United States Patent [19]

Hammelmann

[11] **3,791,394**

[45] **Feb. 12, 1974**

[54] **APPARATUS FOR CLEANING VESSELS HAVING AN INLET**

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[22] Filed: **Aug. 22, 1972**

[21] Appl. No.: **282,626**

[30] **Foreign Application Priority Data**

Aug. 27, 1971 Germany 2142978

[52] **U.S. Cl.** ..... **134/167 R,** 134/177

[51] **Int. Cl.** **B08b 9/08**

[58] **Field of Search** .... 134/167 R, 168 R, 22 R, 24, 134/166 R, 175, 177

[56] **References Cited**

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[57] **ABSTRACT**

A housing has an outlet and can be mounted on a vessel so that the outlet communicates with the inlet opening of the vessel. The housing accommodates a reel on which a hose is mounted and the hose carries one or more hydrodynamic cleaning devices which can be lowered into and withdrawn out of the vessel by turning of the reel. A valve can close the outlet when the cleaning device is not to be used.

9 Claims, 7 Drawing Figures

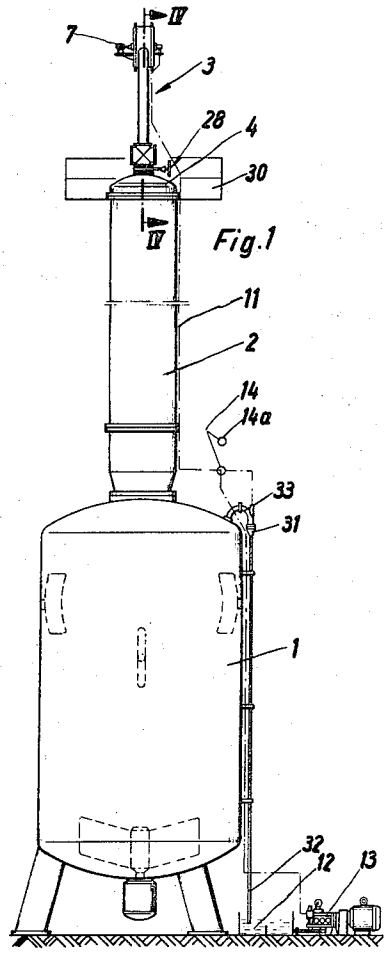

Fig.1

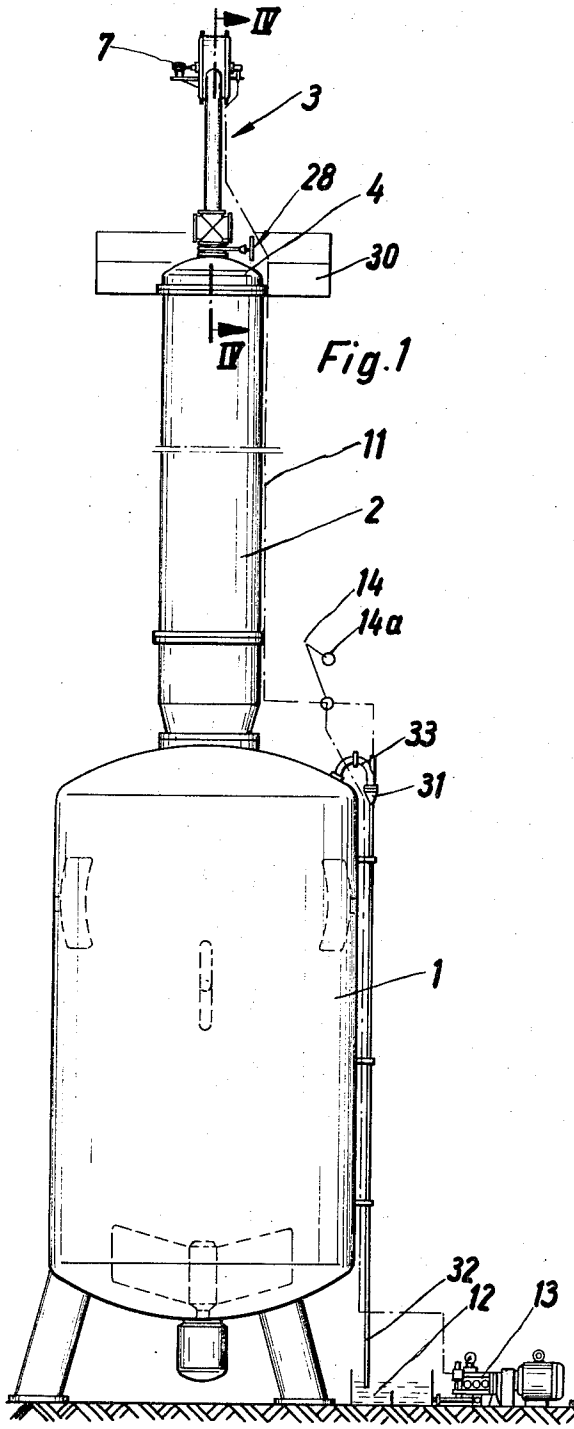

Fig.1

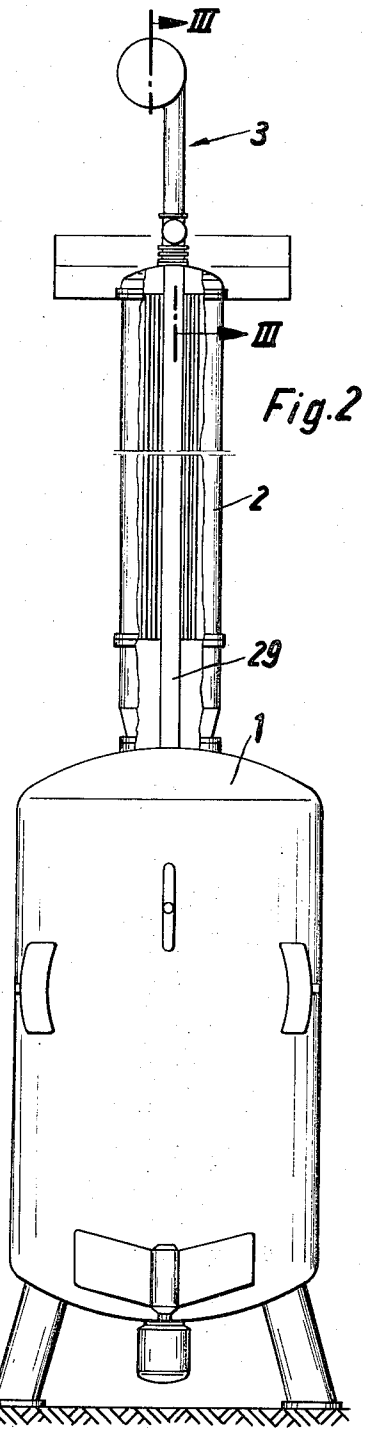

Fig.2

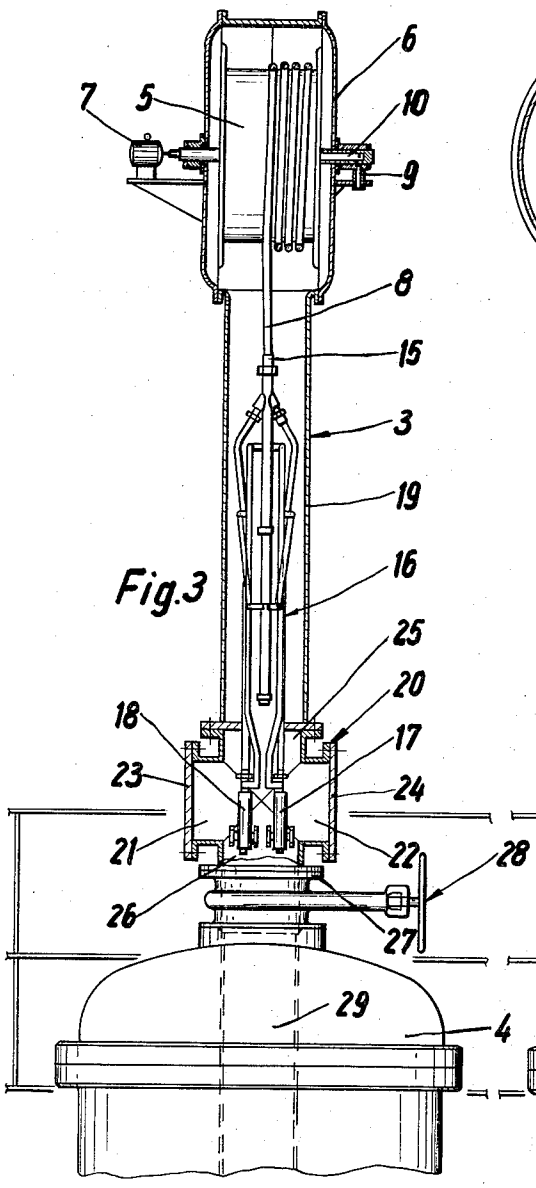

Fig.3

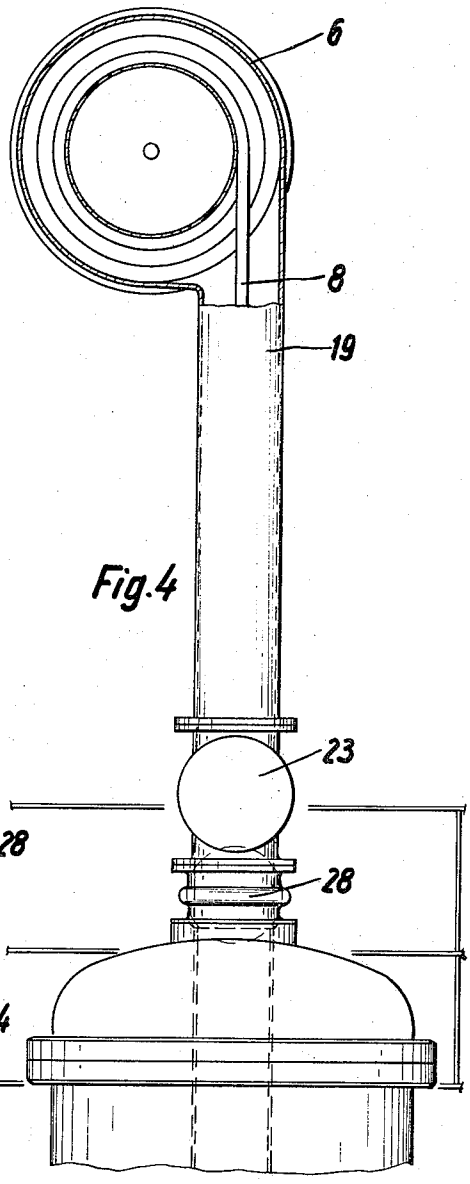

Fig.4

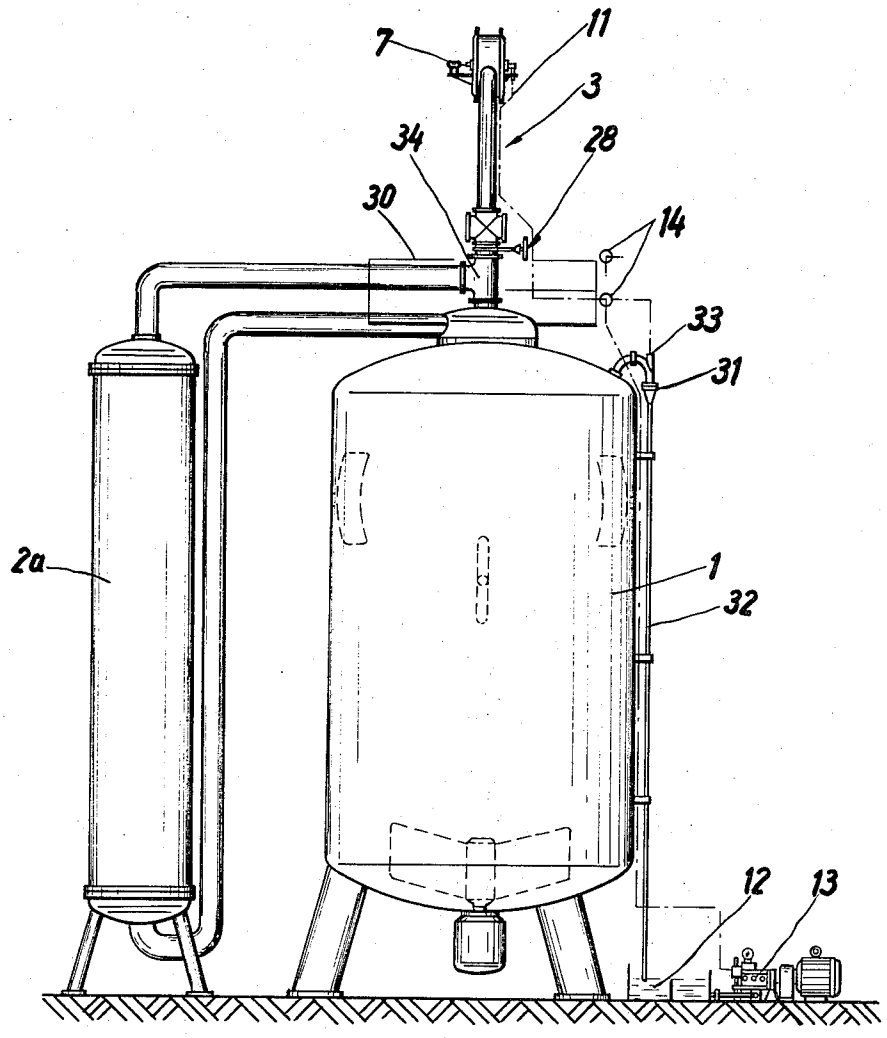

Fig.5

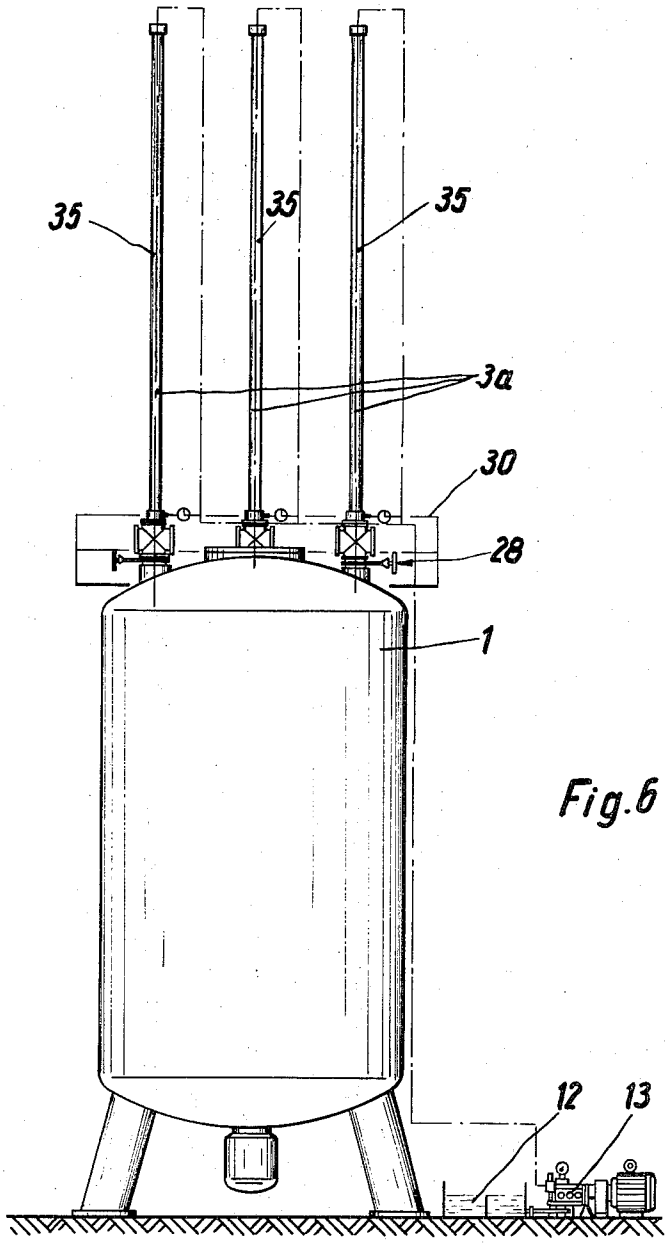

Fig.6

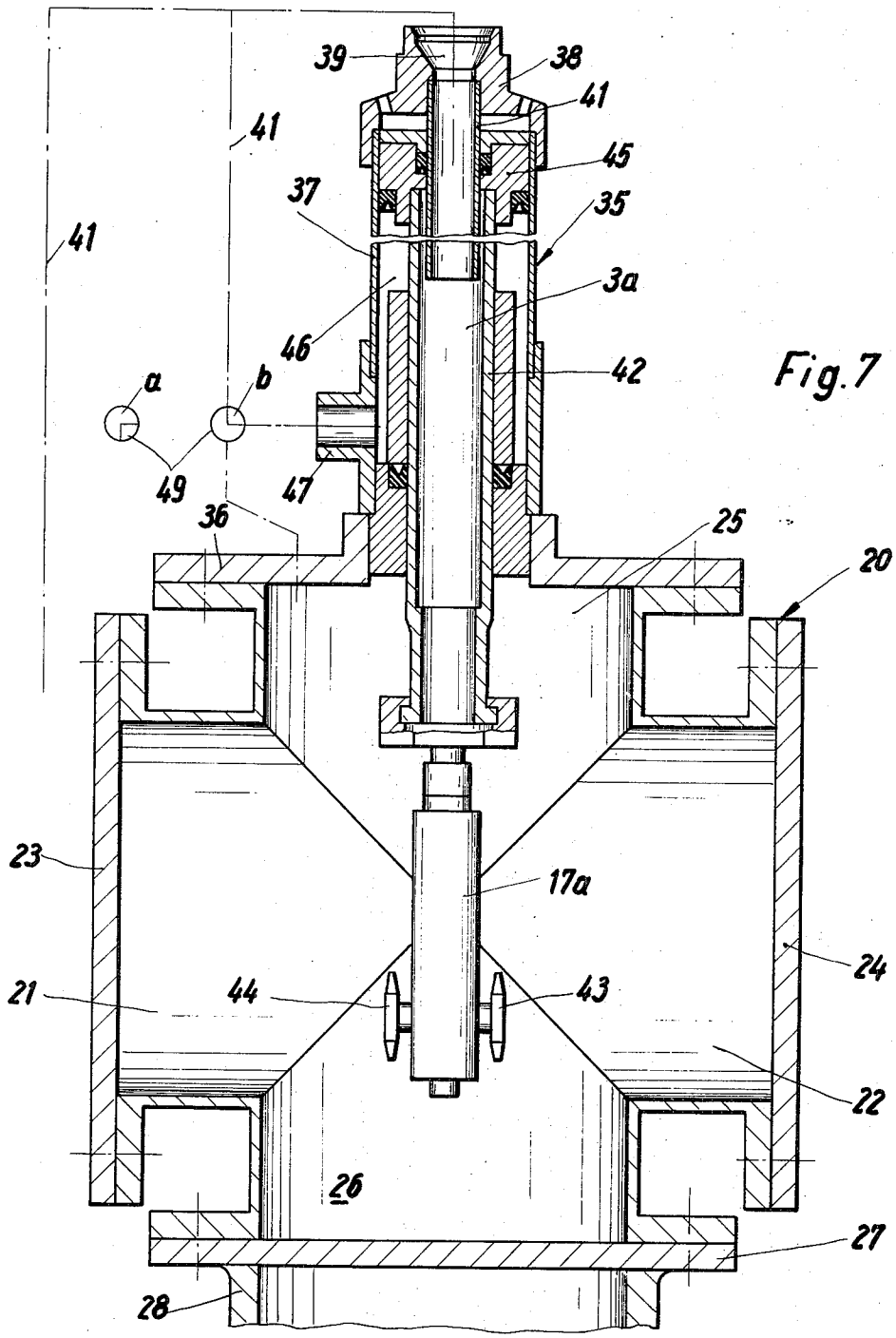
39
38
41
41
45
37
35
41
3a
46
42
a
b
49
47
36
25
20
23
17a
24
21
44
43
22
26
27
28

Fig. 7

APPARATUS FOR CLEANING VESSELS HAVING AN INLET

BACKGROUND OF THE INVENTION

The present invention relates to cleaning devices, and more particularly to an apparatus for cleaning of vessels having an inlet. Still more specifically the invention relates to an apparatus for the cleaning of vessels in the chemical industry, the steel industry, the food industry and the like.

In many instances, for instance in the case of autoclaves, spray towers, mixing and agitating vessels and the like, it is necessary to clean the interior of such a vessel after a charge of material has been removed therefrom, or after an operation conducted therein has been completed. Heretofore the known cleaning devices have required rather extensive time periods to carry out this cleaning, requiring that during this time the vessel be non-productive.

The cleaning devices known from the prior art for the cleaning of such vessels are separate units which are transported to the vessel when the latter has been emptied, and are then inserted into the vessel. Subsequently they must be withdrawn from the vessel and transported away. Evidently, this is time consuming, requires additional labor and, in many instances, is clumsy in terms of the handling involved.

It is therefore a general object of the present invention to overcome the disadvantages of the prior art.

More particularly it is an object of the invention to provide an improved apparatus for cleaning of such vessels having an inlet, an apparatus which avoids the aforementioned disadvantages.

Still more particularly it is an object of the present invention to provide an apparatus of the type under discussion which is simple in its operation and most uncomplicated in handling and construction.

In keeping with these objects, and with others which will become apparent hereafter, one feature of the invention resides, in an apparatus for cleaning of vessels having an inlet, in a combination which comprises a housing having an outlet and being mounted in a vessel so that the outlet communicates with the inlet of the vessel. At least one cleaning device is provided in the housing, and first means mounts the cleaning device for movement from the housing and through the outlet into the vessel to be cleaned. Second means is provided for closing the outlet.

Thus, the interior of the housing can be completely shut off from the vessel when the cleaning device is not in use, so that the vessel can be employed in any desired manner, including applications in which it must be evacuated or in which it must be subjected to internal pressure.

Advantageously, at least one access opening is provided inwardly of the closure means in the housing of the cleaning apparatus, so as to permit access to the cleaning device or devices at all times. This makes it possible to gain access to the cleaning device while the vessel itself is in operation, and to make repairs, inspections or adjustments on the cleaning device so that any necessary maintenance on the cleaning device can be carried out while the vessel to be cleaned is in operation, and not while the vessel is empty. This means that any down-time due to maintenance of the cleaning apparatus itself is avoided because the maintenance can be carried out at such times as the cleaning apparatus is not required to be used.

The cleaning device or devices used in the apparatus according to the present invention may be of various different types known per se in the art. For instance, they may be hydrodynamic cleaning devices and may be mounted or carried on a hose which in turn can be reeled onto and off a reel which is turnably journalled in the housing. In this construction it is advantageous if the housing comprises one portion in which the reel is accommodated and another tubular or conduit-shaped portion which extends from the first-mentioned portion to the inlet of the vessel, or to the vicinity thereof, and through which the hose with the cleaning device or devices is paid out and reeled in. The tubular or conduit-shaped portion is then connected with the vessel or with components fast with the vessel.

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 drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a somewhat diagrammatic side-elevational view of an apparatus according to the present invention;

FIG. 2 is a view similar to FIG. 1 but seen from the left of FIG. 1 looking towards the right, with the heat exchanger of the vessel to be cleaned being partially broken away;

FIG. 3 is a section taken on line III—III of FIG. 2;

FIG. 4 is a section taken on line IV—IV of FIG. 1;

FIG. 5 is a view similar to FIG. 1 illustrating a further embodiment of the invention;

FIG. 6 is a view similar to FIG. 5 illustrating another embodiment of the invention; and

FIG. 7 is a longitudinal section through a cleaning device used in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now firstly the embodiment illustrated in FIGS. 1–4 it will be seen that for purposes of orientation and better understanding I have illustrated a large-dimensioned vessel 1 to be cleaned, for instance a vessel as is used for the manufacture of synthetic plastic materials in industry. Mounted above the vessel 1 is a heat-exchange 2 whose particular construction and operation is of no importance for the invention. The upper cover of the heat-exchanger 2 has connected with it a cleaning device according to the present invention so that the device is mounted above the heat-exchanger 2.

Reference should now be had to FIGS. 3 and 4 where details of the cleaning device of FIGS. 1 and 2 are illustrated on an enlarged scale. It will be seen that the cleaning device has a housing composed of a portion 6 and a tubular or conduit-like portion 19 which extends downwardly from the portion 6. The portion 6 accommodates a hose reel 5 which is turnably mounted in the housing 6 and may be protected against the influence of pressure therein. A motor 7 is provided for rotating the reel 5.

A hose 8 can be reeled onto and off the reel 5 and has supplied water to it via a nipple 9 and a nipple 10. The nipple 9 receives water from the water supply pipe 11 which is shown in broken lines in FIG. 1 and which in turn receives water from a pump 13 which withdraws it out of a reservoir 12. Of course, instead of water another cleaning liquid or cleaning fluid could be employed, but water is mentioned here because in most instances it will be the cleaning fluid of choice. A known three-way valve 14 is interposed in the conduit 11 to permit control of the operation, and in one position the valve 14 an evacuation of the vessel 1 is possible as will be discussed later.

The lower end portion 15 of the hose 8 carries the actual cleaning unit which in the illustrated embodiment operates with high-pressure water. Evidently, several such units may be provided and they are well known in the art. They have been illustrated here by way of example in form of several hydrodynamic cleaning units 17, 18 of a construction known per se, mounted at the lower end of a spreadable support 16 which is carried by the end portion 15 of the hose 8.

The end portion 15, the support 16 and the units 17, 18 can be retracted so as to be located in the tubular housing or casing portion 19 whose cross-sectional configuration may be as desired and which communicates at its upper end with the housing portion 6.

It has been pointed out before that it has been desirable to permit ready access to the units 17, 18 at all times at which they are not in actual use. To permit this the housing portion 19 is provided at its lower end with a transverse conduit portion 20 having lateral tubular sockets 21 and 22 whose openings can be closed by removable covers 23, 24. Thus, removal of one or both of the covers 23, 24 permits access to the units 17, 18 via the sockets 21 or 22.

A socket 25 is provided which is connected via suitable flanges with the housing portion 19 and another socket 26 is connected with the upper flange 27 of a closure device 28, such as a valve. The purpose of the valve 28 is, of course, to close the upper opening of the heat-exchanger 2 through which the units 17, 18 can be lowered into the vessel 1, pressure tightly if and when desired. In particular this would be effected when the vessel 1 is in operation, that is at a time when the cleaning units 17, 18 are not required and are retracted into the housing portion 19. A tube 29 is provided in the region of the heat-exchanger 2 which passes centrally through the same and through which the units 17, 18 can move together with the support 16, into and out of the vessel 1. It is advantageous to provide the cleaning apparatus in the region of the valve 28 with a working platform or catwalk 30 to permit access to the sockets 21, 22 by personnel required to inspect, repair or otherwise maintain the units 17, 18. Of course, it will be noted that the valve 28 is located downwardly of the sockets 21 and 22 so that when it is closed, the interior of the housing portion 19 where the units 17, 18 are located, will be strictly shut off from the heat-exchanger 2 and the vessel 1.

In such circumstances where the process to be carried out in the vessel 1 requires that the latter be evacuated before a new charge can be admitted into it, it is advantageous to incorporate in the arrangement a water pressure injector 31 as shown in FIG. 1. When it is desired to evacuate the vessel 1 it is then merely necessary to operate the three-way valve 14 to place it into the position 14*a* for evacuating purposes. In this case the water which is supplied under pressure by the pump 13 passes via the three-way valve 14 to the injector 31, flows through the same and flows via the gravity pipe 32 back into the reservoir 12, withdrawing air from the vessel 1 via the nipple 33 in so doing. The operation of such injectors 31 is well-known per se.

Coming to the embodiment in FIG. 5 it will be seen that this differs from that of FIGS. 1–4 in that the heat-exchanger is designated with reference numeral 2*a* and is located laterally adjacent the vessel 1, rather than on top of it. The apparatus 3 according to the present invention is flanged to the connecting element 34 through which the cleaning unit is inserted into the vessel 1 when the valve or other closure device 28 is opened. In other respects the embodiment of FIG. 5 does not differ from that of FIGS. 1–4 and will therefore be readily understood without further discussion.

The embodiment in FIGS. 6 and 7 again has a vessel 1 which, however, has three cleaning apparatuses 3*a* associated with it. These differ from the apparatus 3 insofar as the insertion and removal of the cleaning unit 17*a* is effected by means of a hydraulically driven cylinder and piston unit 35 which is connected via flange 36 with the upper socket 25 of the tubular conduit portion 20.

The unit 35 has a stationary cylinder 37 an upper end of which is provided with an end cap 38 to which water under pressure is supplied via a nipple 39 by a conduit 40 in which it is moved by a pump. A tube 41 is mounted in the end cap 38 and conducts the water under pressure into a hollow piston rod 42 from which it moves into the cleaning unit 17*a* which again may be a hydrodynamic unit of a construction known per se and is provided with ejection nozzles 43, 44 through the water is ejected under high pressure. The piston rod 42 is connected with the piston 45 which is reciprocably mounted in the cylinder 37.

A control chamber 46 is provided as shown in FIG. 7, and when this control chamber 46 is open so that water can move out of it, the unit 17*a* moves into the vessel 1 due to a force which develops and acts constantly in downward direction (in FIG. 7) as a result of the continuous supply of water under pressure into the unit 17*a*. It will be noted that the chamber 46 has an outlet 47 which is in communication with the branch conduit 48 of the pipe 40, in which branch conduit 48 there is mounted a three-way valve 49 which, when it is in the position *a* permits movement of the device 17*a* into the vessel whereas, when it is in the position *b* it permits retraction of the device 17*a* out of the vessel and into the cleaning apparatus. When the three-way valve is in the position *b* water under pressure is admitted via the three-way valve 49 into the chamber 46, and this causes on the piston 45 a force acting contrary to the downwardly acting force, lifting the piston to the upper end position shown in FIG. 7 and thus resulting in retraction of the unit 17*a*.

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 an apparatus for cleaning vessels having an inlet, 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. In an apparatus for cleaning vessels having an inlet, a combination comprising a housing having an outlet and being mountable on a vessel so that the outlet communicates with the inlet of the vessel;

at least one cleaning device in said housing;

first means mounting said cleaning device for movement from said housing and through said outlet into the vessel to be cleaned;

and second means for closing said outlet.

2. A combination as defined in claim **1**;

and further comprising at least one access opening in said housing inwardly of said second means, and a removable cover for said access opening.

3. A combination as defined in claim **1**;

and further comprising a tubular portion extending through said housing communicating with the interior for access thereto and having two access openings, and removable covers for said access openings.

4. A combination as defined in claim **1**,

said first means comprising a reel turnably mounted in said housing, and a hose mounted on said reel for take-up and pay-off;

and wherein said cleaning device is mounted on said hose.

5. A combination as defined in claim **4**,

said housing including a first housing portion accommodating said reel, and a tubular second housing portion extending from said first housing portion and having remote from the same said outlet.

6. A combination as defined in claim **5**, wherein the vessel includes a heat-exchanger located above it;

said housing being arranged above the heat-exchanger and including a tubular extension for said tubular housing portion, extending the same past the heat-exchanger to the inlet of the vessel.

7. A combination as defined in claim **4**, wherein said cleaning device is a hydro-dynamic cleaning device.

8. A combination as defined in claim **1**, said cleaning device being a hydro-dynamic cleaning device;

and wherein said first means comprises a hydraulic cylinder-and-piston unit for effecting movement of said cleaning device into and out of the vessel.

9. A combination as defined in claim **1**;

and further comprising a work platform on said housing in the region of said second means.

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