Dec. 29, 1959 J. GARVEY 2,918,714

SPLIT PLODDER NOZZLES

Filed March 22, 1957 3 Sheets-Sheet 1

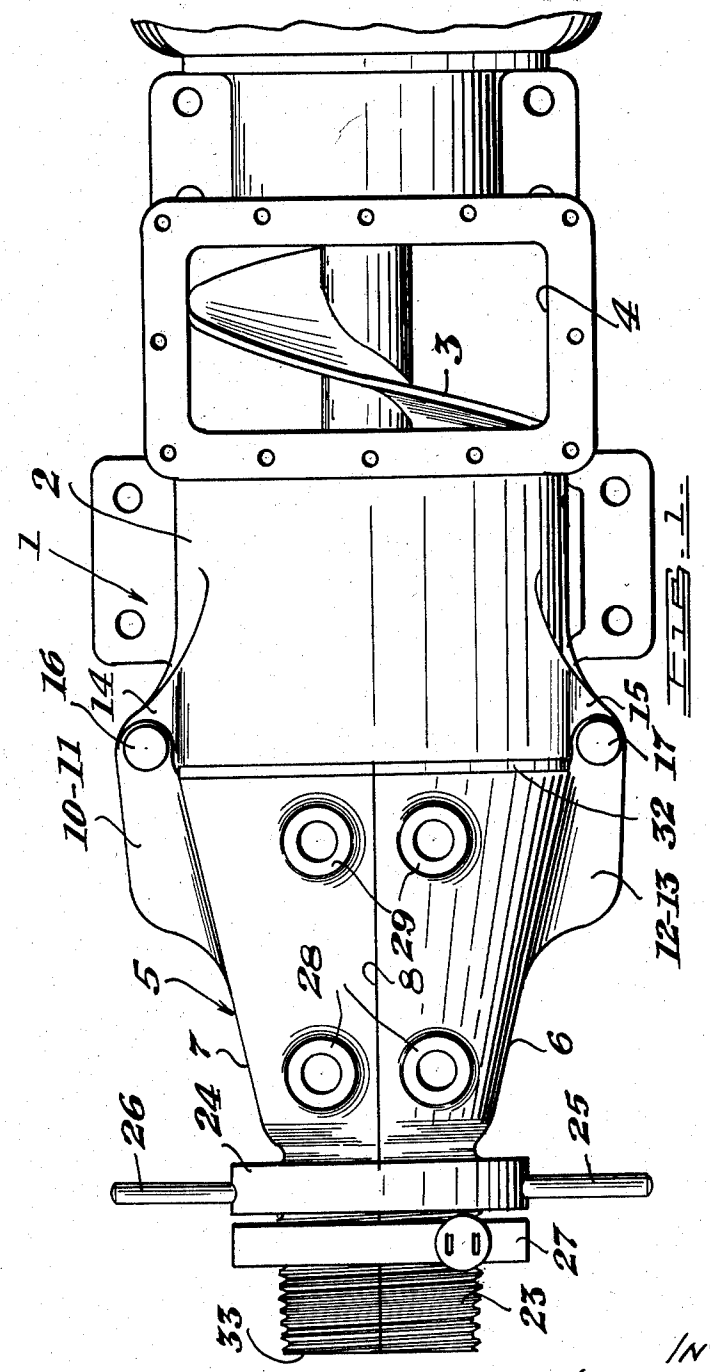


FIG. 1.

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Filed March 22, 1957 3 Sheets-Sheet 2

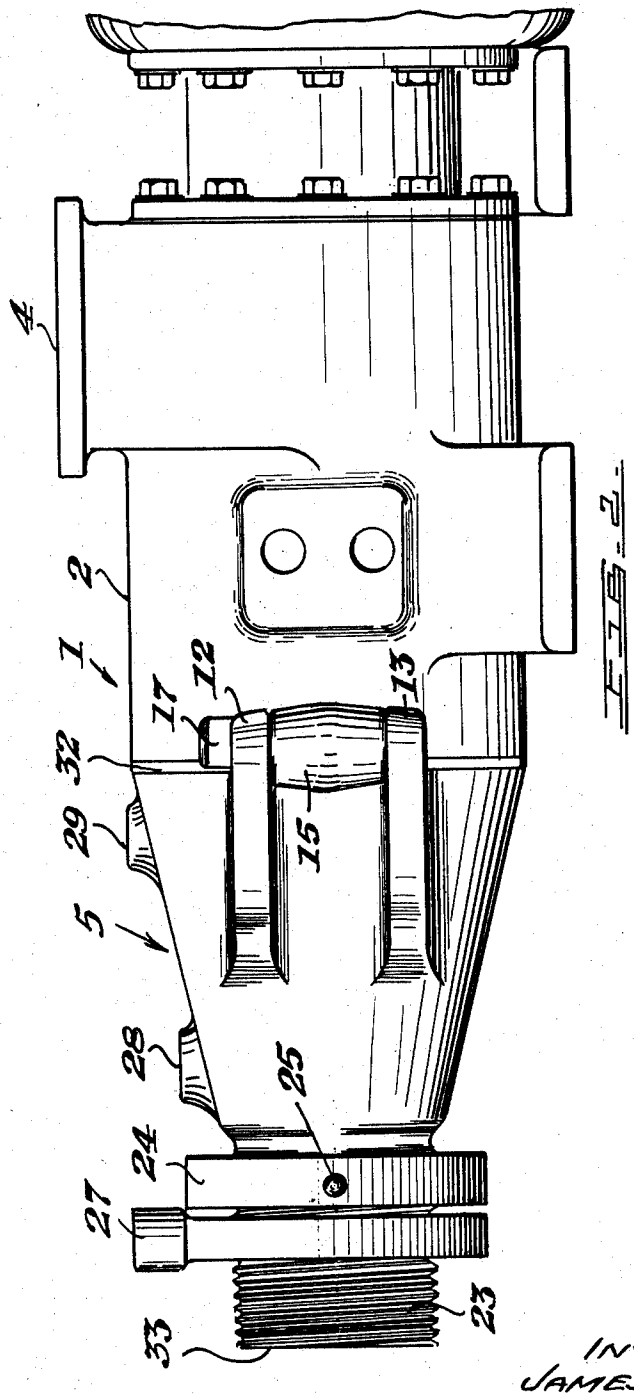


FIG. 2.

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Dec. 29, 1959 J. GARVEY 2,918,714

SPLIT PLODDER NOZZLES

Filed March 22, 1957 3 Sheets-Sheet 3

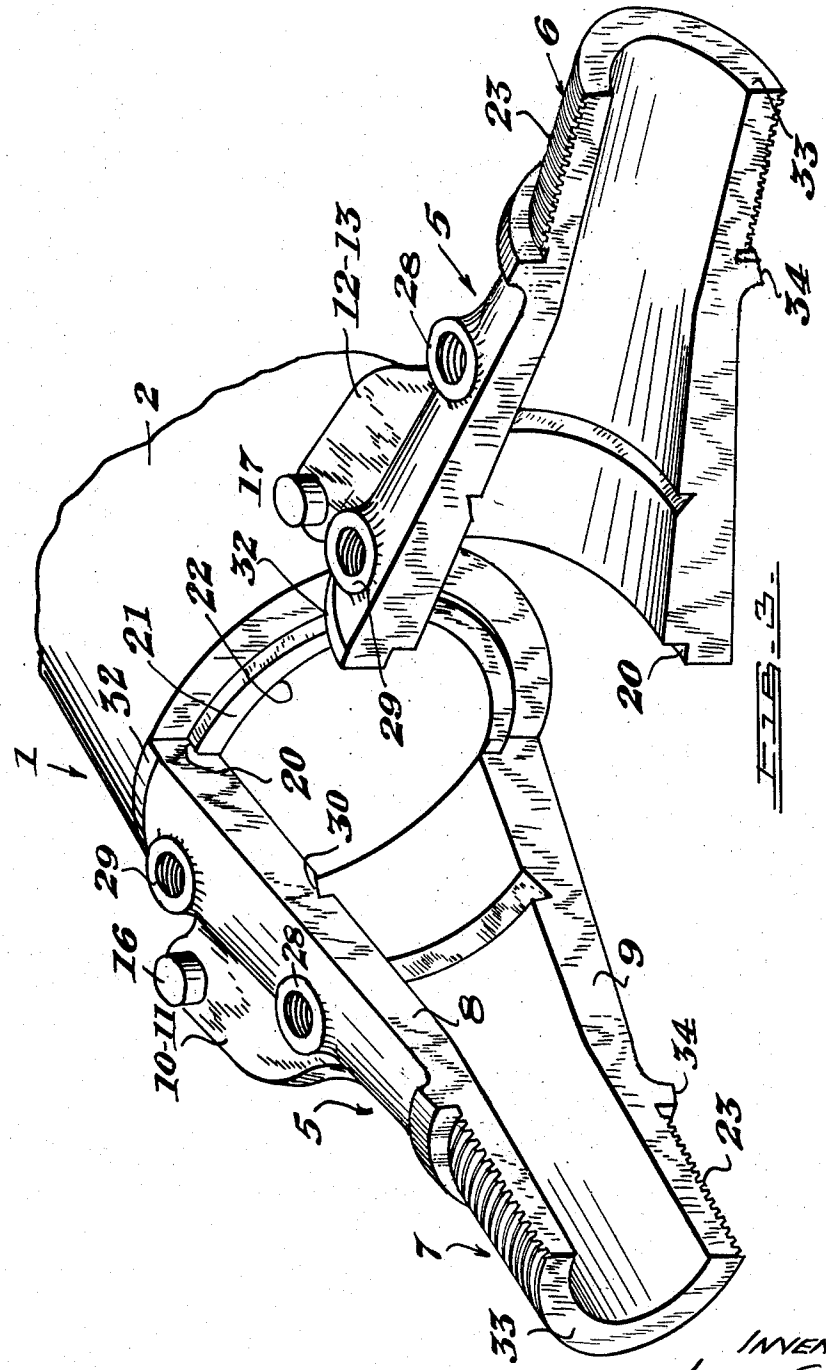


FIG. 3.

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SPLIT PLODDER NOZZLES

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4 Claims. (Cl. 25—17)

This invention relates to nozzles adapted to be connected to the cylinder of finishing plodders used for the final physical working of soap or detergent. In such machines the material to be extruded is fed into the cylinder, compressed by either a piston or a helical screw, and forced forward into the nozzle where it is subjected to further compressing forces and finally extruded through a single, appropriately shaped aperture of a forming plate or die attached to the forward or exit end of the nozzle.

Prior to the present invention the tapered nozzles used on orthodox extrusion machines have usually been in the form of a single piece casting, appropriately machined, hinged to the cylinder to permit rotation of the whole nozzle away from the front end of the cylinder and thus allow access to both the inside of the nozzle and the cylinder. When such a machine is in operation the large or rear end of the nozzle is commonly held in rigid, pressure tight, engagement with the front end of the cylinder by means of a plurality of U-shaped lugs, spaced equally around the outside of the nozzle, and which are in releasable engagement with corresponding swing bolts and nuts attached to the cylinder. When for any reason it is necessary to open a machine of this type in order to clean the inside of the nozzle or the cylinder, the theory is that it would only be necessary to release the nuts, thus allowing the swing bolts to rotate clear of the U-shaped lugs, and then merely swinging the whole nozzle off to one side of the cylinder by means of the hinge. The entry aperture at the large, entry end of the nozzle and the inside surface of the cylinder at its front end would then be exposed so that the cleaning operation could be completed.

Unfortunately in many instances the opening and cleaning of such machines has not been nearly as easy to perform as their design was supposed to make possible. In the case of soap, or detergent materials, for instance, which are extruded by means of a helical screw rotating inside the cylinder, even a slight delay in disconnecting the nozzle from the cylinder would allow the soap or detergent to harden inside the machine. In such circumstances a rigid and brittle column of material extends from the flights of the screw inside the cylinder through to the tip of the nozzle would then prevent swinging the nozzle away from the front end of the cylinder even after the swing bolts had been released from the U-shaped lugs. It is then necessary to use "brute-force" methods in obtaining release of the nozzle. The swing bolts would be released and the joint between the entry end of the nozzle and the front end of the cylinder forced open sufficiently to allow chisels, wedges and the like to be applied to the column of material inside the machine. Only when this necessarily messy and time consuming job is completed could the nozzle be swung the 90° or more required to give adequate access to the inside of the nozzle and the cylinder. Even when this had been done, however, still further difficulties are usually encountered in attempts to remove from the inside of the nozzle the conically shaped column of material which is wedged therein under pressure and which often possessed a considerable degree of adhesiveness to the nozzle walls. To remove this plug of material from inside the nozzle, the heater ring, usually located on the small, exit end of the nozzle is removed and a so-called plug remover screwed on in its place. Such a plug remover comprises a bushing with a thread adapted to engage with the external thread on the exit end of the nozzle and a rod threaded through the centre of the bushing and provided with a handle on one end and a mushroom tip on the other. When the bushing is secured in place the handle is rotated so as to advance the mushroom tip into the interior of the nozzle, the theory being that this mushroom tip will force the conical plug of material out the large end of the nozzle. Since it is necessary to apply this plug remover to the smaller, exit end of the nozzle the mushroom tip had to be of relatively small area compared with the cross-section of the plug at even the mid-point of the nozzle, let alone its entry end. The result is that in many cases the mushroom tip, instead of moving the entire plug out of the nozzle, merely dislodges a column of material of approximately its own diameter so as to leave a hole through the centre of the plug. When such occurs it is necessary to complete the cleaning operation inside the nozzle by manual means such as chipping and scraping the material from the entry end of the nozzle. This again involves lost time and production and, because such cleaning operations are necessary whenever a machine is stopped for any appreciable period of time or when the material being extruded is changed, e.g. for another colour or formula, the losses occasioned by this so-called "down-time" have been recognized as a major source of diseconomies in production.

Such prior designs of extruder nozzles have also involved at least one other serious disadvantage. After the machines have been cleaned and it is desired to commence production again, it is essential that the nozzle, after being swung back to engagement with the front end of the cylinder, be very tightly and evenly secured into place by means of the swing bolts, nuts and U-shaped lugs. In the all too frequent cases where this operation is done carelessly, and one or more of the nuts on the swing bolts is not sufficiently tightened, serious damage to the machine can result. When the machine is turned on and the material being extruded forced up into the nozzle under pressure, the stress on the nozzle-cylinder fastenings is unevenly distributed, the strain becomes excessive and one or more of the U-shaped lugs or swing bolt fastenings fails. Since these elements have to be very firmly attached to the machine (and are usually integral with the castings themselves) their failure is a serious matter involving complete close down of the machine and often its dismantling and reshipment back to the manufacturer for repair. This again is an expensive and time consuming operation seriously reducing the productive capacity of any given machine.

From the foregoing discussion it will be obvious that considerable advantages could be gained from a nozzle which would provide a certain amount of "self-cleaning" action and at the same time be free from the dangers caused by careless adjustment of the fastening arrangements which rigidly connect the rearwardly facing or entry end of the nozzle to the cylinder. I have found that these advantages can be obtained by providing a nozzle which has a passage of generally decreasing cross-sectional area from its entry to exit apertures, which nozzle is split longitudinally along lines extending from the entry aperture to the exit aperture so as to divide the nozzle into at least two longitudinal segments. Each of these segments is, at some appropriate point on the outside periphery of the nozzle adjacent the entry end thereof, swingably connected to the cylinder by means of a heavy duty hinge. On the outside of the exit end

of the nozzle a clamping means is provided so that, when the machine is in operation, the segments of the nozzle can be very rigidly clamped together and form pressure tight joints along the lines of partition between the segments and between the entry end of the nozzle and the cylinder. When for any reason it is desired to open the machine to permit access to the inside of the nozzle and the cylinder, the clamping means is removed so that the various segments of the nozzle are free to swing on their respective hinges and move outwardly from one another in a divergent fashion. In practice this movement can best be obtained by putting the machine into operation for a very short period of time immediately after the clamping means is removed. This will cause the conical column of material inside the nozzle to advance slightly and loosen the inside surfaces of the segments from the adhesive action of the material inside the nozzle and at the same time allow the segments of the nozzle to swing outwardly, away from each other in divergent fashion. There is thus obtained an automatic cleaning action which, within a very short period of time and with a minimum amount of manual labour, dislodges a substantial part of the material impacted inside of the nozzle. Moreover, from the very fact that the cleaning action is effected in this manner, it is clear that careless adjustment of the clamping device prior to placing the machine in operation will ordinarily result in nothing more serious than the slight outward movement of the respective segments of the nozzle which may release the pressure tight joints between the segments themselves and between the entry end of the nozzle and the cylinder. But even when this does occur it will be noted that substantially even stress distribution has been maintained on the nozzle-cylinder fastening arrangements, thereby reducing the risk of failure.

It is thus an object of my invention to provide a split nozzle for an extrusion machine which will permit easy access to the inside surface of the nozzle and to the cylinder itself.

It is also an object of my invention to provide a longitudinally segmented nozzle for an extrusion machine which will, after the clamping arrangement on the exit end of the nozzle is removed, "open out" by itself when the machine is placed in operation and the column of material inside is advanced slightly.

It is another object of my invention to provide a split nozzle for an extrusion machine which will have a self-cleaning action.

It is a still further object of my invention to provide a nozzle for an extrusion machine which will reduce the hazard of breakages due to improper or careless adjustment of the fastening arrangements connecting the entry end of the nozzle to the cylinder of such machine prior to its being placed in operation.

These and other objects and advantages of my invention will become apparent as the following description proceeds. It will be noted that the invention has been described as applied to a helical screw type finishing plodder machine of a type commonly used for the final physical working of soap or detergent. Such an application is by way of example only; the split nozzle shown herein will have usefulness when used in association with a variety of extruding machines.

In the drawings:

Figure 1 is a top plan view of a helical screw type soap plodder machine having a cylinder to which the split nozzle is attached;

Figure 2 is a side elevation of the device shown in Figure 1; and

Figure 3 is a perspective view of a split nozzle with one segment of the nozzle rotated about 90° from its position in engagement with the cylinder.

Referring now to Figure 1, 1 indicates generally an extruder machine of the helical screw type, commonly used in the manufacture of bars of soap and detergent, having a cylinder 2 inside which rotates helical screw 3 which can be viewed through the aperture 4 on top of which is mounted a hopper (not shown) for holding the raw material being fed into the machine. The flights of helical screw 3 force the soap along the cylinder 2 toward the nozzle generally indicated at 5 so that it is compressed, its texture is changed, and eventually it is forced out as a single, dense column, through the single exit aperture of the nozzle which is provided with a forming plate or die (not shown) serving to impart to the column the required cross-sectional configuration.

At the front end 22 of cylinder 2 there is attached the nozzle 5, the entry end 32 of the nozzle, defining the entry aperture, being maintained in pressure tight engagement with the end 22 of cylinder when the machine is in operation. The exit end 33 of the nozzle is oriented at the front end of the machine and is thus that part of the nozzle most remote from the screw 3.

The nozzle 5 provides a passage having a generally decreasing cross-sectional area between its entry and exit apertures, the term "generally" as used in this specification and claims appended thereto being intended to indicate that, over a substantial proportion of its length, the walls of the passage converge, but at the same time not to negative the possibility that notches or other discontinuities may be provided at certain positions along the passage such as will be referred to hereafter. In the nozzle illustrated, the passage has a substantially continuously diminishing circular cross-section which is concentric with the cylinder 2 as are the entry and exit apertures. The nozzle is, moreover, split into two substantially equal longitudinal segments 6 and 7 along lines 8 and 9 which are positioned on the same diameter on opposite sides of the nozzle. The mutually facing surfaces of the segments are carefully finished so that when the machine is in operation the segments of the nozzle can be maintained in accurate pressure tight engagement. Similarly, a pressure tight connection is effected between the entry end 32 of the nozzle and the end 22 of cylinder by means of careful machining of the respective parts. A tight step type joint is obtained by the provision of an annular flange 21 extending longitudinally from end 22 at the inside periphery of cylinder 2, this flange being adapted to engage with a complementary notch 20 which is machined on the inside surface of the entry end 32 of the nozzle.

The exit end 33 of the nozzle is provided with a thread 23 on its outside surface. This thread is of heavy duty construction in order to withstand the very considerable stress placed on the nozzle by the operation of the machine. On the outside surface of the nozzle, just behind the thread 23, there is a tapered land 34 designed to facilitate clamping of the segments of the nozzle together. A lock ring 24, having handles 25 and 26, is provided with a matching thread and a complementary conical surface on its rearwardly facing end adapted for wedging engagement with tapered land 34.

The swingable connection between the segments and the cylinder is effected by means of a heavy duty hinge assembly associated with each segment. One element of each hinge is connected to the segment in question and the other element is attached to the cylinder. A hinge pin or pins extend through both elements and effect a swingable connection. As is obvious, rotation of the segments 6 and 7 so as to be free from mutual obstruction requires the axis of rotation of the hinge pins to be at least as far back on the machine as the forward end of the cylinder i.e. the axis is spaced from the exit end of the nozzle a distance at least as great as the length of the nozzle itself. In the particular embodiment of the invention illustrated in the drawings, the hinge elements connected to segments 6 and 7 comprise, in each case, a pair of hinge knuckles, 10, 11 and 12, 13 respectively, centrally located on the outside surface of the segments. These pairs of hinge knuckles cooperate with hinge barrels

14 and 15 respectively and are rotatably connected to the hinge barrels by hinge pins 16 and 17 respectively. This particular arrangement has been given by way of example only; as is obvious a variety of types and positions of hinge elements can be used, the requirements being, firstly, as to the position of the axis of rotation of the hinge pins as given above, and secondly, that the elements be of heavy duty construction able to withstand the high stress without appreciable strain.

When the machine is in operation the segments 6 and 7 are rigidly clamped together to effect a pressure tight joint along lines 8 and 9 and between the entry end of nozzle 5 and end 22 of the cylinder. This is accomplished by the action of the hinge assemblies connecting the nozzle to the cylinder on each side of the machine and the lock ring 24 which, when screwed on to the exit end 33 of the nozzle, is advanced along the thread until a secure wedging engagement is obtained between the tapered land 34 and the complementary conical portion of the lock ring. After the lock ring 24 is in position, a heater and thermostat assembly 27 can be screwed onto the exit end of the nozzle. Additionally, some type or forming plate or die adapted to impart the desired cross-sectional shape to the extruded column of material (not shown) will be placed across the exit aperture of the nozzle and maintained in position by a fastening device (not shown) which engages threads 23.

If required, cooling or heating of the nozzle by fluid means can be accomplished by the provision of channels running inside each of the segments 6 and 7. For this purpose inlet and outlet orifices 28 and 29 can be provided on each segment as shown. Additionally, if it is desired to have some type of apertured plate extend across the nozzle about midway between its ends, a notch 30 having a vertical edge 31 against which such a plate may bear, is located on the inside periphery of the nozzle at an appropriate position along its length.

When the machine is to be shut down for cleaning or repairs, or if it is desired to gain access to the inside of the nozzle and the cylinder, the forming plate and heater-thermostat assembly 27 are unscrewed from the exit end 33 of the nozzle. The lock ring 24 is loosened by means of handles 25 and 26 and removed entirely from the end of the nozzle. The machine is then put into operation momentarily so that the screw 3 rotates and advances the material inside the cylinder and nozzle. Because of the wedge shape of the extruding material plug inside the nozzle, this forward movement will cause an outward pressure on each of the nozzle segments so that they move away from each other and the pressure tight joint along breaks 8 and 9 and between the entry end 32 of the nozzle and end 22 of the cylinder is broken. Once a small movement of this nature has taken place the machine is stopped and the segments 6 and 7 are each swung outwardly to convenient positions at the respective sides of the machine. This allows the material inside the nozzle to be ejected, and the screw inside the cylinder to be removed for cleaning.

When the machine is again to be put in operation the segments are swung back into engaged position and the lock ring 24 is screwed onto the exit end 33 of the nozzle. The lock ring 24 is advanced along the thread 23 until it engages the tapered land 34 and is thereby easily tightened so as to clamp firmly together the segments 6 and 7. It will be noted that in the case of this split nozzle the only removable fastening element is the lock ring 24 and the most probable consequence of carelessly attaching it to the machine is that the segments 6 and 7 will not be tightly clamped together. This could only result in some of the material being squeezed out between the entry end of the nozzle and the cylinder and through the aperture formed by breaks 8 and 9. Even then, however, the stress on the fastening elements, which comprise the hinge knuckles, barrels and pins and the lock ring itself, will be substantially evenly distributed with the result that failure of one of these elements because of higher than normal stress is most unlikely. In this way the split nozzle construction overcomes the serious disadvantage of prior nozzle designs due to danger of failure of the fastening elements consequent on their careless adjustment prior to the machine being placed in operation.

What I claim as my invention is:

1. In a finishing plodder machine adapted to effect physical working of soap or detergent and extrude the same in the form of a dense, single column adapted to be sliced into bars: a cylinder; means in the cylinder for forcing said material towards one end thereof; a nozzle having an entry end adapted to effect a releasable pressure-tight joint with said end of the cylinder, an entry aperture at said entry end, and a single exit aperture smaller than said entry aperture and substantially coaxial therewith, said nozzle providing a passageway of generally decreasing cross-sectional area between, and substantially concentric with, said entry and exit apertures; said nozzle comprising at least two longitudinal segments adapted to be separated along lines extending from the entry aperture to the exit aperture; and hinge means connecting each of the segments to the cylinder, removable fastening means on said nozzle adapted to maintain the longitudinal segments in tight abutting relation against the pressure of the soap or detergent in the nozzle tending to separate the segments whereby, when the fastening means is removed, the pressure-tight joint is released and the segments swing outwardly from one another in divergent fashion.

2. A device as claimed in claim 1 wherein the passage is of generally conical form.

3. A device as claimed in claim 2 wherein the nozzle comprises two equal segments adapted to be separated along lines co-planar with the axis of the passage.

4. A device as claimed in claim 1 comprising a thread on the outside surface of the nozzle adjacent the exit end, a tapered land on said surface adjacent the thread, and wherein the removable fastening means comprises a lock ring adapted to screw on the thread and having at its rearwardly facing end a conical surface adapted for wedging engagement with the tapered land.

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