No. 878,225. PATENTED FEB. 4, 1908.

J. C. MILLER.

PASTEURIZER.

APPLICATION FILED AUG. 10, 1903.

4 SHEETS—SHEET 1.

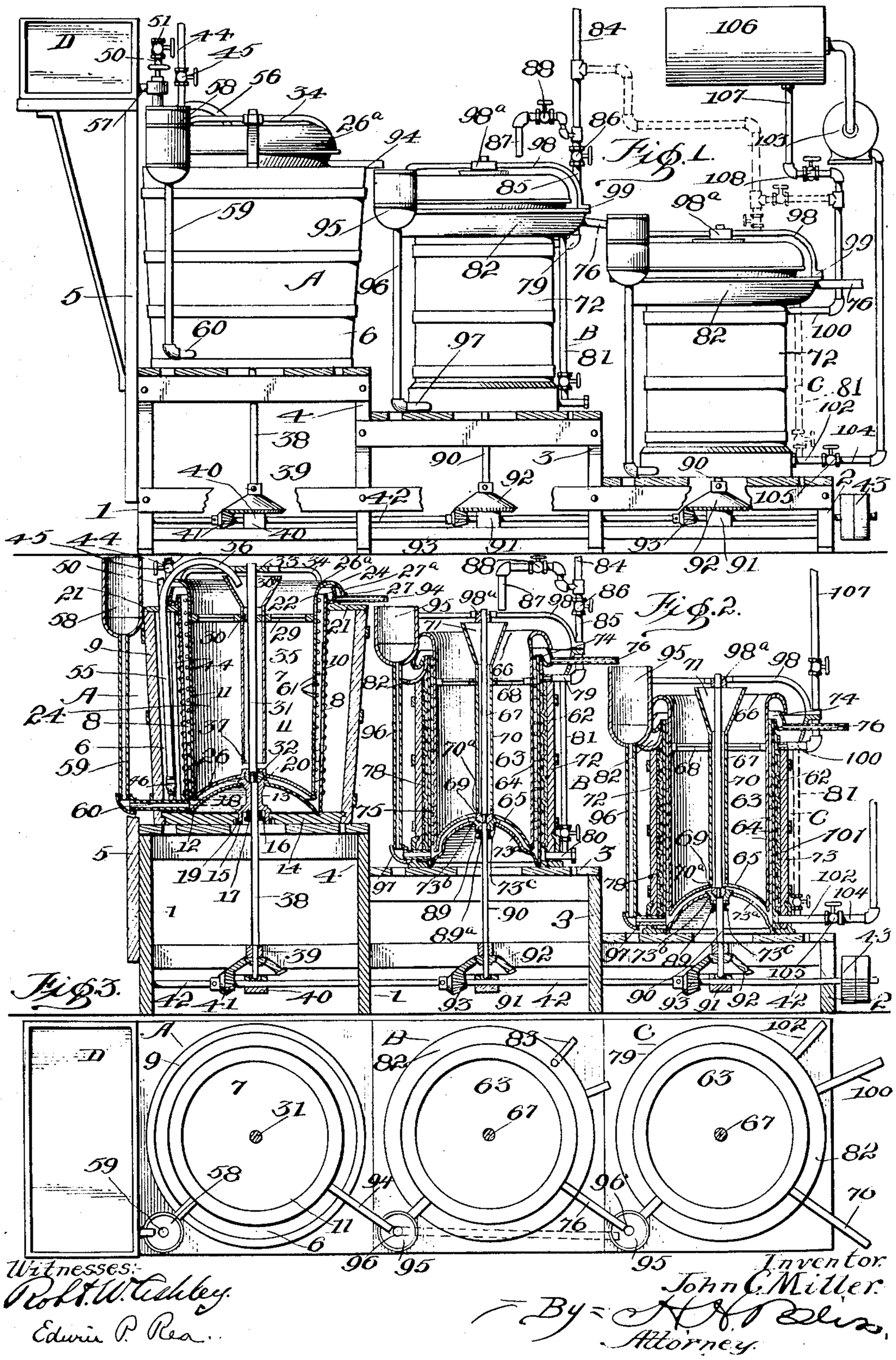

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Fig. 5.

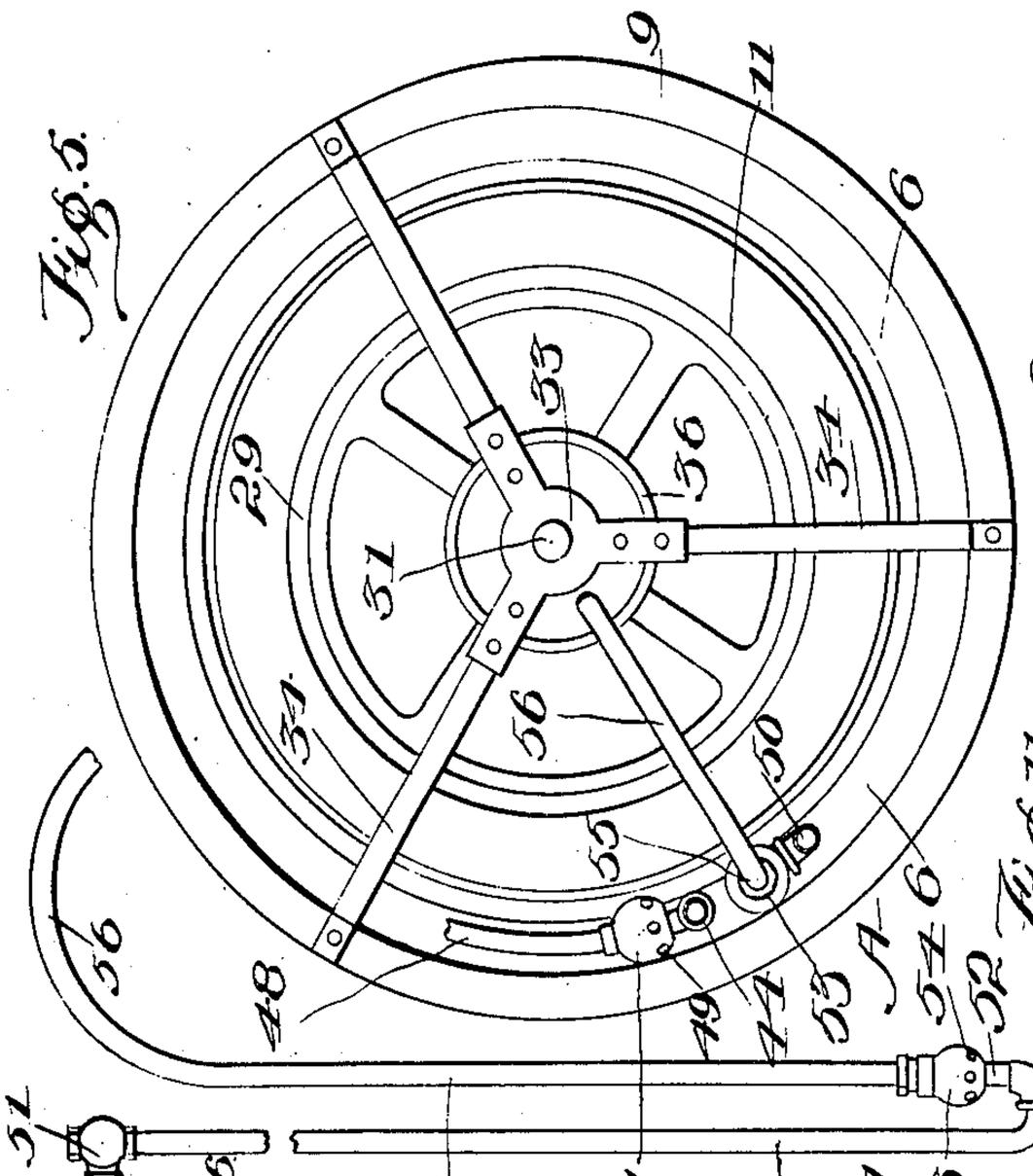


Fig. 6.

Fig. 7.

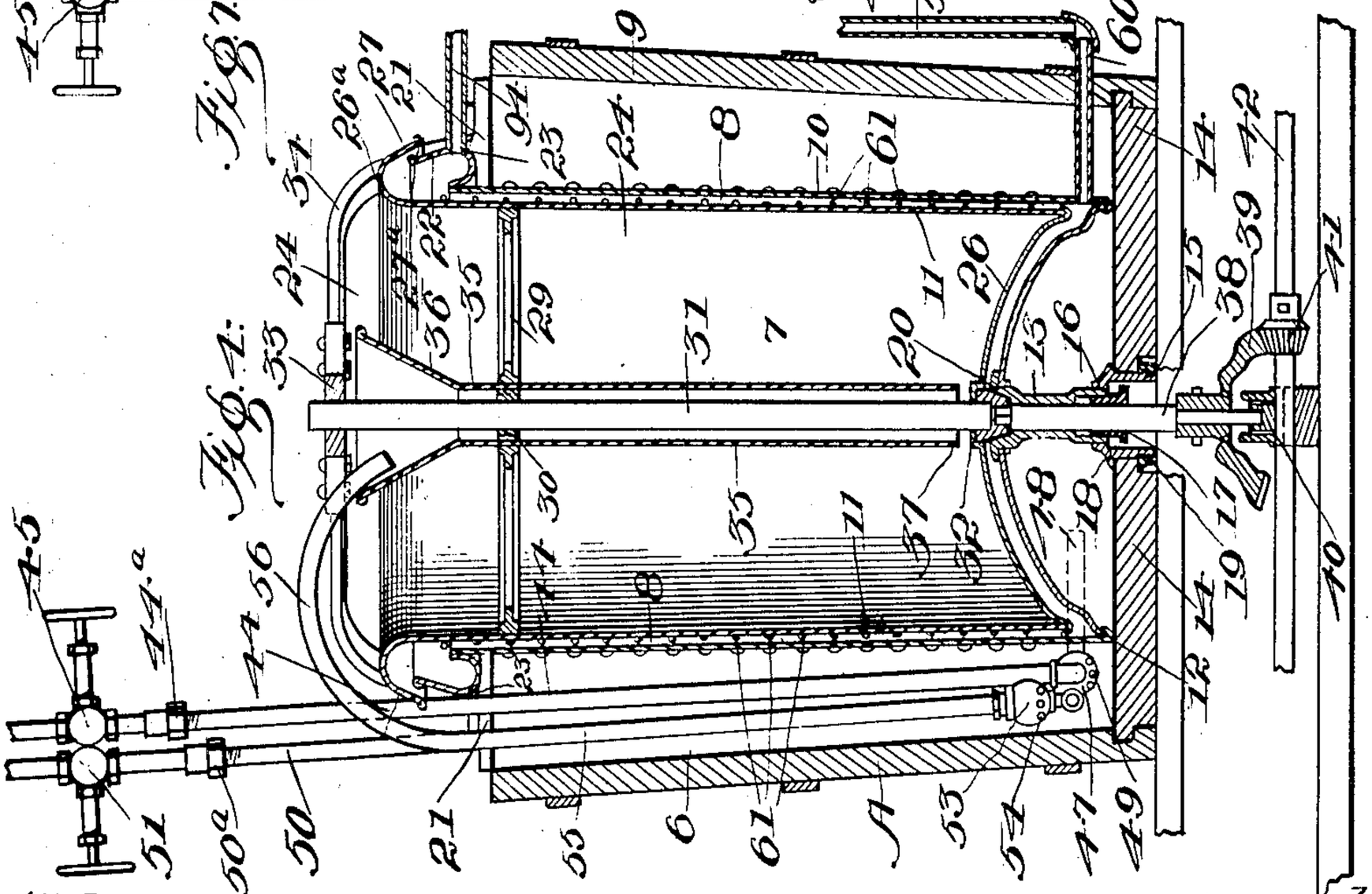
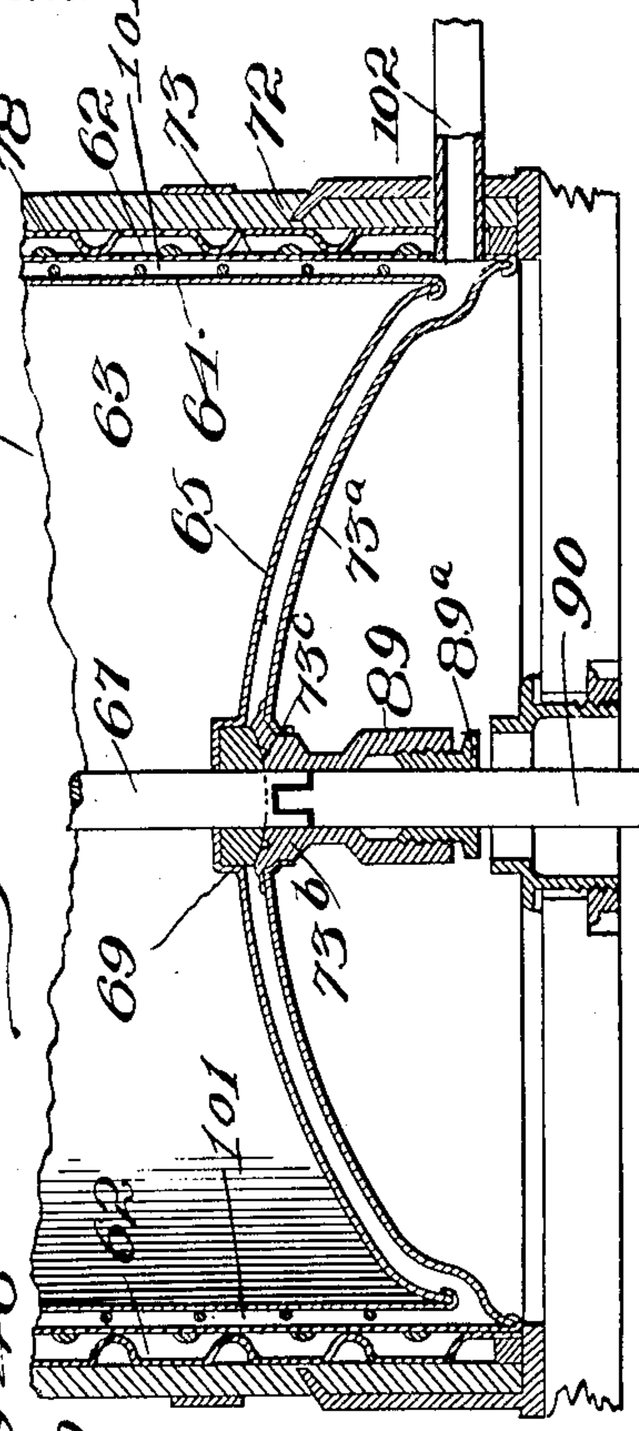


Fig. 11.



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4 SHEETS—SHEET 3.

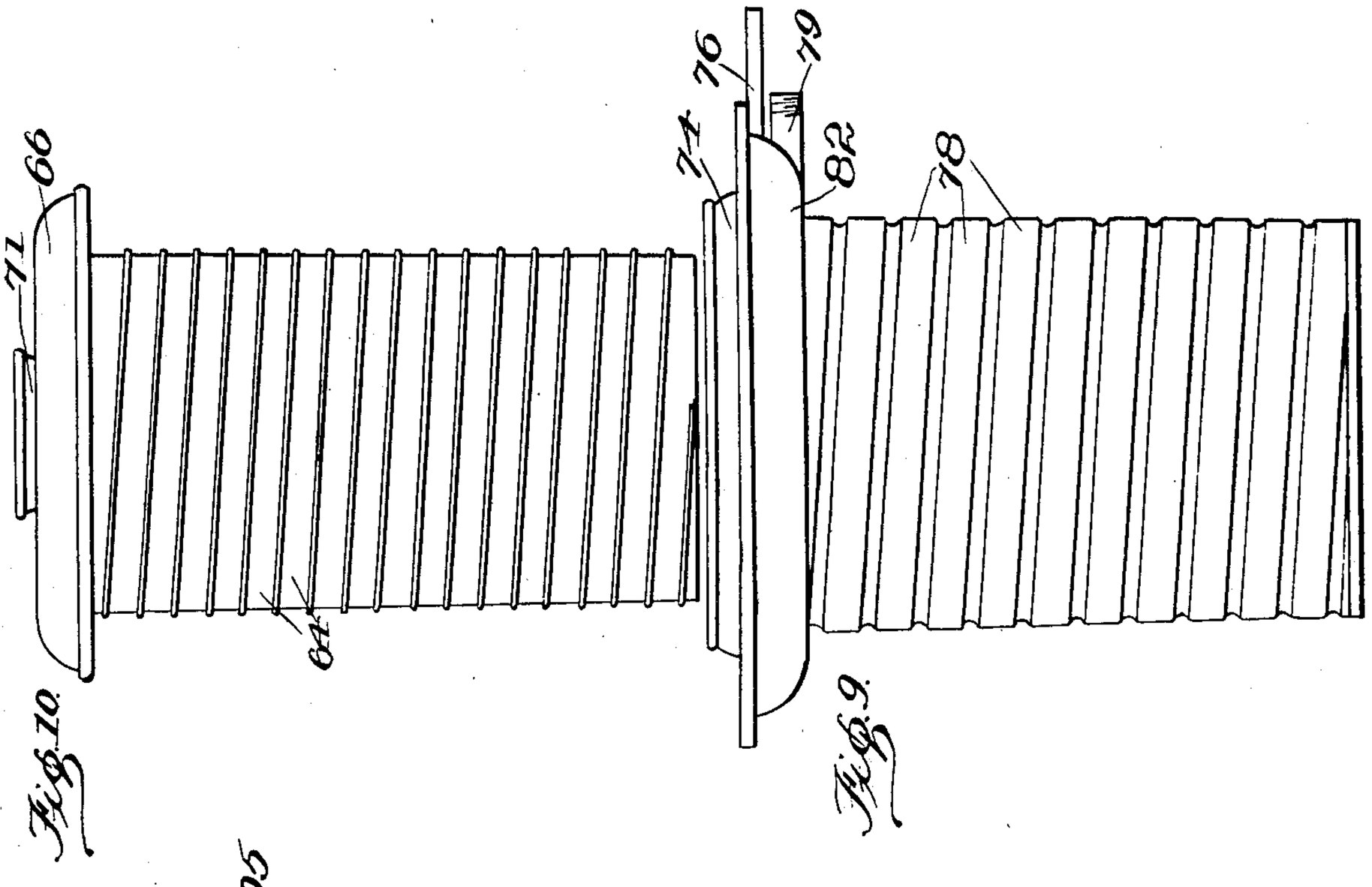

Fig. 10. Fig. 9.

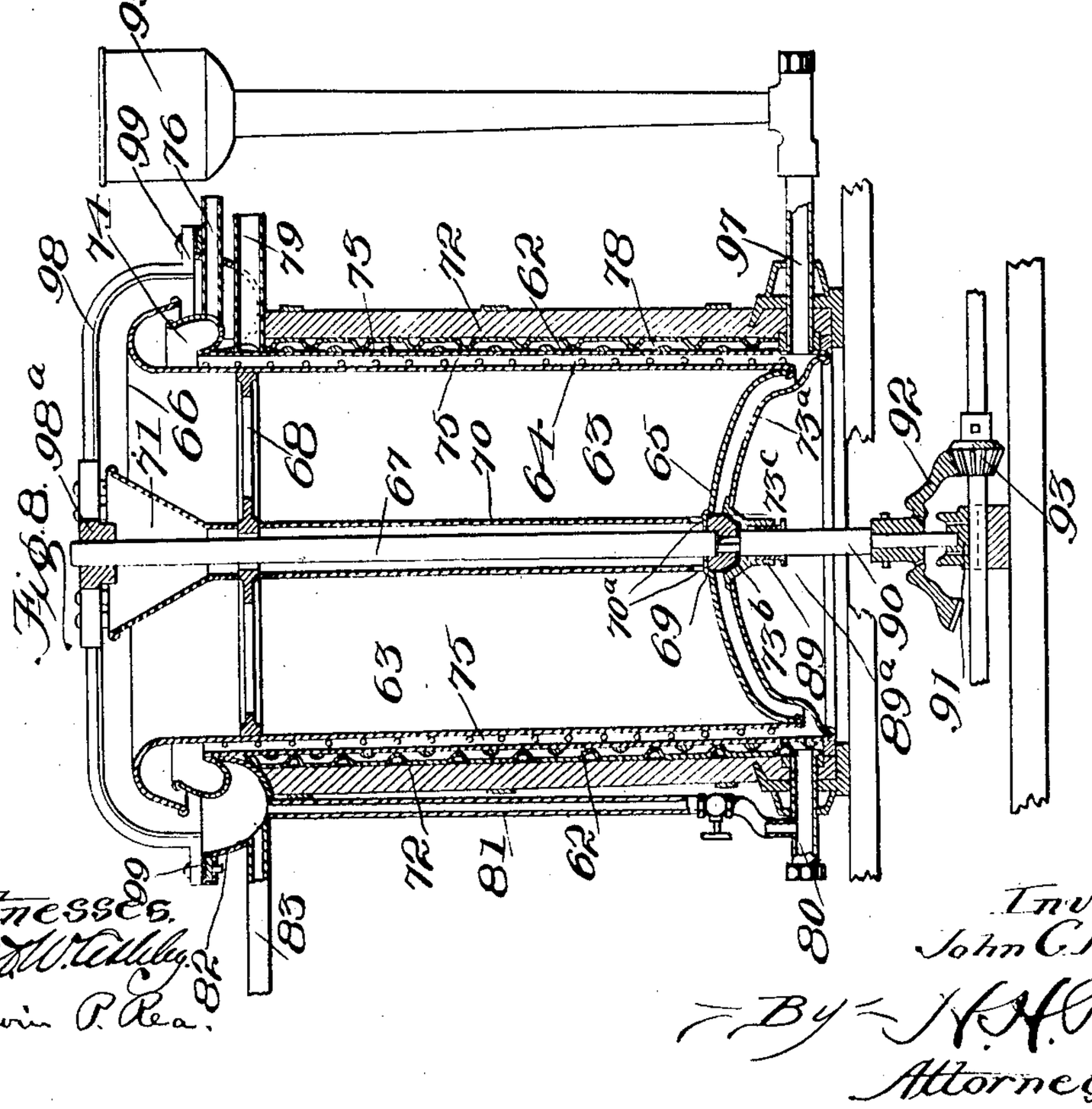

Fig. 8.

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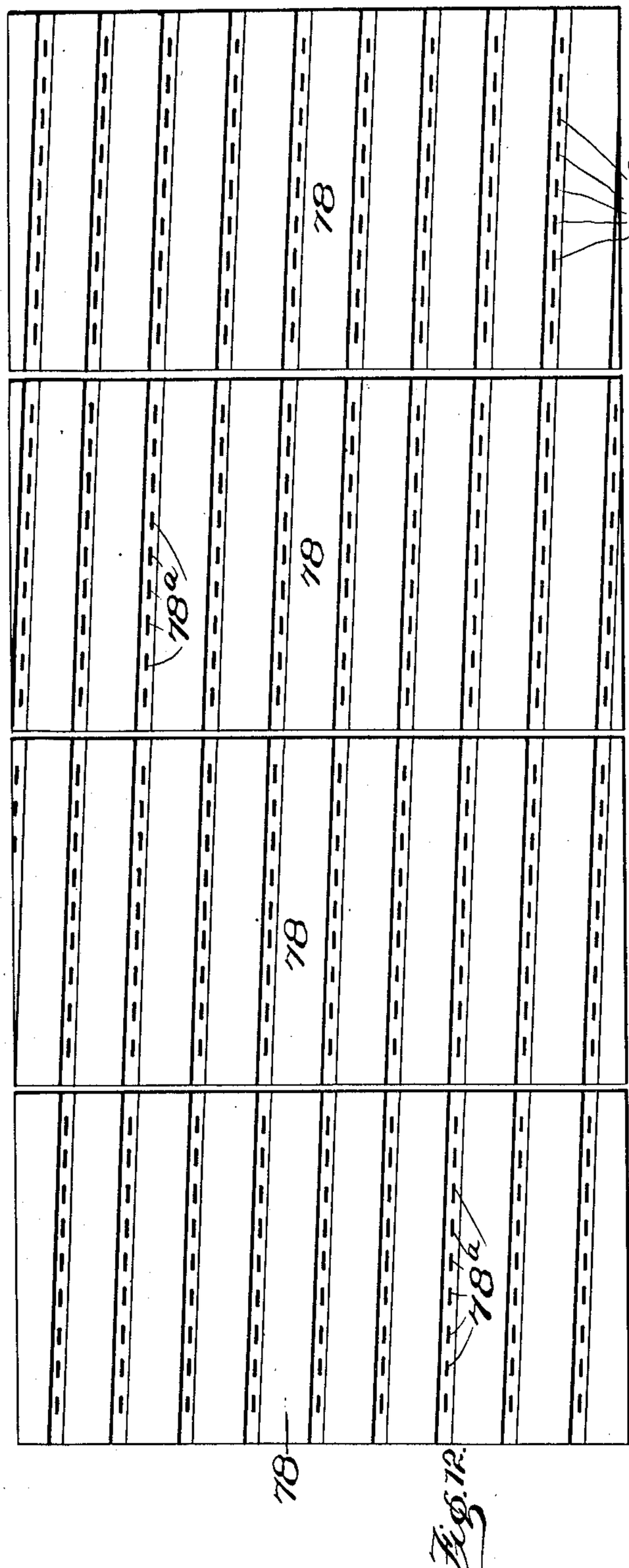

Fig. 12.

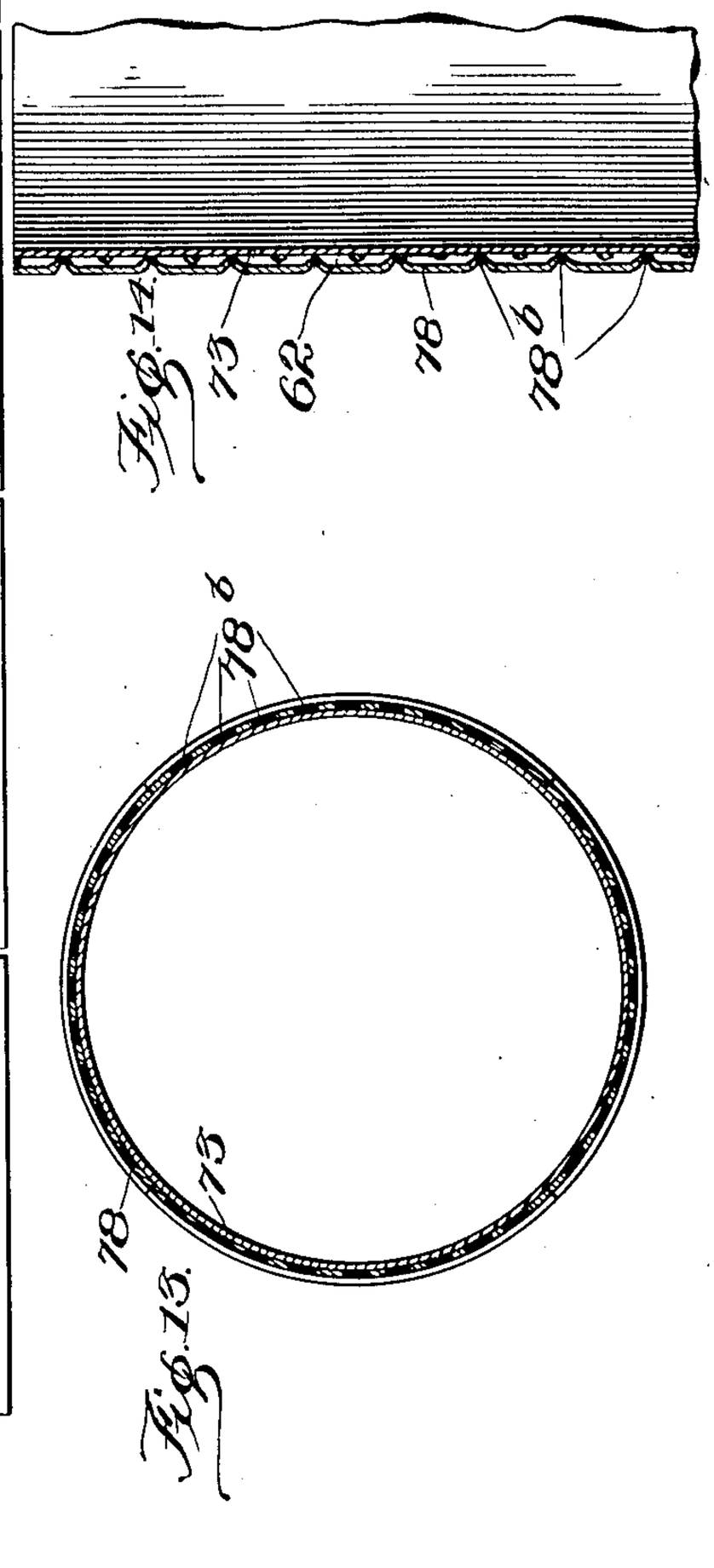

Fig. 14.

Fig. 13.

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JOHN C. MILLER, OF CANTON, OHIO, ASSIGNOR TO THE MILLER PASTEURIZING MACHINE COMPANY, OF CANTON, OHIO, A CORPORATION OF OHIO.

PASTEURIZER.

No. 878,225. Specification of Letters Patent. Patented Feb. 4, 1908.

Application filed August 10, 1903. Serial No. 169,024

To all whom it may concern:

Be it known that I, JOHN C. MILLER, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Pasteurizers, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an improved apparatus for treating milk and other liquids, pertaining more particularly to apparatus by which bacteria or similar organisms are destroyed by first heating the milk and then cooling it.

Figure 1 is a side elevation of a mechanism embodying my improvements. Fig. 2 is a section showing the several parts or sets of devices in their relation to each other. Fig. 3 is a plan view of the apparatus. Fig. 4 is an enlarged section of the parts of the heater shown separately. Fig. 5 is a plan view. Fig. 6 is a side elevation of the injector part of the water circulating devices. Fig. 7 is a side view of the inlet ducts for steam for the outer water chamber. Fig. 8 is a vertical section of one of the cooling devices. Fig. 9 is a side elevation of the exterior cooling vessel in Fig. 8. Fig. 10 is a side elevation of the rotary inner vessel. Fig. 11 is an enlarged vertical sectional view of a portion of the lower end of a cooler showing a modified form of connection for the driving shaft. Fig. 12 shows in side elevation the four sections of corrugated metal from which the cooling coils are formed. Fig. 13 is a cross section of the cooling coil, and Fig. 14 is a vertical section of the same.

I provide a framework with a supporting bed 1, having a series of steps or platforms 2, 3, 4, and an upright frame section at the end as at 5.

A indicates the heating apparatus as a whole, B the preliminary cooler and C the final cooler in which the milk is reduced to a temperature relatively very low. These several parts are so arranged as to respectively hold bodies or columns of milk, the body in B having its top level lower than that in the heating mechanism at A, and the body in C in turn having a level lower than that in the devices at B.

At D is supported on the framework the initial holder or receptacle for the milk, this holding it at a level somewhat above that in the heating mechanism at A.

The heater is constructed in such way as to provide an outer water holding chamber 6, and an inner water holding chamber 7, these being so arranged that the outer wall of the latter and the inner wall of the chamber 6 form an exceedingly reduced passageway 8 for the milk that is to be treated. Preferably I provide these chambers and the passageway by forming three cylinders 9, 10 and 11. 9 can be a wooden vat or tub, and in order to prevent loss of heat it is generally so made. The cylinder at 10 is of sheet metal and is formed with a bottom 12 which is preferably concavo-convex as shown. This bottom at its edge is secured liquid tight to the lower edge of the wall 10 of the outer vessel. At its center it is secured to a tube or sleeve 13. This sleeve extends downward and at its lower end is rigidly mounted in and tightly fastened to the bottom 14 of the exterior vessel. To thus secure it, it is fastened to a sleeve 15 which is fitted in an aperture in the bottom and has a boss 16 secured to the sleeve 13. 17 indicates a gland or stuffing box provided with packing and a screw for preventing liquid from escaping around the shaft.

At 18 there is a shoulder on the sleeve 15 fitting the inner surface of the bottom wall 14 and at 19 there is an annular nut engaging with a thread on the sleeve 15 for tightly binding the parts to the bottom wall 14 with a liquid tight union.

At 20 there is a step cavity wherein the inner rotary vessel has bearing, as will be described.

At the upper end the cylinder 8 is fastened in position and centered with respect to the outer walls 9 and 10 by means of bracing bars 21 which are bolted or screwed to the wall 9 and extending inward to the cylinder or wall 10. 22 indicates a trough which is secured to or formed at the upper edge of the cylinder wall 10 and is adapted to collect the milk which overflows from the milk passage and conduct it to the place of exit. The brace bars 21 are formed with ears or lugs 23 which are fitted to the trough and support it and assist in bracing firmly the cylinder 8.

The inner water holding chamber 7 is provided by means of a vessel indicated as a whole by 24. It has a wall or cylinder 11 and a bottom 26. The latter is concavo-convex and shaped so as to be approximately parallel to the bottom wall or diaphragm 12 of the other vessel. At its upper end this inner ves-

sel has its wall turned over and outward as shown at 26ª, the lip at 27 overlapping that at 27ª on the trough 22 of the inner vessel. This vessel 11 on its interior has a spider frame 29, the central hub 30 of which is secured to the shaft section 31. The latter at the bottom is secured to a step piece 32 which is fitted to the step cavity 20, above described, in the stationary bearing sleeve 13. The shaft extends to points above the vessels and is mounted in a bearing at 33 which is carried by carrying and bracing arms 34 which are bent downward and detachably secured to the outer vessel, preferably by having quickly detachable fastening devices for joining them to the brace bars 21.

35 is a water inlet conductor in the form of a large tube secured to and concentric with the shaft 31 and having at its upper end a funnel 36. The water delivered to the funnel 36 passes through the pipe 35 and escapes at the orifice 37 into the inner water chamber 7.

38 is the driving shaft section. It is mounted in the tubular or sleeve bearing 13 at its upper end and at its lower end is seated in a bearing 40. It carries a bevel wheel 39 which meshes with the pinion 41 on the main driving shaft 42. The shaft is mounted in the base frame 1 and extends below the several sets of operative devices, A, B, C, and is adapted to impart power simultaneously to the movable parts of each. At 43 it is provided with a fast pulley and a loose pulley and with it is connected a belt which can be moved from one pulley to the other when power is to be applied.

In order to maintain uniformity of temperature in the two water chambers 6, and 7 I produce a circulation of water between them by means of steam of constant pressure and temperature.

44 is a steam pipe extending from a boiler, the passage of steam therein being controlled by a valve at 45. At the bottom it is provided with a nozzle 46 which is fitted into the wall of the chamber 47 connected to a pipe 48 which is extended around the bottom of the outer water chamber 6 in a form approximately circular. The chamber at 47 is approximately globe-like in form and is provided with a series of apertures 49. When steam is permitted to enter through the nozzle at 46 it tends to pass around the duct 48 and at the same time violently suck in streams of water through the apertures 49 and drive them simultaneously through the pipe. At 50 another steam inlet pipe is shown which also extends downward to points near the bottom of the outer chamber 6, and is provided with a control valve 51. It has a nozzle at 52 which is fitted into the wall of a globe like chamber at 53 having apertures 54 similar to those above described. This is connected to the lower end of an uptake pipe 55 which, at the top, has an inwardly curved portion 56 adapted to deliver water to the interior water chamber at 7.

When steam is admitted through the pipe 44 it heats and causes circulation of the water in the outer chamber 6, and if, at the same time, the steam is entering through the pipe or through the injector devices at 52, 54, causes the forcible movement upward of water from the outer chamber, which water passes over into the inner chamber 7. When this chamber becomes filled to the top of the rim at 26ª any additional water that is delivered to it will cause an overflow from this rim into the outer chamber 6. The steam acts as a heating agency and also as a water elevating agency in the pipes 55, 56. The water of condensation being relatively inconsiderable the volume of water in the two chambers remains approximately constant and the steam acting in the way described supplemented by the overflow from the inner to the outer chamber produces a temperature throughout the two bodies of water which is practically uniform and constant.

The milk is delivered from the receptacle at D to the space or passageway 8 through the valve control duct 57, the funnel 58, the vertical pipe 59 and the inlet pipe 60. The "head" or level of the liquid in the tank D is somewhat above that in the funnel at 58, and the level in the latter can be kept slightly above that in the space or passageway 8.

The inner wall 11 being close to the adjacent one at 10, it, when rotated by the devices above described, acts to prevent the coagulation of the milk; this resulting also from the fact that by the means set forth the temperature of the walls or sheets of metal are substantially alike, one on one side of the thin sheet of metal and the other on the other. The filaments or membranes of coagulation that tend to form are immediately broken. To increase the efficiency of the parts in this respect, and also to assist in causing the milk to flow rapidly upward through the reduced passage, I employ a helically arranged rib 61 secured preferably to the outer face of the inner vessel. This is in or nearly in contact at all points with the wall 10 of the outer vessel. Hence, the outer surface of the pathway is rapidly traversed by the rib, and while the whipping or violent agitation of the milk is prevented (such as is secured by the beaters or agitating blades some times employed) there is a prevention of the adherence of the milk particles to the surface. Again, the helically arranged rib assures that there shall be a great prolongation of the pathway through which the milk must travel, although its total rise from the bottom to the top of the mechanism is limited. Through this elongated passage it rises rapidly and the heating is speedily effected and with uniformity, as above described. The mechanism indicated as an entirety by B also

comprises an outer water chamber or vessel 62 and an inner chamber .63. The inner chamber is provided by a cylinder-like vessel having the wall 64, the bottom 65, the rim 66, the shaft 67, the spider 68, the step-bearing 69, the tube 70, and the funnel 71, each substantially similar to the corresponding parts above described in the apparatus indicated at A. The outer vessel in this cooling apparatus at B has an outer wall 72, preferably of wood, and an inner wall 73 of sheet metal arranged closely adjacent to the wall 64 of the inner vessel. At the upper edge of this inner wall 73 of the outer vessel there is a collecting trough 74 into which the milk can run which rises in the reduced passageway 75 between the walls 64 and 73.

At 76 there is an escape duct for the milk which has collected in the trough.

The metallic parts of the outer and inner vessels are illustrated detached in Figs. 9 and 10, in side view. The outer water chamber 62 in this case is in the form of a helical passage way. To provide it, sheets of metal are subjected to a pressing action for the purpose of forming therein sections of helical grooves 78. After they have been pressed the sections are placed together in such a way as to surround the cylindrical wall 73 and they are tightly and continuously fastened thereto by solder or otherwise. The corresponding groove sections are arranged so as to register and when the parts have all been fastened together there is provided a continuous helical passageway as aforesaid and indicated by 62. The sections of this water jacket are shown in Fig. 12. The inwardly pressed helically grooved parts are provided with rows of perforations, as shown at 78[a]. After the jacket sections are put in place, as above described, they may be fastened by introducing solder through these rows of small perforations, the solder binding together the two sheets of metal, as shown at 78[b], Figs. 13 and 14. 79 is an inlet duct or pipe, which communicates with the top convolution of this helical passageway and supplies the cooling medium thereto.

80 is the withdrawing duct.

81 is a vertical conductor which carries the water upward to the escape duct.

82 is a trough or receptacle at the upper end of the wall 73 extending to points outside of and lying below the metallic trough 74. When water is fed to the inner chamber 63 through the funnel 71, and the pipe 70, it escapes from the pipe at the orifice 70[a]. The water descends from the refrigerator or cooler through the pipe 84.

85 is a connection between the pipe 84 and the duct 79, 86 being a valve for controlling the flow of water through it.

87 is a pipe carried inward from that at 84 and provided with a valve 88. The pipe 87 delivers the water to the chamber 63. The water that enters the bottom of the inner chamber 63 rises to the top thereof and finally flows from the rim at 66 into the trough at 82. From this it escapes through the duct at 83. Thus the streams of water, the one that has passed downward through the outer cooling chamber or helical path, and that which flows over from the inner chamber are both received in the trough 82 and escape through the duct 83. The outer vessel of this part of the mechanism has a bottom 73[a] of sheet metal concavo-convex in form, and is secured to the wall 73. At its center it is secured to a metallic bearing piece 73[b], having a step socket 73[c] to receive the wearing piece 69 secured to the lower end of the shaft 67. There is a short sleeve 89 projecting down from the bearing and provided with a packing 89[a]. The driving shaft section 90 in this case at its lower end mounted in a step 91 and has secured to it a bevel wheel 92 engaging with a bevel pinion 93 on the aforesaid shaft 42.

The milk which flows from the heating mechanism is carried through the duct 94 to the funnel 95 which delivers the milk to a vertical pipe 96, the latter in turn delivering it to the horizontal inlet 97 which communicates with the reduced space or passageway 75 between the inner and outer cooling vessels. The milk thus fed in at the bottom finally reaches the top of the passageway and flows over the inner wall of the outer vessel into the trough 74 from which it passes through the pipe 76.

The upper end of the shaft section 67 is mounted in the bearing 98[a] carried by the bent bracket arms 98 detachably fastened at 99 to the rim of the trough 82. The shaft sections 90 and 38 are separably connected with their respective rotary vessels above them. This connection is provided by forming each shaft section with a square upper end adapted to fit into a corresponding shaft socket in the bearing head 69 or 32. By having the train of rotary vessels situated above the power shaft and so constructed as to be readily detached therefrom, I provide for taking the parts apart for cleansing, manipulating and again assembling them entirely independently of the power mechanism, which latter can be left in permanent position, the mechanism in this respect being superior to those which I have heretofore employed, such as shown in my patent, No. 678,892 of July 23, 1901. With my earlier machines referred to, the gearing, shafting and the framework which supported them were arranged above the operative parts of the apparatus, and the separating of the cylinders from each other, or the removal of one of the parts, could be accom-

plished only with difficulty, and after rigid clutch members had been loosened and separated.

With the present devices either the rotary heating cylinder or the rotary cooling cylinder can at any time be withdrawn, the only part to be loosened in either case being the simple bracket bar or spider at the top, and after the removal thereof the vertical space above the fixed vessels is unencumbered and vessels of even the largest size can be readily lifted out and replaced.

As will be more fully set forth below, the object aimed at with that part of the apparatus so far described is to effect the uniform and sudden heating of the milk to a relatively high degree, and to immediately thereafter as the milk flows in a continuous stream as suddenly and uniformly lower its temperature. This I have found can be accomplished by the use of water of ordinary temperature, such as can be readily obtained even in warm weather or can be obtained without any expensive use of refrigerating material. For instance, if the heating is carried in the apparatus at A up to 160 degrees and is by the apparatus at D suddenly and uniformly reduced to, say, 70 degrees, I have found that the pasteurizing can be thoroughly accomplished, and this ready withdrawal of the heat can be accomplished without the employment of ice or expensive refrigerants. But after this pasteurizing has been accomplished, I find it is desirable in many cases to still further lower the temperature of the milk, and for this purpose I can with economy employ a refrigerant of the nature of cooling brine and I apply it by means of the third set of devices illustrated as an entirety by C.

This apparatus can, as concerns most of its details, be regarded as similar to that illustrated at B, there being an inner vessel and an outer vessel for holding the cooling liquid, having a helical passageway with an inlet and outlet similar to that above described. In this case, however, because of the cooler brine it is not necessary to have the inner body of cooling liquid. The brine or refrigerating fluid is admitted to the inlet at 100, passes downward around the milk passage 101, following the helical conduit and escapes at the outlet 102. At 103 there is a pump connected with the outlet 102 by means of a duct 104 having a valve 105. The pump draws the brine out at the bottom of the interior passage and forces it into the vat 106, and from the latter it flows downward through the pipe 107 to again enter through the inlet 100, its passage through the latter pipe being controlled by the valve at 108. With these exceptions I prefer to make this brine cooler at C substantially similar to that at B, above described. When so made it becomes possible, if the operator so wishes, to modify the treatment of the milk if occasion should demand. Thus he can carry it, if required, directly from the heater to the brine cooler by connecting the outlet 94 across to the feed funnel 95, as indicated by dotted lines in Fig. 3. Or, again, he can prolong the cooling treatment by water, if found desirable, by cutting off the connection with the brine vat and pump and making connections between the inner water vessel and the outer water vessel at C, and the source of water which supplies the apparatus at B, these connections being similar to those at 84, 85, 87, etc., and shown in dotted lines in Fig. 1.

When it is desired to remove the inner cylinder of the heater A, the pipe systems 45 and 50 may be detached respectively at the connections 44^a and 50^a. By removing the spider or bracket 44, the inner cylinder may then be readily removed. In order to remove the inner cylinders of the coolers in which water is used, it will be understood that all that will be necessary is to swing the pipe 87 out of the way and to remove the bracket or spider 98.

What I claim is:—

1. In an apparatus for treating milk and other liquids, the combination of a frame, a heating mechanism having two concentric vessels, of which one rotates relatively to the other, means for supplying a heating agent to each of the said vessels, a tank supplying milk to said receptacle and adapted to hold a body thereof higher than that of said heating mechanism, a cooling mechanism adapted to hold the milk after it leaves the heating mechanism at a level lower than the level of the milk in the heating mechanism and comprising two concentric vessels adapted to hold bodies of a cooling medium and of which vessels one is rotatable relatively to the other, a power mechanism below the said heating mechanism and cooling mechanism, two trains of devices for connecting the rotary vessels respectively in the heating and cooling mechanisms with power mechanism, and conductors for conveying milk or other liquid from the heating mechanism to the cooling mechanism, substantially as set forth.

2. In an apparatus for treating milk or other liquids, the combination of a supporting frame, a heating mechanism having a stationary external vessel and an inner rotary vessel, the adjacent walls of which vessels form a reduced passageway around the inner vessel for the milk, a cooling mechanism having a stationary outer vessel and a rotary inner vessel, the adjacent walls of which form a reduced passageway for the cooling of the milk, a rotary vertical power shaft passing through the bottom of the outer vessel of the heating mechanism and detachably connected with the inner rotary

vessel, a vertically arranged power shaft passing through the bottom of the outer vessel of the cooling mechanism and detachably connected with the inner rotary cooling vessel, power devices below the heating mechnism and the cooling mechanism and connected to both of said vertical shafts, substantially as set forth.

3. In an apparatus for treating milk and other liquids, the combination of a frame, a stationary vessel mounted on said frame and adapted to hold a body of water around the passageway for the milk which is being treated, an inner rotary vessel holding a body of water inside of the said milk passageway and cut off from the body of water in said stationary vessel, a driving shaft mounted in fixed relations to the outer vessel and below the inner rotary vessel, said inner rotary vessel being arranged to be detached upwardly from said shaft and to be lifted out from the exterior vessel independently of the said shaft, and the power transmitting devices below the inner rotary vessel for driving said shaft, substantially as set forth.

4. In an apparatus for treating milk and other liquids, the combination of an inner rotary vessel adapted to hold a body of water, an outer chamber having an inner cylindrical wall 73 and an outer wall formed with a helical groove 78 extending continuously from the top to the bottom, said outer wall being secured to the inner and forming a continuous helical passageway for liquid, substantially as set forth.

5. In an apparatus for treating milk and other liquids, a metallic heat-conducting wall with which the milk or liquid to be treated is arranged to contact, and a helically grooved wall having rows of perforations through its helically grooved portion and solder connections between said first described heat-conducting wall and said helically grooved wall extending through said perforations in said helically grooved wall.

6. In an apparatus for treating milk or other liquids, the combination of a heating mechanism having a rotatable milk-treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for suddenly and substantially uniformly heating all of the particles of said milk while it is so traveling over said rotatable wall, a tank supplying milk to said heating mechanism and adapted to hold a body of milk at a level higher than the level of the milk in said heating mechanism, a cooling mechanism adapted to hold the milk after it leaves the heating mechanism at a level lower than the level of the milk in the heating mechanism, said cooling mechanism having a rotatable treating wall over which the said milk is spread and travels in a relatively thin or attenuated stream, power mechanism arranged beneath the said rotary walls of the said heating and cooling mechanisms, two trains of power transmitting devices for connecting the rotatable treating walls, respectively, of the heating and cooling mechanisms to said power mechanism, and means for conveying milk or other liquid from said heating mechanism to the cooling mechanism.

7. In an apparatus for treating milk or other liquids, the combination of a heating mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively attenuated stream or film, a preliminary cooling mechanism arranged to receive the heated milk immediately upon its leaving the said heating mechanism and to hold it at a level lower than the level of the milk in the said heating mechanism, said preliminary cooling mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively thin or attenuated stream or film, a final cooling mechanism arranged to receive the milk immediately upon its leaving the said preliminary cooling mechanism and to hold it at a level lower than the level of the milk in the said preliminary cooling mechanism, said final cooling mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively thin or attenuated stream or film, a suitable frame supporting said heating, preliminary cooling, and final cooling mechanisms, power mechanism mounted in said frame beneath said rotatable milk treating walls, and three trains of power transmitting devices for connecting the said rotatable treating walls, respectively, of the heating, the preliminary cooling, and the final cooling mechanisms to said power mechanism.

8. In an apparatus for treating milk or other liquids, the combination of a heating mechanism having a rotatable milk-treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for suddenly and substantially uniformly heating all of the particles of said milk while it is so traveling over said rotatable wall, a tank supplying milk to said heating mechanism and adapted to hold a body of milk at a level higher than the level of the milk in said heating mechanism, a preliminary cooling mechanism arranged to receive the heated milk immediately upon its leaving the said heating mechanism and to hold said milk at a level lower than the level of the milk in said heating mechanism, said cooling mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively thin or attenuated stream or film, means for causing water to contact with said rotatable treating wall and cool it, a final cooling mechanism arranged to receive the milk immediately upon its leaving the said preliminary cooling mech-

anism and to hold it at a level lower than the level of the milk in said preliminary cooling mechanism, said final cooling mechanism having a treating wall along one surface of which the milk is arranged to travel in a relatively thin or attenuated stream or film, means for causing brine to flow in contact with the opposite surface of said wall, means for conveying milk or other liquid from said heating mechanism to said preliminary cooling mechanism, means for conveying milk or other liquid from said preliminary cooling mechanism to said final cooling mechanism, power mechanism arranged beneath the rotatable treating walls of said heating and cooling mechanisms with which the milk flows in contact, and two trains of power transmitting devices for connecting the rotatable treating walls, respectively, of the heating and the preliminary cooling mechanisms to said power mechanism.

9. In an apparatus for treating milk or other liquids, the combination of a heating mechanism having a rotatable milk-treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for suddenly and substantially uniformly heating all of the particles of said milk while it is so traveling over said rotatable treating wall, a water cooled mechanism arranged to receive the said heated milk immediately upon its leaving the said heating mechanism and to hold said milk at a level lower than the level of the milk in said heating mechanism, said water cooled mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for conducting water to and from said rotatable treating wall to suddenly and rapidly cool all of the particles of said milk while they are traveling over it, a brine cooled mechanism arranged to receive the said milk immediately upon its leaving the said water cooled mechanism and to hold it at a level lower than the level of the milk in said water cooled mechanism, said brine cooled mechanism having a rotatable treating wall over which the said milk is spread and travels in a relatively thin or attenuated stream or film, means for conducting brine to and from and for circulating it in the said brine cooled mechanism to reduce the temperature of all of the particles of the said milk while they are traveling over the said rotatable treating wall therein, a suitable frame supporting said heating, water cooled mechanism, and brine cooled mechanism, power mechanism mounted upon said frame and arranged beneath the said rotatable treating walls of said heating and cooling mechanisms, three trains of power transmitting devices for connecting the rotatable treating walls, respectively, of the heating, the water cooled, and the brine cooled mechanism to the said power mechanism, means for conducting milk or other liquid from said heating to said water cooled mechanism, and means for conducting milk or other liquid from said water cooled to said brine cooled mechanism.

10. In an apparatus for treating milk or other liquids, the combination of a heating mechanism having a rotatable milk-treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for suddenly and substantially uniformly heating all of the particles of the milk while it is so traveling over said rotatable wall, a preliminary cooling mechanism arranged to receive the said heated milk immediately upon its leaving the heating mechanism and to hold said milk at a level lower than the level of the milk in said heating mechanism, said cooling mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively attenuated stream or film, means for suddenly and rapidly cooling all of the particles of the said milk while it is so traveling over said rotatable cooling wall, a final cooling mechanism arranged to receive the milk immediately upon its leaving the said preliminary cooling mechanism and to hold it at a level lower than the level of the milk in said preliminary cooling mechanism, said final cooling mechanism having a rotatable treating wall over which the milk is spread and travels in a relatively thin or attenuated stream or film, means for reducing the temperature of all of the particles of said milk while it is so traveling over said rotatable wall, a suitable frame supporting said heating, preliminary cooling and final cooling mechanism, power mechanism mounted upon said frame, three trains of power transmitting devices for connecting the rotatable walls, respectively, of the heating, the preliminary cooling, and the final cooling mechanisms to said power mechanism, means for conducting milk or other liquid from said heating to said preliminary cooling mechanism, and means for conducting milk or other liquid from said preliminary cooling mechanism to said final cooling mechanism.

11. In an apparatus for treating milk and other liquids, the combination of an inner water holding vessel, an outer water holding vessel, the adjacent walls of said vessels forming a reduced passage way between them for the milk to be treated, means for introducing milk at the bottom of said passage way, means for collecting it at the top thereof, means for maintaining the water within both of said receptacles at substantially uniform temperature, a second pair of vessels arranged similarly to the first pair to have a reduced passage way for the milk between them, means for conducting milk from the top of the first pair of vessels to the bottom of the passage way between the second

pair of vessels, means for supplying water to the vessels of the second pair, a brine cooler comprising inner and outer vessels arranged to form a reduced passage way for the milk between them and having a brine coil incasing the outer of said vessels, means for conducting the milk from the top of said second pair of vessels to the bottom of the milk passage way in said brine cooler, and means for drawing off the milk at the top of said brine cooler.

12. In an apparatus for treating milk, the combination of an outer vessel adapted to hold a body of water, a rotary inner vessel adapted to hold a body of water cut off from the body of water in said outer vessel, said vessels providing between them a passageway for the milk, the inner rotary vessel being removable upward from the outer vessel and having a substantially unobstructed space above it, and a driving mechanism for rotating the inner vessel engaging therewith at points below the top thereof, means for supplying a stream of water to the inner vessel, and means for supplying milk to the bottom of the said passageway between the vessels, substantially as set forth.

13. In an apparatus for treating milk and other liquids, the combination of a frame, a stationary vessel supported on said frame and adapted to hold a body of water around the passage-way for the milk which is being treated, an inner rotary vessel holding a body of water inside of the said milk passage, a driving shaft detachably connected with said inner vessel and projecting downwardly therefrom, said inner rotary vessel being arranged to be detached upwardly from said shaft and to be lifted out from the exterior vessel independently of said shaft, and power transmitting devices for driving the said shaft.

14. In an apparatus for treating milk, the combination of a stationary water-holding vessel, a milk-treating wall having one surface arranged to be engaged by the water in said water-holding vessel and its other surface arranged to form one side of a milk passageway, a second wall arranged to form the other side of said milk passageway and adapted to be freely raised and lowered relative to said first described wall to permit the cleaning of said walls, and power transmitting mechanism for rotating one of said walls and connected with it from underneath to permit the said raising and lowering at will of the said second milk-treating wall without disturbing the said power transmitting mechanism.

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

JOHN C. MILLER.

Witnesses:
C. GEIDLINGER,
HARRY H. MILLER.