

[54] **CLEANING DEVICE**
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 239/265, 280.5, 548, 532

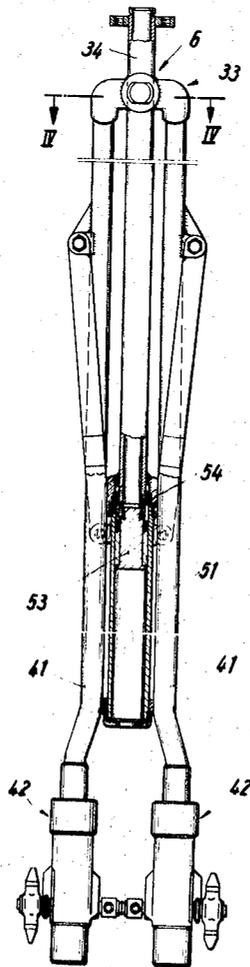
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[57] **ABSTRACT**

A cleaning device for the interior of tanks, silos and the like has a foldable and spreadable framework carrying spray heads. The framework can be folded to permit insertion through an opening, and can then be spread in the interior of the receptacle. The interior framework can be rotated about a longitudinal axis, and each of the spray heads can in itself be rotated with reference to the framework.

12 Claims, 6 Drawing Figures

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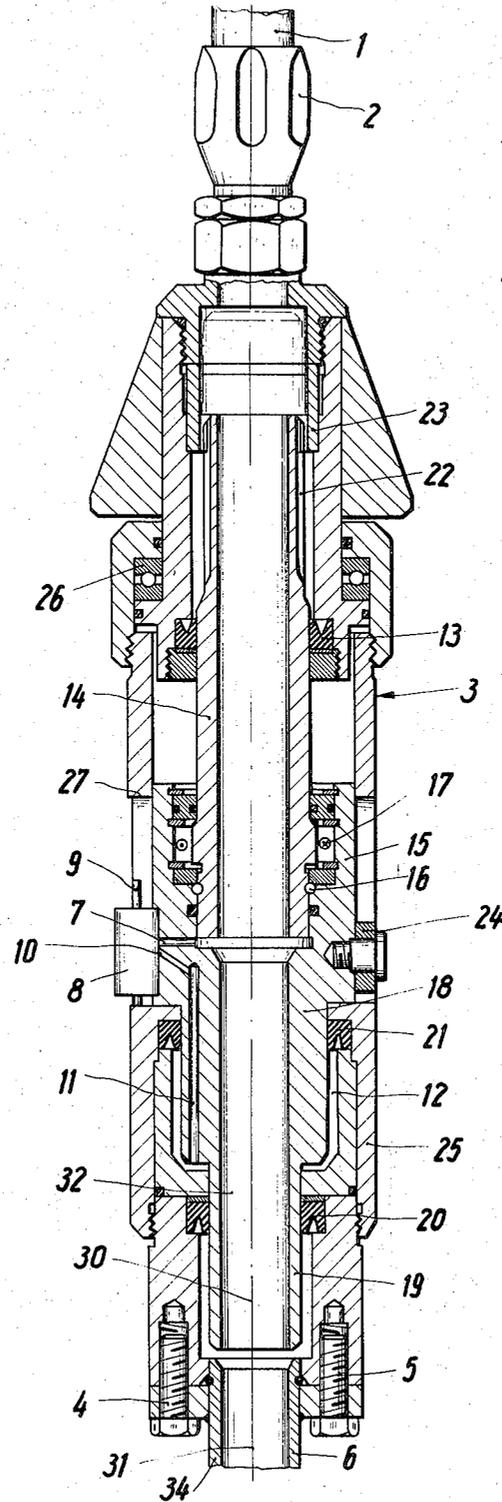


Fig. 1

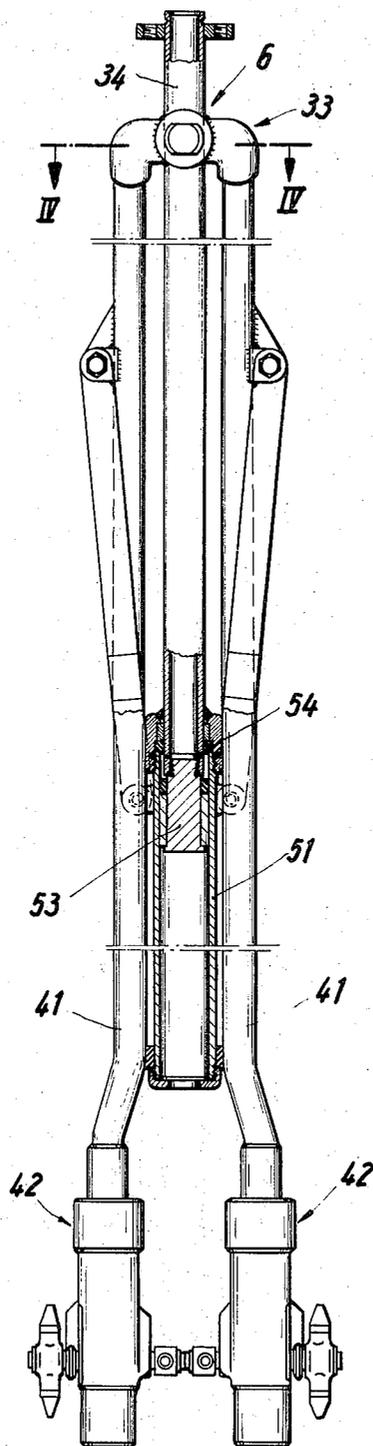


Fig. 2

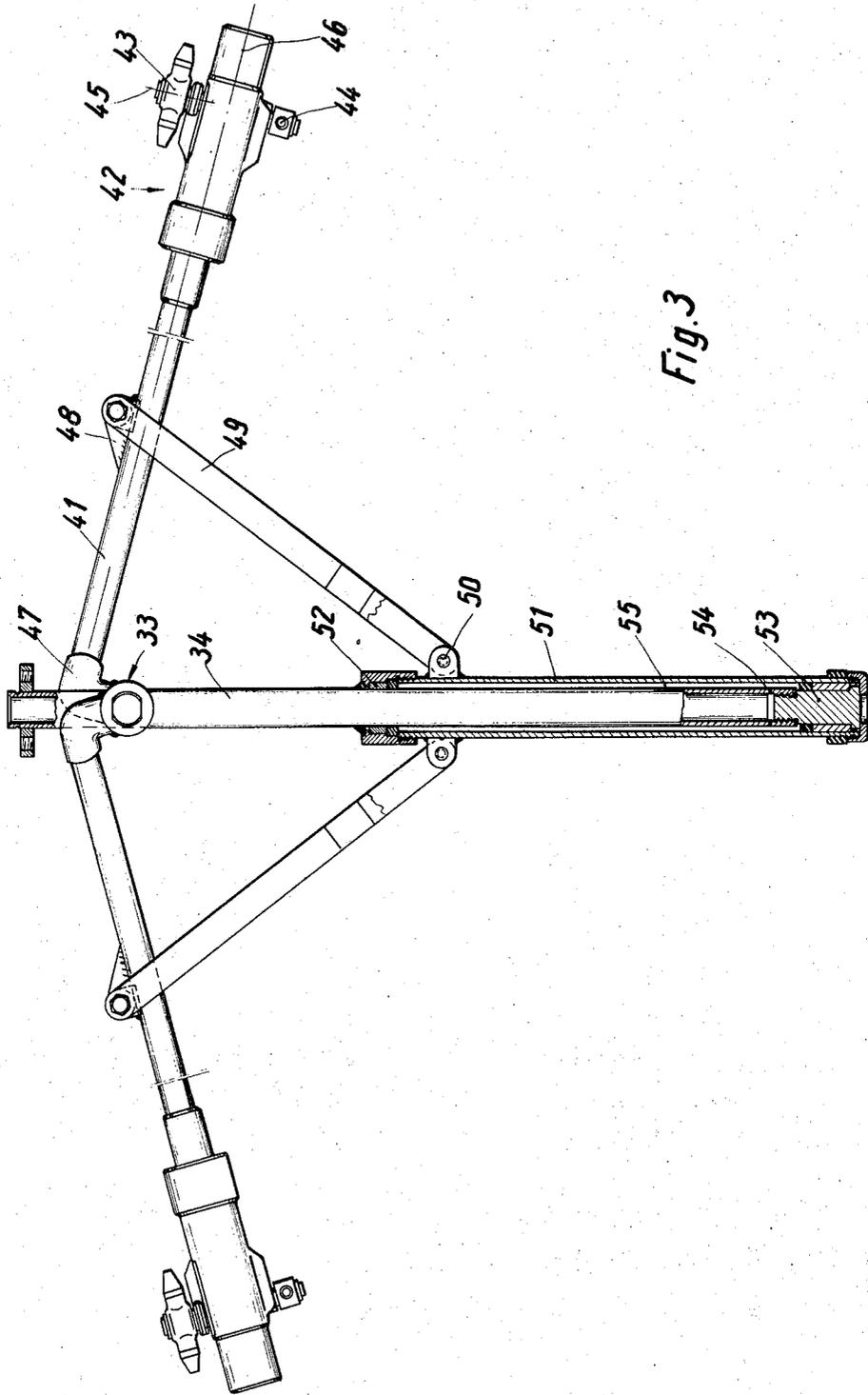


Fig. 3

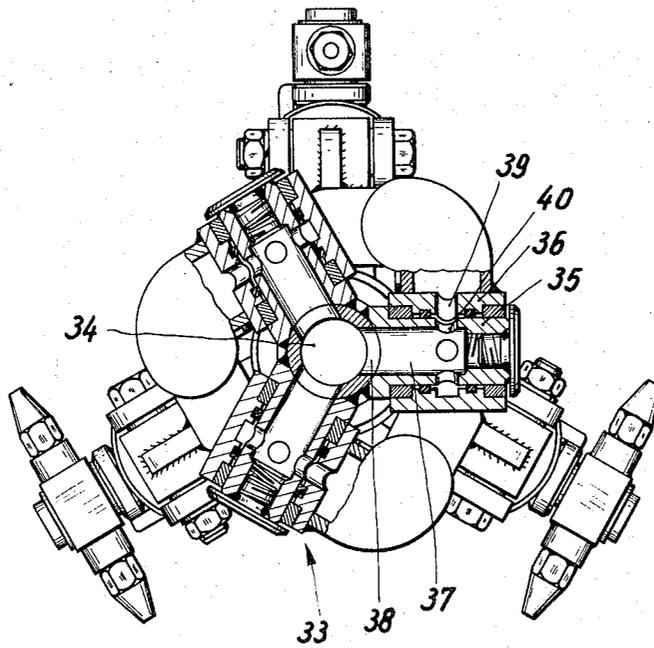


Fig. 4

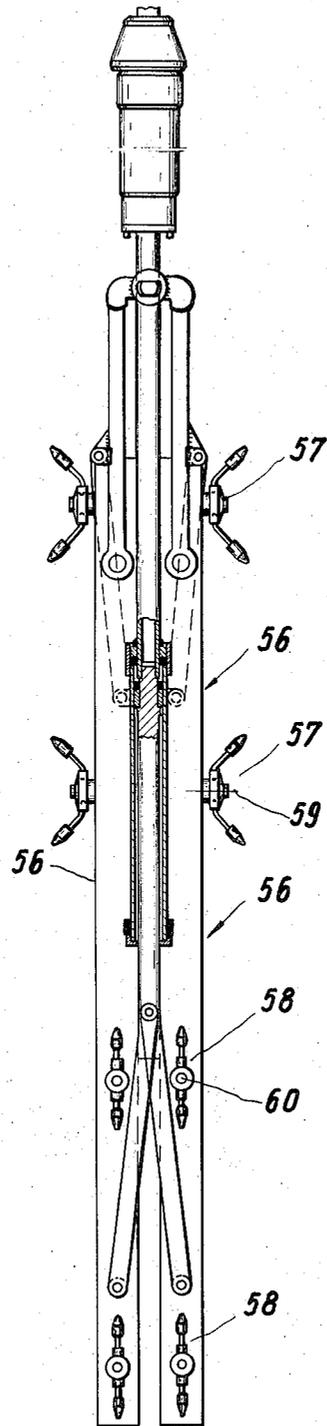
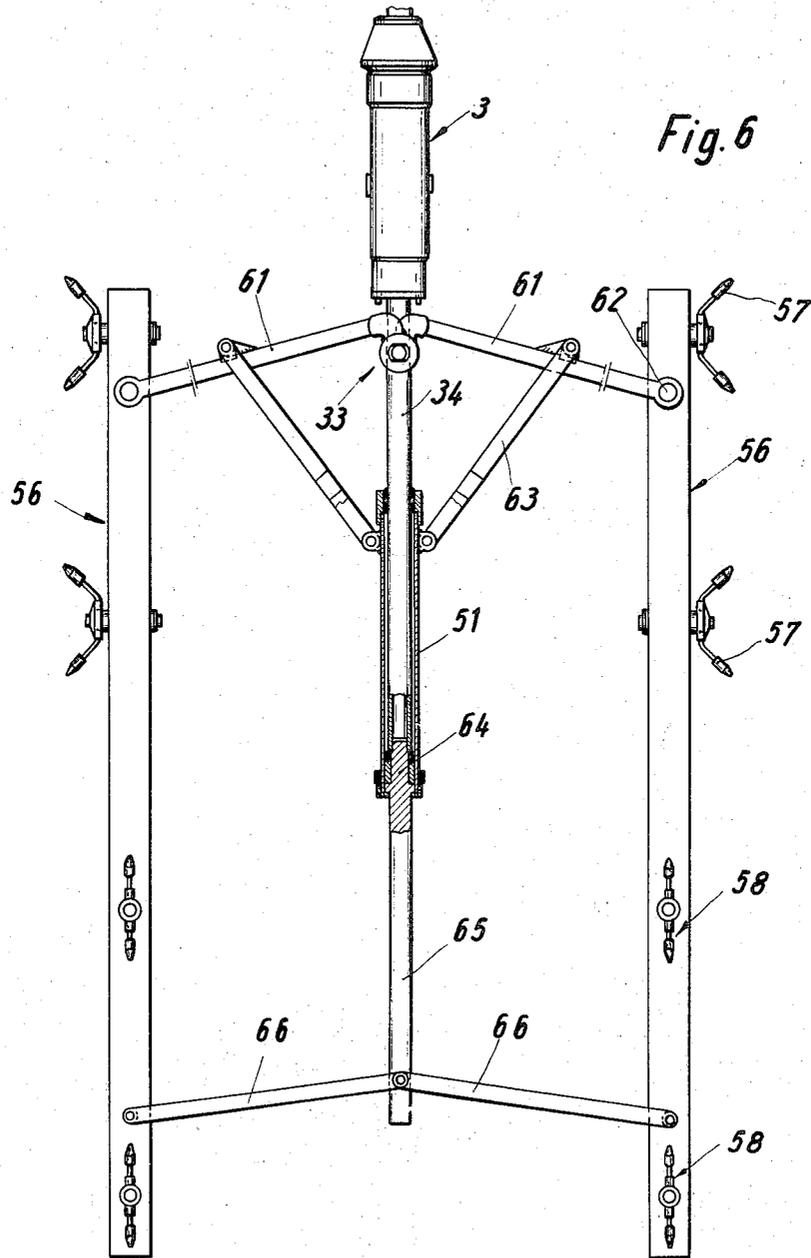


Fig.5



CLEANING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates generally to a cleaning device, and more particularly to a cleaning device for cleaning the interior of receptacles such as autoclaves, spray towers, silos, tanks and the like.

It is frequently necessary to clean the interior of a receptacle, and of course such receptacles may be quite large, such as large tanks, autoclaves, spray towers, silos and the like. In many instances these receptacles have a relatively small dimensioned opening through which the cleaning device must be inserted and withdrawn. To facilitate the cleaning action the spray heads or spray nozzles of such cleaning devices, from which water or another suitable cleaning fluid is ejected under pressure, should be relatively close to the inner surfaces of the respective receptacle which are to be cleaned. It is therefore known from the prior art to provide such a cleaning device having a cylindrical tube or pipe which can be inserted into the opening of a receptacle and which carries a framework not unlike the supporting frame of an umbrella. In a manner which is also reminiscent of an umbrella, this framework can be spread apart or folded against the pipe by means of a piston which is shiftably or slidably mounted on the pipe and connected with the framework. The framework is composed of tubular elements through which water is supplied to the spray heads carried at the outer ends of the tubular elements. This prior-art device already represents an improvement over what was known before it. However, there is a tendency towards larger and larger receptacles of the type here in question, and because the device once inserted into the opening is stationary except for the possibility of folding or spreading it, coupled with the fact that the jets of water or similar cleaning fluid that can be ejected have only a limited reach, it has been found that with increasing inner diameter of the receptacles to be cleaned the prior-art device in question does not operate fully satisfactorily.

SUMMARY OF THE INVENTION

It is, accordingly, a general object of the present invention to avoid the disadvantages of the prior art.

More particularly it is an object of the present invention to provide an improved cleaning device, particularly a cleaning device suitable for cleaning the interior of receptacles, which overcomes these disadvantages.

Still more specifically, it is an object of the invention to provide such a cleaning device which makes it possible for jets of cleaning fluid ejected from the spray heads or nozzles of the device to be directed against the surfaces to be cleaned from an optimum distance, and for them to be capable of contacting the entire surface which is to be cleaned.

In addition, the cleaning device according to the present invention should be relatively simple in its construction, rugged, and reliable in operation.

In keeping with these objects, and with others which will become apparent hereafter, one feature of the invention resides in a cleaning device, particularly for cleaning the interior of receptacles, which comprises a foldable and spreadable framework, and operating means for folding and spreading the framework as de-

sired. A plurality of spray heads is mounted on the framework and supply means is provided for supplying fluid under pressure to these spray heads. Mounting means mounts the framework for rotation about an axis and drive means is associated with the framework and is operative for effecting rotation of the same about this axis.

Thus, the cleaning device according to the present invention can after its insertion through whatever opening into the respective receptacle, be rotated about the aforementioned axis and will thus provide for significantly improved cleaning of the surfaces in question.

The drive means may be pneumatic, it may be electric or hydraulic, or it may in fact be of any type suitable. Particularly advantageously the drive means may have a drive unit which is driven via a partial stream of the cleaning fluid, and which causes the framework to be rotated about the aforementioned axis in steps, rather than continuously. Thus, each spray or jet of cleaning fluid ejected from the respective spray heads will have the opportunity to impinge upon a given portion of a surface to be cleaned for a given period of time rather than simply move over it, and the cleaning action afforded by the cleaning device according to the present invention is thus significantly improved.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a slightly diagrammatic axial section through a hydraulic drive means of a cleaning device according to the invention;

FIG. 2 is a diagrammatic partially sectioned illustration showing the remainder of the cleaning device which is driven by the drive means of FIG. 1, with the framework in folded condition;

FIG. 3 illustrates the components of FIG. 2 but in spread condition;

FIG. 4 is a section taken on line IV—IV of FIG. 2;

FIG. 5 is a view similar to FIG. 2 illustrating a further embodiment of the invention; and

FIG. 6 is a partially sectioned view similar to FIG. 3 but illustrating the framework of FIG. 5 in spread condition.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing firstly the embodiment illustrated in FIGS. 1-4 it will be seen that reference numeral 1 identifies a water hose or pipe which is connected via a pressure tight screw coupling or fitting 2 with a hydraulic drive means 3. Connected with the drive means 3 by the aid of bolts 4,5 is the framework 6 which is illustrated in more detail in FIGS. 2 and 3.

The drive means or unit 3 has a center flow passage 32 having a longitudinal axis 30 and communicating with the water pipe 1. It is further provided with a bore 7 communicating with the passage 32 and diverting a partial stream of the pressure fluid (such as water) which is introduced into the passage 32 from the pipe

1. An automatically operating reversible control 8, whose operation will be described in more detail later, is provided and communicates with the passage 7. The control 8 has a control slide 9 which, when it is in the appropriate position, permits water from the bore 8 to pass via additional bores 10 and 11 into a control chamber 12.

The drive unit 3 has an axially shiftable tube 14 which is sealingly engaged on a cylindrical portion thereof by a seal 13 which determines a cross section that is constantly under pressure, tending to shift the tube 14 and all components connected with it, namely a housing 15 with guide 16, a sealing arrangement 17 and the unit 8, downwardly (in FIG. 1) in the direction of flow of the pressurized liquid.

The housing 15 will be seen to have two cylindrical extensions 18 and 19 of which the former has a larger diameter than the latter but a smaller diameter than the remainder of the housing 15. Seals 20 and 21 are provided and cooperate with the projections or extensions 18 and 19 to seal the chamber 12. Due to the fact that the diameter of the extension 19 is smaller than the diameter of the tube 14, a part of the constantly and downwardly acting hydraulic pressure or force is compensated by the pressure acting upon the cross section determined by the seal 20. However, a substantial residual component of force remains, tending to displace the tube 14 in the direction of the flow of pressurized liquid, that is downwardly in FIG. 1.

When the drive unit 3 is in the position shown in FIG. 1, that is when the unit 8 is in the illustrated position, the control slide 9 permits communication between the bores 7, 10 and 11 so that water which is branched off the passage 32 via the bore 7 can enter the chamber 12. This causes the pressure in the chamber 12 to rise sufficiently for a relative movement of the housing 15 and the components associated with it in a direction counter to the flow direction of the liquid through the passage 32. In other words, the tube 14 is caused to move upwardly in FIG. 1.

The end portion of the tube 14 which is the upper end portion in FIG. 1 is provided with a plurality of spiral flutes 22 which mesh with similar internal flutes provided in a guide member 23, but loosely enough so as to permit a rotation of the tube 14 about its longitudinal axis 30 as the tube 14 is being lifted due to the pressure building up in the chamber 12. The free wheeling unit 17, which is known per se, imposes this rotary movement on the housing 15 and via a slide 24 on the outer sleeve 25 at the lower end of the drive unit 3. A thrust bearing 26 absorbs the non-compensated hydraulic forces which develop in the interior of the unit 3, and facilitates the movement of the tube 14.

The position illustrated in FIG. 1 is the position which the unit will have as the movement of the tube 14 in upward direction just begins. This movement continues until the slide 9 which moves with the tube 14 and the unit 8 butts with its upper free end against an abutment 27 provided for this purpose. Slightly continued movement of the tube 14 and the unit 8 causes the slide 9 to be displaced downwardly into the unit 8, thus blocking the passage of pressure liquid from the bore 7 into the bore 10 and at the same time communicating the bores 10 and 11 with the exterior of the drive unit 3. This terminates the force acting in the chamber 12 to move the tube 14 in upward direction; because the tube 14 is under a constant downward pressure from

the pressurized fluid passing through it in downward direction, tube 14 now is caused to move downwardly, at the same time expelling sufficient liquid from the chamber 12 via the passages or bores 11 and 10 so that such movement can take place. Of course, the tube 14 now also turns in the opposite direction from before, due to the presence of the spiral flutes 22 and the spiral grooves of the guide 23. It is, however, not desired that the housing 15 which, as will become clearer from FIGS. 2-4, is connected with the remainder of the cleaning device including the framework, should share in this return rotation. Instead, it is desired that it not participate when the tube 14 rotates in this opposite direction, and this is achieved by having the free wheeling device 17 become disengaged when the tube 14 rotates in the opposite direction as it moves downwardly in FIG. 1. The housing 15 therefore remains stationary while the tube 14 moves downwardly. This means that the housing 15 is subjected only to stepwise rotation and only in one direction, whenever the tube 14 moves upwardly in FIG. 1.

The tube 34 (see FIGS. 1 and 2) of the framework (see FIG. 2) is connected with the drive unit 3 by means of the bolts 4 and 5. Its longitudinal axis 31 is coaxial and in axial alignment with the axis 30 of the passage 32. The tube 34 extends to a distributor 33 which, as FIGS. 2-4 show, is in form of three nipples 35 which extend at right angles from the tube 34 and each of which carries a sleeve 36 that is rotatable on it. The interior 37 of the nipples 35 communicates via a respective opening 38 with the interior of the tube 34 and flow apertures 39 and 40 are provided in the nipples 35 and 36 to permit liquid under pressure to enter from the tube 34 into the spray tubes 41 forming a part of the framework and having outer free ends each of which carries a spray head or spray nozzle 42. In the illustrated embodiment spray heads 42 are each provided with two pairs of nozzles 43, 44 which are offset relative to one another by 90° and mounted so that they can rotate about the respective axis 45 as well as performing a stepwise rotary movement about the respective axis 46. In a region of their connection with the distributor 33 the tubes 41 are provided with bends 47. The manner in which the tubes 41 can pivot between the spread position shown in FIG. 3 and the folded position shown in FIG. 2 will be obvious from FIG. 4.

Connected with the tubes 41, or in this case with lugs 48 connected with the tubes 41, are arms 49 which are pivoted to them and whose opposite ends 50 are pivoted to a tubular piston 51 which is slidably journaled on an extension portion 53 of the tube 34, as well as being similarly journaled with its forward endcap 52 on the tube 34 itself. Above the endcap 52 there is provided a throttle bore 54 through which liquid under pressure can pass from the interior of the tube 34 into a chamber 55. The throttle bore 54 assures that the speed of sliding movement of the piston 51 is limited, so that the speed at which the tube 41 can be folded and spread is similarly controlled.

For further details of the construction and operation of the drive unit 3 with its hydraulic controls, and of the spray heads 42, reference may be had to my prior U.S. Pat. No. 3,437,271 where such details are disclosed.

It will be appreciated that the framework is inserted in the folded condition of FIG. 2 through an opening in a receptacle whose interior is to be cleaned. If thereafter water or other liquid under pressure is admitted via

the passage 32 into the tube 34, the piston 51, the arms 49 and the tubes 41 with the spray heads 42 move to the illustrated spread position of FIG. 3. The nozzles 43 and 44 will start to turn about the common axis 45 and will also begin to perform stepwise rotary movement about the axis 46. In addition, the entire framework 6 will perform a stepwise rotary movement about the longitudinal axis 31 of the tube 34. This assures the desired intensity for cleaning of a surface with which the unit is juxtaposed.

In the embodiment of FIGS. 5 and 6 there is provided a plurality of spray units 56 which carry respective groups of spray heads 57 and 58 each of which has two or more nozzles and can turn about an axis 59. The group of spray heads 57 is offset through 90° with reference to the group of spray heads 58. The units 56 may be hollow so that pressurized liquid can be supplied via them to the spray heads 57 and 58 which latter are associated with control means moved in the interior of the respective unit 56 in longitudinal direction thereof and in a reciprocatory manner, in order to impose a rotary movement upon the spray heads about the axis 59 and 60.

In other respects the embodiment of FIGS. 5 and 6 is quite reminiscent of that in FIGS. 1-4 to which reference may be had for details which have not been specially illustrated in FIGS. 5 and 6. It will be seen that this latter embodiment also has a central tube 34 connected with the hydraulic drive unit 3. The supply of pressurized liquid to the unit 56 is effected as in the preceding embodiment via a distributor 33 and via supporting pipes 61 which are pivoted at 62 to the units 56 and which have pivoted to them in turn respective arms 61 which are actuated in the same manner as described in FIGS. 1-4 by the piston 51.

The tube 34 in the embodiment of FIGS. 5 and 6 has an end portion with a downwardly extending projection or extension 65 which there are pivoted arms 66 whose other ends are pivoted to the respective units 56. The arms 66 in conjunction with the tubes 61 assure that the unit 56 will move in complete parallelism with the longitudinal axis of the tube 34 during the spreading or folding of the framework. The piston 51 here surrounds the tube 34 and, depending upon its location, also the extension 64 thereof, intermediate the distributor 33 and tube 61 on the one hand, and the pivot point of the arms 66 on the other hand.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a cleaning device, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A cleaning device, particularly for cleaning the interior of receptacles, comprising a foldable and spreadable framework including a plurality of elongated members; mounting means including a pipe pivotably mounting said framework for rotation about an axis; drive means associated with said framework and operative for effecting rotation of the same about said axis; operating means for folding and spreading said framework, including a sleeve slidable along said pipe, linkage arms articulately linking said members with said sleeve, and moving means for effecting movement of said sleeve along said pipe between two end positions in which said framework is respectively folded and spread; a plurality of spray heads mounted on said framework; and supply means for supplying fluid under pressure to said spray heads.

2. A cleaning device as defined in claim 1, wherein said drive means comprises a hydraulic drive unit.

3. A cleaning device as defined in claim 2, wherein said hydraulic drive unit is powered by some of the fluid under pressure and comprises a rotatable output portion coaxial with said axis.

4. A cleaning device as defined in claim 3, wherein said output portion is an outer sleeve of said hydraulic drive unit; further comprising connecting means connecting said mounting means with said outer sleeve for rotation therewith; and motion-imparting means for imparting stepwise rotary motion to said outer sleeve.

5. A cleaning device as defined in claim 4, said hydraulic drive unit having a center passage for liquid under pressure, and said pipe being coaxial with said passage and having an inner cross-section corresponding to that of the passage.

6. A cleaning device as defined in claim 5; further comprising a distributor associated with said pipe and spray heads for distributing fluid under pressure from the former to the latter.

7. A cleaning device, particularly for cleaning the interior of receptacles, comprising a foldable and spreadable framework including a plurality of elongated members; mounting means including a pipe pivotably mounting said framework for rotation about an axis and including an extension and a plurality of spray heads; a distributor associated with said pipe and spray heads for distributing fluid under pressure from the former to the latter, said extension projecting beyond said distributor; drive means associated with said framework and operative for effecting rotation of the same about said axis, said drive means including a hydraulic drive unit powered by some of the fluid under pressure and having a rotatable output portion in form of an outer sleeve coaxial with said axis, said hydraulic drive unit having a center passage for liquid under pressure which is coaxial with said pipe and has an inner cross section corresponding to that of said pipe; operating means for folding and spreading said framework, including a sleeve slidable along said extension, linkage arms articulately linking said member with said sleeve, and moving means for effecting movement of said sleeve along said extension between two end positions in which said framework is respectively folded and spread; connecting means connecting said mounting means with said outer sleeve for rotation therewith; motion-imparting means for imparting stepwise rotary

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motion to said sleeve; and supply means for supplying fluid under pressure to said spray heads.

8. A cleaning device as defined in claim 7, wherein said members of said framework are elongated units each provided with a plurality of said spray heads and each articulately carried by said pipe.

9. A cleaning device as defined in claim 8, said framework further comprising a plurality of tubes each having a first end portion articulated to said distributor, and a second end portion articulated to one of said units in an end region thereof, a plurality of arms each having spaced end portions articulated to said extension and to an opposite end portion of one of said units, respectively; and wherein said sleeve surrounds said extension intermediate said distributor and said arms.

10. A cleaning device as defined in claim 8, wherein respective arms of said spray heads on said units are angularly offset with reference to one another by 90°.

11. A cleaning device, particularly for cleaning the interior of receptacles, comprising a foldable and spreadable framework including a plurality of tubes each having one end portion and another end portion; mounting means including a pipe mounting said framework for rotation about an axis; a distributor associated with said pipe and having a plurality of nipples extending from and communicating with the interior of said

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pipe, and a connecting sleeve turnably mounted on each of said nipples and having at least one aperture communicating with the interior of the associated nipple, each of said one end portion being fixed to and communicating with one of said connecting sleeves; spray heads on said other end portions; drive means associated with said framework and operative for effecting rotation of the same about said axis, said drive means including a hydraulic drive unit powered by some of the fluid under pressure and having a rotatable output portion in form of an outer sleeve coaxial with said axis, said hydraulic drive unit having a center passage for liquid under pressure which is coaxial with said pipe and has an inner cross section corresponding to that of said pipe; operating means for folding and spreading said framework; connecting means connecting said mounting means with said outer sleeve for rotation therewith; motion-imparting means for imparting stepwise rotary motion to said outer sleeve; and supply means for supplying fluid under pressure to said spray heads.

12. A cleaning device as defined in claim 11, wherein said tubes each have a bend adjacent the respectively associated connecting sleeve.

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