Nov. 9, 1965

C. M. SCHOTT, JR

3,216,061

DISPENSER FOR PLASTIC

Filed April 18, 1963

4 Sheets-Sheet 1

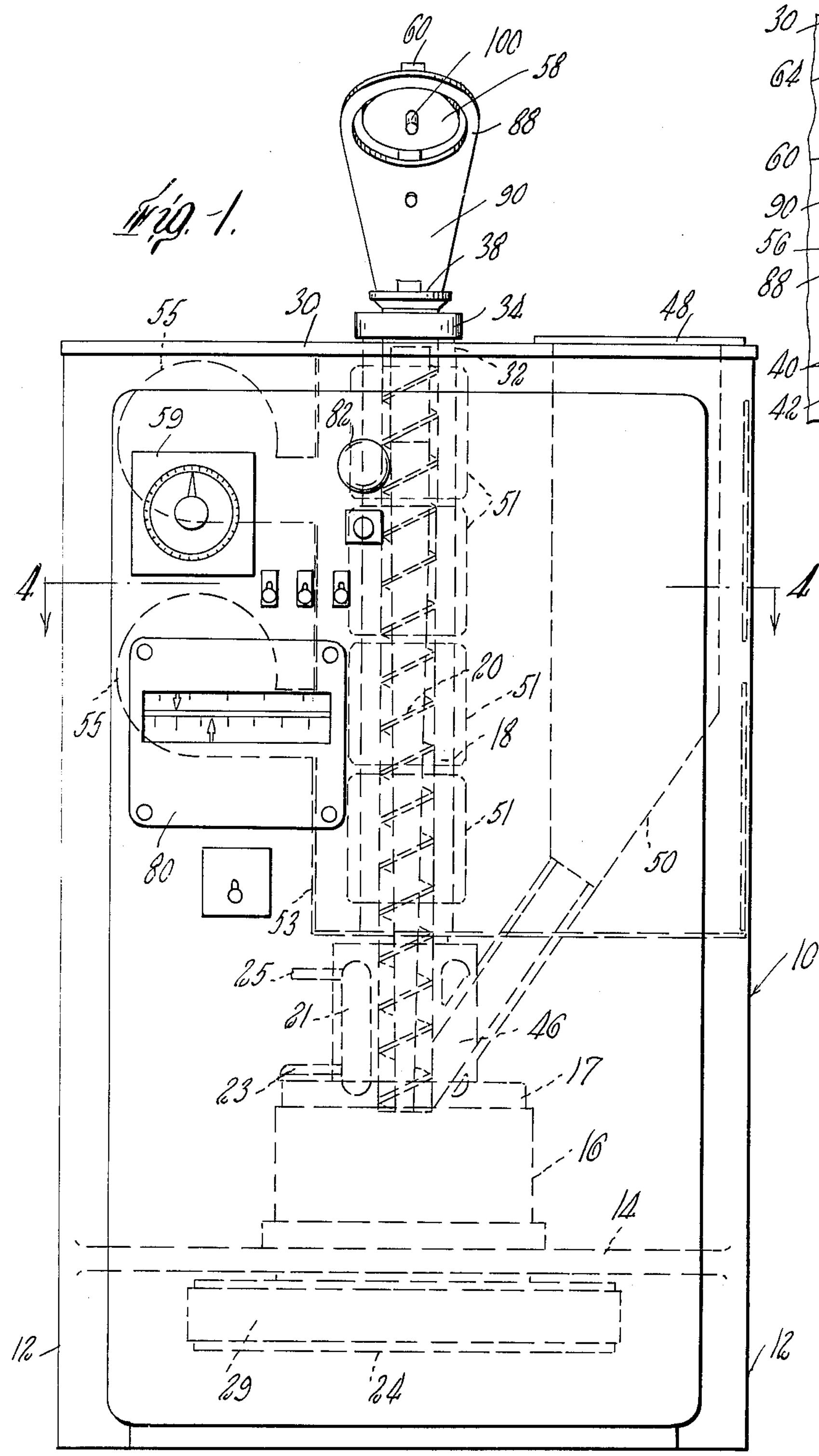

Fig. 1.

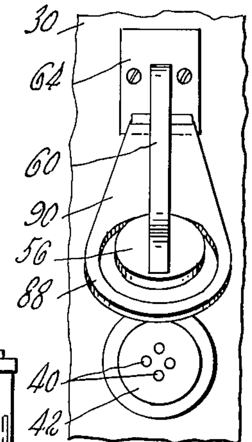

Fig. 2.

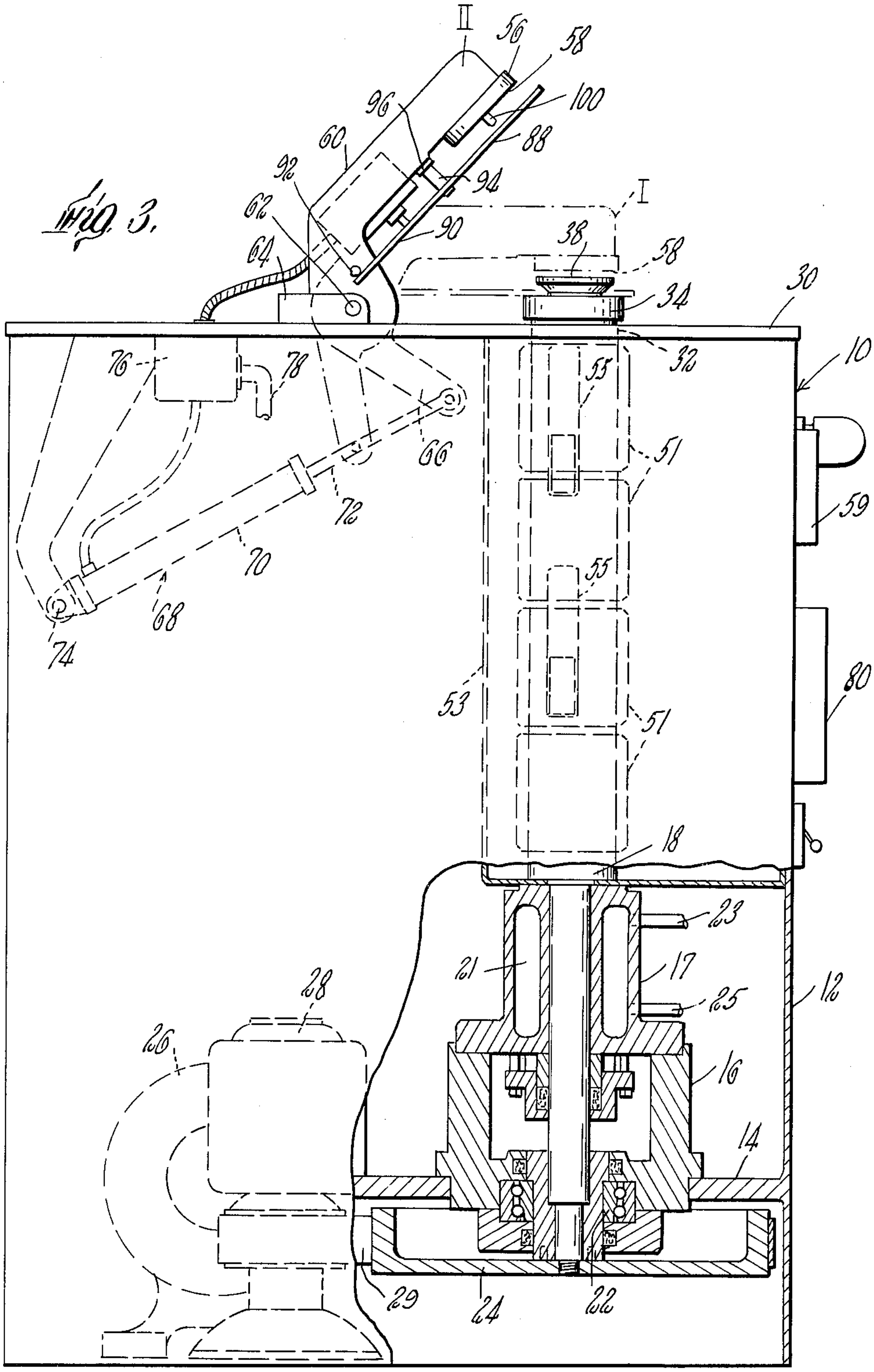

Fig. 3.

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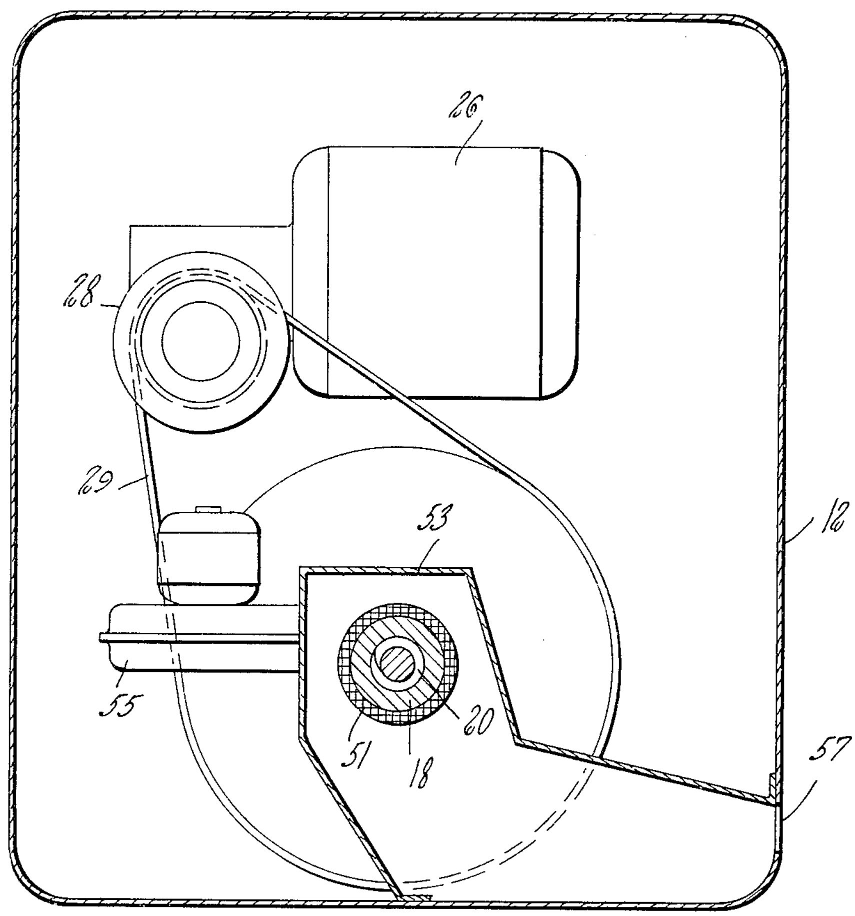

Fig. 4.

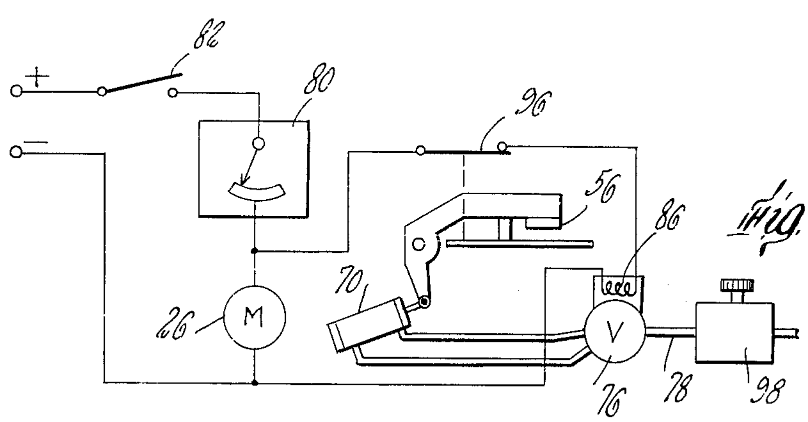

Fig. 5.

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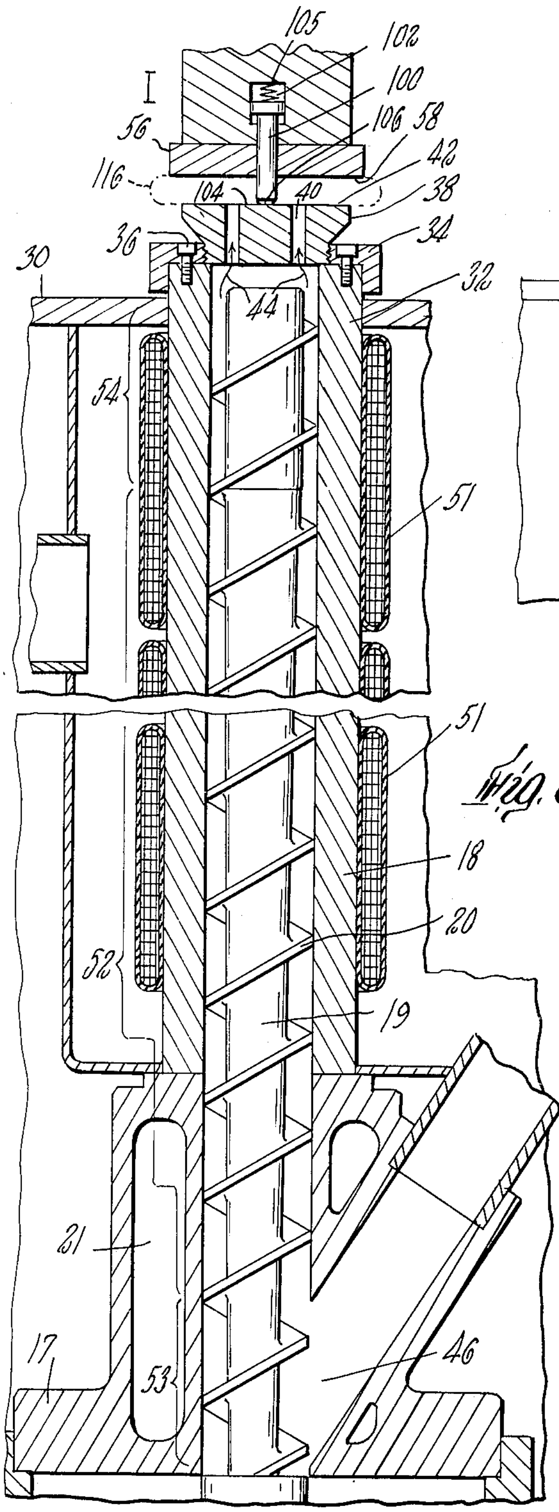

Fig. 6.

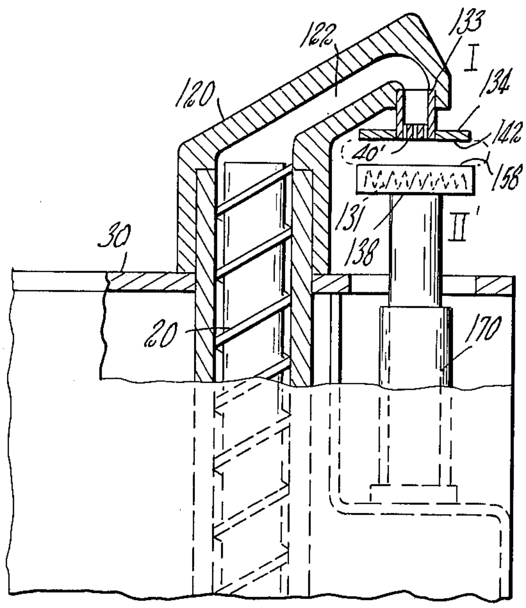

Fig. 7.

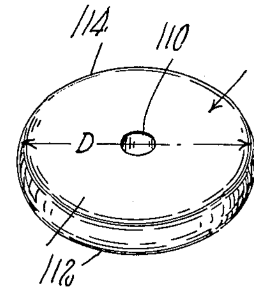

Fig. 8.

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3,216,061
DISPENSER FOR PLASTIC

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Filed Apr. 18, 1963, Ser. No. 273,928
11 Claims. (Cl. 18—5)

This invention relates to a dispenser for dispensing plastic to the operator of a stamping machine for phonograph records.

In the prior art it has been customary to dispense a spaghetti-like mass of heated plastic to the stamping machine operator who works the mass into a flattened form, ordinarily by use of gloved hands. The operator places the flattened plastic charge in the middle of the stamping dies between two labels. The dies are then brought together to form the phonograph record and affix the labels.

In this procedure it is necessary to discard a remarkably large number of phonograph records, e.g. 3 to 5 percent, because of nonfilling of the grooves and split labels, and the operator must spend a considerable percentage of time in flattening each plastic charge. Furthermore, the prior art plastic dispensers have been objectionable from the standpoint of requiring too much floor space in the case of horizontal screw mechanisms or in being too high and cumbersome in the case of overhead mounted screw mechanisms.

It is the main object of this invention to overcome each of the above disadvantages and to provide an improved dispenser apparatus.

In particular, it has been realized that the 3 to 5 percent of phonograph discs that must be discarded due to imperfections is to a large degree caused by the physical form of the plastic charge as it is placed in the stamping machine; the more uniform the thickness of the flattened charge, the more circular it is in form, and the more accurately it is centered in the stamping dies, the better are the grooves in the dies filled during stamping and the less likely it is that the paper labels will be split. It has also been realized that the hand working of the plastic mass by the operator introduces lint and other foreign matter into the plastic which can also lead to imperfections. Furthermore, if the considerable percentage of the operator's time spent in forming the plastic charge could be reduced, the time could be spent in trimming the flash from discs, in placing them in jackets or in operating additional stamping machines, which would be very advantageous because of the highly competitive nature of the industry.

Accordingly, it is a particular object of the invention to provide an inexpensive device for accurately pre-forming a plastic charge for insertion into a phonograph record stamping machine that can more than justify its cost by the improvement in quality of records and efficiency it contributes.

It has also been realized that the prior art dispensers are inefficient with regard to the space that they require, and in the case of the overhead dispensers, low ceilinged rooms cannot even be used.

Accordingly, it is a further object of the invention to provide a cabinet-type dispenser that requires little space, that forms a table surface and does not extend above the operator.

Regarding one aspect of the invention, it has been found that the plastic mass can be pre-formed as it moves through a dispenser outlet by radial extrusion between a first annular forming surface, advantageously flat, that surrounds the outlet and a second forming surface, advantageously flat, that is mounted in opposition to the outlet. The two forming surfaces define a passage that is at a

large angle to the flow from the outlet, preferably perpendicular, and extends radially in all directions. It is found that the mass extrudes through the passage in all directions so uniformly that it assumes a circular form soon after flow commences, the mass growing in diameter but maintaining its circular form as flow continues. Advantageously, the passage is not circumferentially closed or bounded, a provision that eliminates expensive machining and reduces the pumping capacity, hence the length required of the feeding screw. The final diameter and thickness of the mass can then be regulated by the spacing of the forming surfaces and the amount of plastic introduced.

According to the invention a vertical screw is mounted on the floor with upward drive by the screw instead of being mounted overhead with downward drive, while still presenting an outlet at the arm height of the operator. It is found that the ratio of the length of the screw to its diameter can be less than 16:1 rather than 20:1 used by the prior art, so the barrel even beyond the screw can be vertical with the outlet directed upwardly like a fountain yet at arm-level height of the operator, e.g. 40–42 inches above the floor. This is facilitated by the use of a liquid coolant path at the bottom of the barrel to prevent the melting of plastic particles in the supply passage before they enter the screw so that the particles do not stick to the supply passage walls, although the plastic, a small distance from the supply passage, is heated a considerable degree by heaters and by working of the screw.

In pre-forming the plastic mass against the outlet of the dispenser, whether the unique radial extrusion above described or a pressing operation after the plastic has all passed through the outlet is employed, the material is found to preferentially stick to the hottest of the two forming surfaces. According to the invention, the hottest forming surface is advantageously caused to be the lower one so that gravity and the tendency to preferentially stick do not act in opposition to pull the pre-formed mass apart, but rather cause the pre-formed mass to remain on the lower forming surface and to separate from the upper forming surface as the surfaces are moved apart. The operator is then easily able to peel the mass from the lower surface. Such peeling is particularly facilitated by sizing the lower forming surface smaller than the diameter of the mass being formed to provide an overhang which the operator can readily grasp. The fountain-type flow dispenser of this invention employs this principle by having its outlet and the annular forming surface that surrounds the outlet located below the other forming surface, the annular forming surface having a diameter smaller than the charge being formed. Advantageously, this annular forming surface can be defined by heat-conductive material that is in heat-transfer relation to the barrel and its contents so that it is maintained at a higher temperature than the upper forming surface.

Even for screws of large diameter wherein even the less than 16:1 ratio makes the upward acting screw extend above operator-arm height, the teachings of the invention can be applied. A U-shaped barrel extension can be disposed above the top of the screw, and convert the flow from upward to downward, the downward flow passage extending to an outlet at operator-arm level. In such an embodiment the outlet and annular forming surface are above the other forming surface, the latter can be of smaller diameter than the mass being formed and can be heated. The upward drive screw of either the fountain or the reverse flow type enables the dispenser to be in the form of a floor-supported cabinet having a horizontal table surface available to the operator for other uses. The movable forming surface can be mounted above this horizontal table while the safety of the operator who uses the table can be assured by a safety ring that surrounds the movable forming surface to stop its movement towards the other forming surface if an obstruction is encountered.

In the drawings:

FIG. 1 is a front elevation of one preferred embodiment of the dispenser according to the invention;

FIG. 2 is a top plan view of a portion of the embodiment of FIG. 1;

FIG. 3 is a side elevational view, partly broken away, of the embodiment of FIG. 1;

FIG. 4 is a cross-sectional view of the embodiment of FIG. 1 taken on line 4—4 thereof;

FIG. 5 is a control diagram of the embodiment of FIG. 1;

FIG. 6 is a vertical cross-sectional view of the barrel, screw and forming plates of the embodiment of FIG. 1;

FIG. 7 is a side elevational view, partially broken away, of another embodiment according to the invention;

FIG. 8 is a perspective view of a formed charge of plastic produced according to the invention.

Referring to FIGS. 1 and 3, a cabinet structure **10** has side walls **12** supported upon the floor and a horizontal transverse wall **14** adjacent the floor is supported between the side walls **12**. A barrel mounting collar **16** and a barrel flange piece **17**, supported by the transverse wall **14**, mount an elongated vertical barrel **18**. A vertical upwardly acting helical screw **20** is rotatably mounted within barrel **18**, provided at its bottom end with thrust bearing **22** and drive pulley **24** driven by motor **26** through reduction gears **28** and belt **29**.

At the top of the cabinet **10** the side walls **12** support a horizontal table plate **30** having a hole through which the end portion **32** of barrel **18** extends, see also FIG. 6. To the upper end of the barrel a collar **34** is secured by bolts **36**. The collar has a threaded central opening into which an end plate **38** is screwed. The end plate **38** (see FIG. 2) has a number of small centrally arranged openings **40** defining the outlet from barrel **18** and immediately adjacent thereto the end plate defines an outer annular forming surface **42**, here a planar surface, extending at a right angle to the direction of flow indicated by the arrows **44** through the outlet.

Referring to FIG. 1, the flange piece **17** and the bottom of the barrel **18** are provided with a supply opening **46** to the screw. Walls **50** define a supply passage that extends from supply opening **46** up to an opening **48** in the table plate **30** into which plastic particles, e.g. granules or powder, can be fed. The flange piece **17** is made of heat-conductive metal and defines a liquid coolant passage **21** that surrounds the barrel adjacent the supply opening, the coolant passage connected to inlet and outlet coolant conduits **23** and **25**, respectively.

Referring to FIG. 6, above the supply section **53** the helical screw **20** has a transition section **52** in which the plastic is progressively compressed and heated by mechanical working in a conventional manner due to decrease in flow cross-section provided by the upwardly increasing taper of the root shaft **19** of the screw **20**. The helical screw **20** has at its upper end a metering section **54** of constant root diameter extending only two turns of the screw. The ratio of the combined length of the transition and metering sections (the "working" length) to the outer diameter of the screw flight is less than 16:1. In this preferred embodiment the outer thread diameter is 1½ inches, the pitch of the screw is 1½ inches, the root diameter at the beginning of the transition section is ¾ inch, the root diameter at the end of the transition section is 1½ inches and the overall length of the barrel including the supply section is 27 inches. It is therefore possible for the cabinet **10** to be supported directly on the floor while the upper surface of end plate **38** at the top of the barrel is disposed at operator-arm height.

A series of cylindrical heaters **51** surround the barrel **18**. A blower shroud **53** surrounds the heaters and has openings through which air from blowers **55** is introduced and has an outlet **57** through which hot air can escape. An adjustable temperature control device **59** (FIG. 1) is adapted to turn the heaters **51** and the blower **55** on and off to regulate the temperature of plastic within barrel **18** in a conventional manner.

A forming plate member **56**, preferably planar as shown, defines movable upper forming surface **58**. It is supported on movable mount **60** that moves between two positions, position I shown in dotted lines in FIG. 3 and in solid lines in FIG. 6, and position II shown in solid lines (FIG. 3.) In position I upper forming surface **58** is placed in opposition to the outlet **40** and substantially parallel to the annular lower forming surface **42** adjacent the outlet. The movable mount **60** in position II locates the first forming surface **58** at an inoperative position, spaced a substantial distance from forming surface **42**. Preferably, as shown in FIGS. 2 and 3, the movable mount **60** is an arm that is pivoted about axle **62** in bracket **64** mounted on table plate **30**. A bell crank **66** below table plate **30** is connected to the arm and a control mechanism **68** is provided to move the movable mount, preferably comprising pneumatic cylinder **70** having a push rod **72** connected to bell crank **66**, the pneumatic cylinder pivotally connected at its opposite end to axle **74** fixed to the cabinet structure. The pneumatic cylinder **70** is connected through control valve **76** to a source **78** of compressed air. An adjustable regulator **98** controls the force applied by the cylinder.

Referring to FIG. 5, timer mechanism **80** (FIG. 1) is controlled by starting switch **82** and in turn controls screw drive motor **26** and, through microswitch **96**, a solenoid **86** that controls control valve **76**.

Referring to FIGS. 1–3, a safety ring member **88** is supported below the movable forming plate member **56**, the safety ring member supported by arm **90** that is pivoted on axle **92** to movable mount **60**. A spring **94** urges the pivot arm **90** away from movable mount **60** and a microswitch **96** is supported on movable mount **60**, positioned to be opened by pivot arm **90** in the event the ring member **88** is displaced toward the movable mount. The microswitch **96** when opened breaks the circuit from the timer to the solenoid **86** of the control valve **76** thus to interrupt the flow of air to the pneumatic cylinder **70** to stop the movement of movable mount **60** toward position I in the event an obstruction is encountered by the safety ring member **88**.

In this preferred embodiment a spindle pin **100** is resiliently mounted by a spring **102** to extend downwardly from forming surface **58**. The spindle pin **100** is located centrally of the outlet **40** in position I. An abutment **104** in the center of the outlet **40** is adapted to engage the end **106** of the spindle pin, and the spring maintains the spindle pin engaged with said abutment, regardless of the thickness of the plastic mass being formed. An abutment **105** behind spindle pin **102** serves as a stop that prevents engagement of the two forming plates **38**, **56**.

In operation the operator feeds plastic particles through opening **48** in the table **30**, the particles proceeding to the supply opening **46** at the bottom end of the screw. The operator adjusts the temperature of the temperature control device and the screw drive motor is energized to fill the barrel. Thereafter when the operator requires a formed plastic charge for his phonograph disc stamping machine, he presses starting switch **82**. This energizes the timer mechanism **80** and for a selected interval of time voltage is applied to motor **26** and solenoid **86**, thus to position the movable forming surface **58** in position I, and to cause the helical screw **20** to turn. The screw forces plastic to flow through outlet **40** defined in the preferred embodiment by 4 orifices of about $\frac{3}{16}$ inch diameter, the plastic thus flowing out in limber spaghetti-like form until the space immediately above the outlet 40 is filled. Thereafter the plastic extrudes radially outwardly in all directions between the two forming surfaces 42 and 58. As the upward force transmitted through the plastic increases, the first forming surface 58 is forced upwardly slightly depending upon the value of the air pressure applied by adjustable regulator 98; this resiliency of the forming surface promotes smooth lateral movement of the plastic. The plastic charge grows in biscuit-like form with a circular periphery for the duration of the movement of the screw. The thickness of the charge depends substantially upon the air pressure controlled by regulator 98 and the height of the upper surface of the bottom plate 34, and the diameter of the charge depends upon the duration of movement of the screw, controlled by timer mechanism 80. Bottom plates 34 of various heights and of various diameters can be inserted to adjust the thickness while preserving the parallel relation between the two forming plates.

Referring to FIG. 8, the thus-formed plastic charge 108 has a central opening 110, flat opposite sides 112 and a circular periphery 114 centered on central opening 110. Advantageously, as shown in FIG. 6, the end plate 38 that provides the annular forming surface 42 has a diameter less than the diameter D of the plastic charge 108 so that when the charge is fully formed it has an overhanging portion 116 relative to the end plate 38.

According to the invention it is realized that the plastic tends to adhere to the hottest of the forming surfaces. The end plate 38 therefore is advantageously formed of heat-conductive material such as aluminum and is disposed as shown in FIG. 6 in a heat-conducting relation with barrel 18 and its contents, both barrel 18 and collar 34 being comprised of heat-conductive material. The plate member 56 defining the first forming surface is not heated in this embodiment but air cooled and hence it is maintained cooler than the annular forming surface 42. Accordingly, at the end of the timer cycle, when current is interrupted to control valve 86 to cause the pneumatic piston to move forming plate 56 to the inoperative second position II, that upper forming plate 56 preferentially separates from the plastic charge, the charge remaining adhered to the lower forming surface 42 due to the combination of the preferential heat adherence and gravity. But because the plastic charge 108 has the overhang 116 relative to the lower plate member 38, the operator can readily grasp the charge and peel it from the lower plate member 38, and immediately introduce it to the stamping machine where the central opening 110 of the charge can accurately position the entire mass upon a spindle in the stamping dies.

The fountain-type dispenser of FIGS. 1–6 is unique in a number of ways. It provides a simple means of accurately pre-forming a charge of plastic and presenting it at the operator-arm height. The plastic is uniformly distributed about the center of an opening. The forming surfaces can merely be flat machined surfaces, much less expensive than dies, with the cavity in which the plastic charge is formed having an unbounded periphery. This, in conjunction with the thickness and diameter adjustments allows changes to be tailor-made for the kind of records desired. The dispenser can be used in any room, there being no ceiling limitation as there is with the prior art are overhead dispensers. A substantial table surface is provided, housing the dispenser mechanism and available to the operator for other uses. The unbounded periphery of the preferred radial extrusion passage imposes such a low pumping requirement that the less than 16:1 length to diameter ratio, upward flow screw can be employed. Particularly in conjunction with the liquid coolant at the entry of the plastic particles to the screw, the length to diameter ratio of the screw can be less than 16:1 rather than the ordinary 20:1, which enables floor mounting while still the charge being formed on the top of the outlet is presented at arm-height level. The liquid coolant maintains the bottom-most portion of the screw and the supply passage cool so that the plastic particles can flow freely and not stick in the supply passage, even if the upper portion of the barrel becomes overheated.

Numerous of the above advantages of the invention are obtained, however, with the embodiment of FIG. 7 in which at the top of the vertical, upward flow screw 20, a barrel extension member 120 is provided defining a passage 122 in the form of a U redirecting the flow of plastic from upward to downward. A member 133 defines downward flow outlet 40′, and an annular plate member 134 provides an air-cooled horizontal planar annular upper forming surface adjacent to outlet 40′. A pneumatic cylinder 170 supports a bottom plate member 138 of a diameter smaller than that of the charge to be formed. A heater means 131 maintains the bottom forming surface 158 defined by the bottom plate member 138 hotter than the upper forming surface 142. In an alternative embodiment the bottom plate 138 may rest on a weighing scale as the plastic flows through the outlet 40′, and the scale can stop the screw when the proper weight of plastic is dispensed.

Numerous other specific details can be varied within the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. In a thermo-plastic dispenser having an elongated heated barrel, an elongated screw rotatably mounted within said barrel, a supply opening at one end of said barrel, and an outlet at the opposite end of said barrel, the dispenser adapted to heat thermo-plastic material supplied through said supply opening and force it to flow to said outlet, and the dispenser having a flow regulating means to cause a predetermined quantity of plastic to flow through said outlet, the combination of means defining an annular first forming surface that surrounds said outlet and is adjacent thereto, said first forming surface extending at a substantial angle to the axis of said outlet, means defining a second forming surface, a movable mount for said second forming surface adapted to move it between first and second positions, said mount adapted to locate said first position of said second forming surface in spaced apart flow-diverting opposition to said outlet and spaced apart and substantially parallel to said first forming surface, in proximity thereto to cause said forming surfaces to define a passage set at a large angle to the direction of flow through said outlet, said first and second forming surfaces cooperatively constructed and arranged to define said passage at least substantially cylindrical in cross section, coaxial with said outlet and peripherally unbounded, the passage extending radially from said outlet in all directions, said second position of said second forming surface being spaced an inoperative distance from said first forming surface to allow removal of the formed plastic mass, and control means synchronized with said flow regulating means to forcibly hold said movable mount and said second forming surface in said first position during flow of plastic from said outlet to cause said plastic to divert and extrude radially into said passage in all directions, and said control means adapted thereafter to move said movable mount to said second position.

2. The dispenser of claim 1 wherein said first and second forming surfaces are arranged substantially horizontally one over the other and means is provided to maintain the lower forming surface at a temperature higher than that of said upper forming surface.

3. The dispenser of claim 1 wherein said first and second forming surfaces are arranged substantially horizontally one over the other, said outlet being directed upwardly, said first forming surface being the lower of said forming surfaces, and said barrel is straight throughout its length and is adapted to be supported by the floor and locate said outlet at operator-arm height, the working

portion of said screw having a working length to diameter ratio of less than 16:1, and means defining a liquid coolant path located at the bottom of said barrel adjacent the supply opening.

4. The dispenser of claim 1 wherein said control means includes adjustable means adapted to resiliently hold said forming surfaces in spaced apart, opposed relation whereby as plastic flowing through said outlet increases the force exerted upon said forming surfaces the spacing therebetween can increase to increase the thickness of the mass being extruded and to maintain smooth radial extruding movement of said plastic between said forming surfaces.

5. The dispenser of claim 4 wherein said control means comprises a pneumatic cylinder adapted to force one of said forming surfaces toward each other and adjustable means controlling each air pressure to said cylinder to regulate the force applied.

6. The dispenser of claim 4 wherein a spindle member is resiliently mounted relative to one of said forming surfaces and extends generally perpendicularly therefrom, located centrally of said outlet, and means defining an abutment surface at said outlet in a fixed relation to said other of said forming surfaces, adapted to engage the end of said spindle member, the spindle member adapted, by the resiliency of its mounting, to maintain contact with said abutment as the spacing between said forming surfaces increases.

7. The dispenser of claim 6 wherein a safety member is disposed at a level between said forming surfaces and is mounted to move with said movable forming surface, said safety member adapted to be displaced relative toward said movable forming surface upon encountering an obstruction, and a switch adapted to be actuated by the said relative movement of said safety member, said switch adapted to halt the movement of said movable forming surface toward the other forming surface.

8. A thermo-plastic dispenser having an elongated heated barrel, an elongated screw rotatably mounted within said barrel, a supply opening at one end of said barrel, and an outlet at the opposite end of said barrel, the dispenser adapted to heat thermo-plastic material supplied through said supply opening and force it to flow to said outlet, and the dispenser having a flow regulating means to cause a predetermined quantity of plastic to flow through said outlet, the combination of means defining an annular first forming surface that surrounds said outlet and is adjacent thereto, said first forming surface extending at a substantial angle to the axis of said outlet, means defining a second forming surface, a movable mount for said second forming surface adapted to move it between first and second positions, said mount adapted to locate said first position of said second forming surface in spaced apart flow-diverting opposition to said outlet and substantially parallel to said first forming surface, in proximity thereto to cause said forming surfaces to define a passage set at a large angle to the direction of flow through said outlet, said forming surfaces cooperatively

constructed and arranged to define said passage cylindrical in cross section, coaxial with said outlet, and peripherally unbounded, the passage extending radially from said outlet in all directions, said second position of said second forming surface being spaced an inoperative distance from said first forming surface to allow removal of the formed plastic mass, and control means including a pneumatic cylinder and adjustable means adapted to control the air pressure of said cylinder, said control means synchronized with said flow regulating means to resiliently hold said movable mount and said second forming surface in said first position during flow of plastic from said outlet to cause said plastic to divert and extrude radially into said passage in all directions, said adjustable pneumatic cylinder adapted to permit the movement of said second forming surface in the direction away from said first forming surface to enable the mass extruding from said outlet to increase in thickness simultaneously as it increases in diameter as it extrudes through said cylindrical cross section passage, said control means adapted to move said movable mount to said second position to expose the formed plastic mass for removal, said forming surfaces cooperatively arranged so that one has a substantially greater amount of adhesion to said plastic mass whereby adherence of said plastic mass to said forming surface can occur when said second forming surface is moved away.

9. The plastic dispenser of claim 8 wherein said forming surface having said substantially greater amount of adhesion comprises said first forming surface surrounding said outlet, whereby said plastic mass is enabled to remain on said outlet when said second forming surface is moved away.

10. The dispenser of claim 9 wherein said forming surface having said greater adhesion is given said quality at least in part by means maintaining the temperature of said forming surface higher than that of the other forming surface.

11. The dispenser of claim 8 wherein said flow regulating means to cause a predetermined quantity of plastic to flow through said outlet comprises an adjusting timing means whereby the shape of said extruded plastic mass is simply controllable by adjustment of said timing means and adjustment of the air pressure of said pneumatic cylinder.

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