

Nov. 25, 1958

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2,861,784

APPARATUS FOR CONTINUOUS PRODUCTION OF BUTTER

Filed Aug. 9, 1956

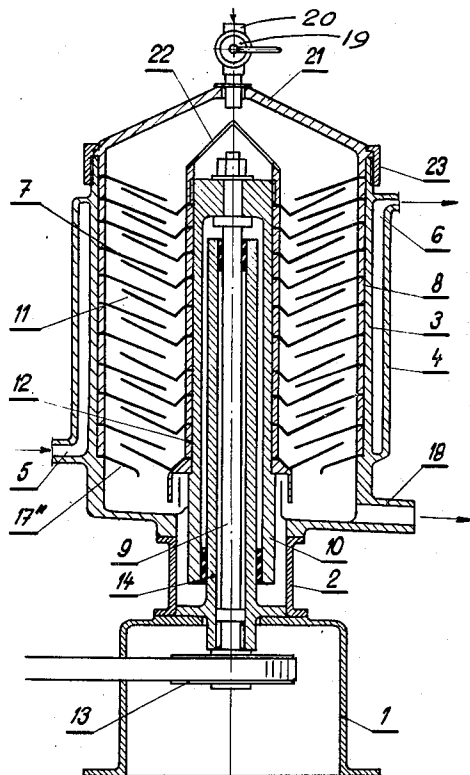


FIG. 1.

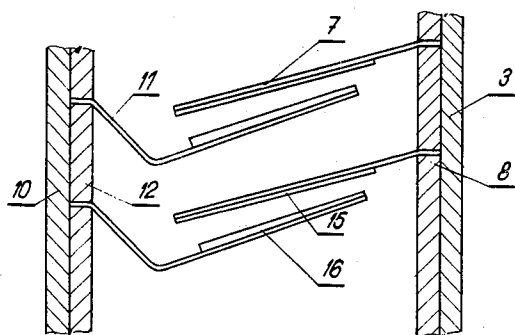


FIG. 2.

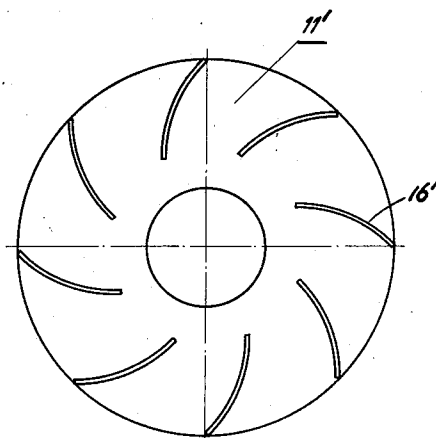


FIG. 3.

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APPARATUS FOR CONTINUOUS PRODUCTION OF BUTTER

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Application August 9, 1956, Serial No. 603,058

2 Claims. (Cl. 259—107)

This invention relates to improvements in an apparatus for continuous production of butter, the present application being a continuation-in-part of our application Serial No. 474,414, filed December 10, 1954, now Patent No. 2,840,460, issued June 24, 1958, and entitled "Method For Continuous Production of Butter."

The main object of the present invention is to provide an apparatus for continuous production of butter, which is simple in construction and operation and permits full control of the churning process.

Another object of the invention is to provide an apparatus of the referred to type, which will ensure the production of butter of the highest quality either from sweet or sour cream.

A further object of our invention is to provide an apparatus for production of butter, which operates on principles that will secure exceedingly high yields.

To the accomplishment of the foregoing and other objects which will appear hereinafter, our invention consists in the apparatus elements and their relation one to the other, as are more particularly described in the specification and sought to be defined in the claims.

The specification is accompanied by a drawing in which: Fig. 1 shows, in a vertical section, one form of the apparatus according to the invention;

Fig. 2 shows details of the apparatus, again in a vertical section, to enlarged scale; and

Fig. 3 illustrates a modification of the details.

Referring to the drawing in greater detail, and initially to Fig. 1, a vertical hollow cylinder or drum 3 is mounted on a base 2 on the frame 1 of the machine. The cylinder is provided with a jacket 4 for the passage of a cooling medium. In the modification selected for illustration, the cooling medium is supplied to the jacket through the tube 5 at the lower end, and withdrawn through the tube 6 at the upper end.

Rings 7 are removably secured in a spaced superposed relationship to the inner walls of the cylinder 3 and held in place by spacers 8 or by screws (not shown). The number of rings as well as their spacing from each other may be varied as required. A sleeve 10 is mounted on a shaft 9 in alignment with the axis of the cylinder 3, which sleeve carries a series of spacedly superposed discs 11. The spacing of the discs 11 as well as their number may be adjusted as required by means of spacing rings 12 or screws (not shown). As shown, each ring 7, except the uppermost and lowermost, projects into the space between two adjacent discs 11 and each disc is shown to project into the space between two adjacent rings. The rings extend substantially downwardly, and the discs extend substantially upwardly. Each disc is angularly shaped, when viewed in cross section, and is formed by an inner annular portion extending outwardly and downwardly, and an outer annular portion extending outwardly and upwardly. The discs are thus shaped to form circular collecting troughs. The shaft 9 with the sleeve 10 and the discs 11 constitute the rotor of the apparatus, the rotor being driven by a pulley 13 or directly by a

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motor over a clutch and gear box, making changes in the speed of the rotor possible. The rings 7 are stationary and form the stator of the apparatus.

The sleeve 10 with the discs 11 is mounted for displacement in axial direction along a tubular member 14. The spacing between the discs 11 and rings 7 may thus be adjusted according to requirements.

The stationary rings 7 are provided on their undersides with radially extending churning vanes 15 (see Fig. 2), whereas the revolving discs 11 have on their upper sides similar vanes 16. The vanes 15 and 16 cooperate to perform the churning operation.

In Fig. 3 the discs 11' are shown to be provided with substantially tangentially extending vanes 16'. It will be understood that the discs 11' revolve as the discs 11 do and that the vanes 16' are provided on the upper sides of the discs 11' to cooperate with similarly tangentially extending vanes provided on the undersides of stationary rings corresponding to the rings 7. As in the construction of Fig. 2, the upper faces of the stationary rings and the under faces of the discs 11' are smooth.

The space between a ring 7 and the next following disc 11 increases in downward direction. It is smallest at the top and largest at the bottom. Both rings and discs may have an increasing number of churning vanes in downward direction.

The cream is supplied from a container (not shown) to the upper part of the cylinder 3 through a pipe 20 which is provided with a control valve 19 and passes through the cover 21 of the cylinder. On top of the rotor is a conical cap 22, the axis of which is in alignment with the axis of the cylinder and the inlet pipe 20. The apex of the cone is on top.

The cream-holding container is preferably provided with a device which ensures a uniform supply of cream under constant pressure, for instance a float or the like.

The cover 21 is secured to the cylinder, for instance, by means of a threaded sleeve 23, a bayonet joint, or in any other way.

The lowest ring 17" serves as a collecting ring for the mass under treatment, which mass is removed from the bottom of the cylinder 3 via line 18 to be led to a location for further treatment of the butter.

An oil chamber may be provided interiorly of the base 2 for the lubrication of the bearings of the shaft 9.

The apparatus operates as follows:

Cream supplied through the pipe 20 is spread by the cap 22 in a thin and uniform layer over the upper surface of the uppermost stationary ring and flows from the latter by gravity, since the ring is downwardly directed toward its center, to the upper surface of the uppermost revolving disc. When viewed in cross section, the discs are angularly shaped, the outer and main portions being upwardly directed. On the revolving disc, the cream is thrown by centrifugal force into the first operative station where it is exposed to the beating action of the vanes 15 of the uppermost ring and the vanes 16 of the uppermost disc (see Fig. 2). While the cream moves relatively slowly over the uppermost ring toward the center of the apparatus, on the uppermost disc it is thrown with great speed away from the center. Upon leaving the uppermost disc, the cream drops by gravity onto the next following ring, where it flows, again by gravity, toward the center of the apparatus and onto the next following disc. This kind of movement continues. The direction of flow of the cream as well as its velocity changes continuously in uniform intervals. The cream follows substantially the course of a series of sharp turns. It will be appreciated that the cream moves relatively slowly from operating station to operating station and that the movement of the cream within the operating stations, that is, the movement of the cream over the discs, due to the

centrifugal forces acting upon the cream, is of a whirling nature.

The undersides of the rings and the upper sides of the rings are provided with radial or substantially tangential cooperating churning vanes so that each pair of such surfaces which face each other forms a station or working zone in which the cream is churned during its passage therethrough. While the lower surfaces of the rings and the upper surfaces of the discs are equipped with churning means, the upper surfaces of the rings and the lower surfaces of the discs are smooth. Pairs of smooth surfaces which, too, face each other form rest zones. Each working zone is followed by a rest zone. The cream or mass being treated is moved at a high speed during the working zones, while it is violently beaten at the same time, and flows by gravity through the rest zones.

Due to the arrangement according to our invention, a churning process is performed which consists of two continually alternating procedural steps, a churning operation proper and a rest period. The whole churning process is thus divided into a series of partial churning processes interrupted by periods of rest, which gives the non-fatty component of the cream ample time to pass into the butter milk in the course of the churning process. The active proteinic substances of the milk serum, while becoming enriched with the individual fat globules, produce a foam and have a tendency to expand and to form larger surfaces. To ensure a condition which serves this tendency, our invention introduces the referred to so-called rest periods.

Our apparatus increases the efficiency of making butter to such a degree that not only sweet cream but also sour cream of a higher viscosity may be used, and ensures most economical results.

The butter milk with butter globules proceeds from the collecting disc 17" to the bottom of the cylinder 3 and through the line 18 to a device in which butter milk is separated from the butter globules. The latter are then conveyed to a washing machine where they are subjected to a double washing action, and to a kneeding machine with mixing chambers, from which a continuous stream of butter passes to the molding and packing machines.

The devices used for separating the butter globules

from the butter milk, the washing and kneeding machines, as well as the necessary conveyors, are known per se and may be mounted on the base 1 of our machine or separately.

It will be apparent that while we have shown and described our invention in a preferred form only, showing at the same time details in two forms, many changes and modifications may be made without departing from the spirit of the invention defined in the appended claims.

We claim:

1. Apparatus for continuous production of butter from cream, comprising a vertical cylinder, a central shaft extending axially into the cylinder and being rotatable relative to the latter, a series of spacedly superposed discs secured to the shaft, the discs being angularly shaped, when viewed in cross section, each disc being formed by an inner annular portion extending outwardly and downwardly, and an outer annular portion extending outwardly and upwardly, a series of spacedly superposed rings interiorly secured to the cylinder wall to extend inwardly and substantially downwardly, the rotating discs and stationary rings alternating with each other, each ring except two at the most projecting partly into the space between two discs, each disc except two at the most projecting partly into the space between two rings, and churning means provided on the upper sides of the discs and on the undersides of the rings.

2. In the apparatus according to claim 1, a sleeve mounted on the central shaft to carry the discs, and a tubular member provided between the central shaft and the sleeve, the sleeve being arranged to be displaced in axial direction along the tubular member.

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