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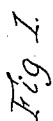
H. FELDMEIER ET AL

1,759,231

LIQUID DISTRIBUTOR

Filed March 12, 1927

2 Sheets-Sheet 1



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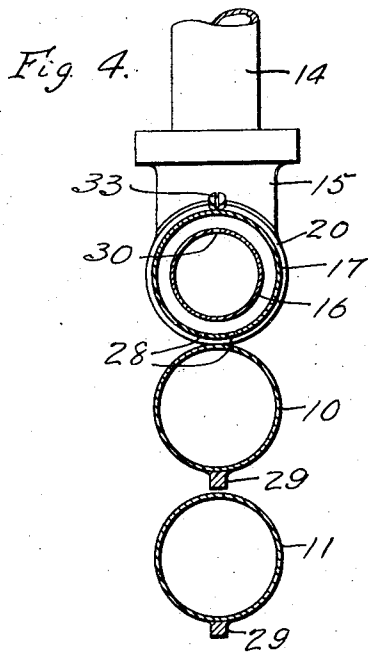
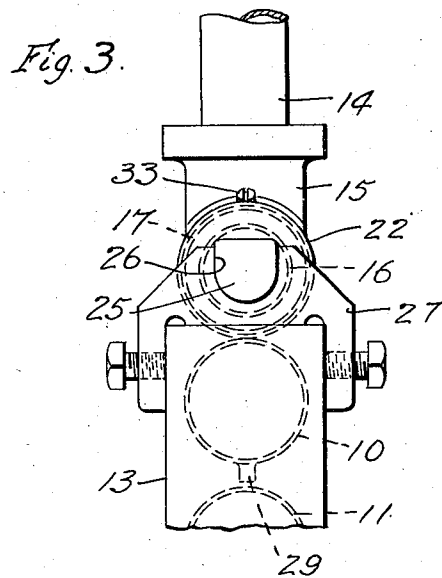
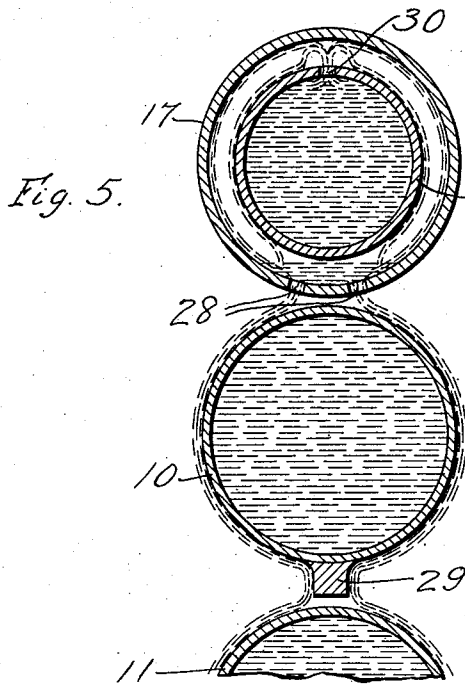
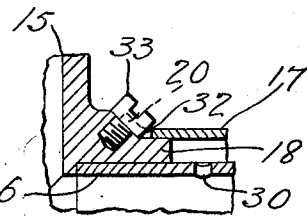
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LIQUID DISTRIBUTOR

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

HARVEY FELDMEIER AND CHARLES B. DALZELL, OF LITTLE FALLS, NEW YORK, ASSIGNORS TO D. H. BURRELL & CO., INC., OF LITTLE FALLS, NEW YORK

LIQUID DISTRIBUTOR

Application filed March 12, 1927. Serial No. 174,922.

This invention relates to liquid distributors, and more particularly to those which may be employed in connection with the treatment of liquids, such as milk, where the parts of the distributor exposed to the liquid should be easily accessible for cleansing purposes. Heretofore, it has been a common practice in the treatment of milk or cream, such as during the cooling or heating of the same, to flow the same as a film over a heat interchanger wall or surface which may be in the form of superposed but spaced horizontal pipes, so that the liquid will flow over the surfaces of the pipes successively and be cooled or heated by a heat transfer with a suitable cooling or heating medium which is circulated through the pipes, the discharge of the milk or cream upon the upper portion of the heat interchanging wall or uppermost cooling or heating pipe, for example, without spattering of the milk or cream so deposited upon such wall or upper pipe, has been difficult to accomplish, and difficulty has also been experienced heretofore in obtaining a uniform distribution of the liquid film along such surface or pipes through all variations in the rate at which the liquid is deposited upon such heat interchange surface or pipes.

An object of this invention is to provide an improved liquid distributor with which a liquid to be treated may be flowed over a heat interchanging surface or wall as a film at various rates without spattering and with a substantially uniform distribution of the flow along said surface or wall, unaffected by the rate of flow.

A further object of the invention is to provide an improved device for depositing a liquid to be treated upon a heat interchanging surface uniformly along the length of the same, and with which all parts exposed to the contact of the liquid may be easily reached for cleansing purposes.

A further object is to provide an improved device for accomplishing each or any of the above objects, which will be relatively simple, durable, practical and inexpensive.

A further object of the invention is to provide an improved method of uniformly distributing a liquid to the treated upon a heat

interchanging wall or surface, at all operating rates.

Various other objects and advantages will be apparent from the following description of an embodiment of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a front elevation of the upper part of a heat interchanger constructed in accordance with this invention;

Fig. 2 is a similar elevation of a part of the same in longitudinal section;

Fig. 3 is an end elevation of the same;

Fig. 4 is a transverse, sectional elevation of the same, with the section taken approximately along the line 4—4 of Fig. 1;

Fig. 5 is a transverse, sectional elevation of the same, approximately along the line 5—5 of Fig. 1, and illustrating the manner in which the liquid is distributed uniformly upon the heat interchanging surfaces; and

Fig. 6 is a fragmentary, sectional elevation through a part of the coupling head and illustrating the manner of connecting the outer tube thereto.

In the illustrated embodiment of the invention, the heat interchanger may include a vertically disposed row of pipes 10, 11, 12, etc., which extend between spaced headers 13 through which the ends of the pipes are connected together alternately, so that a fluid may be circulated successively through said pipes or tubes or between the uppermost and lowermost pipes of the set. The details of such interchangers are well known in the art, and therefore a detailed description thereof is omitted in the interest of clarity.

The liquid to be treated may be conveyed by a pipe 14 to a coupling head 15 having a horizontal discharge passage. The head is disposed just above the uppermost horizontal cooling pipe 10 and, if desired, at a point intermediate the ends of the same, as shown in Fig. 1. A supply pipe 16 is secured to the discharge passage of the head, so as to form a horizontal continuation thereof, the end of the pipe 16 being received within the bore of the discharge passage and secured

therein any suitable manner, such as by welding, brazing or shrinking.

A second or distributing pipe or tube 17, considerably larger than the pipe 16, is fitted over the pipe 16 in spaced relation therewith, and fitted at one end over a boss 18 which surrounds the discharge passage of the head from which the pipe 16 extends. The boss may have a beveled abutment wall 19 against which an outwardly flanged end 20 of the pipe or tube 17 may abut, as shown in Fig. 2. A ferrule 21 may be secured to the free end of the inner pipe 16 in any suitable manner, such as by welding, brazing or shrinking the same thereto, and this ferrule may be externally threaded to receive an enclosing flange of a cap 22 which abuts the free end of the pipe or tube 17.

The free end edge of the flange of the cap 22 may also have a beveled or inclined surface 23 for abutting against an outwardly extending flange 24 at the free end of the tube or pipe 17, as shown in Figure 2, so that when the cap is threaded upon the ferrule, it will wedge itself into the adjacent or free end of the outer pipe or tube 17 and effectively close the space between the concentric pipes 16 and 17 at their free ends, as well as force the outer pipe 17 firmly against the beveled shoulder or surface 19 of the head 15. This provides a simple and practical manner of connecting the pipes 16 and 17 to the head 15 and for closing the space between the free ends of the pipes 16 and 17. The cap may have a lug 25 extending from its outer end face, which may be received and mounted in a slot 26 in a bracket 27 removably clamped to the upper end of an adjacent header 13 of the cooler. The bracket 27 and the cap thus serve to support the free ends of the pipes 16 and 17 in proper horizontal positions over the upper heat interchange pipe 10.

The outer pipe or tube 17 is provided along its lower portion with one or more rows of apertures 28 (Figs. 4 and 5) there being preferably two rows of such apertures arranged along the length of the pipe or tube 17 at points slightly spaced laterally from a vertical plane through the center of that tube or pipe. The tube or pipe 17 is slightly spaced above the uppermost cooler pipe 10, so that a liquid in the pipe or tube 17 flows therefrom through said rows of apertures and fall upon the pipe 10 slightly at each side of the uppermost edge or surface of the pipe 10, as shown in Fig. 5. Thus a liquid in the pipe or tube 17 will leave it in two sets of streams, which in striking the pipe 10 will flow down opposite sides thereof in films, as shown in Fig. 5. The liquid reaching the lower portion of the pipe 10 will be guided or deflected, such as by a bar or fin 29 therein, to opposite sides of the next lower pipe 11 in two similar streams, so that the two films will flow successively from pipe to pipe under the influence of gravity,

and while so passing over the pipes 10, 11, 12, etc., the liquid film will be subjected to a heat transfer through these pipes with the fluid circulating through said pipes.

The inner pipe 16 is provided with an outlet slot or plurality of outlet passages or apertures 30 arranged along the length of the same, so that a liquid to be treated which enters the coupling head 15 will pass into the inner pipe 16 and be discharged therefrom into the outer pipe or tube 17 at a plurality of points along the length of the same. The liquid thus discharged into the outer pipe 17 at different points along the length of the same will tend to seek its own level in the outer pipe, and thus will leave the outer pipe through the rows of apertures 28 thereof under a head which is substantially uniform throughout the length of the pipe 17, regardless of the rate at which the liquid is supplied thereto, and substantially independently of the arrangement or size of the apertures 30 along the inner pipe 16 through which the liquid is supplied thereto, provided, of course, that the rate at which the liquid enters the tube 17 must not exceed the rate at which it can leave the apertures 28 under a head less than the diameter of the tube 17. In other words, the relation of the apertures 30 and 28 is such that the tube 17 never runs full of liquid.

Preferably the apertures 30 are arranged in a row along the upper part of the inner pipe 16, as shown in Figs. 2 and 5, so that the jets of the liquid discharged therethrough will enter the surrounding pipe or tube 17 at points out of alinement with the apertures 28, and preferably spaced angularly therefrom about the axis of the tube 17. This arrangement aids in promoting a uniform distribution of the liquid to be treated, along the length of the pipe 17. The jets of liquid leaving the apertures 30 may strike and be spread by the inner surface of the surrounding pipe or tube 17, and in flowing down the inner surface of the pipe 17 will also be distributed more or less uniformly along the length thereof. These features all assist in obtaining levels of the liquid in the pipe 17 always substantially uniform throughout its length, under all operating conditions.

The inner pipe 16 may also be provided with a small drainage aperture 31 in its lower part, through which the contents of each inner pipe may drain into the surrounding pipe whenever the liquid supply is cut off from the head 15, and the liquid thus draining into the outer pipes will of course be discharged through the aperture 28 upon the heat interchanging walls or pipes.

The relative capacities of the apertures in the inner and outer pipes 16 and 17, is such that during normal flow of the liquid through the pipes, a head of liquid will be maintained in the outer tube.

The end of the outer pipe or tube 17 which is received upon the head 15 may be provided with a slot 32, which slidably straddles a pin or screw 33 provided upon the boss 18 of the head, in order to insure proper positioning of the rows of apertures 28 relatively to the heat interchange surface.

From the foregoing it will be observed that when a liquid to be treated is forced through the head 15 into the inner pipe 16, it will be discharged, at a plurality of points along the same, through the aperture 30 into the outer pipe or tube 17, and the liquid thus entering the outer pipe or tube at a plurality of points along the same will tend to seek its own level therein and flow therefrom at a relatively low velocity through the rows of apertures 28 at substantially uniform rates along the entire length of the pipe 17 regardless of the rate at which the liquid is forced into the pipe or tube 17, also independently of the height of the level of the liquid in the tube 17, and also substantially independently of the distribution and size of the apertures 30 along the inner pipe 16, provided that the tube 17 never runs full of liquid. Thus a flow of liquid over the heat interchanging walls or pipes will be obtained, which automatically is uniformly distributed thereon throughout all variations in the operating conditions of the device. The head 15 may be disposed at one end of the interchanger or be in the form of a T and be disposed, as shown, between the ends of the pipes 10, 11, 12, etc. and supplying two sets of pipes 16 and 17 extending in opposite directions.

The device may be readily taken apart for the cleaning of all surfaces exposed to the liquids, by merely removing the caps 22 and then removing the outer pipes 17. The inner pipes then are exposed for the cleansing of both inner and outer surfaces, and the passages of the head 15 are also then accessible for cleansing. The inner surface of each pipe 17 is also thus conveniently accessible for cleansing.

While there will be a short section of the pipe 10 immediately beneath the head upon which the liquid to be treated will not be directly sprayed or discharged, this space is comparatively short compared to the whole length of the cooler, and as the liquid passes downwardly over the pipe 10, it will tend to spread endwise of the pipe and cover this relatively short section. Ordinarily, this liquid will have covered the surface along the entire length of the pipes 10, 11, 12, etc., before the bottom pipes are reached. However, it will be understood that a few holes may, if desired, be provided in the bottom surface of the head 15 for discharging some of the liquid directly upon that short section of the pipe 10, but these holes in the head are not really necessary, and might tend to

cause some of the spattering, the avoidance of which is sought by this construction.

It will be observed that with the apertures 30 in the inner pipes 16 opening upwardly, any foreign matter that may enter these pipes 16 drops to the bottom so as not to stop or clog the apertures 30 or cut down the distribution or flow into the distributing or outer pipes 17. If the holes 30 opened downwardly, any foreign matter getting into the pipes 16 might entirely stop the apertures or cut down the effective capacity of the pipes 16.

While the invention has been described in connection with an embodiment particularly applicable for the cooling of milk or cream, it will be understood that the device is equally useful in and applicable to all heat interchangers or the like, whether heating or cooling, where a uniform distribution of a flowing liquid under various operating conditions is desired.

It will be obvious that various changes in the details, which have been herein described and illustrated, in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

We claim as our invention:—

1. In a liquid distributor, a coupling head, a pipe extending horizontally from and communicating with the bore of said head and having a ferrule at its free end, a tube surrounding said pipe in spaced relation thereto and fitted at one end to said head, a cap connected between said ferrule and the free end of said tube to close the space between the tube and ferrule at the free end of the pipe and also close the free end of the pipe, said tube having apertures arranged along the lower portion thereof, said pipe having apertures opening into the space between it and the tube at points out of alignment with the apertures in said tube, whereby a liquid entering said pipe from said head will enter said tube at a plurality of points spaced along the same, and the liquid leaving said tube will flow under a head which is uniform throughout the length of the tube, substantially independently of the distribution along the tube of the liquid entering therein from the pipe.

2. In a liquid distributor, a coupling head, a pipe extending horizontally from and communicating with the bore of said head and having a ferrule at its free end, a tube surrounding said pipe in spaced relation thereto and fitted at one end to said head, a cap connected between said ferrule and the free end of said tube to close the space between the tube and ferrule at the free end of the pipe and also close the free end of the pipe, said tube having apertures arranged along the lower portion thereof, said pipe having

apertures opening into the space between it and the tube at points out of alinement with the apertures in said tube, whereby a liquid entering said pipe from said head will enter said tube at a plurality of points spaced along the same, and the liquid leaving said tube will flow under a head which is uniform throughout the length of the tube, substantially independently of the distribution along the tube of the liquid entering therein from the pipe, said pipe also having a small aperture in its lower part to permit drainage of any liquid remaining in said pipe into the tube when the supply of liquid to said pipe is cut off.

3. In a liquid distributor, a coupling head having a horizontally disposed discharge opening, a horizontally extending pipe connected to said head and forming a continuation of said opening, a tube surrounding and spaced from said pipe and fitted at one end against said head, means for closing the free end of said pipe and the space between said pipe and tube at the free end of said pipe, said tube having apertures arranged lengthwise along the lower part thereof, said pipe having apertures opening into the space between the pipe and tube at a plurality of points along the same, whereby the liquid leaving said tube through its apertures will flow under a head substantially uniform throughout the length thereof, independently of the amount of liquid entering the tube at any point along the length of the same, and independently of the level of the liquid in the tube at any time.

4. In a liquid distributor, a coupling head having a horizontally disposed discharge opening, a horizontally extending pipe connected to said head and forming a continuation of said opening, a tube surrounding and spaced from said pipe and fitted at one end against said head, means for closing the free end of said pipe and the space between said pipe and tube at the free end of said pipe, said tube having apertures arranged lengthwise along the lower part thereof, said pipe having apertures opening into the space between the pipe and tube at a plurality of points along the same, whereby the liquid leaving said tube through its apertures will flow under a head substantially uniform throughout the length thereof, independently of the amount of liquid entering the tube at any point along the length of the same, and independently of the level of the liquid in the tube at any time, said pipe also having a drainage opening in its lower part leading to said tube, whereby when the supply of liquid to said head is cut off, all of the liquid remaining in said pipe will drain into said tube and leave said tube through the apertures in the latter.

5. In a liquid distributor, a coupling head having a horizontally extending discharge opening, a pipe extending horizontally from

said head and forming a continuation of said opening and being open at its free end, a tube surrounding and spaced from said pipe and seated at one end against and attached to said head, and a cap closing the space between said pipe and tube and also closing the open end of said pipe, said tube having apertures arranged lengthwise along its lower part, and said pipe opening into said tube at a point intermediate the ends of the same, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

6. In a liquid distributor, a coupling head having a horizontally extending discharge opening, a pipe extending horizontally from said head and forming a continuation of said opening and being open at its free end, a tube surrounding and spaced from said pipe and seated at one end against and attached to said head, and a cap closing the space between said pipe and tube and also closing the open end of said pipe, said tube having apertures arranged lengthwise along its lower part, and said pipe having openings into said tube at a plurality of points along the same, the apertures in said pipe being out of alinement with those of the tube, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

7. In a liquid distributor, a coupling head having a horizontally extending discharge opening, a pipe extending horizontally from said head and forming a continuation of said opening and being open at its free end, a tube surrounding and spaced from said pipe and seated at one end against and attached to said head, and a cap closing the space between said pipe and tube and also closing the open end of said pipe, said tube having apertures arranged lengthwise along its lower part, and said pipe having openings into said tube at a plurality of points along the same, the apertures in said pipe being arranged at points spaced angularly about the axis of the pipe from the apertures in said tube, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

8. In a liquid distributor, a coupling head having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a tube surrounding and spaced from said pipe and removably fitted at one end to said head, a cap removably attached between the pipe and tube at their free ends for closing the space between the pipe and tube and closing the free end of said pipe, said tube having apertures arranged lengthwise along the lower part thereof to discharge its contents, and said pipe opening into said tube at at least a point intermediate the length of the same, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

9. In a liquid distributor, a coupling head

having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a tube surrounding and spaced from said pipe and removably fitted at one end to said head, a cap removably attached between the pipe and tube at their free ends for closing the space between the pipe and tube and closing the free end of said pipe, said tube having apertures arranged lengthwise along the lower part thereof to discharge its contents, and said pipe having apertures opening into said tube at a plurality of points along the length of the same, the apertures in said pipe being spaced out of alinement with the apertures in said tube, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

10. In a liquid distributor, a coupling head having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a tube surrounding and spaced from said pipe and removably fitted at one end to said head, a cap removably attached between the pipe and tube at their free ends for closing the space between the pipe and tube and closing the free end of said pipe, said tube having apertures arranged lengthwise along the lower part thereof to discharge its contents, and said pipe having apertures opening into said tube at a plurality of points along the length of the same, the apertures in said pipes being disposed along the upper part thereof, said pipe also having a drainage aperture along its lower part opening into said tube, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof.

11. In a liquid distributor, a coupling head having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a second pipe surrounding and spaced from said first pipe and removably fitted at its free end to said head, a cap threaded to the free end of one of said pipes and abutting with the free end of the other of said pipes for closing the space between said pipes, and also closing the free end of said first pipe, said outer pipe having apertures arranged lengthwise along the same at its lower part, said first pipe having a plurality of apertures arranged along the same and opening into the space between the pipes, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof, the removal of said cap permitting removal of said outer pipe to permit cleansing of both surfaces of both pipes.

12. In a liquid distributor, a coupling head having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a second pipe surrounding and spaced from

said first pipe and removably fitted at its free end to said head, a cap threaded to the free end of one of said pipes and abutting with the free end of the other of said pipes for closing the space between said pipes, and also closing the free end of said first pipe, said outer pipe having apertures arranged lengthwise along the same at its lower part, said first pipe having a plurality of apertures arranged along the same and opening into the space between the pipes, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof, the removal of said cap permitting removal of said outer pipe to permit cleansing of both surfaces of both pipes, said head and outer pipe having cooperating parts insuring the positioning of the outer pipe with its apertures in the lower part thereof whenever the outer pipe is attached to said head.

13. In a liquid distributor, a coupling head having a horizontally opening discharge passage, a horizontal pipe connected to said head and forming a continuation of said passage, a second pipe surrounding and spaced from said first pipe and removably fitted at its free end to said head, a cap threaded to the free end of one of said pipes and abutting with the free end of the other of said pipes for closing the space between said pipes, and also closing the free end of said first pipe, said outer pipe having apertures arranged lengthwise along the same as its lower part, said first pipe having a plurality of apertures arranged along the same and opening into the space between the pipes, whereby the liquid leaving said tube will flow under a head uniform along the entire length thereof, the removal of said cap permitting removal of said outer pipe to permit cleansing of both surfaces of both pipes, said cap also having an extension serving as a support for the free ends of the pipes.

14. A distributing device for a liquid having a tendency to foam, comprising a pair of horizontal tubes, one enclosing the other, means for supplying the liquid under pressure to the inner tube, said inner tube having a series of holes arranged lengthwise along its top, the outer tube being spaced from the bottom of the inner tube and having a plurality of holes arranged along its bottom, the relative capacities of the openings in the inner and outer tubes being such that during normal flow of the liquid through said tubes, a head will be maintained in said outer tube, whereby the liquid will pass through said outer tube and equalize its level in said outer tube, and be discharged therefrom as a relatively broad stream which remains uniform throughout its width independently of the rate of flow, and foam of the discharged liquid will be dissipated.

15. A distributor for liquids having a tendency to foam, comprising a horizontally ar-

5 ranged pipe having apertures arranged at intervals along the length of said pipe closely adjacent its bottom, a second horizontally arranged pipe communicating with the first
10 pipe at a plurality of points along the length of the same, and from the same vertical level in the second pipe, and means for supplying said liquid under pressure to said second pipe, the relative capacities of the apertures
15 and the communications between the inner and outer pipes being such that during normal flow of the liquid through said pipes, a head will be maintained in said outer tube whereby said liquid will be supplied to said
20 first pipe approximately uniformly throughout its length, the liquid will equalize its own level in said first pipe, and the foam in said liquid will be dissipated throughout the stream discharged from the first pipe.

20 16. A distributor for liquids having a tendency to foam, which comprises a pair of tubes one within and largely spaced from the other, the outer tube having apertures arranged along its bottom for discharging
25 its contents, and said inner tube having apertures arranged at the same level and at a plurality of points along its length for discharging its contents into said outer tube, and means for delivering the liquid under
30 pressure to said inner tube, whereby the liquid will be discharged as a thin broad stream, uniform throughout its width and independently of the rate of flow, and any foam forming will be dissipated in the dis-
35 charged liquid.

17. A distributor for liquids having a tendency to foam, which comprises a pair of tubes one within and largely spaced from the other, the outer tube having apertures ar-
40 ranged along its bottom for discharging its contents, the inner tube having apertures arranged at the same level and at a plurality of points along its length for discharging its contents into the outer tube, the aper-
45 tures in the inner tube being disposed angularly about the axis of the inner tube from the apertures in the outer tube, whereby the liquid in the space between the tubes will have an opportunity to adjust its own level
50 before being discharged from the outer tube, and means for supplying said liquid under pressure to the inner tube.

18. The method of discharging a liquid having a tendency to foam, in a relatively
55 thin broad stream substantially free from foam, which comprises discharging said liquid from a horizontal pipe at a plurality of points along the pipe into an enclosing chamber, building up a head of liquid in and
60 partially filling said chamber, and discharging said liquid under said head from said chamber at a plurality of spaced points arranged to form said thin broad stream.

HARVEY FELDMEIER.
CHARLES B. DALZELL.

CERTIFICATE OF CORRECTION.

Patent No. 1,759,231.

Granted May 20, 1930, to

HARVEY FELDMEIER ET AL.

It is hereby certified that the above numbered patent was erroneously issued to "D. H. Burrell & Co., Inc., of Little Falls, New York", whereas said patent should have been issued to "Cherry-Burrell Corporation, of Wilmington, Delaware, a corporation of Delaware", said corporation being assignee of the entire interest in said invention, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of June, A. D. 1930.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.