United States Patent

[11] 3,559,958

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[33] **Italy**
[31] **7442A/67 and 7152A/68**

[54] **CONTINUOUS MACHINES FOR THE INSTANTANEOUS PRODUCTION OF WHIPPED CREAM**
8 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **259/10**
[51] **Int. Cl.** **B01f 7/04**
[50] **Field of Search** 259/9, 10, 109, 110, 25, 26, 45, 46, 6, 7, 8, 22, 23, 24, 43, 44, 107, 108

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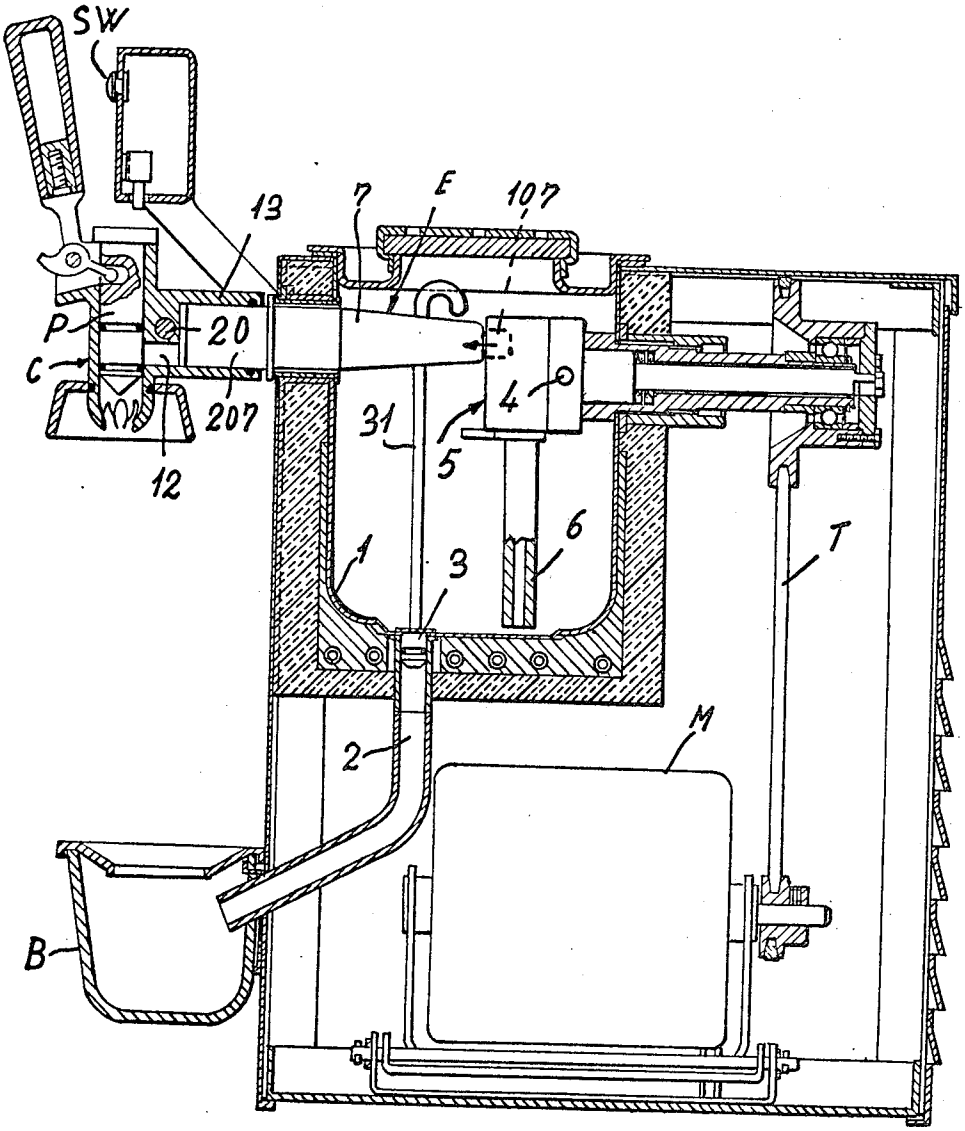
Primary Examiner—Robert W. Jenkins
Attorney—Imirie and Smiley

ABSTRACT: Liquid cream and air are drawn from and pumped under a strong pressure by a gear pump as a rough mixture through an open ended emulsifying homogenizer where the mixture is subjected to subsequent squeezings, fractionings, and expansions until said mixture, at the outlet of the homogenizer, has become soft and fluffy, like a conventional whipped cream.



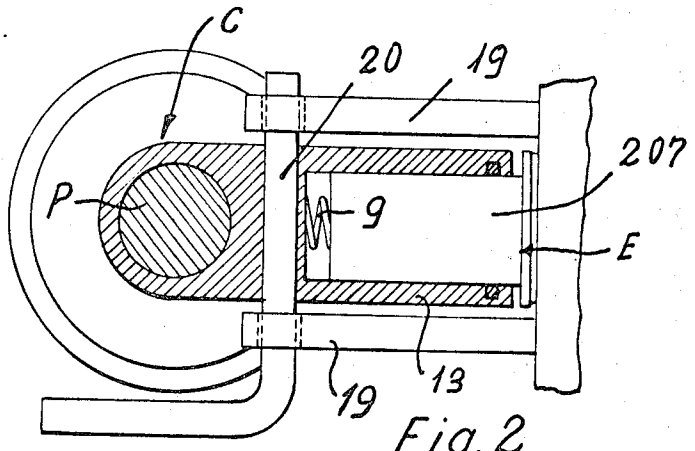


Fig. 2

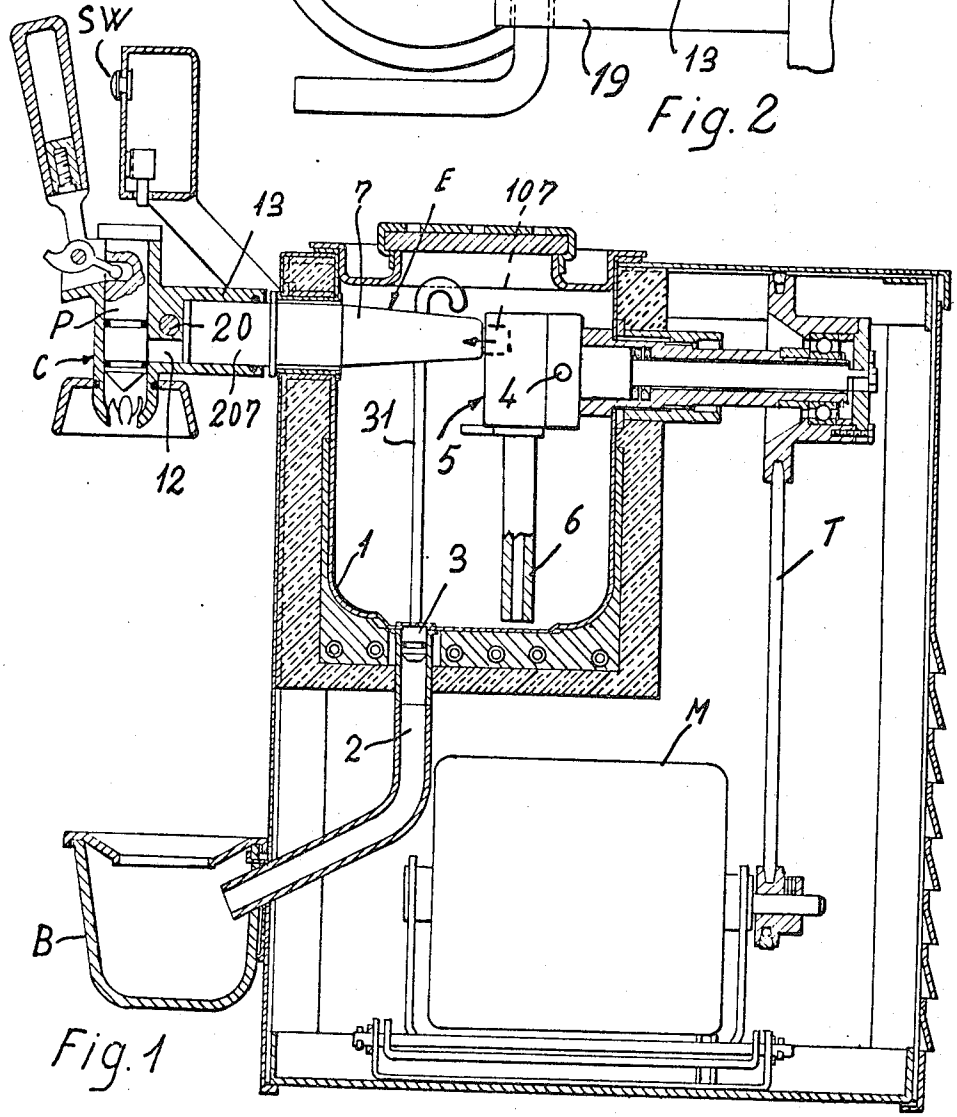


Fig. 1

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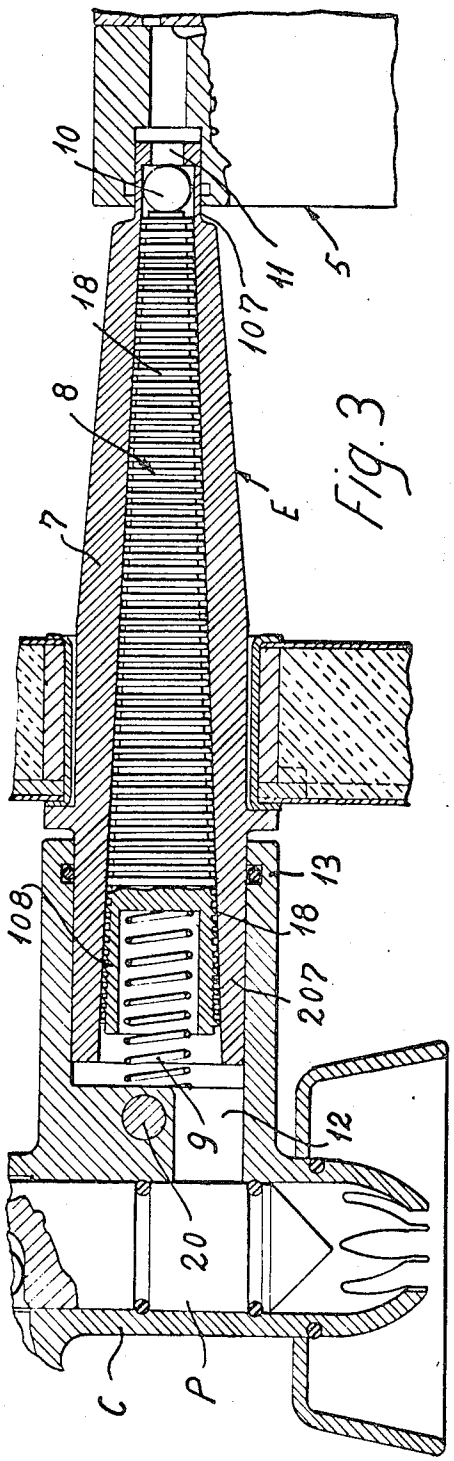

Fig. 3

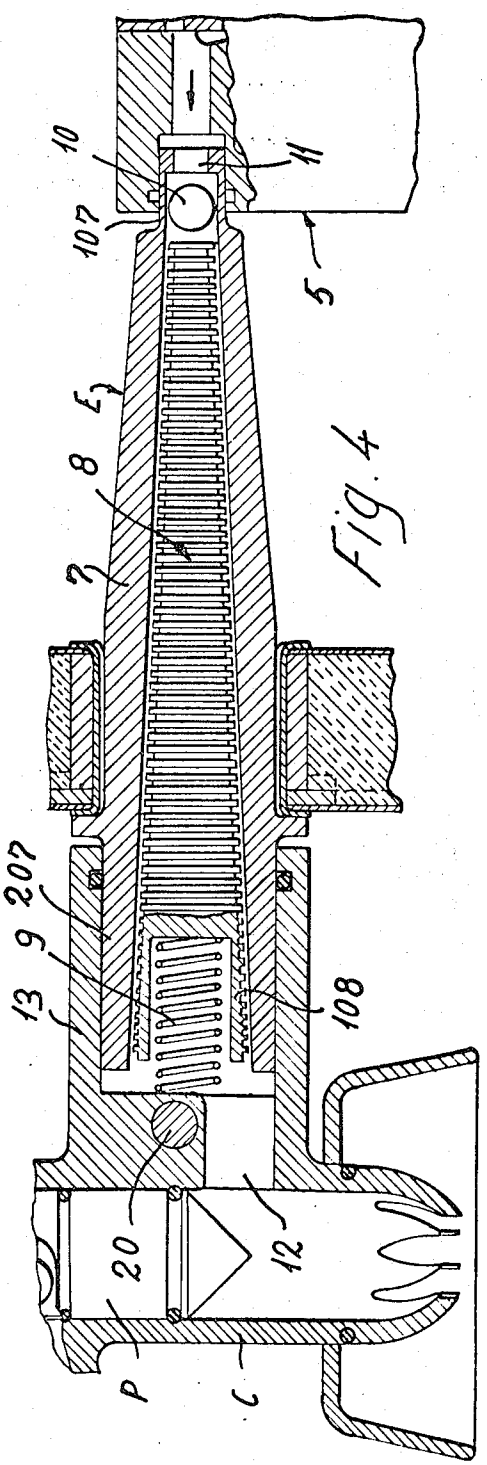

Fig. 4

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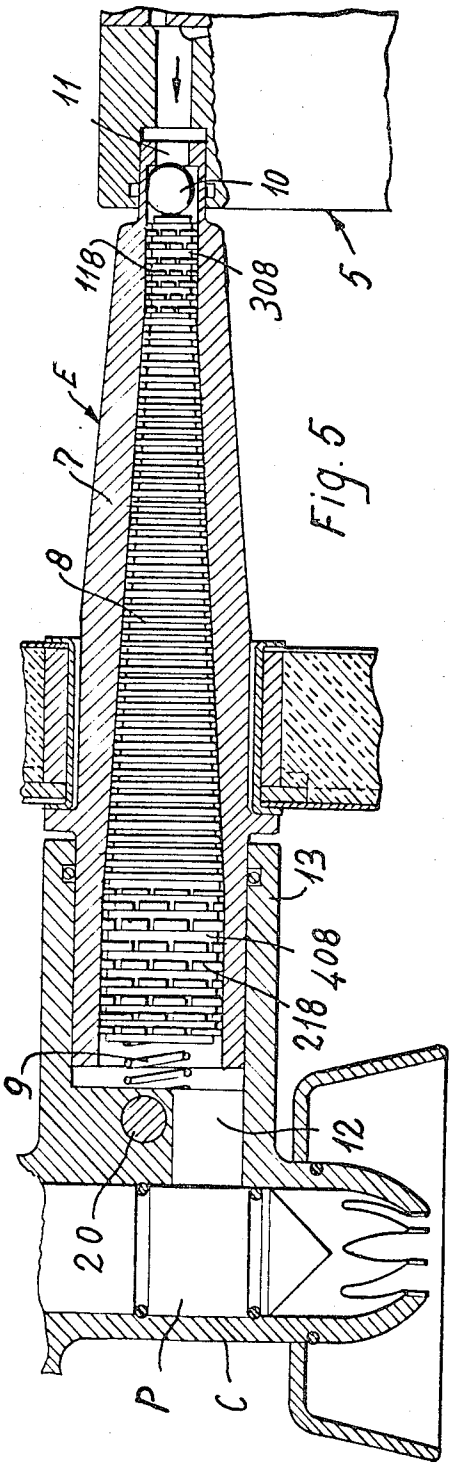

Fig. 5

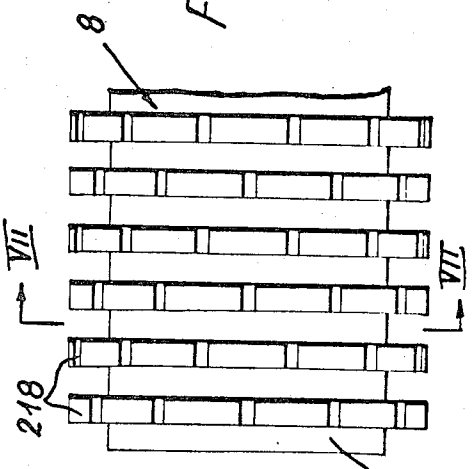

Fig. 6

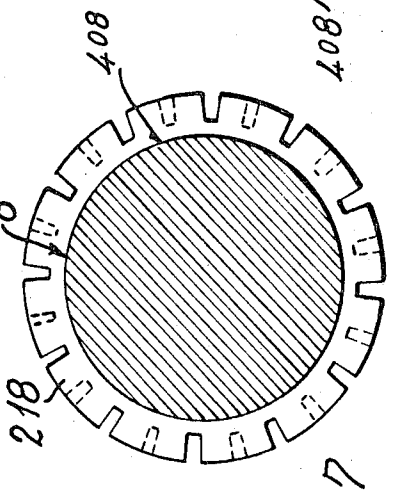

Fig. 7

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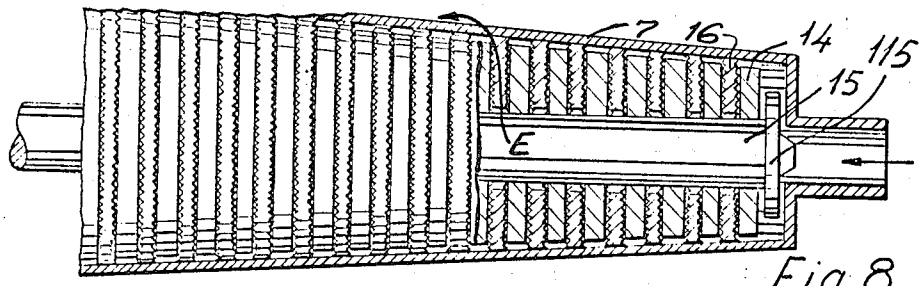

Fig. 8

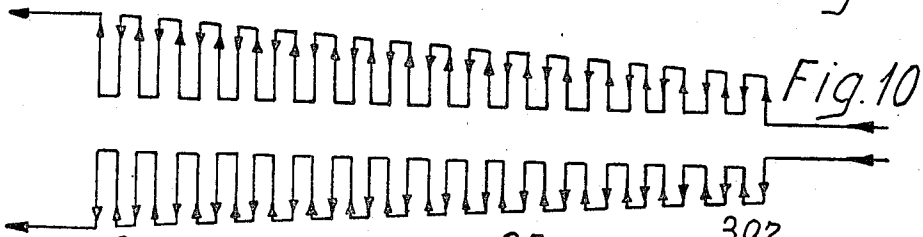

Fig. 10

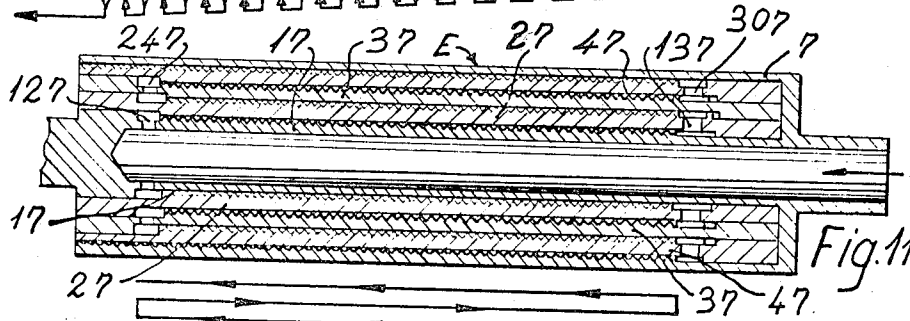

Fig. 11

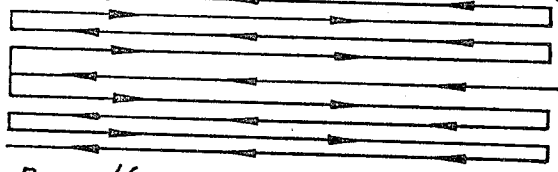

Fig. 13

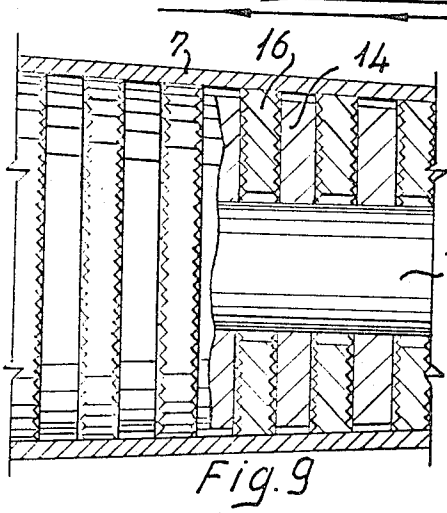

Fig. 9

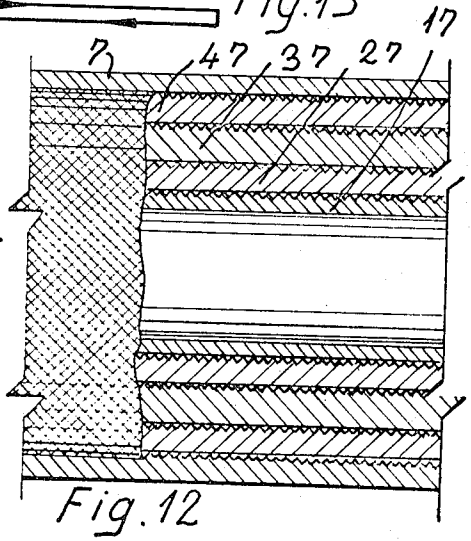

Fig. 12

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CONTINUOUS MACHINES FOR THE INSTANTANEOUS PRODUCTION OF WHIPPED CREAM

BACKGROUND OF THE INVENTION

This invention relates to an improved machine for the continuous and instantaneous making of a fine emulsion of liquid cream and air, which, due to the conventional method of making same, shall be called, as usual, "whipped cream" while the machine for making the so-called whipped cream by the improved industrial method and machine shall be called hereinafter "continuous whipped creammaking machine."

The machine according to the invention is of the kind comprising a tank or container for the liquid cream, means for pumping said liquid cream and air drawn from the exterior through open ended emulsifying homogenizers. Said mixture of liquid cream and air, by passing through said homogenizers, is intimately mixed so as to produce instantaneously a fine emulsion, which is discharged continuously, as soon as it is made, from the said homogenizers, and may be consumed as soon as it is discharged. The continuous whipped creammaking machine according to the invention may be operated at intervals, so as to produce by each operating cycle substantially only the required amount of whipped cream, to be instantaneously dispensed to customers. Thus the improved machine, for the manufacture of what might be called also "espresso whipped cream," permits of avoiding of manufacturing, as do the conventional machines, large quantities of whipped cream which, after the whipping operation, are poured off into containers from which it is dispensed to single customers by scooping off small portions, even through a quite long time.

The known continuous whipped creammaking machines, which prepared instantaneously a fine emulsion of liquid cream and air by feeding a rough mixture of liquid cream and air through emulsifying homogenizers presented, among others, the drawback that the mixture, when passing through said emulsifying homogenizer, had not sufficient space to increase its volume, by expanding as does the conventionally prepared whipped cream. Consequently the whipped cream prepared by emulsifying liquid cream and air in a restricted space was not sufficiently soft and fluffy, as a well whipped cream must be.

Therefore, the object of the present invention is a continuous creamwhipping machine provided with a liquid cream reservoir and with a gear pump for drawing together liquid cream and outside air and effecting a first rough emulsion and then pumping said rough emulsion through an open ended emulsifying homogenizer in which it is subjected to successive squeezing and fractioning and progressive expansions, so that at the outlet end of the said homogenizer a good quality whipped cream is ejected into an outlet collecting chamber, from which it may be dispensed through a conventional dispensing device, such as a piston cock or the like.

According to a further characteristic feature of the invention, the "homogenizers" may comprise an open ended shell and a single or multiple core in said shell leaving a through passage for the cream-and-air emulsion, said through passage comprising very narrow laminating slits and adjoining or aligned passage and expansion chambers, whereby said slits and passages formed in proximity of, or by proceeding towards the shell, have a flow area that is greater than that of the preceding expansion chamber.

According to some preferred embodiments of the invention, the increase of volume of the overflow passages is obtained by providing a substantially conical shell for the homogenizer, so that each chamber defined by the interior of said shell and the periphery of a corresponding spaced core section is greater than each preceding like chamber having a smaller diameter.

Other advantageous features of the machine improved according to the invention will be apparent from the following specification, made with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a vertical section through a complete continuous whipped creammaking machine provided with a conical homogenizer according to the invention;

FIG. **2** is an enlarged horizontal section showing in detail the fastening arrangement of a dispensing piston cock;

FIGS. **3** and **4** show a vertical longitudinal section through an embodiment of conical homogenizer in rest and operating position respectively;

FIG. **5** shows, also in longitudinal section, a variation of the embodiment of conical homogenizer of the kind of that shown in FIG. **3**;

FIG. **6** is a side view of part of the larger cylindrical section of the core of the homogenizer shown in FIG. **5**;

FIG. **7** is a cross section on line VII–VII of FIG. **6**;

FIG. **8** is a longitudinal section through the conical shell and part of the core of another variation of embodiment of conical homogenizer, the remaining part of the core formed by a pile of washerlike discs being shown in side view;

FIG. **9** is an enlarged side view and longitudinal section through a part of the homogenizer shown in FIG. **8**;

FIG. **10** shows the path of the emulsion of cream and air through the homogenizer shown in FIG. **8**;

FIG. **11** is a longitudinal section through an homogenizer according to the invention provided with a cylindrical shell;

FIG. **12** is an enlarged longitudinal section through a part of the homogenizer as shown in FIG. **11**; and

FIG. **13** shows the path of the emulsion of cream and air through the homogenizer as shown in FIG. **11**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A continuous whipped creammaking machine, such as that shown in FIGS. **1** and **2**, comprises a preferably heat-insulated and refrigerated liquid cream container or tank **1** mounted on a suitable frame and provided with a drain opening closed by a plug **3** provided with a gripping stem **31** and to which opening a drain tube **2** is connected, which opens in a drain container B. This drain container, as it appears from the drawing, is arranged preferably below a whipped cream-dispensing piston cock C and serves also for collecting any cream or like drops falling down from the cock.

Within the tank **1** a gear pump **5** is mounted, which is driven by an electric motor M through a conventional pulley-and-belt transmission T. Pump **5** has its suction side connected to an air intake **4** and a liquid cream draw pipe **6** opening in proximity of the tank bottom. The delivery side of the pump opens into the inlet end of an open ended emulsifying homogenizer E which, according to the invention, is provided with a preferably conical shell **7** ending at its inlet and outlet ends with two cylindrical necks **107** and **207**, the first for inserting with a tight fit into the delivery port of pump **5** and the other for inserting also with a tight fit into a sleeve **13** provided with a rubber ring packing and constituting the fastening member of a cock C and for example the piston cock as shown. This is supported by a pair of arms **19** and is fastened by means of a bolt **20**.

This piston cock C, whose construction is known, is preferably arranged in proximity of a pushbutton switch Sw which, each time the piston P is in its opening position, with its top end operates the switch and starts the motor M, while when the piston is shifted to its closing position, interrupts the current to said motor.

According to one of the preferred embodiments, as shown in FIGS. **3** and **4**, the emulsifying homogenizer E comprises a conical shell **7** with cylindrical end sections **107** and **207**, in which a conical core **8** provided at its surface with parallel annular ribs **18** is fitted. A ball valve **10** is adapted to close the inlet port **11** connected to the delivery of pump **5** (see arrow).

The front end **108** of the core **8** is tumbler-shaped and contains a helical pressure spring **9** reacting against a shoulder of the piston cock casing, above the piston cock inlet **12**.

When the piston cock is opened and the pump **5** is in operation, the rough mixture of liquid cream and air pushes ball valve **10** open. At the same time, the core **8** is axially shifted against the action of spring **9**, thus slightly spacing the ribs **18** from the interior of the shell **7** and permitting to the cream-and-air mixture to be squeezed through the slits between the subsequent ribs **18** and facing shell bore part.

Due to the increasing diameter of the shell **7** and core **8**, both the slits in correspondence of the ribs and the annular overflow spaced between adjoining ribs become of increasing total flow area, thus permitting the expansion of the cream-and-air emulsion, as does the conventionally prepared whipped cream.

The embodiment of emulsifying homogenizer according to FIGS. **5**, **6** and **7** is very like the just-described embodiment, as shown in FIGS. **3** and **4** from which it differs in that the core **8** has two cylindrical end sections **308** and **408** provided with annular crowns of rib sections **118** and **218** extending along two corresponding cylindrical bore sections of the shell **7**. By this arrangement, the core **7** is guided during its sliding towards and away from the piston cock C by the cylindrical bore sections and, as the corresponding rib parts slide always in contact with the shell bore, the flow of the emulsion of the cream and air is effected through the longitudinal slits between pairs of rib sections. As clearly shown in FIGS. **6** and **7**, these longitudinal slits are angularly shifted in adjoining crowns of ribs, so that the flow of the emulsion of cream and air takes place, both at the inlet and outlet ends of the homogenizers, along a tortuous path, thus increasing the homogenization of the emulsion.

According to the embodiment as shown in FIGS. **8** and **9**, into the conical shell **7**, a composite core is introduced, which is formed by a central rod **15** provided at its free end with a disc-shaped head **115** and carrying a pile of pairs of disclike washers **14** and **16**. The washers **14** have a central bore equal in diameter to bar **15**, so that they are threaded with a tight fit onto bar **15**, and are spaced at their periphery from the bore of shell **7** while the washers **16** are larger in diameter than the adjoining washers **14**, so that they fit tightly against the corresponding parts of the bore of shell **7**, while the diameter of their central bore is substantially greater than the diameter of rod **15**. Either of the faces of both washers **14**, **16** or both the faces of either of said washers (in the case as shown, both faces of smaller-diameter washers **16**) are provided with fine indentations so that between each pair of adjoining washers of the pile numerous intersecting narrow and tortuous passages are left, by passing through which, the cream and air mixture pumped under strong pressure by the gear pump **5** is emulsioned by flowing along annular paths like those shown diagrammatically (as in longitudinal section) in FIG. **10**. As may be seen from this FIG., due to the increasing surface between each pair of washers, starting from the small and going towards the larger end, and to the increasing diameter of the annular overflow passages formed between the periphery of washers **16** and the corresponding section of the bore of the shell **7**, the increasing flow spaces permit the required expansion of the "whipped" cream.

A like effect may be obtained by providing in a shell **7**, FIGS. **11** and **12**, a core formed by a cylindrical tube **17** preferably provided with an indentated surface a plurality of coaxial sleeves **27**, **37** and **47** provided at either end with overflow passages **127**, **137**, **247** and **307** forming together with the annular passages between each pair of sleeves very tortuous passages (see flow diagram of FIG. **13**) whose flow area is increasing stepwise from the most central sleeve **17** to the outer sleeve **47**.

Of course, the invention may undergo numerous other changes, though remaining within the scope of the appended claims.

I claim:

1. A continuous whipped creammaking machine of the kind comprising a container for the liquid cream, an intake for said cream, another intake for the air and an open ended narrow-passages emulsifying homogenizer or "emulsifier" and means for feeding under pressure a rough mixture of the liquid cream and air, sucked from said intakes, through said emulsifier, characterized by the feature that the said narrow passages are in form of subsequent slits connected together by larger overflow passages and that the flow area through said slits, starting from the inlet and proceeding to the outlet end of the homogenizer, is increasing, at least stepwise, with the increase of the total diameter of said slits.

2. A machine according to claim **1**, wherein said emulsifier comprises a core having an indentated or ribbed surface and fitted in a correspondingly bored shell having a narrower inlet and a wider outlet, in such a manner as to provide a plurality of subsequent narrow slits whose flow area is increasing, at least stepwise, by proceeding from the inlet towards the outlet of said homogenizer, whereby said outlet is connected to a dispensing device, such as a piston cock.

3. A machine according to claim **2**, wherein the said core and the said bore of the emulsifying homogenizer are conical, at least in their middle section.

4. A machine according to claim **3**, wherein the conical bore of said emulsifier shell is smooth while the surface of the corresponding conical core is provided with annular ribs; spring means in the larger end of said shell pressing the corresponding wider head end of the core against the walls of the shell bore, the whole being so arranged that when a mixture of liquid cream and air is pumped under pressure into said inlet of the emulsifier, it shifts axially said core, against the action of said spring means, and slightly spaces said annular ribs from the corresponding shell bore, thus generating a plurality of subsequent annular slits of increasing diameter and flow area.

5. A machine according to claim **4**, wherein the said bore of the shell is conical in its intermediate section, but is cylindrical at its ends, and the corresponding core has cylindrical end sections, provided with annular ribs composed of separate segments, leaving between subsequent segments a narrow passage, the narrow passages of each segment being not in alignment with the passages of adjacent segments; the whole so as to permit the flow of the cream-and-air mixture at the inlet and outlet ends, through the said narrow passages, and in the intermediate conical section, between the ribs on the conical part of the core and the corresponding shell walls.

6. A machine according to claim **1**, wherein the conical bore of said shell is substantially smooth, while the surface of the corresponding conical core is provided with annular ribs, means being provided for slightly spacing said ribs from the corresponding surface of the conical bore of said shell.

7. A machine according to claim **1** wherein the said bore of the emulsifier shell is conical and the corresponding core comprises a supporting rod, pairs of washerlike discs either of which has a central bore fitting exactly on said rod, while its diameter is substantially less than the diameter of the corresponding section of the shell bore and the other of which discs has a diameter which corresponds to the diameter of the corresponding shell section, when the core is exactly mounted, while its central bore is substantially wider than the section of the said supporting rod, whereby either of the contacting faces of the discs present fine indentations leaving between the adjacent disc faces a plurality of intersecting very fine flow slits, by passing through which the said mixture is finely emulsified while its volume may increase by proceeding from the central part of the discs towards their periphery.

8. A machine according to claim **1**, wherein the said emulsifier comprises a shell having a cylindrical bore and a plurality of sleevelike core members concentrically arranged in said shell bore and fitted upon a central tube acting as feed tube for the mixture to be emulsified and as supporting rod; rough or indentated surfaces on said concentrical core members and on said central tube for forming between adjoining cylindrical surfaces a large number of fine intersecting slits and overflow passages at the ends of alternate core sections for permitting the flow of the mixture from any one of the slitted passages between each pair of adjoining cylindrical surfaces and the subsequent passage, whereby said subsequent cylindrical passages, being of greater diameter, permit a stepwise increase of the flow area of cream-and-air emulsion.