July 31, 1945. W. R. BREND 2,380,499

APPARATUS FOR APPLYING A PLASTIC COATING

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FIG.1.

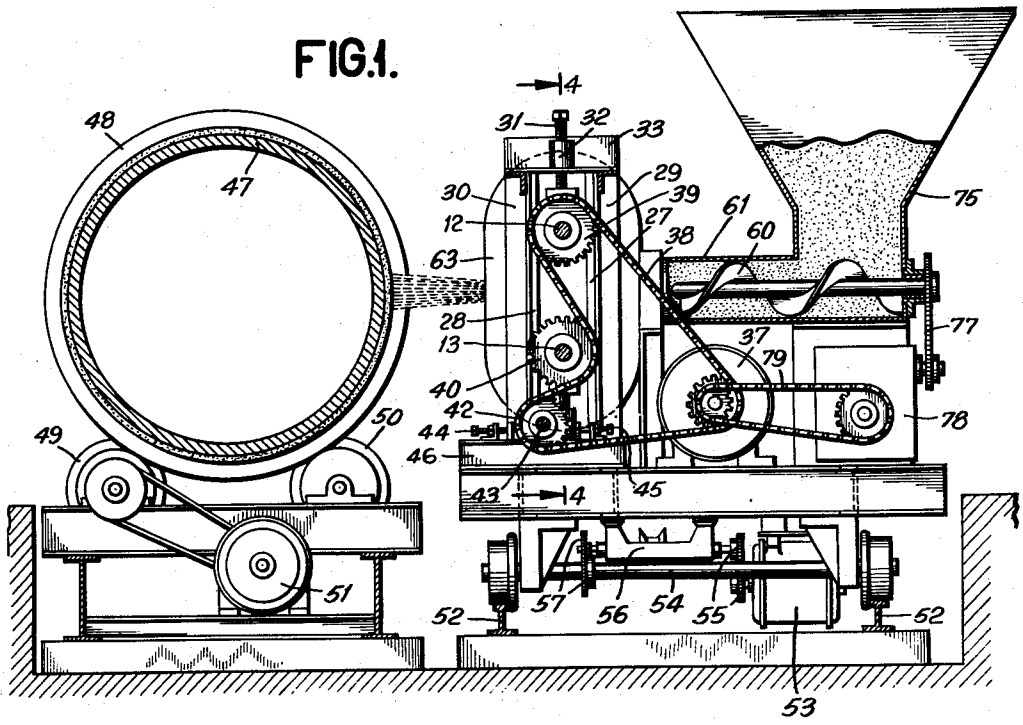


FIG.2.

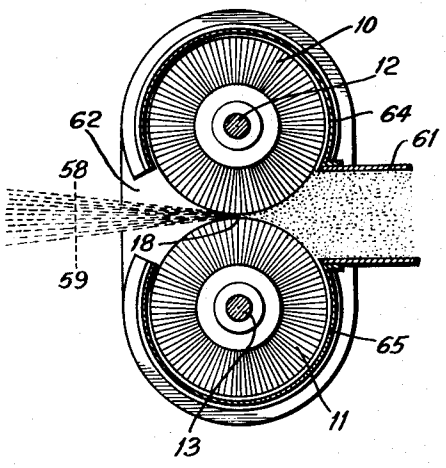
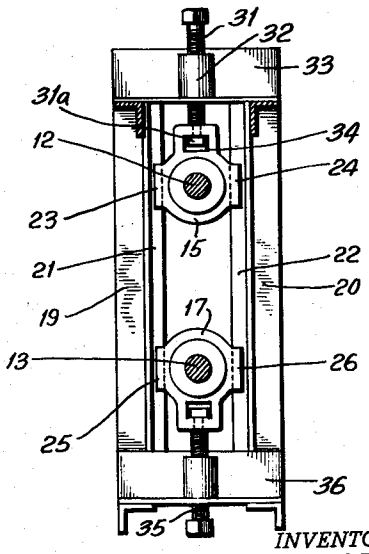


FIG.3.



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APPARATUS FOR APPLYING A PLASTIC COATING

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FIG.4.

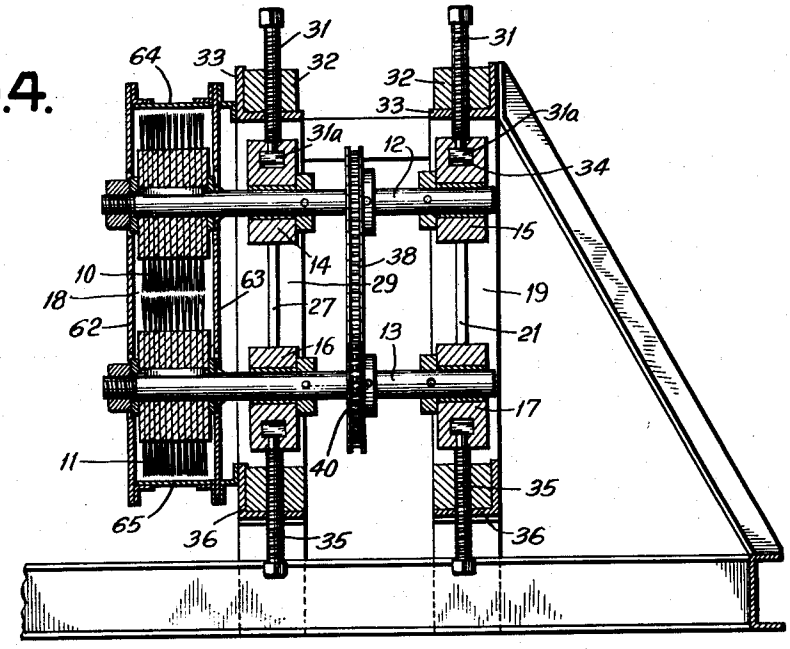
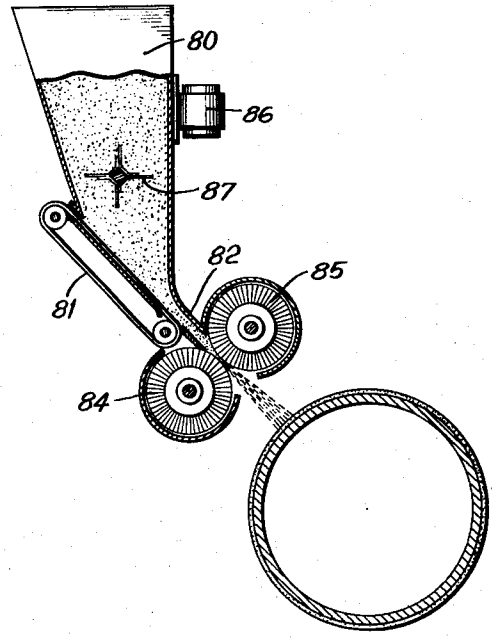


FIG.5.



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APPARATUS FOR APPLYING PLASTIC COATINGS

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Application January 14, 1942, Serial No. 426,711

10 Claims. (Cl. 91—44)

This invention relates to apparatus for projecting plastic material to form a coating. Among the objects of this invention is to provide apparatus for continuously projecting a stream of cementitious material without causing segregation of the particles contained in the material and without otherwise upsetting or affecting the uniform consistency of the stream of material being projected.

Another object of the invention is to provide apparatus for projecting plastic mortar or concrete in a concentrated stream at a high velocity and to utilize these qualities of the stream for obtaining a dense and strong layer of mortar or concrete.

Another object of the invention is to provide an arrangement of rotary brushes which reduces wear on brush bristles and at the same time minimizes friction loss and thereby reduces the amount of power and cost of brush replacement which had formerly been experienced in the use of rotary brushes to impel mortar or concrete.

Another object of the invention is to provide apparatus having brushes which are adjustable for projecting cementitious mixtures having a wide range of sizes of the contained particles of sand or stone and which are capable of projecting different mixtures effectively and without appreciable variation in operating efficiency.

A rotary brush impeller for projecting cementitious plastic material and wherein the ends of the bristles come into contact with a table or steel plate, which together with the brush forms the discharge throat of the impeller, operates effectively enough as long as proper adjustment is maintained, but in such apparatus there is a tendency for the efficiency to lower as the ends of the bristles and the table gradually wear away through abrasion and cause enlargement of the clearance through the throat. As a result frequent and costly replacements become necessary. The apparatus of the present invention obviates the use of a table and, in addition to bringing about a reduction of the cost of operation and a higher operating efficiency, achieves less loss of material through diminution of side spray and provides a more concentrated stream by causing the various particles constituting the mass of mortar or concrete being projected to more nearly assume the same velocity throughout any given cross-section of the projected stream. A consequence of this is that a stronger and denser concrete is obtainable than when a single brush was used. The stream is more concentrated for a given quantity of mateiral being projected and a high velocity is possible with better coatings ensuing.

In addition to overcoming the above-mentioned shortcomings of a single brush machine, the present invention accomplishes further and other objects as will be set forth in the accompanying specification and claims and demonstrated by the drawings which show by way of illustration, a preferred embodiment and the principle of the invention and what is now considered the best mode for applying that principle. Other embodiments of the invention employing the same principle may be used and structural changes made as desired by those skilled in the art, within the spirit of the appended claims and without departing from the present invention.

In the drawings,

Fig. 1 is a section through an apparatus embodying the present invention;

Fig. 2 is a section through the discharge throat of the apparatus showing the relationship of the rotary brushes and material received and projected thereby;

Fig. 3 is an elevational view showing one set of side bearings for the rotary brushes;

Fig. 4 is a section on line 4—4 of Fig. 1; and

Fig. 5 illustrates a modified form of feeding mechanism for supplying plastic material to the brushes.

In applying mortar or concrete, wear upon impelling mechanism is experienced because of the granular character of the material being projected, the hardness of contained particles and the inertia of the material. The wear becomes greater when mortar containing coarse sand is projected. The employment of larger aggregate, such as is used in many forms of concrete, usually increases the wear proportionately. When a rotary brush is used in conjunction with a stationary member or fixed conduit the velocity of the material in the stream varies from maximum next to the brush, to minimum along the stationary member which together with the brush constitutes practically the entire inside area of a discharge orifice. Accordingly in such an arrangement the average velocity of the stream is relatively low and much power is wasted in scouring the stationary member with material. In accordance with the present invention these objections are obviated and advantages are gained.

The present invention involves employment of a moving throat which imparts high velocity to a stream of material while forming and accurately controlling it. The drawings illustrate one manner of accomplishing these results. The ap-

paratus shown utilizes a pair of brushes which rotate in opposite directions and which are so related that their cylindrical surfaces, as outlined by the ends of their bristles, come into contact with the material being projected. The ends of the bristles form a roughened surface which takes hold of the material.

The brushes 10 and 11 are mounted upon parallel shafts 12 and 13 (Fig. 2). The brushes are disposed to cooperate with each other so that their peripheries provide material-impelling surfaces which move in the same direction and at the same velocity. These two moving surfaces constitute a moving throat through, by and from which the material is projected.

Shaft 12 is mounted in a pair of bearings 14, 15 and shaft 13 is mounted in a pair of bearings 16, 17 (Fig. 4). These bearings are preferably so supported as to permit adjustment of the shafts towards and away from each other.

Adjustability of the bearings is provided, particularly for enabling selection of the most desirable spacing between the peripheries of the two brushes to obtain the best operating characteristic for the stream of projected material. In general, the projection of a mortar having fine sand will be better accomplished by a fairly close spacing of the ends of the brush bristles of the two brushes at the locus of discharge 18 and a slightly greater spacing is more desirable for mortars containing coarser sand. For concrete mixtures containing aggregate in the form of gravel or broken stone, the spacing will be enlarged accordingly, but in all cases latitude is permissible to vary the quantity of flow.

Referring to Figs. 3 and 4, the upper and lower bearings for shafts 12 and 13 at one side of the apparatus are supported in a rectangular frame having a pair of standards 19, 20, connected together at their upper and lower ends. Each of these standards is provided with a guide rail 21, 22, extending inwardly toward the shafts. The upper bearing block 15 has two pairs of ears 23, 24 (Fig. 3), one pair at each side, engaging each of the guide rails 21, 22, respectively, the inside faces of a single pair of ears being so spaced as to be in sliding contact with the sides of its associated guide rail. Bearing block 17 of shaft 13 is disposed directly beneath bearing block 15 and is similarly provided with pairs of ears 25, 26, at each side for engaging the respective guide rails 21, 22, by which they are guided.

Upper and lower bearing blocks 14 and 16 which support the ends of shafts 12 and 13, respectively, adjacent the brushes, are similarly provided with pairs of ears at their sides for engaging similar vertical guide rails 27, 28 (Figs. 1 and 4). These vertical guide rails are supported by a pair of standards 29, 30, similar to standards 19, 20. The four standards are connected together into a rigid frame at their upper and lower ends.

The bearing blocks, and hence the shafts 12 and 13 supported thereby, are themselves supported by individual screw and nut units by which the spacing between the shafts can be changed. The screw and nut unit supporting bearing 15, for example, comprises a screw 31 engaged by a nut 32 which is supported upon a cross-bar 33 connecting the upper ends of standards 19, 20. The lower end of the screw has a mushroom head 31a which fits into a T-slot 34 at the upper portion of the bearing block. This connection permits rotation of the screw with respect to the bearing block.

Lower bearing block 17 is maintained in a desired spaced relation with respect to upper bearing block 15 by a similarly constructed and mounted adjusting screw 35 which extends upwardly from member 36. As seen in Fig. 4 similar screw and nut-adjusting units are employed for maintaining the correct spacing between bearing blocks 14 and 16. Under operating conditions the reaction of the material passing between the brushes tends to cause separation of the brushes and of the shafts upon which they are mounted with resulting tension in the adjusting screws. By adjusting the screw and nut units alignment and desired spacing of the shafts may be obtained.

The brushes may be of standard construction and have steel wire bristles extending radially from a hub. It is preferable that these bristles be formed of tough metal, although vegetable bristles can be used. Brush 10 is keyed to shaft 12 and brush 11 is keyed to shaft 13. The shafts are driven by a motor 37 (Fig. 1) through a chain connection 38 which passes over sprocket 39 and sprocket 40 which are carried by shafts 12 and 13, respectively. The chain is trained to rotate the brushes in opposite directions and idler sprocket 42 is so placed as to lengthen the driving connection between the chain and sprocket 40.

The support for idler 42 permits adjustment of chain tension and of the spaced relation between the rotary brush shafts 13 and 14. This idler sprocket is mounted on a shaft 43 which is carried by a bearing arranged for permitting lateral adjustment of the shaft. A pair of adjusting screws 44, 45 are provided on each side of the bearing whereby the bearing and idler may be laterally adjusted along sill 46 which supports the bearing and adjusting screws.

The entire material-projecting assembly is mounted upon a carriage by which it may be moved along the surface to be covered. In the present embodiment of the invention I have illustrated the rotary brush mechanism arranged for travelling along the outside of a pipe, but it can be employed with a carriage which travels upon an arm extending within a pipe for use in applying a lining or coating to the interior wall.

The pipe is rotated as the mechanism is guided or driven along its length. The effect of the axial movement of the mechanism for applying the material and the rotation of the pipe is to cause the material to trace a helical path upon the outside of the pipe, but it is to be understood that the relative movement of the material-projecting mechanism and pipe is incidental only to the application of a continuous coating and that the movements of either the pipe or of the applying mechanism can be different from the arrangement specifically illustrated without affecting the results obtained, and that the mechanism may be used to apply layers of material to planar as well as curved surfaces.

In Fig. 1 the pipe 47 is suitably supported by trunnion rings 48, one at each end of the pipe. Each trunnion ring rests upon a pair of rolls 49 and 50. One of the rolls is driven by a motor 51. The projecting mechanism is mounted upon a carriage which travels on a pair of rails 52 disposed alongside of the pipe. The carriage is driven by a motor 53 which transmits motion to the axle 54 of the carriage through intervening gearing 55, variable speed transmission 56 and gears 57.

An important feature of the present invention is its capability of projecting a substantially uniform stream of material wherein all of the par-

ticles of material are moving at substantially the same velocity. This is because the material which is presented to the brushes and projected from a locus midway between the axes of the brushes is contacted above and below by propelling surfaces or projections which have a common linear velocity. This is particularly true when the ends of the bristles of the brushes pass quite close to each other. Substantially the same result is had when the spacing between the brushes is increased because under such condition the particles proximate the ends of the bristles impart their movement to particles nearer the midpoint of the stream and the impelling force acts from above and below. The ends of the bristles constitute a moving orifice.

It is apparent that the thickness of the stream of material cannot be altogether prevented from increasing as it moves beyond the brushes but each particle of material disposed along a line **58**, **59** throughout any given cross-section of the stream is moving at very nearly the same velocity because all of the particles have a common initial velocity imparted to them by the combined action of the brushes. This combined action of the two brushes tends to concentrate the stream by minimizing dispersion after the material leaves the brushes and all of the material is projected with equal effectiveness for forming a compact coating. The avoidance of variation of the velocity of particles negatives any tendency to segregation between the coarser particles and the finer particles and consequently the uniformity of the mixture is not varied by the impelling action.

It is desirable that the material be fed to the brushes at a uniform rate and without interruption. This feeding may be accomplished by the use of screw element **60** which is contained within a round conduit **61** which opens directly against the brushes as shown in Fig. 2. The conduit flares at its discharge end to merge with and continue into the side walls **62**, **63** and engage peripheral walls **64**, **65** which enclose the brushes. The connection with the four walls encasing the brushes is sufficiently tight to enable delivery of the material to the brushes under pressure.

It is convenient to mount the screw element **60** and its containing conduit **61** at the lower portion of the hopper **75** by which material is supplied to the conduit. A constant source of material will result in a constant feed of material to the brushes which is effected by power rotation of the screw.

Inasmuch as a definite relationship exists between the speed of the brushes and the feed of the material to the brushes, there is advantage in driving the screw and the brushes from the same source of power. This is accomplished by a sprocket and chain connection **77**, speed reducing transmission **78** and chain and sprocket connection **79** between the transmission and the motor **37**. The employment of power feed for the material advancing to the brushes has particular advantage in that it enables the use of relatively dry mixes, and also assures a more uniform delivery of material to the brushes and consequently a flow of material from the brushes at uniform velocity.

In Fig. 5 I have illustrated another form of mechanism for advancing material to the brushes. In this embodiment of the invention the material contained in hopper **80** is discharged from the lower end of the hopper onto a travelling conveyor **81** which directs the material along the conduit formed between the conveyor and the lower end **82** of the hopper. The conveyor is operated by power. The pull of gravity acts to provide a constant supply of material to the rotating brushes **84**, **85**.

In order to assist the passage of material to the conveyor **81**, mechanical devices may be resorted to, such as, for example, a vibrator and motor **86** mounted on a wall of the lower portion of the hopper **80**. An agitator **87** having a plurality of laterally-extending blades, when rotated, will shred the material at the lower end of the hopper and ease its progress towards the conveyor. Brushes **84** and **85** are related to each other and operate in the manner described with respect to brushes **10** and **11**.

The impelling brushes may assume the form of a pair of high speed endless belts, preferably carrying bristles on their exteriors, and arranged to pass a locus forming a discharge throat between them in the manner and form of the throat **18** between the two rotary brushes shown in Fig. 2.

What is claimed is:

1. In apparatus for applying a plastic coating, the combination comprising a pair of oppositely positioned driven elements for impelling plastic material from therebetween, said driven elements having like means defining their peripheries for engaging and impelling plastic cementitious material containing discrete particles, means for directing flow of plastic material simultaneously to approaching material-engaging portions of both of said peripheries, means supporting said driven elements so as to present recurring portions of their peripheries to plastic material directed thereto, and means for actuating said driven elements and material-engaging means thereon at the same speed to impel the plastic material directed thereto in a constant stream.

2. In apparatus for applying a plastic coating, the combination comprising a pair of driven elements for impelling plastic material, means on the surfaces of said driven elements for engaging plastic cementitious material containing discrete particles for imparting motion thereto, means for mounting said driven elements opposite each other so that the motion-imparting surfaces thereon can be moved in the same direction at their positions of closest approach to each other, means for directing plastic material simultaneously to approaching portions of both of the motion-imparting surfaces carried by said driven elements, means for simultaneously driving said driven elements to cause them to project a stream of plastic material from between their motion-imparting surfaces, and means for adjusting said driven elements to change the dimension of their closest approach.

3. In apparatus for applying a plastic coating, the combination comprising a pair of rotary elements for impelling plastic material, bristles carried by said rotary elements and extending substantially radially thereof, means for mounting said rotary elements opposite each other on parallel axes so that the bristles of one of said rotary elements and the bristles of the other of said rotary elements can pass a given locus between the rotary elements without touching each other, means for directing plastic material to said locus between the rotary elements, and means for driving said rotary elements in opposite directions so as to cause them to project a stream of plastic material from therebetween.

4. In apparatus for applying a plastic coating,

the combination comprising a pair of cylindrical brushes, each of said cylindrical brushes having bristles projecting outwardly from the axis of rotation of the cylindrical brush, means for mounting said cylindrical brushes opposite each other on parallel axes, said means being spaced sufficiently apart to provide a locus for the discharge of material from between the brushes, means for supplying plastic material to the locus between the brushes, and means for driving said brushes in opposite directions to project plastic material from said locus between the brushes.

5. In apparatus for applying a plastic coating, the combination comprising a pair of cylindrical brushes, each of said cylindrical brushes having bristles projecting away from the axis of rotation of the brush, means for mounting said cylindrical brushes opposite each other on parallel axes so that the bristles of one of said cylindrical brushes and the bristles of the other of said cylindrical brushes can pass a given locus between the cylindrical brushes when they are rotated, means for adjusting the separation of the peripheries of said cylindrical brushes at said given locus, means for supplying plastic material to the locus between said rotary brushes, and means for driving said cylindrical brushes in opposite directions to cause the bristles carried by the cylindrical brushes to pick up plastic material and project it from said given locus.

6. In apparatus for applying a plastic coating, the combination comprising a pair of rotary elements, each having bristle-like peripheral surfaces, means mounting said rotary elements so as to provide a discharge throat between the bristle-like peripheral surfaces of the rotary elements, means for driving said rotary elements so as to provide between them continually changing bristle-like surfaces at said discharge throat, and means for applying plastic material to said discharge throat between the adjacent rotary elements.

7. In apparatus for applying a plastic coating, the combination comprising a pair of rotary elements, each having bristle-like peripheral surfaces, means mounting said rotary elements so as to provide a discharge throat between the bristle-like peripheral surfaces of the rotary elements, means for driving said rotary elements so as to provide between them continually changing bristle-like surfaces at said discharge throat, conduit means for directing plastic material to said discharge throat between the adjacent rotary elements, and means for forcibly advancing plastic material through said conduit means and into said discharge throat.

8. In apparatus for applying a plastic coating, the combination comprising means including a pair of driven elements cooperatively arranged to present moving surfaces for impelling plastic material from between said surfaces, means mounting said driven elements with portions of said moving surfaces opposite each other so as to present a fixed locus through which the moving surfaces of said driven elements pass and form a throat for the passage of plastic material coming into contact with and between the moving surfaces, conduit means for conveying plastic material to the throat at said locus, means for forcibly advancing plastic material through said conduit means and against approaching portions of both of the moving surfaces of said plastic material-impelling elements, and means for driving said plastic material-impelling elements to cause their moving surfaces to pick up and project plastic material advanced thereagainst and project the same in a stream.

9. In apparatus for applying plastic material, the combination comprising a pair of cylindrical brushes having substantially continuous outer surfaces, means supporting said brushes with portions of their cylindrical surfaces opposite each other so as to provide a discharge throat with the surfaces of said brushes forming opposite walls of the discharge throat, a conduit having a discharge end for supplying plastic material to the ingress portion of said throat, means for feeding plastic material through said conduit under pressure, and means for simultaneously actuating said feeding means and said brushes for causing constant delivery of a stream of plastic material from said throat.

10. In apparatus for applying plastic material, the combination comprising a discharge throat having oppositely disposed surfaces having projections for gripping plastic cementitious material containing discrete particles, means supporting said discharge throat with portions of its material-gripping surfaces opposite each other, means for driving said surfaces in the same direction at said throat, a conduit having a discharge end for supplying plastic material to the ingress portion of said throat, means in said conduit for exerting pressure on plastic material contained in said conduit for forcibly advancing the same onto said plastic material-gripping surfaces of the ingress portion of said throat, and means for simultaneously operating said driving means and said pressure exerting means to cause the projection of plastic material from said throat.

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