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METHOD OF CLEANING AND STERILIZING TUBULAR MEMBERS

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2 Sheets-Sheet 1

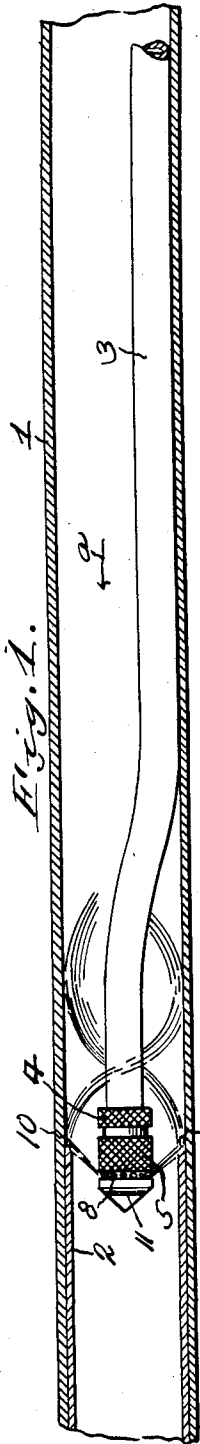


Fig. 3.

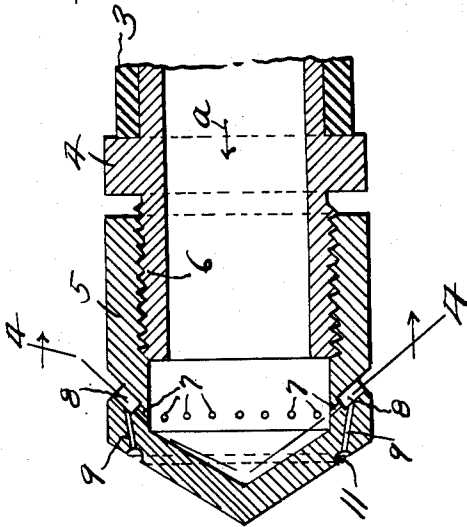


Fig. 4.

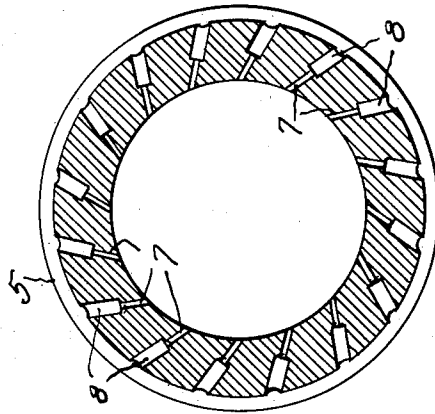
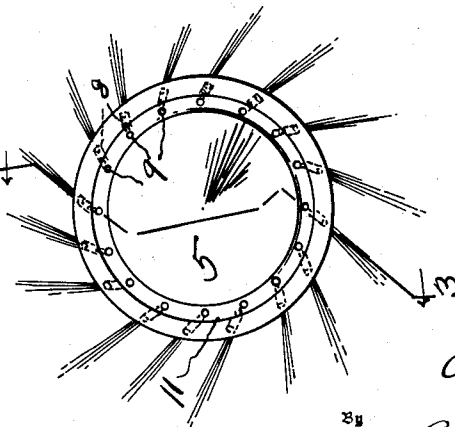


Fig. 2.



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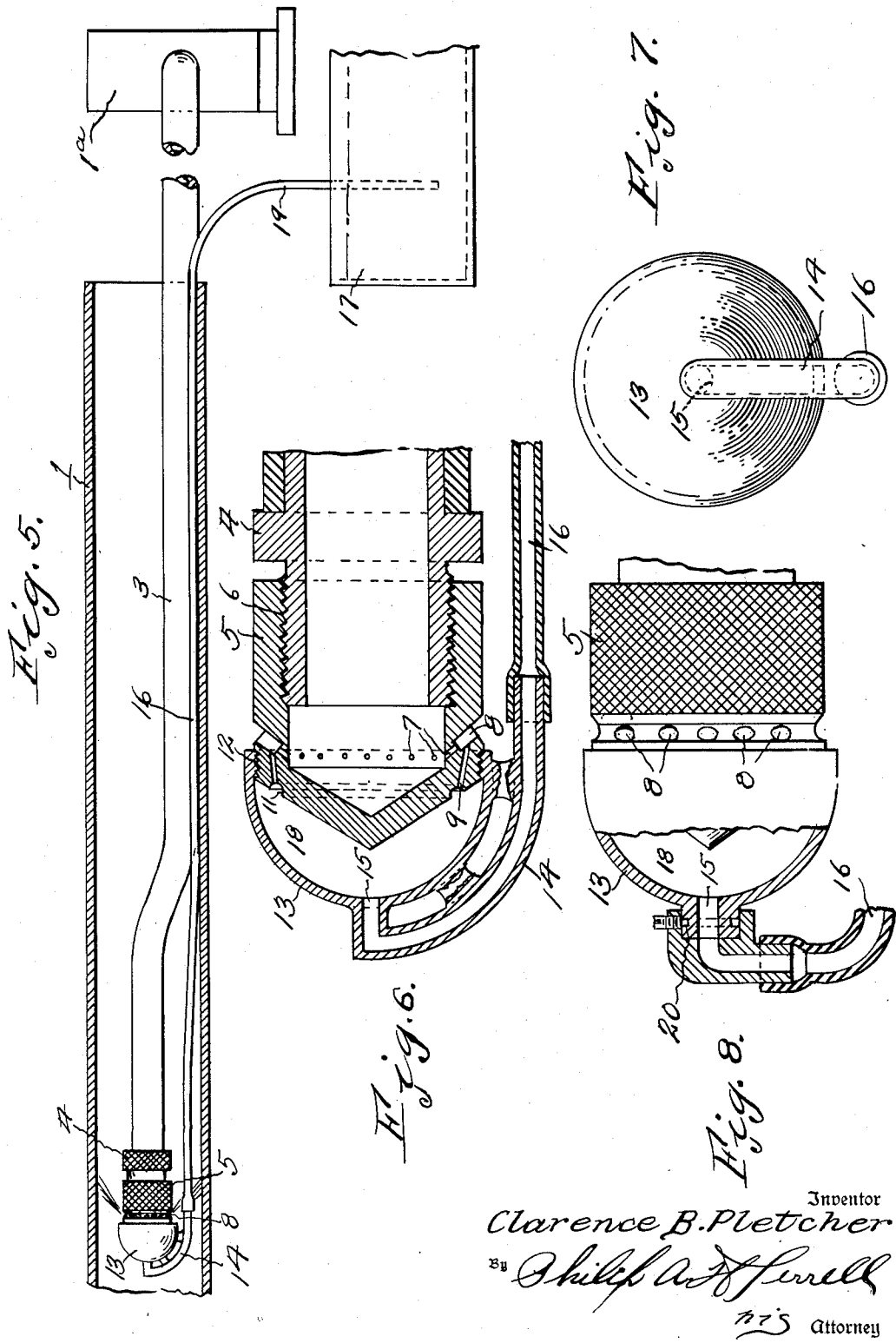
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METHOD OF CLEANING AND STERILIZING TUBULAR MEMBERS

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2 Claims. (Cl. 134—24)

The invention relates to methods of cleaning and sterilizing, particularly hollow articles, such as tubes and containers, and has for its object to provide a method wherein foreign matter is dislodged from the wall of the tube or container, and at the same time the wall of the tube or container is sterilized by means of liquid, for instance water, under high pressure, and with which liquid air is mixed before the water projection from a nozzle, said mixture of water and air forming the sterilizing medium.

A further object is to provide a method of cleaning and sterilizing the inner periphery of a tube by means of a nozzle carried by a flexible tube or hose on which the nozzle is mounted, said flexible hose conveying water, under pressure, to the nozzle, and to add air to the nozzle and water within the nozzle for projecting a sterilized stream of mixed water and air against the interior of the tube.

A further object is to provide a tube sterilizing device comprising a flexible hose passing through the tube and terminating in a spray nozzle, projecting streams of mixed air and water from the nozzle against the wall of the tube, said nozzle being axially centered within the tube by the projected fluid therefrom.

A further object is to project the sprayed material from the nozzle in a rearwardly and outwardly extending direction at angles between tangential and radial position, or in directions other than radial.

A further object is to provide a sterilizing nozzle through which water, under high pressure, is forced, discharge ports in the nozzle, and through which ports the water is forced to air mixing chambers, said air mixing chambers and ports inclining rearwardly and outwardly at angles other than radial, and air intake ports extending between the mixing chambers and the forward end of the nozzle.

A further object is to provide a removable cap on the forward end of the nozzle and having a flexible tube leading to a source of sterilizing liquid supply, and through which cap and flexible tube a sterilizing liquid is sucked and mixed with the sprayed waters in the mixing chambers for a final chemical washing, which is a requirement in some States by the laws now in force.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawings, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawings:

Figure 1 is a vertical longitudinal sectional view through a tubular member, showing the nozzle and liquid supply hose carried by the nozzle, and the nozzle centered incident to projected liquid therefrom.

Figure 2 is an enlarged front elevation of the nozzle.

Figure 3 is a vertical longitudinal sectional view through the nozzle, taken on line 3—3 of Figure 2.

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Figure 4 is a vertical transverse sectional view through the nozzle taken on line 4—4 of Figure 3.

Figure 5 is a view similar to Figure 1, showing the chemical wash or sterilizing attachment applied to the nozzle.

Figure 6 is a view similar to Figure 3, showing the after wash cap applied thereto.

Figure 7 is a front elevation of the after wash cap.

Figure 8 is a side elevation of the nozzle, partly in section showing a swivel connection between the nozzle and solution supply pipe.

Referring to the drawings, the numeral 1 designates a tubular conduit to be cleaned. These conduits are used to a great extent in food preparation, and in milk treating machines and the like. It will be understood applicant's method may be used in cleaning tubes or conduits of any type.

In food processing plants the tubes must be sterilized from time to time and cleaned in a manner whereby coatings of foreign matter 2 are dislodged. This has heretofore been a laborious operation, as well as a slow one, and applicant's method and apparatus is designed not only to remove the deposit or coatings 2, but to simultaneously sterilize the wall of the tube, and preferably by means of water, under high pressure, mixed with the air in fine streams, in a manner whereby the coatings 2 are not only dislodged, but at the same time the sterilizing effect is obtained, incident to the mixing of air with the water. The water may be cold or hot as desired.

To accomplish the cleaning and sterilizing result, water, under high pressure, is forced from a pump 1a, through a flexible hose 3, the water pressure can be from 100 to 4,600 pounds, but 600 pound pressure gives good results, and the sterilizing tests have been found to be far superior to ordinary brushing, steaming and other type of cleaning now used. The hose 3 is provided with a conventional form of coupling 4, on which coupling the nozzle head 5 is threaded at 6. The outer end of the nozzle head is preferably frusto conically shaped as shown. The water, under high pressure, passes in the direction of the arrow a, Figure 3, and is discharged outwardly and rearwardly at angles, other than radial, through the discharge ports 7. The discharge ports 7 discharge into enlarged mixing chambers 8 in axial relation to the ports 7, and air is supplied to the enlarged mixing chambers 8 through forwardly extending relatively small air supply ports 9, to which ports air is supplied from a position in advance of the nozzle. It has been found that, by mixing the air and water in the chambers 8, the projection of the spray, under high pressure, against the inner wall of the tubular member 1, there is a sterilizing effect and the sterile tests are high. By projecting the sprays rearwardly and in a direction other than radial, there is a whirling of the water, as shown in Figure 1, which washes the dislodged material 2, which has been previously dislodged at 10, from the tube. This high pressure easily cuts the material 2 from the tube.

The forward end of the nozzle is preferably provided with a circumferential groove 11 to facilitate the drilling of the air ports 9. In the use of the device, the flexible member 3, with its nozzle, is passed into the tube in the direction of the arrow a, as the liquid and mixed air leaves the nozzle, as shown in Figures 1 and 2, the liquid impinges against the inner periphery of the tube, and this action causes the nozzle to assume a position on the axis of the tube, as shown in Figure 1, hence it will be seen that the spraying operation is uniform on all parts of the inner periphery of the tube. This is a decided advantage in cleaning long tubes, as the operator will not have to center any cleaning hose of ordinary type, and at the same time uncleaned spots are obviated. It will be noted that the discharge ports are uniformly distributed

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entirely around the nozzle, hence it will be seen that the spraying operation will be uniform, as to the amount of water mixed with the air projected entirely around the circumference of the nozzle, therefore there will be a uniform cleaning and sterilizing throughout the length of the tube.

In a few States there are laws still in force requiring a chemical washing, particularly a final washing, and to comply with these laws, an attachment is provided for a final chemical treatment of the tube, as shown in Figures 5 to 7 inclusive.

The chemical sterilizing is accomplished by threading at 12 on the forward end of the nozzle a dome shaped cap 13 having a liquid supply tube 14. The liquid supply tube 14 is provided with a discharge port 15 on the axis of the nozzle, and with a chemical supply tube 16. Flexible tube 16 leads to a chemical supply tank 17. It will be seen that as the air is sucked from the chamber 18 of the cap 13, the liquid chemical will hit the apex of the nozzle, or will be equally distributed towards the ports 9. During an ordinary spraying operation, the intake end 19 of the tube 16 is out of the tank 17, hence the spraying action for sterilizing purposes with air and water progresses as shown in Figure 1. After the sterilizing and cleaning by air and water, the end 19 of the tube is placed in the tank 17 for a final chemical sterilization of the tube to comply with the laws above referred to.

Referring to Figure 8 wherein a modification is shown, the operation of the device is the same as in Figure 5 with the exception the cleaning solution supply pipe 16 has a swivel connection 20 to the forward end of the nozzle so the solution supply pipe may assume various positions in relation to the nozzle and twisting of the supply pipe around the air supply pipe will be obviated.

The invention having been set forth what is claimed as new and useful is:

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1. A method of cleaning and sterilizing the bore of a tubular member comprising the steps of passing a liquid supply pipe axially through the bore of the tubular member, ejecting liquid under high pressure from one end of the pipe through a plurality of passages in a spraying nozzle in the form of projecting jets extending in a circumferentially spaced uniform fashion in a common circle around the nozzle and issuing rearwardly and tangentially from the passages and projecting against the surface of the bore at angles less than right angles, drawing air from the bore of the tubular member in front of the nozzle into the nozzle passages and mixing the air with the liquid in the passages in the nozzle.

2. A method of cleaning and sterilizing the bore of a tubular member comprising axially passing a liquid supply pipe through the bore and passing liquid at high pressure through the pipe, ejecting the liquid through a plurality of passages in a spray nozzle, rearwardly toward the surface of the bore, drawing a second fluid from a volume in front of the nozzle into the nozzle passages and mixing said second fluid with the liquid in the passages in the nozzle.

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