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3,016,026

PELLET PRESS

Filed July 16, 1958

Fig. 1.

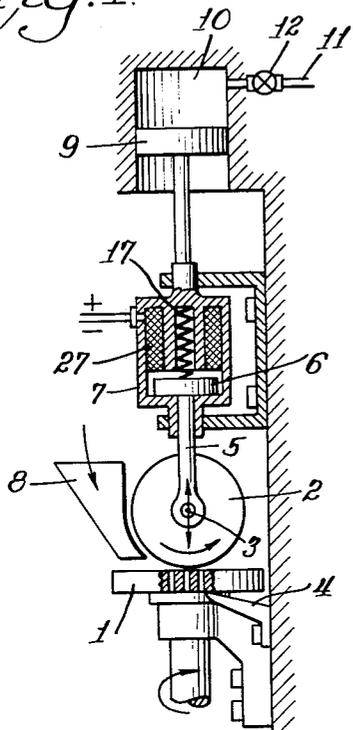


Fig. 2.

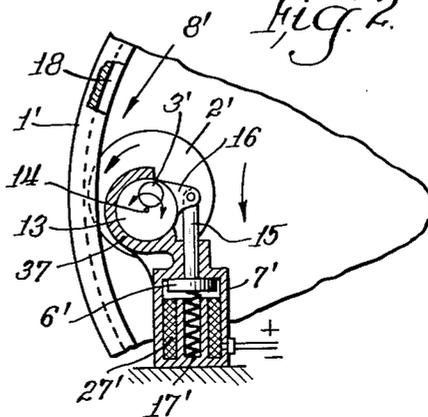
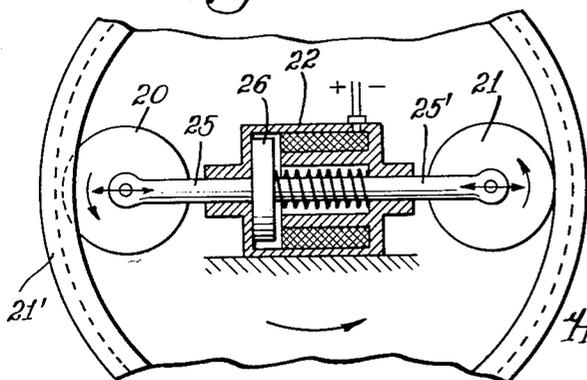


Fig. 3.



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3,016,026
PELLET PRESS

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This invention is concerned with a pellet press, more particularly, a machine for compressing and extruding primarily cylindrical bodies, so called pellets, made of powdered granular or similar comminuted material, especially material to be used as animal feed.

A machine of this type preferably comprises a matrix provided with holes, at least one pressure element movably disposed at one side of the matrix for pressing the material to be processed through the holes extending therethrough and, if desired, at least one cut-off member disposed at the other side of the matrix.

The compressing of feed, for example, green feed, offers considerable advantages, especially insofar as preservation of the feed and storage space are concerned. It has also been found that the use of feed pellets permits reduction of the feeding time.

The pellets may be produced by means of machines of various types, for example, screw presses (gear wheel presses), worm presses, rolling-path presses or ring-presses. The initial costs of such machines are high and the operation thereof is expensive.

The present invention proposes to improve the operation of pellet presses by causing the pressure-applying elements to execute relative to one another a motion the velocity of which is higher than the velocity of the material passing through the holes in the matrix. This is effected by the provision of means for imparting vibrating motion to the matrix, to the pressure element, or to both. The invention permits considerable reduction of the power for operating the press while at the same time increasing the output of pellets produced thereby. Moreover, there will be less dust and less waste produced in the operation, and the individual pellets will be better compressed than by the application of steady or uniform pressure.

The invention may be applied in connection with any one of the previously mentioned presses. In the case of rolling-path presses, the pressure rollers pressed against the face of the matrix execute, in accordance with the invention, in addition to their rolling motion along the circular path of the matrix, a rapid oscillatory motion transverse to the surface of the matrix. The pressure roller can for this purpose be freely rotatably journaled upon a bearing member disposed eccentrically upon a driven shaft. Upon subjecting the shaft to rapid oscillatory rotation, the bearing member and therewith the pressure roller will move forth and back with respect to the matrix which moves relative to the pressure roller. The latter, which is rotated by frictional engagement with the matrix and additionally oscillated by the action of its bearing member, imparts a non-uniform motion to the material to be compressed through the matrix holes.

The invention is advantageously employed in connection with presses having a hollow cylindrical matrix cooperating with at least one cylindrical pressure element which rolls in engagement with the inner matrix wall. Coincident with the rolling motion, there are to be executed slight and mainly radially directed motions between the roller and the matrix. The invention proposes to impart to the shaft about which the pressure element (roller) rotates, a vibratory motion so as to impart to the pressure element vibrations, moving it rapidly inwardly in the direction of the matrix axis and back again to the position in which it engages the matrix. This vibra-

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tory motion is limited to avoid damaging the matrix by hammering. A particularly advantageous embodiment will be obtained in the case of presses with rotating ring-matrices and a pressure drum, by journalling the pressure element eccentrically in a carrier connected with a vibrator. The vibration will in such a case not be directed precisely radially.

Regulation must be provided if the same press is to be used for producing pellets of different shape and size. For this purpose, the pressure element may be mechanically connected with a casing or housing containing the vibrator, and connected with the piston of a stationary compressed air cylinder. The pressure in the cylinder is adjustable so as to change the average force with which the pressure element or roller is pressed against the matrix, thus permitting adjustment of the most suitable average pressure force exerted by the pressure roller and its oscillatory motion relative to the matrix, whereby the adjustment which is most suitable is the one at which the machine delivers the pellets having the desired properties. Spring means may also be employed for supplying the desired pressure force, but the adjustment thereof can not be as readily effected as in the case of a piston operated by air pressure.

The desired vibratory motion between the pressure element and the matrix may be produced electrically or mechanically. When using an electromagnetic vibrator, care must be taken in well-known manner, to adjust the moving masses including the pressure rollers and parts oscillating therewith, and the weight thereof, in accordance with the oscillation frequency, so as to avoid resonances which might impermissibly increase the stresses on the supporting parts. The oscillatory motion of the pressure rollers may also be produced mechanically by disposing the bearing for the pressure roller upon a shaft eccentric to the axis thereof and rapidly rotating such shaft.

The various objects and features of the invention will appear from the description which will be rendered below with reference to the accompanying drawing, in which:

FIG. 1 shows a fragmentary schematic view of an embodiment of the invention—

FIG. 2 is a fractional view of another embodiment applied to a press with circular matrix; and

FIG. 3 shows still another embodiment applied to a press with a circular matrix.

In FIG. 1, numeral 1 indicates a matrix and 2 indicates a pressure element, such as found in customary pellet presses. The matrix is a circular member provided with holes extending therethrough, the cross-sectional shape of the holes corresponding to the desired cross-sectional shape of the pellets to be produced. The pressure element 2 is a cylindrical roller which is rotatably disposed at the end of an arm 5 extending from a vibrating member 6 contained in a casing 7, the latter being connected with a piston 9 disposed within a cylinder 10 which is supplied with compressed air from a conduit 11. The air pressure in the cylinder 10 may be adjusted by means of a valve 12 to move the piston 9 and therewith the vibrator casing 7 with the vibrator member 6 downwardly, thereby applying adjusted force to the pressure element or roller 2 to move it into frictional engagement with the matrix 1, which is suitably mounted for rotation as indicated by the arrow on the matrix shaft. The pressure roller 2 is accordingly frictionally rotated about the axis 3. The material to be processed is supplied by means of a hopper 8. The matrix is a disk-like horizontally extending body carried by a vertically extending shaft, the material being supplied thereto moving on the rotating matrix away from the discharge end of the hopper for compression by the pressure roller 2 and extrusion through the matrix holes.

Portions of the extruded material emerging from the matrix holes may be cut off by means of a cutting member 4, to form the pellets. The cutting member 4 may be in the form of a knife disposed directly underneath the matrix, the emerging material thus moving with the rotating matrix against the knife and being cut off, the resulting pellets falling downwardly for collection thereof in suitable manner.

In the embodiment illustrated in FIG. 1, the pressure element or roller 2 is as above described rotated about its axis 3, by frictional engagement with the rotating matrix 1. Rapid vibratory motions are at the same time imparted to the pressure roller 2 so as to move it rapidly toward and away from the matrix. The vibrating member 6 of the vibrator 7 is for this purpose biased by means of a spring 17 disposed within a coil 27 and pulsating current is connected to such coil to produce energization of the electromagnet, thereby producing electromagnetic forces causing periodic attraction of the member 6 and release thereof by the force of the spring 17, thus vibrating the pressure roller 2 relative to the rotating matrix 1. The means for producing the pulsating current are well-known and have therefore been omitted. The release motion of the vibrating member 6 is stopped when such member engages the bottom wall of the casing 7 to avoid hammering action of the roller 2 against the matrix and the material thereon, thereby preserving the material layer.

In the embodiment according to FIG. 2, there is provided a ring-shaped matrix 1'. The shaft 3' of the pressure element 2' is disposed eccentrically upon a disk 13 which is pivotally movable about axis 14. The disk 13 is journaled in a fixed bearing 37 extending from the casing 7' of an electromagnet, and is provided with a lever arm 16 which is linked to the rod 15 extending from the vibrating member 6'. The structure of the electromagnet with its vibrating member 6' and spring 17 thus corresponds to that of similar parts described in connection with FIG. 1. The operation of these parts is likewise similar. The spring 17' presses the member 6' upwardly, the upward motion thereof stopping, as in FIG. 1, when the member 6' engages the transverse wall of the casing 7'. This upward motion of member 6' turns the disk 13 in counterclockwise direction, thereby moving the axis 3' of the pressure roller 2' to the left, and thus moving the pressure roller substantially radially in the direction of the matrix 1' and therewith increasing the pressure on the material which is being processed and which is supplied to the matrix in the direction indicated by the arrow 8'. As soon as the member 6' has reached its illustrated released position in which it engages the transverse wall of the casing 7', it is attracted again by the action resulting from the energization of the coil 27', thereby turning the disk 13 in clockwise direction resulting in moving the pressure roller 2' away from the matrix and therewith relaxing the pressure on the material which is being processed. FIG. 2 shows only one pressure roller; two or more such rollers or elements are usually employed and distributed as desired with respect to the inside of the ring-shaped matrix.

The ring-shaped wall of the matrix 1' is provided on the inside thereof with a groove 18 in which the pressure roller 2' rides; such groove being somewhat wider than the pressure roller so as to contain the material therein. The depth of the groove exceeds the amplitude of oscillation or vibration of the pressure roller so as to guide the latter securely.

The material to be processed may be supplied to the matrix 1' in generally known manner along the line of the arrow 8', for example, by a suitable hopper such as shown in connection with FIG. 1.

The casing 7' of the vibrator may also be mounted for cooperation with a piston, as illustrated in FIG. 1, to provide for the regulation of the average pressure exerted by the pressure roller relative to the matrix, as already described.

In the embodiment shown in FIG. 3, there are provided two diametrically oppositely disposed pressure elements or rollers 20 and 21, which are vibrated by a common vibrator 22 constructed in similar manner and operating in similar manner as the vibrators shown in FIGS. 1 and 2. The vibrating member 26, corresponding to the vibrating members indicated in FIGS. 1 and 2 respectively at 6 and 6', is however equipped with two rods 25 and 25' carrying at their respective ends the pressure rollers 20 and 21. As will be apparent from FIG. 3, the pressure rollers are by the action of the vibrator 22 alternately respectively pressed against and withdrawn from the matrix 21' by amounts corresponding to the amplitude of the vibrations. The vibrator 22 is thus dually utilized. Regulation of the average pressure exerted by the respective pressure rollers may be provided by the use of air pressure controlled means analogous to the one shown in FIG. 1.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

I claim:

1. A press for processing comminuted food stuff to form edible pellets therefrom, comprising a matrix element having holes formed therein which extend therethrough and a pressure element cooperating with said matrix, means for supplying food stuff to said elements, means for effecting relative movement between said elements to move food stuff therebetween, means for imparting to at least one of said elements a vibratory motion, whereby said food stuff is pressed through the holes in said matrix element and extruded therefrom, and means for cutting off portions from the extruded material to form said pellets.

2. A press according to claim 1, wherein said pressure element describes a circular path with respect to said matrix which extends in a horizontal plane.

3. A press according to claim 2, wherein said matrix is cylindrical and said pressure element is cylindrical and disposed for rolling cooperation with the inside of said cylindrical matrix, and means for causing said pressure-applying element to vibrate radially with respect to said cylindrical matrix.

4. A press according to claim 1 comprising a shaft for journaled said pressure element, a carrier for said shaft, means for eccentrically journaled said shaft in said carrier, and a vibrator connected with said carrier.

5. A press according to claim 1, comprising a shaft for rotatably disposing said pressure element, and an eccentric disk carried by said shaft for imparting vibrational forces to said pressure element.

6. A press according to claim 1, wherein said matrix element is a rotating element, roller means constituting said pressure element pressing upon said matrix, and the vibration-generating means is operatively associated with means for journaled said pressure element, the planes extending in the direction of the roller axis and through the junction between said elements being within the range of the vibrations generated.

7. A press according to claim 1, comprising a ring-shaped matrix element, a pair of rollers each constituting a pressure element, rod means for supporting each roller in rolling pressure engagement with said matrix, and vibration generating means operatively associated with and common to said rod means.

8. A press for processing comminuted food stuff to form edible pellets therefrom, comprising a matrix element having holes formed therein which extend therethrough and a pressure element cooperating with said matrix, means for supplying food stuff to said elements, means for effecting relative movement between said elements to move food stuff therebetween, means comprising a carrier for said pressure element, means imparting vibratory motion to said carrier whereby said food stuff is pressed through the holes in said matrix element and

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extruded therefrom, and means for cutting off portions from the extruded material to form said pellets.

9. A press for processing comminuted food stuff to form edible pellets therefrom, comprising a matrix element having holes formed therein which extend there-
 5 through and a pressure element cooperating with said matrix, means for supplying food stuff to said elements, means for effecting relative movement between said elements to move food stuff therebetween, means for im-
 10 parting to at least one of said elements a vibratory motion, whereby said food stuff is pressed through the holes in said matrix element and extruded therefrom, said last mentioned means comprising a casing containing a vi-
 15 brating member, means for linking said pressure element with said vibrating member to impart vibrations thereto, and means for cutting off portions from the extruded material to form said pellets.

10. A press for processing comminuted food stuff to form edible pellets therefrom, comprising a matrix ele-
 20 ment having holes formed therein which extend there- through and a pressure element cooperating with said matrix, means for supplying food stuff to said elements, means for effecting relative movement between said ele-
 25 ments to move food stuff therebetween, means for im-

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parting to at least one of said elements a vibratory mo-
 tion, whereby said food stuff is pressed through the holes
 in said matrix element and extruded therefrom, said last
 mentioned means comprising a casing containing a vi-
 5 brating member, means for linking said pressure element
 with said vibrating member, a cylinder comprising a
 piston connected with said casing, means for supplying
 a pressure fluid to said cylinder, means for adjusting
 the supply of said fluid to said piston to regulate the
 10 pressure applied to said piston, and means for cutting
 off portions from the extruded material to form said
 pellets.

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