No. 708,703. Patented Sept. 9, 1902.

F. H. FLOYD.

MACHINE OR APPARATUS FOR RAISING OR LOWERING THE TEMPERATURE OF LIQUIDS.

(Application filed Apr. 23, 1902.)

(No Model.) 2 Sheets—Sheet 1.

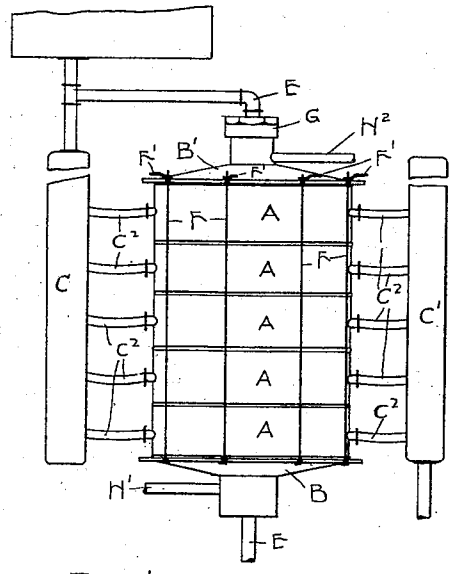


FIG 1

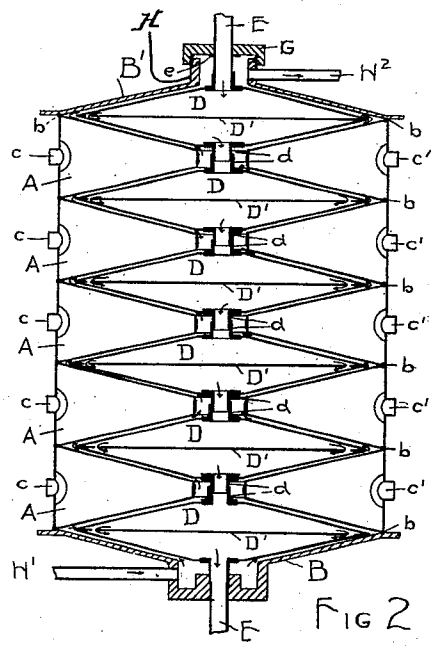


FIG 2

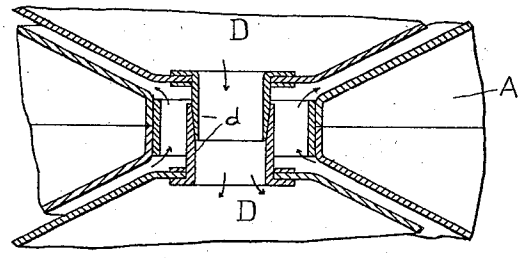


FIG 3

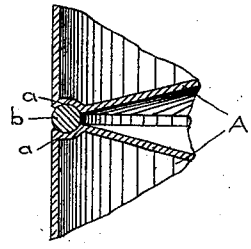


FIG 4

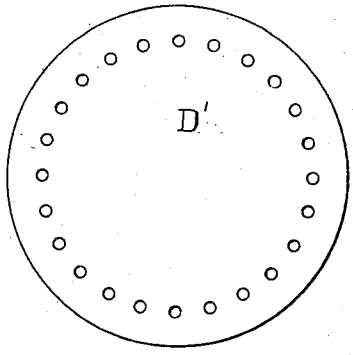


FIG 5

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(No Model.) 2 Sheets—Sheet 2.

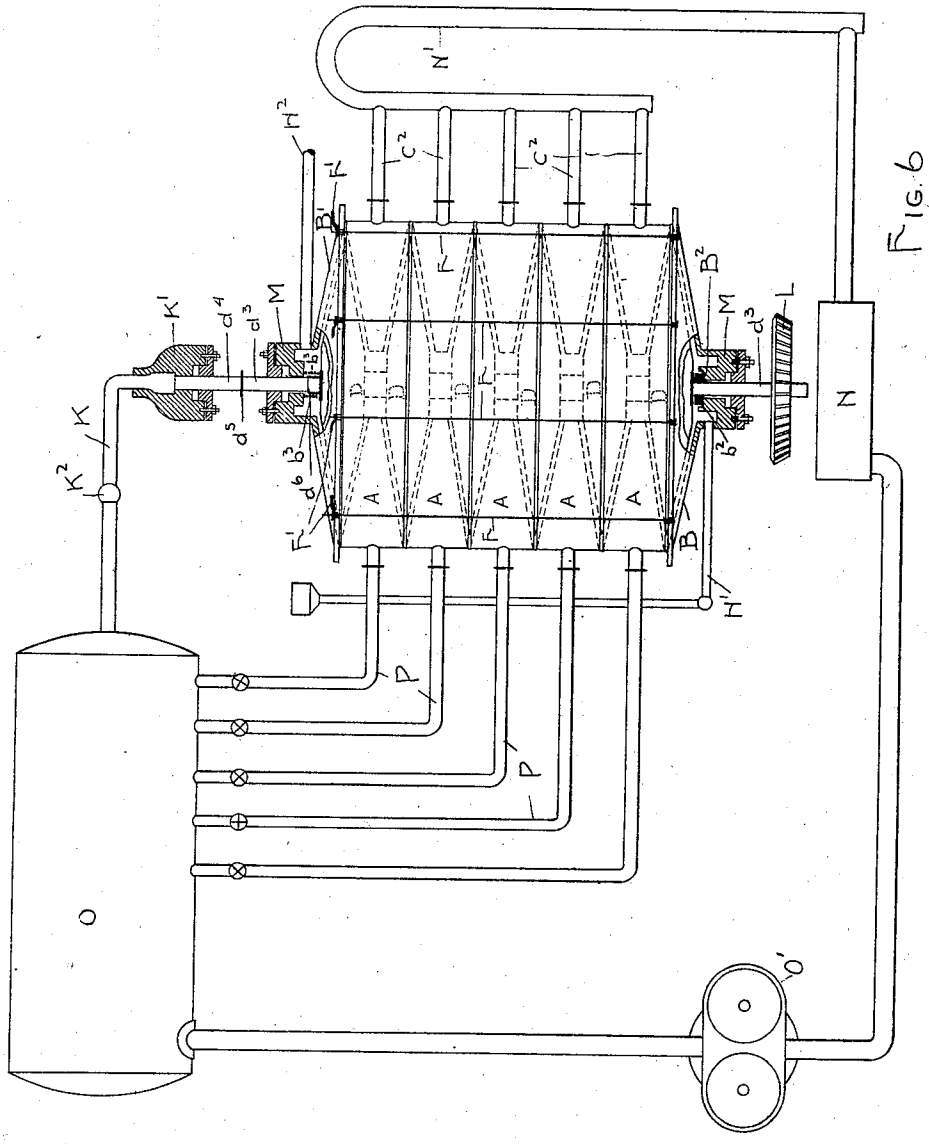


FIG. 6

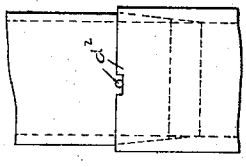


FIG. 7

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UNITED STATES PATENT OFFICE.

FRANK H. FLOYD, OF QUINCY, MASSACHUSETTS.

MACHINE OR APPARATUS FOR RAISING OR LOWERING THE TEMPERATURE OF LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 708,703, dated September 9, 1902.

Application filed April 23, 1902. Serial No. 104,328. (No model.)

To all whom it may concern:

Be it known that I, FRANK H. FLOYD, of Quincy, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Machines or Apparatus for Raising or Lowering the Temperature of Liquids, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to a machine or apparatus for treating milk or other liquids by raising or lowering the temperature thereof, and while it has been particularly designed for use in carrying out the process or method of treating milk known as "pasteurization" it is equally well adapted for use for the similar treatment of other liquids and also forms a very useful means for rapidly and thoroughly cooling liquids of various kinds.

The objects of my invention are, first, to provide in a machine of any given size a maximum area of active heating or cooling surface, and thereby greatly to increase the capacity of the machine; second, to so arrange the active surface as to bring it in contact with both sides of a shallow circulating layer of the liquid under treatment, whereby all portions of the latter are quickly brought to the desired temperature; third, to keep the liquid being treated from contact with the surrounding atmosphere, and, fourth, to provide for ready access to the various parts for frequent and thorough cleaning.

With these objects in view my invention consists in a machine for the purpose described in which the active surfaces are formed by a plurality of hollow readily-separable inner and outer sections of peculiar construction which form conduits for the heating or cooling medium and which are so arranged relatively to each other that the opposing surfaces thereof inclose a tortuous circulating-passage for the liquid to be treated, such passage being of shallow depth, but of considerable length and of great surface area.

My invention also consists in the novel construction, arrangement, and combination of parts, all as hereinafter described, and pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of a machine embodying my invention; Fig. 2, a central vertical section of the same with some of the circulating connections removed; Figs. 3 and 4, detail fragmentary views on a larger scale; Fig. 5, a detail view of one of the baffle-plates; Fig. 6, a view, partly in section and partly in side elevation, showing a modification; and Fig. 7, a detail view of one of the separable clutch-joints.

In the drawings the letter A designates a series of hollow double-concave annular sections which are superimposed one upon another to form a vertical cylinder. These hollow sections rest upon a concave bottom plate B, and upon the top section is a corresponding top plate B′. Each section is formed on both its upper and lower surface near its peripheral edge with a semicircular groove *a*, and the registering grooves of each two adjacent sections form a seat for an annular gasket or packing-ring *b*, of circular cross-section, which forms a liquid-tight joint between them. The top and bottom plates B and B′ are each formed on their inner concave surface with a similar groove to seat similar gaskets, as shown. Each of the sections has an inlet connection *c* for connection to one side of a circulating system C and also an outlet connection *c′* for connection to the other side of said system, as shown at C′.

D designates a second series of hollow sections having double-convex surfaces. One of these sections D is placed centrally in the space between the concave faces of each adjacent pair of the sections A and in the spaces between the top and bottom sections A and the plates B and B′. The sections D are connected with each other through the central openings of the sections A by means of short hollow separable stems *d*, the upper and lower sections D being separably connected to a circulating-pipe E. Within each section D is a centrally-arranged horizontal baffle-plate D′, which causes the circulating medium in passing through the section to keep in contact with the walls thereof.

The several sections A are held in their proper superimposed positions by means of a number of bolts or tie-rods F, which engage slots in the peripheral portions of the plates B and B′ and are secured by hand-nuts F′. The sections D are held together against the

pressure of the circulating medium by means of the nut G, which is seated upon a threaded boss H on the plate B′ and is screwed down against a flange *e* on the pipe E.

It will be seen that with the sections arranged as described there is formed between the opposed adjacent parallel surfaces of the sections A and D a series of very shallow spaces of double conical form connected with each other through the central openings of the sections A and forming an elongated tortuous passage of very great surface area extending from one end of the machine to the other. Communicating with the respective ends of this passage are the circulating-pipes H′ H² for the milk or other liquid to be treated. This liquid is forced under pressure or by gravity into the machine, where it fills the said spaces in a shallow layer exposed on both sides to the active heating or cooling surfaces of the hollow sections through which the heating or cooling agent is constantly circulating. In the drawings I have indicated the circulation of the milk as being from the bottom of the machine upward, while the circulation in the sections D is from the top downward. These directions of circulation may, however, be reversed; but I prefer in the operation of pasteurization that the circulation through the sections D shall always be in a direction reverse to that of the milk or other liquid being treated. It will be noted during its passage through the machine the milk or other liquid is kept entirely away from the air.

In machines of this character it is of great importance that all the parts shall be readily accessible for frequent cleaning. For this purpose I make the stems *d* of the sections D separable, as above stated. Any suitable joint may be used for this purpose. In Fig. 3 I have illustrated one of these joints as consisting of telescoping portions of the stems having tapered and ground-joint surfaces. Each of the sections A has detachable connections c^2 between its inlet and outlet connections *c c′* and the headers C C′ of the circulating system. In the drawings, Fig. 1, I have shown these detachable connections as consisting of short sections of hose provided with detachable coupling-unions. By slacking the nuts F′ the rods F can be removed, leaving the sections A and D free to be disconnected and separated, thus enabling all parts to be taken apart and thoroughly washed. I preferably form both the inner and the outer sections of thin sheet-copper having its outer surface tinned over.

In some cases it may be desirable to impart agitation to the milk or other liquid being treated, although this will not ordinarily be necessary, owing to the thin layer (preferably about one-eighth of an inch in thickness) in which said liquid is disposed in the machine and the more or less rapid circulating movement which may be given it. When agitation is desired, however, the series of inner sections may be made to revolve, as shown in Fig. 6. In this arrangement the sections of the stems *d* are formed with engaging clutch members d^2 of any suitable form, and the end sections are formed with extended stems d^3, which are provided with bearings in the bosses or hubs of the top and bottom plates B and B′. The weight of the sections D is carried on a central bearing B^2 on the hub portion of the bottom plate through a series of loose washers b^2. b^3 indicates a spring seated between the top plate B′ and the section D for the purpose of pressing the sections together. The stem of the upper section has a detachable joint d^4, and the portion above the joint makes connection with the circulating-pipe K by means of a stuffing-box K′, in which the stem rotates. L indicates means (a bevel gear-wheel in the present instance) whereby the sections may be rotated. M indicates stuffing-boxes for preventing leakage of the milk around the stems d^3. The lower stem is arranged to discharge into a tank N, from which the liquid is returned to a heating-tank and reservoir O by means of a pump O′. The sections A are also arranged to discharge into this tank N through the header N′, as shown. In this construction when the machine is to be cleaned the stem d^3 is uncoupled at the joint d^5, and the circulating-pipe K is swung around out of the way on a joint K^2. The lower section of the stem d^3, which has a tapered ground-joint connection d^6 with the upper section D (similar to the joint shown in detail in Fig. 7) is then removed, after which the sections may be separated in the same manner as described in connection with the arrangement shown in Figs. 1 and 2.

In Fig. 6 I have shown the several sections A as having each a separate detachable connection P to the tank O instead of to a header, as in Fig. 1.

I do not wish to limit myself to the particular arrangement and construction of the parts as herein shown and described, as various changes may be made in the details without departing from the spirit and scope of my invention as defined by the following claims.

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

1. In a machine for the purpose described, the combination of a series of hollow outer sections, a series of hollow inner sections arranged within the spaces between the outer sections and separated therefrom by narrow surrounding spaces, circulating connections between the inner sections and also with the end sections thereof, and means for effecting a circulation through the outer sections and also through the spaces between the inner and outer sections.

2. In a machine for the purpose described, the combination of a series of separably-superimposed hollow outer sections, a series of separably-superimposed inner hollow sections

arranged between opposing surfaces of the outer sections and separated therefrom by narrow surrounding spaces, circulating connections between the individual inner sections extending through the outer sections, and means for effecting a circulation through both the inner and the outer sections and also through the spaces between said sections.

3. In means for the purpose described, a series of double-concave hollow annular outer sections superimposed one upon another, a series of double-convex hollow inner sections inclosed between the concave faces of the outer sections and separated therefrom by narrow spaces, and means whereby a circulation may be effected through each of said inner and outer sections and also through the said spaces.

4. In means for the purpose described, a series of double-concave, hollow, annular outer sections separably superimposed one upon another, a series of double-convex hollow inner sections inclosed in the spaces formed between the concave faces of the outer sections, hollow separable connections joining said sections through the central openings of the outer sections, and circulating-pipes connected to the said sections and with the spaces between the same.

5. In means for the purpose described, an inner series of hollow sections, superimposed one upon another and means for effecting a circulation therethrough, an outer series of sections entirely inclosing the sections of the inner series and separated from the surfaces thereof by narrow spaces, means for effecting a circulation through said outer sections, and circulating-pipes connecting with the said spaces.

6. In apparatus for changing the temperature of milk and other liquids, a plurality of hollow sections arranged in an inner and an outer series, the opposing surfaces of the sections of the two series forming between them a connected series of narrow spaces of double conical form adapted for the passage therethrough of the milk or other liquid to be treated.

7. In apparatus for the purpose described, the combination of the outer concave hollow, annular sections superimposed one upon another, and gaskets between said sections, of the inner convex hollow sections inclosed by the concave faces of the outer sections, and separable hollow stems connecting said inner sections through the central openings of the outer sections.

8. In apparatus for the purpose described, the combination of the top and bottom plates having the concave, inner surfaces, the series of separable, double-concave, hollow, annular outer sections, having detachable circulating connections, the inner hollow, double-convex sections having detachable, interfitting hollow stems, circulating connections for the upper and lower inner sections, and circulating connections communicating with the inclosed connected spaces between the inner and outer sections.

9. In apparatus for the purpose described, the combination with the series of separable superimposed hollow, double-concave, annular outer sections, of the series of hollow inner sections inclosed between the concave faces of the outer sections and separated therefrom by narrow spaces, separable hollow clutch connections, and means for rotating the series of inner sections.

10. In apparatus for the purpose described, the combination of the outer series of fixed separable sections, the inner sections inclosed by the outer sections and separably connected with each other, said inner and outer sections having parallel surfaces separated from each other at all points by narrow spaces, a circulating system connected with both inner and outer sections and also with the said spaces, bearings upon which the said inner sections may rotate, and joints in the circulating-pipes leading to said inner sections for permitting rotation thereof.

11. In apparatus for the purpose described, the series of superimposed hollow annular double-concave sections, and gaskets seated between the said sections near their peripheries, in combination with hollow inner sections seated between the concave faces of the outer sections and separated therefrom.

12. In a machine for the purpose described, the combination with a series of hollow outer sections superimposed upon each other at their peripheral portions, but having their adjacent surfaces separated by spaces, hollow inner sections arranged in said spaces with their surfaces separated from the surfaces of the outer sections, and central connections between said inner sections.

13. In a machine for the purpose described, the combination with a series of hollow outer sections, a series of hollow inner sections entirely inclosed by the outer sections and separated therefrom by spaces, means for effecting a circulation through each of said sections and also through the said spaces, and means for rotating the inner sections.

14. The herein-described machine for attemperating liquids, consisting of a plurality of hollow sections for the attemperating medium, separably superimposed upon each other in an inner and outer series and inclosing between their opposing surfaces a narrow passage of large superficial area for the liquid to be attemperated, together with means for effecting a circulation through said sections and passage.

In testimony whereof I have affixed my signature in presence of two witnesses.

FRANK H. FLOYD.

Witnesses:
GEO. H. PARMELEE,
H. W. SMITH.