

Jan. 9, 1968

M. Z. FAINMAN
SUPERCLEAN SPRAY GUN
Filed March 4, 1966

3,362,640

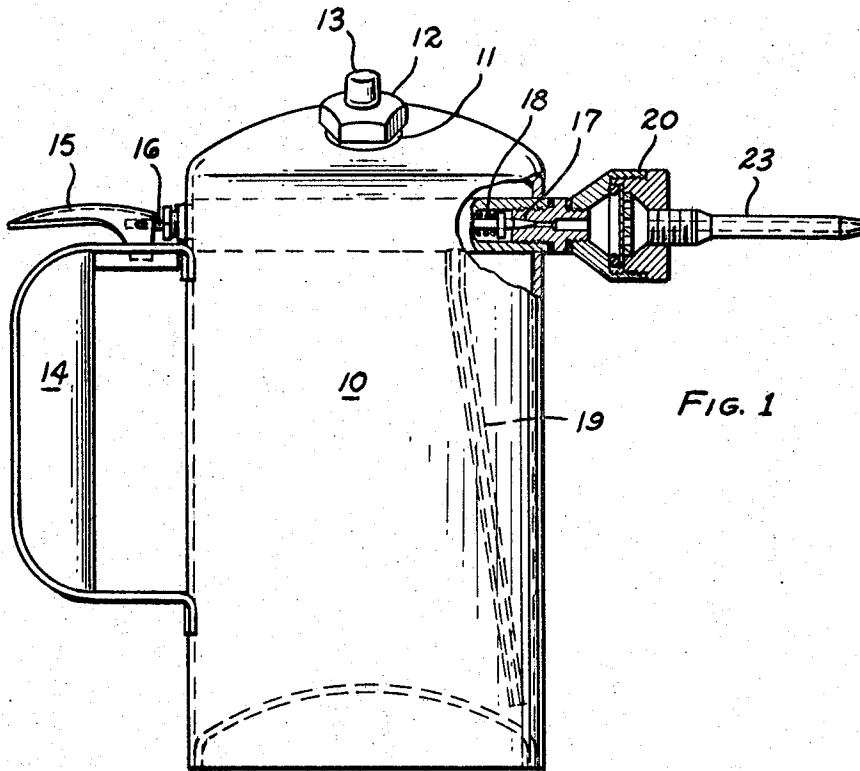


FIG. 1

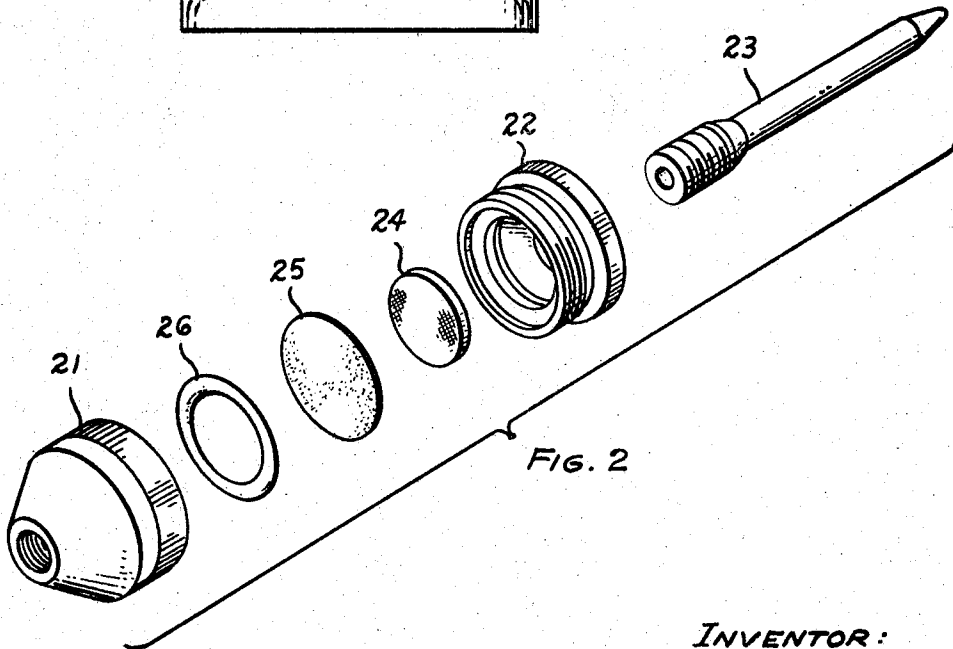


FIG. 2

INVENTOR:
MORTON Z. FAINMAN

1

3,362,640
SUPERCLEAN SPRAY GUN
Morton Z. Fainman, 1200 Homedale St.,
Los Angeles, Calif. 90049
Filed Mar. 4, 1966, Ser. No. 531,956
6 Claims. (Cl. 239-1)

This invention relates to a method and apparatus for cleaning surfaces free of particles down to and including particles having a diameter of 1 micron and even one-tenth micron. The invention is illustrated by a drawing which shows in FIGURE 1 a general view of the apparatus in partial section and in FIGURE 2 an exploded view of the micron-filter structure of FIGURE 1.

In laboratories and instrument assembly plants, it has long been a problem to clean surfaces micronically clean. This is particularly true where assembling instruments within close tolerances of the order of 0.1 to 0.01 mil. It is also a problem in the analysis of hydraulic oils and special lubricating oils to prepare analytical apparatus and containers micronically clean. The term "micronically clean" is used in this specification to mean free of particles down to and including particles of 1 micron diameter. For this purpose, it is desirable to have a jet spray of cleaning fluid which is completely free of particles of this dimension. Heretofore, it has been very difficult to obtain such a clean stream of wash liquid. Liquids for this purpose may be solvents such as naphtha, fluorocarbons, alcohol, acetone, water, etc. Even though every precaution is taken to employ a clean wash liquid, such as distilled water or filtered naphtha, contamination inevitably enters the liquid before it reaches the point of application.

In biological laboratories, hospitals, and dental offices, it has long been desirable to have a spray or jet of sterile solution for washing apparatus and wounds free of bacteria. It is one object of my invention to provide such a spray without the necessity of autoclaving or sterilizing with heat. Thus, for example, the use of heat sterilization precludes the use of numerous solutions, for example, those containing heat-sensitive serums and antibiotics. For this purpose, it is necessary that the filter employed for removing bacteria be 100% effective and, accordingly, the filter membrane must be protected from any undue stresses which would bring about a rupture.

My invention will be more clearly understood by referring to the drawing which shows in FIGURE 1 a container 10 built to withstand a considerable pressure of the order of 100 pounds to the square inch. A filling opening is provided at the top of the container at 11 with closure 12. Pressuring gas inlet valve 13 is indicated as part of the closure cap 12, but this inlet for pressuring the apparatus may be located in any other convenient place. The handle or hand-grip 14 is placed on one side in a convenient location and is provided with a lever 15 for operating the jet. Lever 15 actuates stem 16 which passes through the upper part of container 10 and actuates needle valve 17, which is normally held in the closed position by spring 18. When lever 15 is depressed, as by applying thumb pressure, valve 17 is opened and there is instantly permitted a flow of liquid from container 10 up through conduit 19 and into filter housing 20. Pressuring gas may be air, nitrogen, CO₂, nitrous oxide, dichlorodifluor methane, etc.

The detailed structure of the filter housing 20 and the interior parts thereof are shown in FIGURE 2. The inlet portion of filter housing 20 is shown at 21 whereas the outlet portion 22 is arranged to fasten securely to the inlet portion by means of a threaded joint with a suitable gasket. A jet section or hollow nozzle 23 is arranged to engage the outlet portion of the housing 22 as indicated. Within the filter housing, there is a membrane supporting plate 24 which is preferably made in two sections, a

2

coarsely perforated plate of considerable strength carrying on its surface a very finely perforated plate to support the delicate filter membrane 25. Filter membrane 25 is sealed to the inlet portion of the housing 21 by means of elastic sealing ring 26 which may be made of rubber or preferably of chemically resistant elastomer such as "Teflon," a well known polyfluoro ethylene, or "Viton," an acrylic polymer. Chloroprene rubber also may be used when the solvent employed is a hydrocarbon. The filter membrane 25 is usually made from collodion by a well known process in which the collodion solution is emulsified, made into a film and dried to give a controlled degree of porosity. Other materials such as polyethylene, polyfluoro ethylene (Teflon), etc., may also be used. Membranes of this type are commercially available from such sources as the Millipore Filter Corporation or the Gelman Instrument Company which employs the name "Metricel" for their product. Pore diameters may be obtained from one-tenth micron to 10 microns or greater, depending on the desired application. Because of their porosity, these membranes are rather delicate and will not tolerate mechanical abuse. They commonly have a thickness of only 2 to 10 mils.

A serious problem encountered heretofore in the filtration of interruptedly flowing spray liquid has been the reversal of flow through the filter which has a disrupting effect on the membrane, in addition to loosening particles of solid material which may have been trapped on the surface. According to my invention, this reversal of flow cannot take place, owing to the fact that the liquid in container 10 is constantly maintained under a positive pressure, usually of 5 to 50 pounds per square inch. Furthermore, when the flow is interrupted, the cessation of flow is instantaneous so that no reversal of pressure within the filter housing results. In other words, when the flow of liquid through the filter housing 20 is cut off, the pressure within the housing instantly falls to zero in the direction of the tip of nozzle 23, never falling below zero to give a reverse flow through the filter.

When the filter membrane becomes plugged with debris or it is desired to employ a membrane of larger or smaller pore size, it is only necessary to open the filter housing 20, as by unscrewing, and replace the membrane. The filter housing may be detached from the container at a point down stream from the control valve, then sterilized if desired, by heating in an oven or autoclave in case of biological applications, then re-assembled.

Having thus described my invention, what I claim is:

1. The method of spray cleaning a surface with a jet of liquid free of solid particles of a selected diameter within the range of 0.1 to 10 microns which comprises maintaining under pressurizing gas a supply of wash liquid contaminated with solid particles, conducting a confined stream of said liquid under pressure to a constricted outlet where pressure is released, thereby forming a jet, microfiltering said stream while under pressure at a point immediately before said outlet and interrupting the flow of said liquid as desired, at a point in said confined stream between the point of microfiltration and said liquid supply, thereby removing from said liquid all undesirable contaminating particles present in said supply and accumulated in said confined stream, and directing said jet against said surface.

2. The method of claim 1 wherein the volume of said liquid supply approximates one quart when freshly charged and diminishes to zero volume during the operation of said jet.

3. The method of claim 2 wherein said liquid supply is pressurized with air at about 10 to 50 pounds per square inch pressure.

4. An apparatus for producing a superclean liquid jet consisting essentially of the following parts:

- (1) a container having a capacity of about 0.5 to 1 quart provided with a hand-grip;
- (2) a filling opening with closure near the top of said container;
- (3) a valved inlet near the top of said container for introduction of pressuring gas;
- (4) a conduit leading from a point near the bottom of said container to an outlet in the side thereof;
- (5) a valve in said outlet actuated by a spring holding it in the closed position;
- (6) control means associated with said hand-grip connected to said valve by a stem for overcoming said spring and opening said valve when desired;
- (7) a filter housing sealed to said outlet exteriorly of said container and valve;
- (8) a perforated support plate within said housing;
- (9) a microporous membrane filter resting on said support plate;
- (10) an elastic sealing ring between said membrane and said housing; and
- (11) a conduit leading from said housing providing a channel for liquid passing through said membrane

and support plate to a nozzle at the end of said conduit.

5. The apparatus of claim 4 wherein said filter housing is separable, thereby providing access to said filter membrane for replacing.

6. The apparatus of claim 4 wherein said filter housing is removable from said container to facilitate cleaning and sterilizing after installing the filter.

References Cited

UNITED STATES PATENTS

1,941,898	1/1934	Iddings	239—337
2,355,550	8/1944	Nusbaum	239—337
2,651,546	9/1953	Palm	239—590.3
2,733,835	2/1956	Alfery et al.	222—189
744,025	11/1903	Bell	222—189
3,149,758	9/1964	Bush et al.	222—189

FOREIGN PATENTS

617,180	2/1949	Great Britain.
---------	--------	----------------

EVERETT W. KIRBY, *Primary Examiner.*