Oct. 4, 1927. 1,644,615

D. T. SHARPLES

SEPARATOR

Filed Feb. 11, 1925

FIG. 1.

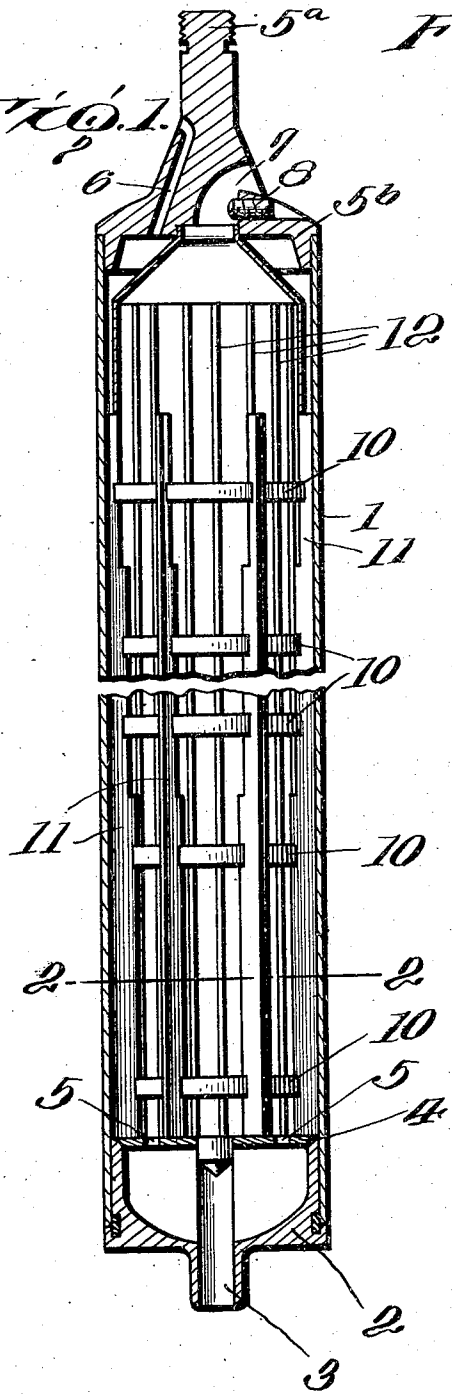
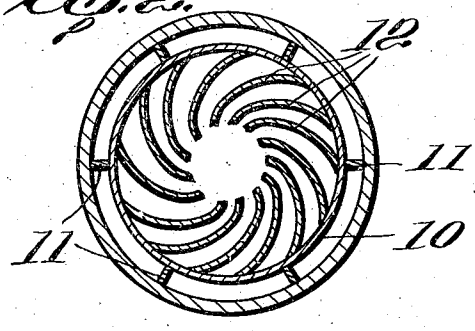


FIG. 2.



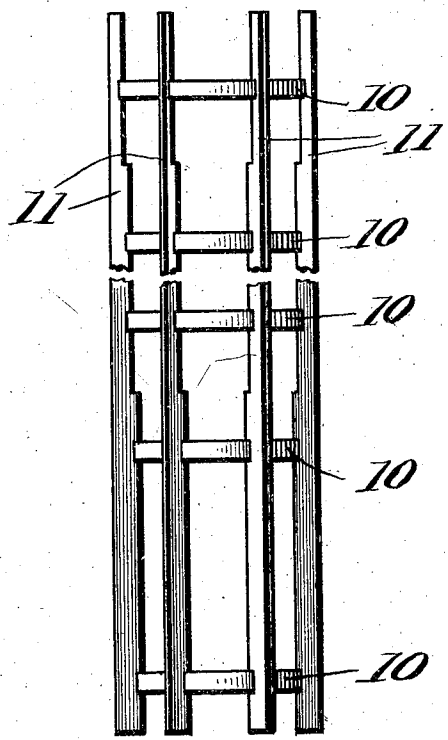


FIG. 3.

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UNITED STATES PATENT OFFICE.

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SEPARATOR.

Application filed February 11, 1925. Serial No. 8,499.

This invention relates to improvements in the construction of centrifugal separator bowls.

The bowls of centrifugal separators are subjected to enormous stresses during operation, by reason of the high speeds employed. A high quality of metal is used to withstand these demands, of very high tensile strength since the bowls of factory separators where power is employed, are driven at the highest speed consonant with safety in regular operation. On the other hand, the higher the speed the more efficient is the machine and its operation, since the centrifugal force increases as the square of the speed or revolutions per minute: the greater the centrifugal force, the more work that can be accomplished in a stated time by the same machine.

However, such steels of high tensile strength have a comparatively small elongation under abnormal load. On the contrary, steels of great elongation under such a load have relatively low elastic limits. A steel of 35% elongation may have an elastic limit of 50,000 pounds per square inch, while a steel with an elastic limit of 150,000 pounds per square inch, may have an elongation of 5% or less.

With power driven centrifugal separators requiring a governor of some type, disasters have frequently occurred when the governor ceases to function properly, by accident or negligence of the attendants. The apparatus may rapidly attain an enormous speed, far beyond the safe limit of the metal, and the steel stretches. If high tensile strength steel be employed, with a low elongation, the bowl breaks to pieces, and the fragments are scattered at tremendous velocity for a considerable distance, and may wreck the machine and building, to say nothing of injuring the attendants.

To avoid such a disaster, it has been proposed to employ steel of great elongation, and relatively lower elastic limit. When a separator bowl constructed of such material runs away, the steel stretches and the bowl is thrown out of balance. Since an unbalanced bowl cannot be driven to the same speed as a properly balanced one, the device slows down immediately under the positive braking action, no matter what the driving power may be. The separator bowl may be ruined, but there is no explosion and no other damage.

However, if steels of the two types above referred to be used in the two cases, it is apparent that much more metal must be employed in the latter case to obtain the same speeds. This means a much greater weight to be moved, and a greater power; both of which may become limiting factors on the size of machines.

According to the present invention, these difficulties are avoided by the preparation of the bowl and its parts of such material as to withstand the great stresses, and yet to yield slowly or gradually to excessive strains and thus develop a positive braking action in emergencies.

In the following specification is set forth a preferred embodiment of our invention, taken in conjunction with the accompanying drawings, in which—

Figure 1 is a longitudinal section of an improved separator bowl;

Fig. 2 is a cross-section on the line 2—2 of Fig. 1; and

Fig. 3 shows a fragment of the cage.

The separator bowl shown in the specific embodiment is of the general type already described in pending applications, Serial Numbers 714,356 filed May 19, 1924 and 729,136 filed June 6, 1924, respectively. It has the outer shell 1 of steel having a great elongation but relatively low tensile strength or elastic limit. This bowl has a bottom member 2 with inlet nozzle indicated at 3, and upper plate 4 with a feeding slot 5 therein, substantially as shown in co-pending application Serial No. 729,136, filed June 6, 1924, to which reference may be made for structural details. The upper end of the bowl is closed by a top member 5^b having an end 5^a adapted to be connected to the driving mechanism, with passages 6 and 7 for the higher and lower specific gravity liquids, and an adjusting screw 8; details of these are likewise set forth in the aforesaid co-pending application.

Located within the shell 1 is a lining or cage comprising the series of rings 10 of steel having high elastic limit but necessarily of comparatively low elongation. These rings are secured to and held in suitable spaced relation by the longitudinal wings or vanes 11. These wings 11 fit the inner wall

of the bowl 1, but may be withdrawn therefrom as a unit for cleaning.

This cage receives a set of accelerator blades of the type shown and described in the aforesaid application, and indicated in cross section in Fig. 2; they are shown at 12. These blades are supported and spaced from the bowl 1 proper by this cage, and form a close fit therein, but may be withdrawn therefrom for cleaning.

In operating this centrifugal separator, the milk or other liquid is admitted through the nozzle 3 to the slot 5. It has already attained a high rotational speed before passing through slot 5 into the separator bowl proper, in which it is divided during its passage upward therethrough, into two liquid components of higher and lower specific gravity; the heavier component, milk for example, issues at the top of the machine through the passage 6, and the lighter component, cream for example, issues at the top of the machine through the passage 7.

The wings 11 define longitudinal passages in the shell, between the accelerator blades 12 and the bowl proper, through which the milk may flow readily. This also provides the large space necessary in factory separators for the accumulation of dirt, without clogging the separator. The rings 10 are made as small in cross-section as possible, to prevent interference with the flow of milk.

Practically the entire centrifugal strain caused by the wings 11 during the bowl's rotation come onto the rings 10. If during operation, for any cause, the strain upon these rings becomes greater than their tensile strength, they break and come into contact with the bowl proper. Any continuance of this strain causes a swelling of the bowl as well, which catches and holds any fragment resulting from the bursting of the rings 10. In so doing, the bowl is unbalanced, and acts as a positive brake. Since its elongation may be as high as 35%, it is apparent that long before it can burst, some part will have come into contact with the outer casing surrounding it, and formed a mechanical brake if the above action has not already reduced the strain.

While such swelling ruins the shell and necessitates replacement of shell and cage, it prevents a disaster to the entire machine and surroundings.

While this improvement has been shown and described as applied to a particular type of separator bowls, it is in no wise limited thereto, but may be employed in any bowl. The gist is to prevent the scattering of fragments; and may be realized by preparing the bowl of two layers of steel. In the latter case, the inner casing would be of material having a high elastic limit, while the outer envelope would be of great elongation. In another case, the two layers of steel might be welded together with either type on the inside; or a single sheet of material might be heat-treated to attain the desired results of elongation and tensile strength.

Other changes and modifications may obviously be made within the scope of the appended claims.

Having thus described the invention, what I claim as new and desire to secure by Letters-Patent, is—

1. In a centrifugal separator, a bowl having an outer envelop of material having a great elongation, and an inner lining of material having a high tensile strength, whereby said envelop retains fragments resulting from accidental bursting of said lining.

2. In a centrifugal separator, a bowl, a skimming device, a plurality of strain receiving rings closely surrounding and supporting the said device against centrifugal stresses and displacement, and a plurality of longitudinal spacing wings rigidly connected with said rings, said rings forming free longitudinal passages adjacent said bowl for the heavier separated material.

3. In a centrifugal separator, a bowl, a removable skimming device, and a cage separable from said bowl and said device, said cage comprising a plurality of strain receiving rings adapted to closely surround said device and be received in said bowl in the mutual assembled condition of said elements and a plurality of longitudinal spacing wings rigidly connected to said rings and forming free longitudinal passages along said bowl for the heavier separated material.

4. In a centrifugal separator, a bowl, a removable skimming device having longitudinal separator plates with successively stepped edges and a separating cage, said cage comprising a plurality of rings each closely surrounding the adjacent stepped portion of the device, and a plurality of stepped longitudinal spaced wings rigidly fastened to said rings and extending substantially from the periphery of said device to the wall of said bowl and forming free longitudinal passages along said bowl for the heavier separated material.

5. In a centrifugal separator, a bowl of material having great elongation, a cage including a series of rings of high tensile strength, and a skimming device removably fitted in said cage and having its centrifugal strain supported thereby.

6. In a centrifugal separator bowl, a shell formed of two qualities of metal, one of said qualities of metal being of relatively great elongation, and the other of said qualities of metal being of relatively high elastic limit.

In testimony whereof, I affix my signature.

DAVID T. SHARPLES.