16 and punches 21, which frequently is a necessary operation. With the novel arrangement of the double threaded cap or thimble 35 supporting the bolt 32, which is clamped to the lug 33 of grid 27, it is possible to adjust and set the grid at the desired level and, when necessary, to unfasten it from 36 and open housing 28 without disturbing the powder on mold-table 30. The bolt 32 is therefore made of such a length that it does not reach down to the support 36 but has a sufficiently free, but threaded, space 32a above cap 35, so that the cap 35 may be screwed-up on 32 when unscrewing 35 from 36 to clear the top of 36. This is accomplished by having the two threads, that is, the thread 32a on bolt 32 and 35a on cap 35, so arranged that they will co-operate properly. Both threads must be cut the same hand, either left-hand or right-hand, and may be of the same pitch, for example, 13 threads per inch, but we prefer to make 32a of a finer pitch than 35a; for example, 13 threads per inch, while 35a is cut with 10 threads per inch. This is so that, in unscrewing cap 35, it will slightly lift the grid 27 away from the mold-table 30, instead of pulling the grid 27 down and clamping it against the mold-table 30, thus jamming the cap 35 and making it impossible to unscrew it, which would be the case if the relative arrangements of the threads were reversed. The grid 27 is adjusted and set by first tightening cap 35 and, with lock-nut 34 loose, the support 32 can be adjusted to hold the grid at the desired level. Then clamp the lock-nut 34 tightly and, when the cap 35 is unscrewed to release the grid 27, it will return to exactly the same original position when again tightened in 36.

Referring to Fig. 4, our invention embodies some new and useful improvements in the construction and operation of the weight-adjusting mechanism or cam. The cam 40 has a long and gentle slope, providing an easy and gradual rise for punch 21 as it is lifted to form the proper cell depth, regardless of the height to which the punch 21 may be lifted within the range of the machine. Cam 40 has a face 40a in the shape of a ring sector, as seen in plan view, Fig. 3, on a radius conforming to the radius of the punch centers, as seen in plan view, and cam 40 is adjustable in a slot or recess 44 of the stationary table 13 and support 48. The cam 40 is provided with a hollow stem 46 extending down into a suitable aperture or support 48. The stem 46 co-operates with the adjusting screw 47 in raising or lowering cam 40 and is held in the desired

position by screw 47 because of the collar 49, on the one side, and hand-wheel 51 on the other side of the support 48. A spring 52 may be used as a lock to prevent the screw from turning accidentally.

Heretofore, instead of the long ring sector 40a, which provides a gentle slope covering the complete range of adjustment for the weight-adjustment, a plug or disk was used, which necessarily was limited in diameter and, therefore, only had a short and abrupt cam surface, usually requiring a series of auxiliary cams or wedges in front and back in order to cover the complete range of adjustment. In addition to the above inconvenience of having to change wedges, it was necessary, when operating at maximum production speeds, to provide a hold-down for the punch to prevent the punch from jumping off the cam as it reached the apex, which jumping would cause uneven weight of tablets and necessitate operating at reduced speeds. By the use of our invention, all the above difficulties are eliminated.

We have also found it desirable to provide a bridge 43 closely following the inside outline of cam 40 and fastened to the top of table 13, to prevent the punch from dropping down below the top of table 13 in case the slot 44 should happen to be wider than the diameter of the punch heads. It will be noticed that the cam is comparatively narrow, so that the punch head extends about one-third over the edge of the cam. Slot 44 may, of course, be machined to a nice fit with cam 40, in which case the table would support the punch, but for the sake of economy in manufacture slot 44 is cored at the time of casting the table and can, therefore, not be held to such close dimensions that it will furnish sufficient side support for the punch when the low points of cam 40 are below the table top. The bridge 43 nicely serves the purpose of co-operating with cam 40 in forming a continuous support for the punch.

Although materials compressed into tablets are supposed to be granular, they usually contain a certain percentage of fines as well as dust and, while the grid 27 is constructed so as to confine as far as possible all the material and prevent any of it from escaping, we find that in machines of this type, where large quantities constantly are in motion, considerable dust is produced and will accumulate around the working parts of the machine. This dust mixes with the lubricant used on the moving parts, creating a very dirty and undesirable condition. With some materials, the dust has a tendency to absorb the oil in the lubricant, thereby quickly drying the surfaces which results in excessive friction, causing the punches to bind in their bearings, the gearing to wear out, and, in general, is a source of serious trouble and expense. Our invention overcomes these difficulties by the novel arrangement of making head 15 and housing 28 co-operate to the extent of preventing dust from accumulating on mold-table 30 and punch bearings 81, and keeping dust out of the gearing and the other parts within the housing. It will be noticed that the head 15 is constructed so that mold-table 30 is of a larger diameter than punch bearings 81 and, therefore, extends out over the punch bearings, and any granulated material dropping off table 30 will fall on the incline 82 of housing 28 and slide down into the gutter away from the rotating head 15. Furthermore, bearings 81 are provided with a shelf which extends out over

the edge 83 of housing 28. Dust and dirt scraped off this shelf 81 will, therefore, drop onto the incline 82 and also slide down the gutter, where all of it can be collected and conveniently removed without interfering with the operation of the machine.

Most of the dust is created at the compression point, where a puff of dust is carried up out of the mold 22, as well as down through the mold, by the air expelled in the process of compressing the tablet. These puffs of dust would float around and settle all over the machine, as well as all over the room, unless removed at the source. By providing an effective suction system mounted on the frame of the machine or on the housing 28, as shown, we have eliminated this source of trouble. The suction system may consist of two nozzles 84 and 85 connected to a suction fan or dust-collecting system, or the two nozzles may be combined into a double nozzle, as shown in Fig. 5, and piped to the exhausting arrangement (not shown). When expensive material is being compressed, a considerable saving is effected by collecting the dust and mixing it with virgin material for re-use.

By the suitable arrangement of protruding shelves on the head 15, in combination with a properly constructed housing 28 and effectively placed suction nozzles, the machine is kept clean, avoiding the losses otherwise caused by frequent shut-downs for cleaning and repairs.

We do not intend to be limited save as the scope of the prior patents and of the attached claims may require.

We claim:

1. In a tablet machine, a stationary table, first means for conveying a plurality of molds and a plurality of punches for co-operation with said molds, second means for compressing material between pairs of said punches, a grid mounted adjacent said molds so that said molds are movable relative thereto, a hopper mounted to feed material to said grid, bolts forming supports for said grid, caps having screw-threaded engagement with said table, a cam projecting through an opening in said table for co-operation with the lower ones of said plurality of punches, said cam having a face in the shape in plan of a ring sector on a radius conforming to the radius of the punch centers, and located so as to raise the lower ones of said plurality of punches and to adjust the amount of material received by said molds, and means mounted on said table adjacent said second means at the point of compression of said punches for removing dust from around said molds and said punches.

2. In a tablet machine, a stationary table, a mold table mounted for movement on said stationary table and carrying therein a plurality of molds and a plurality of punches for co-operation

with said molds, a grid mounted on said stationary table above that portion of said mold table carrying said plurality of molds, bolts forming supports for said grid, and caps having screw-threaded engagement with said bolts and having screw-threaded engagement with said stationary table, whereby said grid may be disengaged from said stationary table by unscrewing said caps.

3. In a tablet machine, a stationary table, a mold table mounted for movement on said stationary table and having a plurality of molds and a plurality of punches for co-operation with said molds therein, a housing mounted on said stationary table and encircling and underlying portions of said mold table, a grid mounted above that portion of said mold table having the molds, bolts forming supports for said grid, and caps having screw-threaded engagement with said bolts and having screw-threaded engagement with said housing so that said grid may be removed without removing said housing by unscrewing said caps.

4. In a tablet machine, a stationary table, a mold table having a plurality of punches and a plurality of molds therein, a grid of labyrinthian shape in plan having perforations therein and mounted above and adjacent that surface of said mold table in which said molds are located, bolts adjustably supporting said grid above and adjacent said mold table, caps having screw-threaded engagement with said bolts and forming supports therefor, and a housing having screw-threaded engagement with said caps, the screw-threads between said caps and said bolts being of no greater pitch than the screw-threads between said caps and said housing, said housing forming a support for said caps and for said bolts and said grid thereon.

5. In a tablet machine, a stationary table, a mold table having a plurality of molds and a plurality of upper and lower punches therein, a cam extending through a perforation in said stationary table and having a face in the shape in plan of a ring sector on a radius conforming to the radius of the centers of said punches, a support for said cam, and screw-threaded means interposed between said cam and said support for adjusting the height of said cam.

6. In a tablet machine, a stationary table, a mold table having a plurality of molds and a plurality of upper and lower punches therein, a cam projecting through a perforation in said stationary table for co-operating with said lower punches, said cam having a face thereon which conforms in plan to the path of movement of said punches, a support for said cam, screw-threaded means interposed between said cam and said support for adjusting said cam, and means for locking said screw-threaded means in position.

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