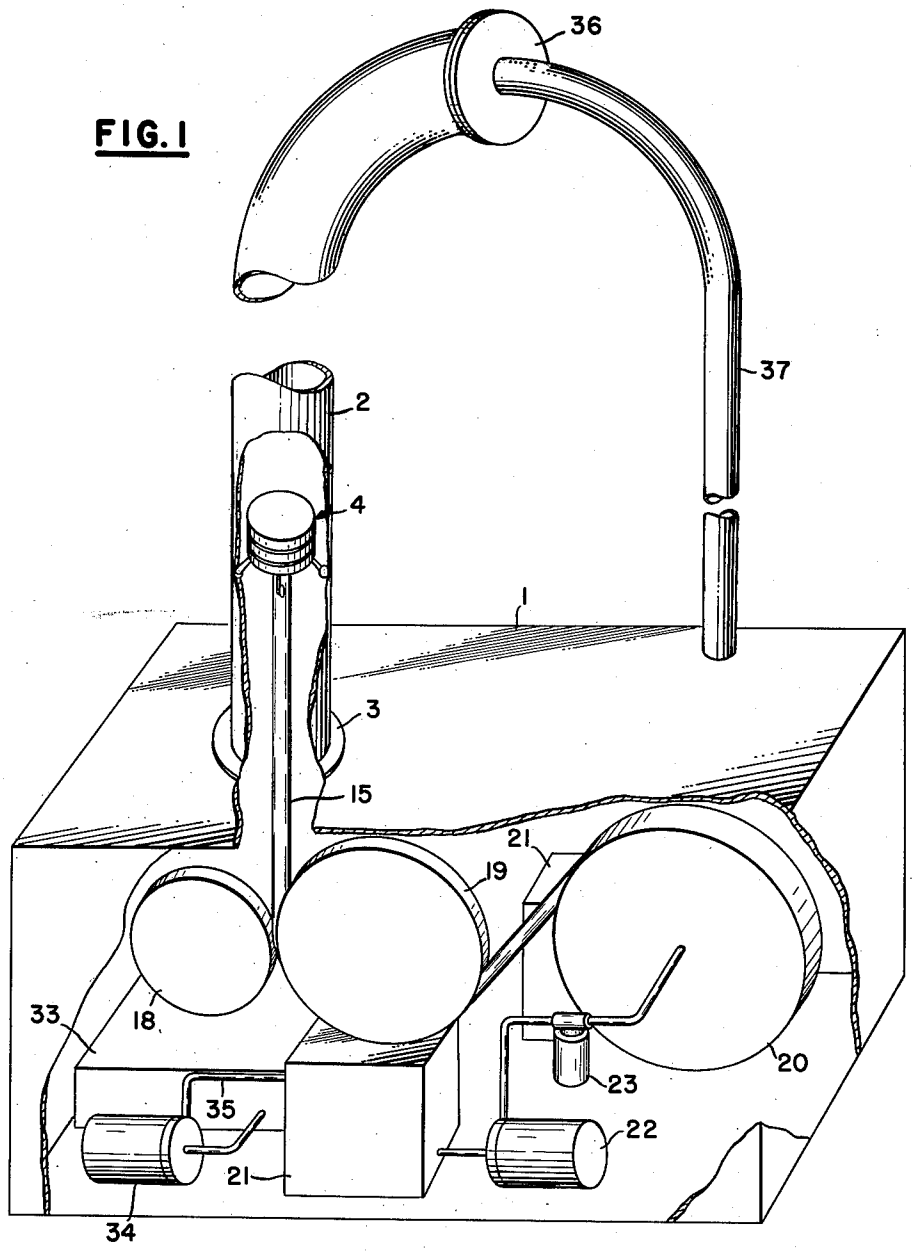
Sept. 28, 1965 K. J. HEINICKE 3,208,460

WASHING APPARATUS FOR CYLINDRICAL PIPES

Filed May 14, 1964 2 Sheets-Sheet 1

FIG. 1



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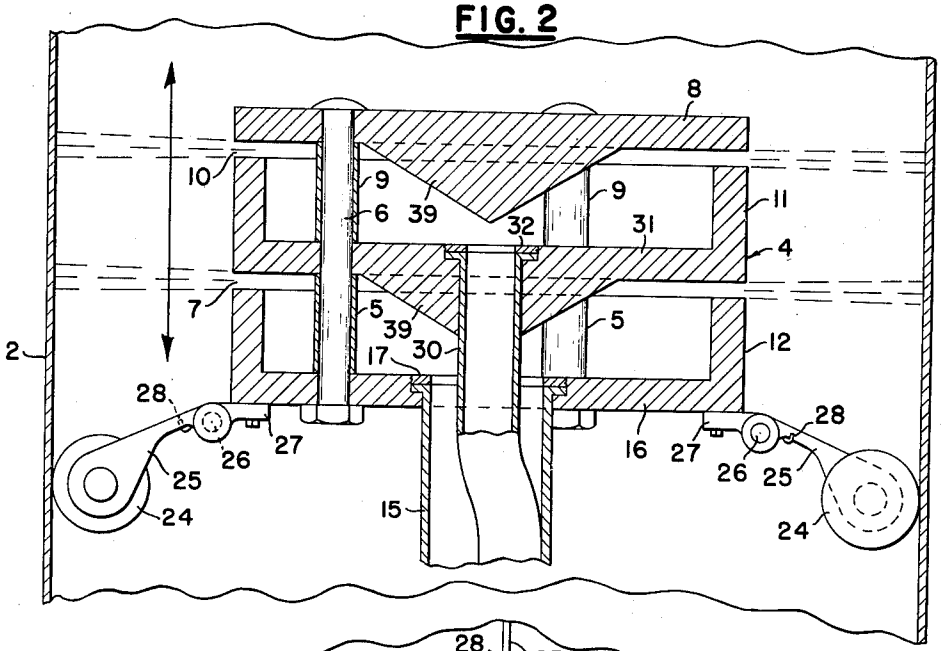
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Filed May 14, 1964 2 Sheets-Sheet 2

FIG. 2



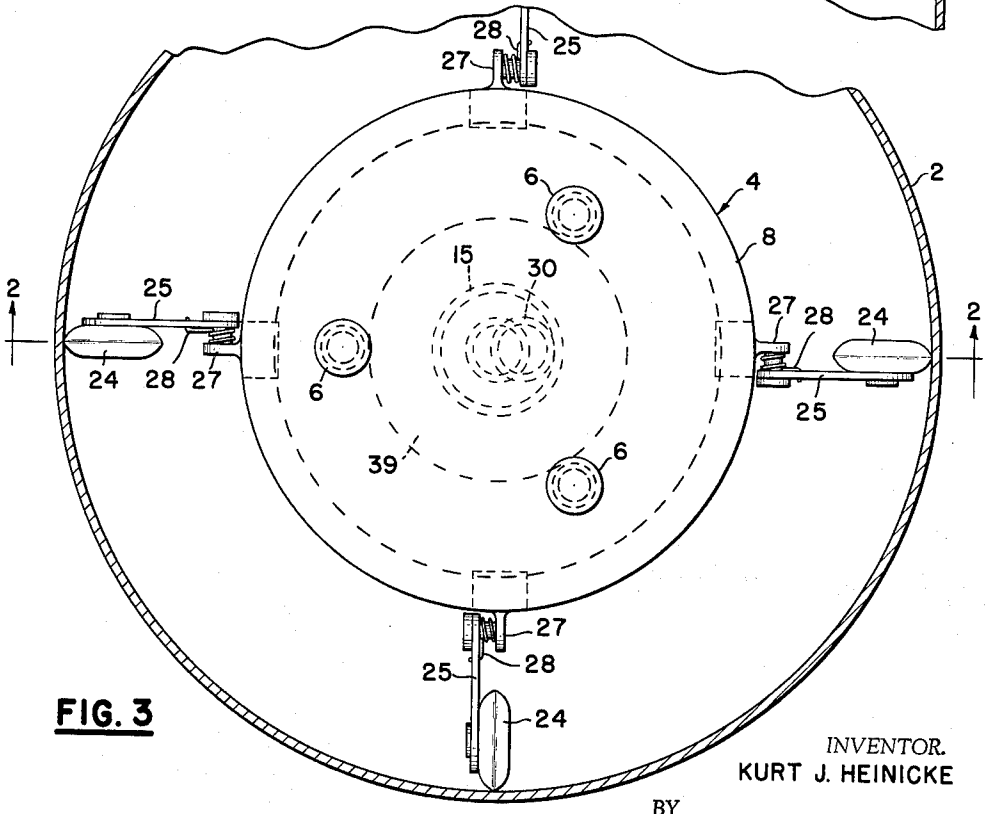


FIG. 3

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United States Patent Office 3,208,460 Patented Sept. 28, 1965

3,208,460

WASHING APPARATUS FOR CYLINDRICAL PIPES

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Filed May 14, 1964, Ser. No. 367,352
4 Claims. (Cl. 134—99)

This invention relates to a device for cleaning the interiors of tubes or tubing having various shapes and internal diameters, which tubing may be of the inflexible type or may consist of any of the types of flexible hose.

It is an object of the invention to provide an efficient means by which it is possible to clean the internal surfaces of a tube with aqueous solutions or solvents, depending upon the contamination to be removed. By means of the improved device all traces of contaminants will be eliminated.

In the missile field and in space vehicles, projectiles etc. various tubes are used in and around the equipment and such must be clean to specified levels and it has been found difficult to secure the required degree of cleanliness and which often creates major problems in the proper functioning of the vehicles and projectiles. This present invention is not limited to use in the missile, space vehicle field, but one of its uses is in connection with pipes or tubes employed in that field.

More particularly, the invention contemplates the provision of a spray head that is axially reciprocated within a tube to be cleaned and which sprays wash fluid and then rinse fluid against the interior walls of the tube, said spray head being connected to pipes or hoses which are respectively coupled to separate chambers in the spray head and from which the fluids are successively sprayed. Means is provided for feeding the hoses through the tubes to be cleaned so that the spray head is reciprocated as above described.

With these and other objects to be hereinafter set forth in view, I have devised the arrangement of parts to be described and more particularly pointed out in the claims appended hereto.

In the accompanying drawings, wherein an illustrative embodiment of the invention is disclosed,

FIG. 1 is a perspective view of a tube cleaning apparatus constructed according to the invention;

FIG. 2 is a vertical sectional view through the spray head and some of the parts associated therewith, the view being taken on the line 2—2 of FIG. 3, looking in the direction of the arrows, and

FIG. 3 is a view looking downwardly on the structure of FIG. 2.

Referring to the drawings, 1 indicates a housing or casing within which the operating parts of the tube cleaning apparatus are contained. A tube to be cleaned is shown at 2, and the same is provided at one end with a clamping ring or other attaching element 3 by means of which the tube will be fastened in an opening in the top of the housing 1 to project upwardly and substantially vertically therefrom as shown in FIG. 1. The tube is illustrated in the drawing as being curved, but it will be apparent that a straight or other shaped tube can also be readily cleaned by the device to be described.

The internal wall surface of the tube 2 is adapted to be washed and then rinsed by means of a spray head generally indicated at 4, the constructional details of which are clearly shown in FIGS. 2 and 3. Said head 4 is generally of cylindrical shape and it includes an upper cup-shaped chamber 11 and a similar chamber 12, the chambers being disposed in superimposed relation and held in vertically spaced positions by means of spacing sleeves 5 which surround bolts 6, this arrangement being such

as to provide a fluid outlet slot or spray opening 7 between the two chambers. Fluid forced into the lower chamber 12 will fill the chamber and be forced therefrom out through the spray slot 7 to impinge against and cleanse the interior wall surface of the tube 2 while the spray head 4 is being reciprocated up and down within the interior of the tube.

The upper spray chamber 11 has a top plate or cover member 8 in the form of a disk, and said plate is held by the bolts 6 and is spaced from the top of the chamber 11 by means of the spacing sleeves 9, this arrangement providing for a slot opening 10 between the top of the chamber 11 and the closure plate 8 and through which another fluid, such as a rinsing fluid, can be ejected in the form of a curtain to impinge against the interior of the tube 2. To facilitate the direction of the fluids out of the chambers 11 and 12, the upper part of each of said chambers is formed with a conical deflector 39. Cleansing fluid is delivered into the lower chamber 12 of the spray head and is forced out through the slot 7 at the top of the same by means of a flexible supply hose or pipe 15 which is connected into the chamber 12 to communicate with the interior of the same, by being fitted in an aperture in the bottom wall 16 of the chamber and held in place by a clamping nut 17 or by other suitable means. Said fluid-delivery hose 15 extends downwardly and out of the lower end of the tube 2 and enters into the housing 1 wherein it passes between a pair of feed rollers indicated respectively at 18 and 19 (FIG. 1) which are rotated by suitable drive means and which co-operate in imparting a reciprocating movement to the hose 15, which by its attachment to the spray head 4, will consequently move the spray head up and down within the tube 2 during the performance of its spraying operation. The delivery tube 15 is drawn from a hose reel 20 contained within the housing 1. The washing fluid for delivery through the hose 15 and conveyed thereby to the spray head, is delivered into the hose 15 from a supply tank 21 by means of a pump 22, after passing through a filter 23 located between the supply tank 21 and the inlet end of the delivery hose 15. The wash fluid need not necessarily be supplied in the manner indicated but may be forced into the hose 15 from any other convenient source.

By means of the mechanism disclosed, the hose 15, being moved up and down within the interior of the tube 2 by the action of the rollers 18 and 19, will have its washing fluid delivered into the chamber 12 and forced therefrom through the outlet slot 7 to impinge against the interior wall surface of the tube 2 to wash the same while the spray head is being moved up and down within the tube.

To facilitate the reciprocating movement of the spray head 4 and to center the same within the tube 2, the spray head is provided with guide rollers 24 which ride against the interior wall surface of the tube 2. Each of said rollers 24 is rotatively carried at the end of an arm 25, the several arms shown, projecting radially from the spray head. Each of the arms 25 is pivoted at 26 in a bracket 27 fastened to the bottom of the spray head. Each arm 26 is biased by means of a torsion spring 28 so that the rollers 24 are held in constant smooth-rolling contact with the interior of the tube 2 and the spray head will move up and down with a minimum of friction. The rollers 24 are positioned below the spray head and are thus disposed out of the way of the spray slots in the spray head.

In addition to supplying a washing fluid, a rinsing fluid is also supplied for ejection against the interior of the tube and usually after the conclusion of the washing operation. For this purpose, a delivery tube 30

is provided, the same in the arrangement disclosed, being contained co-axially within the delivery tube **15**. As an alternative, the hose **30** could be arranged externally of the hose **15**. The hose **30** passes through the lower spray chamber **12** without communicating with the interior of the same and it enters into the interior of the upper chamber **11** through an opening in the bottom wall **31** of said upper chamber. A clamping ring **32** holds the end of the rinsing fluid delivery tube **30** in position.

The above arrangement is such that as the washing-fluid delivery tube **15** is raised or lowered it will raise or lower the rinse fluid tube **30** along with it and when the flow of rinse fluid is caused to be forced through the hose **30**, usually following the washing of the interior of the tube **2** by washing fluid emanating from the hose **15**, the rinse water will be caused to flow through the hose **30**; said rinse fluid will enter the chamber **11** and be discharged therefrom through the slot **10** to impinge against and rinse the inner wall surface of the tube **2**.

The rinse water is supplied through hose **30** from any suitable source not shown.

From the foregoing, the operation of the described tube cleaning apparatus will be readily understood. A tube **2** to be cleaned is attached at the top of the housing **1** and stands upright thereon. The spray head is inserted within the tube **2** and when the apparatus is set in operation, the rollers **18** and **19** will move the spray head up and down within the tube **2** and with the washing fluid pumped through the hose **15**, such fluid will be delivered into the chamber **12** and will be forced therefrom out through the slot **7** to impinge against the inside of the tube **2** while the spray head is thus reciprocated within the tube.

The washing fluid after contacting with the interior of the tube **2** and cleansing the same, will drain down through the tube **2** and be captured by a drain tank contained within the housing **1** and located below the lower end of the tube **2**. Said tank is indicated at **33** in FIG. 1 and the washing fluid collected therein may be reclaimed by means of a pump **34** which delivers it back to the supply tank **21** by means of the pipe **35**. Such washing fluid need not necessarily be reclaimed and reused but can, if desired be drained away after use.

At the conclusion of the washing operation, the flow of the washing fluid is shut off, and then the rinsing fluid is caused to flow through the supply hose **30**. The spray head **4** is moved up and down through the tube **2** while the rinsing fluid is delivered through the spray outlet **10** to cause it to impinge against the interior of the tube **2** to rinse the same.

At the completion of the washing and rinsing operations as above described, the upper end of the tube **2** may be closed by a cap **36** (FIG. 1) which can be connected by a hose **37** to the output of a blower from which heated air can be forced through the hose **37** and down through the tube **2** to dry the interior of the same.

Having thus described an embodiment of the invention, it is obvious that the same is not to be limited thereto, but is broad enough to cover all structures coming within the scope of the annexed claims.

What I claim is:

1. A device for cleaning the interior of a tube comprising, a housing, a tube to be cleaned attached over an opening in the top of the housing, the tube standing upright above the housing, a spray head smaller than the interior of the tube located within the tube and moved up and down within the tube while spraying the interior of the tube, radially-extending spring-biased arms extending from the lower end of the spray head, each of said arms carrying a roller riding against the interior wall surface of the tube, the spray head having a plurality of separated fluid chambers, each of said chambers being provided with a fluid outlet, a fluid supply pipe leading into each of the chambers, said pipes being coupled at one end to the spray head, and means for raising and lowering the pipes within the tube to cause the pipes to raise and lower the spray head axially within the tube while fluid is being delivered from a selected one of said pipes into the spray head and forced therefrom against the interior of the tube.

2. A device for cleaning the interior of a tube as provided for in claim **1**, wherein the chambers in the spray head are arranged in superimposed relation, each of said chambers being cup-shaped, the uppermost of the chambers having a closure plate spaced from the top of said chamber to provide a spray outlet between it and said top of the chamber.

3. A device for cleaning the interior of a tube as provided for in claim **2**, wherein the under side of the closure plate is provided with a conical fluid deflector.

4. A device for cleaning the interior of a tube comprising, a housing having an opening in its top, a tube to be cleaned positioned over the opening and disposed in an upright position thereover, a spray head fitting within the tube and spaced away from the wall thereof, arms extending radially from the spray head, rollers carried by the arms and riding against the interior surface of the tube, the spray head having separated fluid chambers, each of which has a fluid outlet, concentrically-arranged fluid supply pipes respectively communicating with said chambers, rotated rollers engaging the outermost of the concentric pipes to propel the pipes and the attached spray head through the tube while fluid is being delivered from either of the pipes and into the communicating chamber and forced therefrom against the interior of the tube.

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