

# United States Patent

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## [54] ARRANGEMENT FOR TREATING UPRIGHT SURFACES

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[51] Int. Cl. ....B60s 3/02

[58] Field of Search .....114/222; 15/53; 305/34, 17, 305/35 EB; 180/115

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## [57] ABSTRACT

A vehicle is movable along the upright outer surface of a ship's wall in a horizontal path. A mast on the vehicle extends upwardly along the surface and has an upper end portion, the mast being extensible and retractable. An evacuable container is provided on the upper end portion of the mast displaceable at least with reference to and along the surface and having an open side facing and adapted for fluid-tight contact with a registering portion of the surface. Nozzle means is arranged within the container and operative for dispensing a treating medium through the open side onto the registering portion of the surface.

15 Claims, 5 Drawing Figures

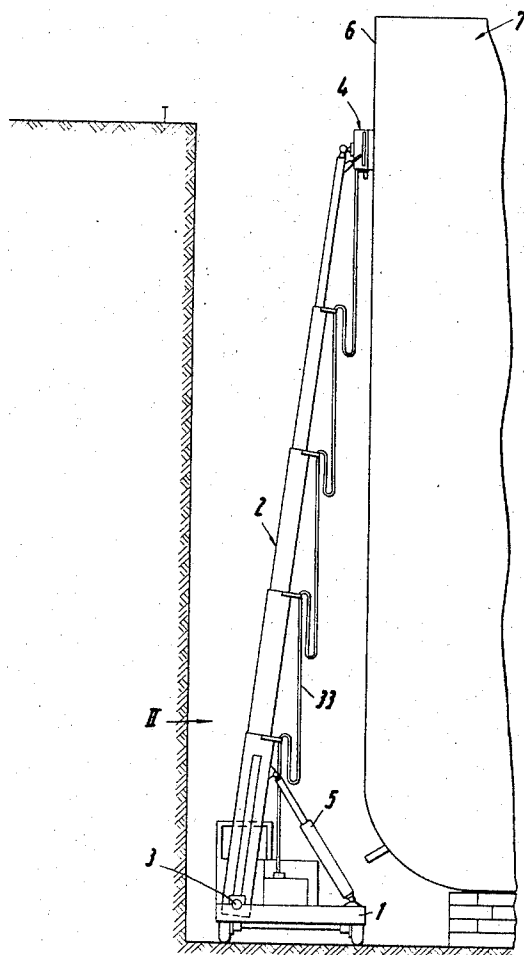
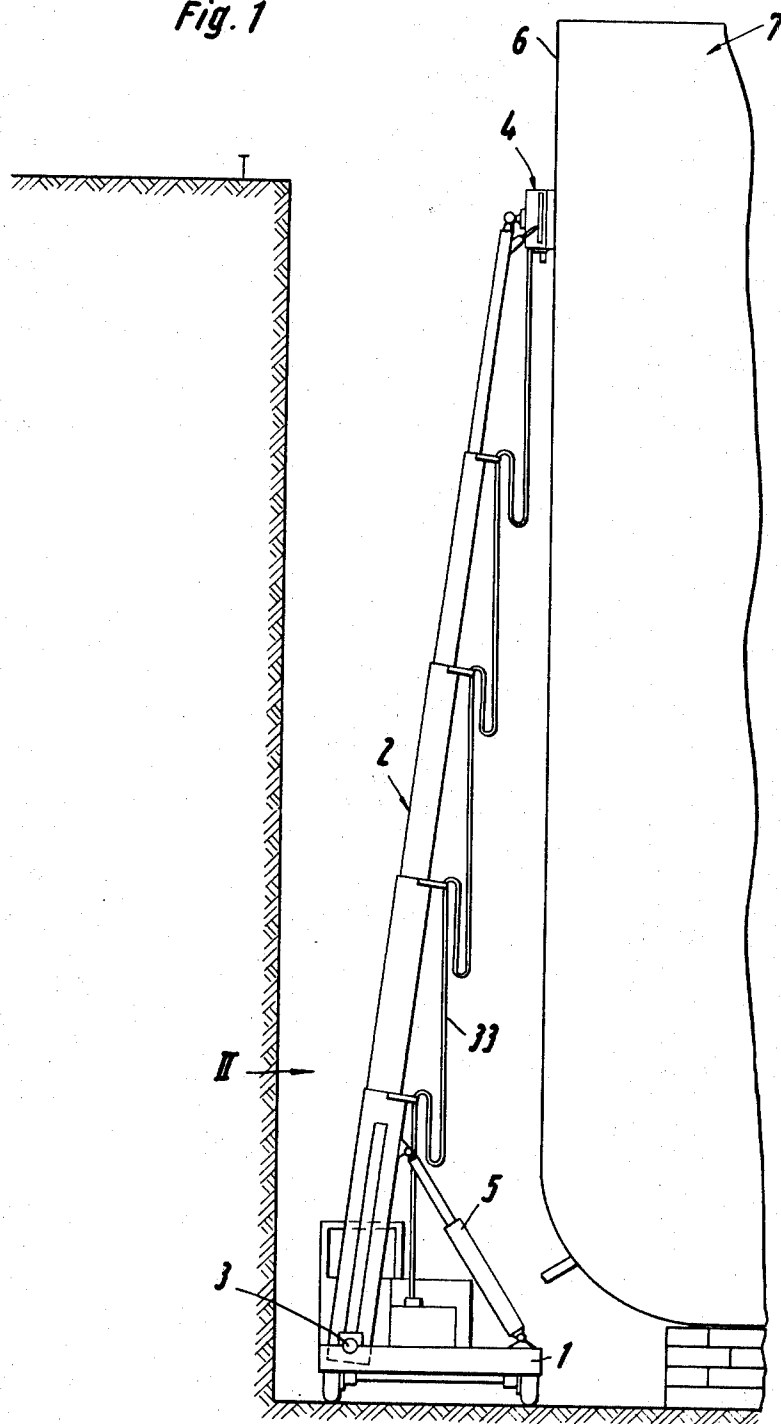
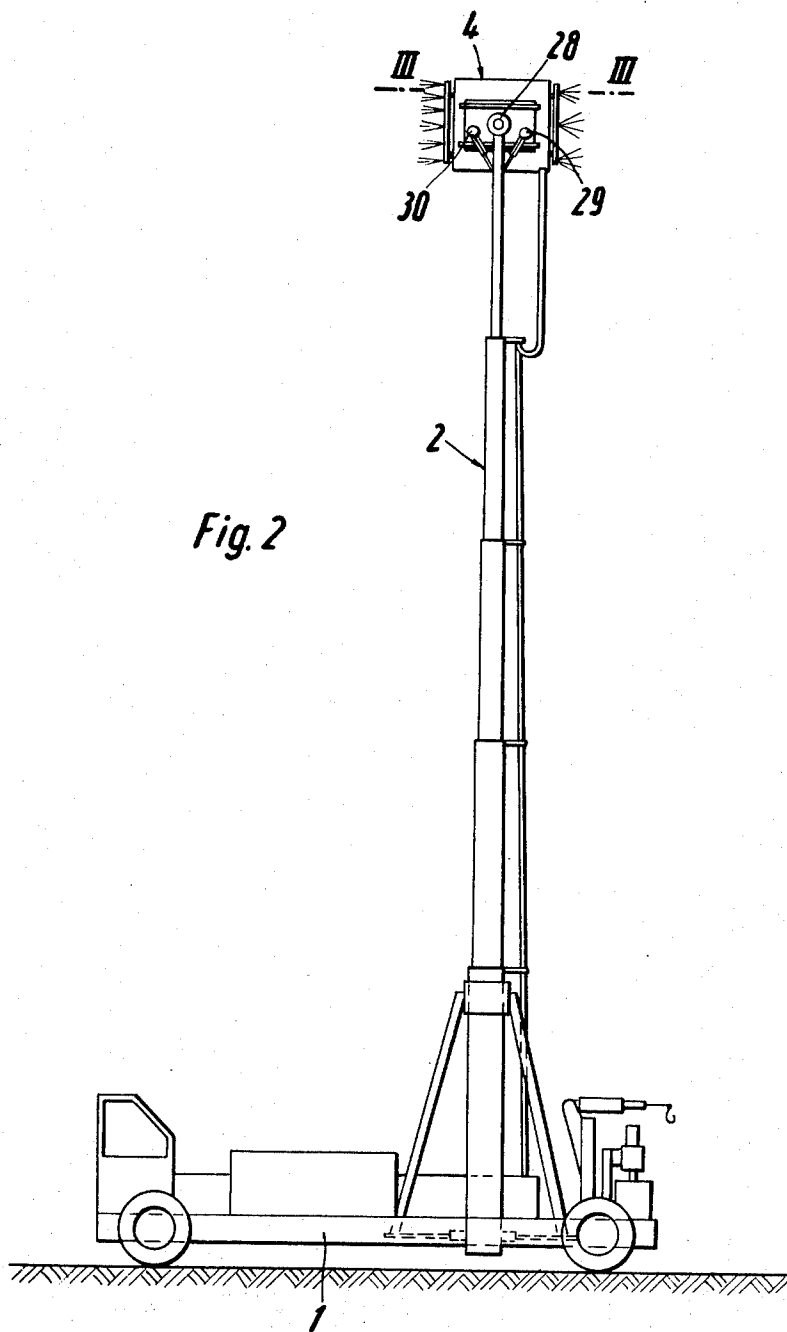


Fig. 1



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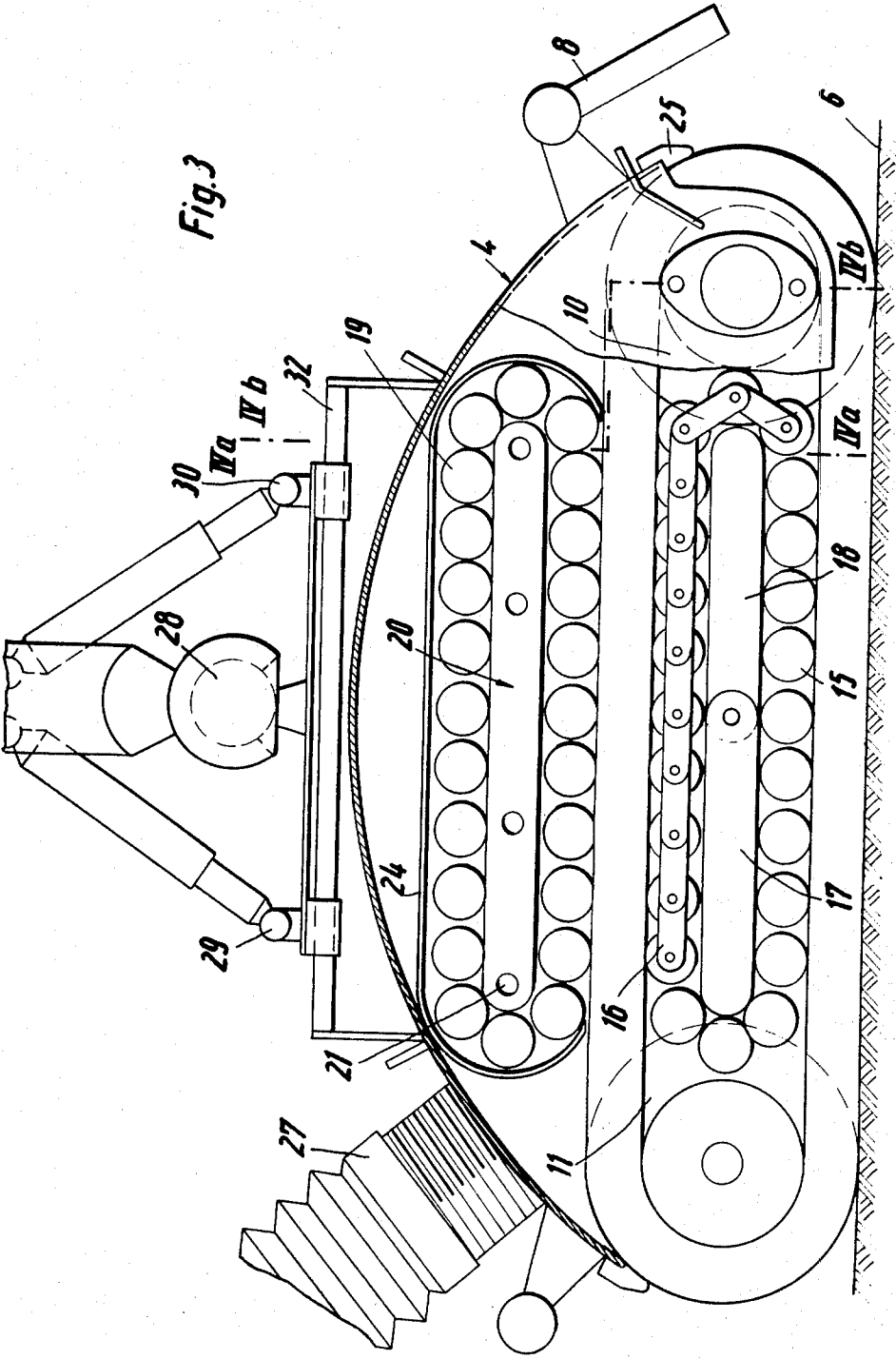
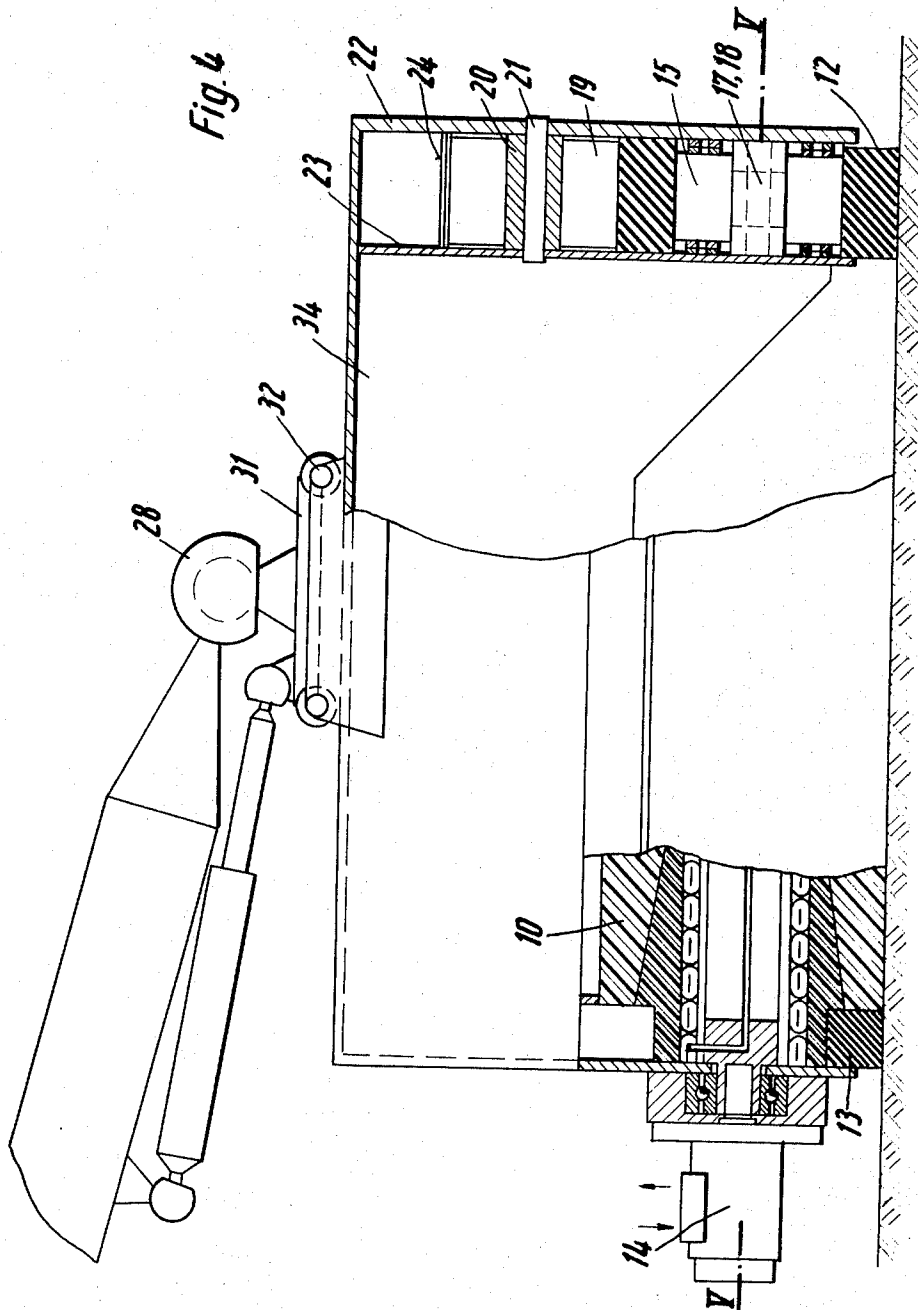


Fig. 3

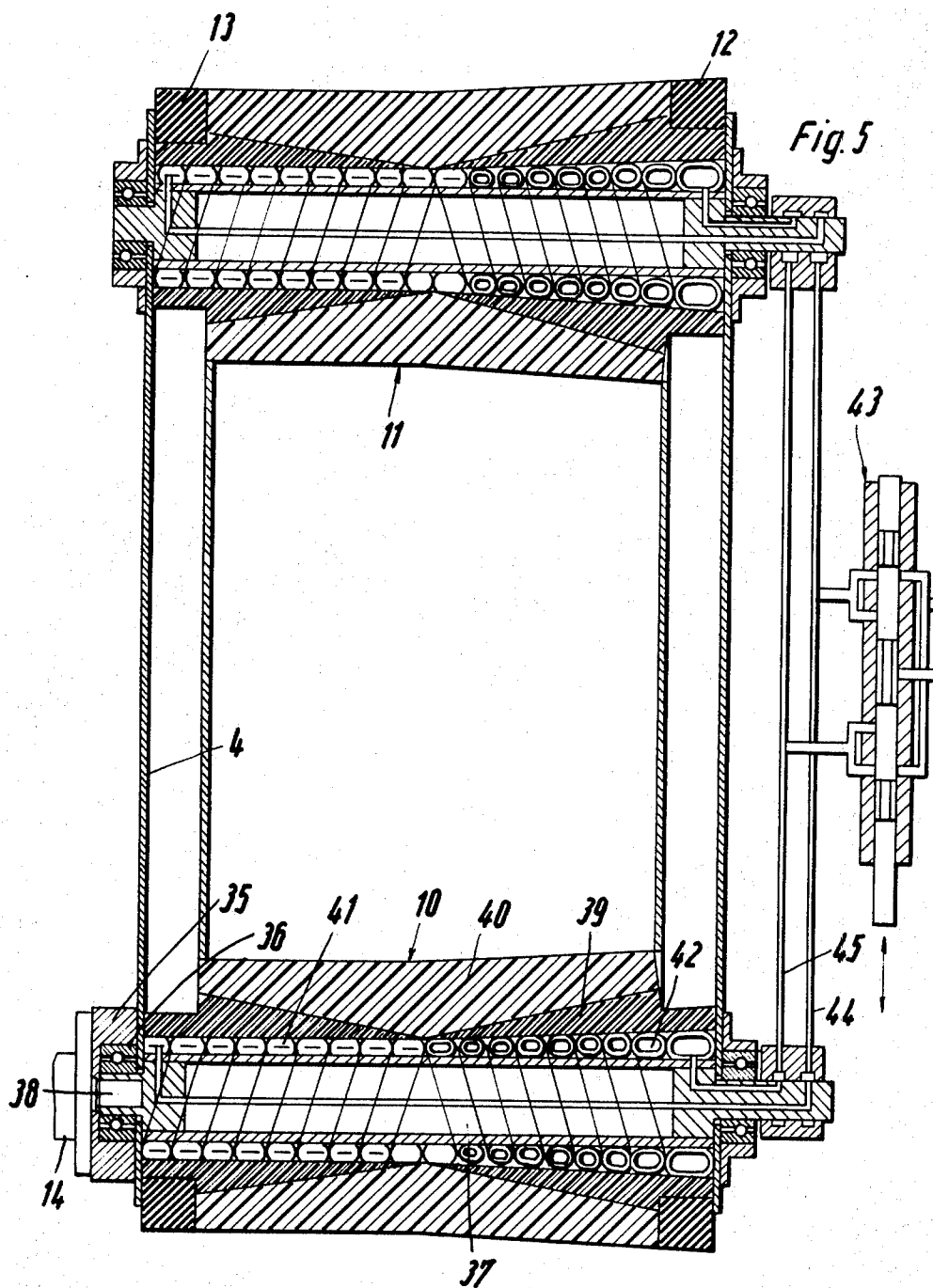
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## ARRANGEMENT FOR TREATING UPRIGHT SURFACES

### BACKGROUND OF THE INVENTION

The present invention relates generally to an arrangement for treating upright surfaces, and more particularly to an arrangement for treating the exterior surfaces of ships' walls and the like.

There is a current and apparently continuing trend to increase further and further the load-carrying capacity of ships, especially of freighters and the like. This is achieved primarily through not exclusively in increasing the draught of the ship, and the greater the draught the higher must necessarily be the ship's wall. Naturally this results in an increase in the problem—both during the construction of such ships and during the regular maintenance thereof—of treating the outer surfaces of the ship's hull. As of this time it becomes frequently necessary to treat outer ships' hull surfaces having a height of 30 meters or more, that is to clean them, paint them or otherwise apply treating medium to them. For instance, they must be provided with corrosion-protecting medium which can guarantee protection against corrosion only if the applied layers of the corrosion-protecting medium reach the necessary minimum thickness at all points of the surface. To assure this vital protection there is an ever-increasing demand for improved arrangements capable of providing such treatments to the outer surfaces of ships' hulls, and of doing so rapidly and economically. Moreover, these arrangements are to be independent of the skills of an operator and of his carefulness—or lack of it.

Arrangements of the general type in question are of course not unknown. In fact, it is known to provide such arrangements wherein a vehicle is provided which travels in a horizontal path along the surface to be treated—and it must be kept in mind that such treatment generally is carried out when the vessel is in drydock where the vehicle can travel along its hull—and carrying an upright mast provided at its upper end with nozzles from which the treating medium is sprayed onto the outer surface of the hull. The mast is extensible and retractable and thus can move not only along the surface as the vehicle carrying it moves in this manner, but can also move upwardly and downwardly over the surface as the mast is extended and retracted. In fact, this prior-art construction has been found to be highly satisfactory in many applications, but it cannot be satisfactorily used when the surface to be treated exceeds a certain height. The reason is that if such height is exceeded, and accordingly the mast must be made correspondingly tall, it is impossible to overcome the oscillations to which the mast is subjected inherently during the operation of the arrangement, and which oscillations are necessarily transmitted to the spray nozzles. Such oscillations, resulting not only from unevennesses in the surface over which the vehicle travels but also by the inherent elasticity of the mast construction itself, cause the spray nozzles to move with differing speeds past the surface to be treated despite the fact that the vehicle travels at a constant speed. The result of this is that the treating medium is not applied uniformly so that the application of a treating medium layer of the required minimum thickness is not guaranteed.

## SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to provide an arrangement of the type under discussion which is not possessed of these disadvantages.

More particularly it is an object of the present invention to provide such an arrangement which overcomes the disadvantages of the prior art in a simple but highly reliable manner and which can be used for the treatment of surfaces of even great height.

Still more particularly it is an object of the present invention to provide such an arrangement which is particularly suitable for so treating the outer surfaces of ships' hulls.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in an arrangement for treating upright surfaces, particularly outer surfaces of ships' hulls, which briefly stated comprises a vehicle movable along a surface to be treated in a horizontal path, and a mast on the vehicle extending upwardly along this surface and having an upper end portion, with the mast being extensible and retractable. An evacuable container means is provided on the upper end portion displaceable at least with reference to and along the surface and having an open side facing and adapted for fluid-tight contact with a registering portion of the surface. Nozzle means is arranged within the container means and operative for dispensing a treating medium through the open side onto the aforementioned portion of the surface.

Advantageously, but not necessarily, the spray nozzles will be carried by the container means itself.

The cross-sectional dimension of the container means may vary in accordance with requirements and may be determined empirically. By way of example it is pointed out that if for instance the cross-sectional configuration of the container means is 1 m<sup>2</sup>, then the force with which the container means will be pressed against the surface of the ships' hull—and assuming that the container means is completely evacuated—would be on the order of 10 tons. This is of course is a multiple of the force actually required to achieve the necessary holding effect of the container means against the surface to prevent uncontrolled oscillations and assure a continuous speed of movement of the container means over the surface. For this reason it will be sufficient to provide only for a partial evacuation of the container means, a step which can be carried out with simple well known instrumentalities and which requires no special complicated equipment.

The container means comprises at least one container which is pivotably mounted at the upper end of the mast and which is movable in parallelism with the surface to be treated relative to the upper end of the mast. A drive motor is provided for the evacuable container and a similar motor or an engine is provided for the vehicle carrying the mast, and according to one embodiment of the invention a synchronous control may be provided between the two prime movers. The container means which is movable with reference to the upper mast end portion provides in this case control impulses for the prime mover controlling the speed of advancement of the vehicle itself so that the vehicle and the evacuated container move in synchronism.

Aside from the fact that with the construction according to the present invention mast oscillations no longer affect the spray pattern of the spray nozzles, there is the further fact that the mast itself no longer has a supporting function with reference to the container means and the spray nozzles during the operation of the arrangement, that is while the container means is evacuated. This makes it possible to provide a considerably simpler mast construction.

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 with regard 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 side view showing the arrangement according to the present invention in one embodiment and in somewhat diagrammatic form;

FIG. 2 is a view of FIG. 1 as seen in the direction of the arrow II in FIG. 1;

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

FIG. 4 shows at the left-hand side a section taken on the line IVa—IVa of FIG. 3 and at the right-hand side a section taken on line IVb—IVb of FIG. 3; and

FIG. 5 is a section taken on line V—V of FIG. 4.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail it will be seen that reference numeral 1 shown in FIG. 1 identifies a vehicle which can travel in a horizontal path along the outer surface 6 of a ship's hull 7 which is accommodated in a drydock. The vehicle 1 carries a mast 2 which is extensible and retractable in upright direction and which is mounted on the vehicle 1 turntable about an axis 3. The upper open end of the mast 2 carries an evacuable container 4. A hydraulic cylinder 5 is provided for displacing the mast 2 about the axis 3 with reference to the vehicle 1.

Provided in the evacuable container 4 are spray nozzles 8 and 9 from which the cleaning, preserving or otherwise treating fluid is sprayed onto the outer surface 6 of the ship's hull. While the vehicle 1 moves in a horizontal path along the ship's hull in one direction, the nozzles 8 and 9 spray within the outline of the evacuable container 4 the treating medium onto the surface 6 in horizontal or vertical strips corresponding to the width of the open side of the container 4.

FIGS. 2-5 show most clearly that the container 4 has in fact an open side facing the surface 6 to be treated. This open side is surrounded by sealing means, which is in form of sealing rollers 10 and 11 arranged at the leading and trailing edges of the container 4, that is those which lead and trail in so far as the direction of advancement of the vehicle 1 is concerned. These rollers 10 and 11 roll on the surface 6 in contact therewith.

The side edges of the open side are bounded and sealed by the strips, belts, tapes or the like identified with reference numerals 12 and 13 and consisting of a suitable sealing material. An oil hydraulic motor 14

drives the sealing roller 10 which in turn drives the belts 12 and 13 which pass through recesses in the sealing rollers. FIGS. 3-5 show clearly that the inner space between the inner and outer runs of the belts 12 and 13, respectively, is filled by articulately connected elements which in the exemplary illustrated embodiment are in form of a guide track 15 the individual rollers of which are connected by tongues 16 to form an endless track. This is illustrated only in part and it will be seen that the roller track is in the illustrated embodiment inwardly supported by two articulately connected plates 17 and 18 which are loosely accommodated in the inner space surrounded by the roller track. It is also possible to provide several plates to increase the possibility of relative movements of the elements.

The endless roller track and the plates constituting a support via which unevennesses of the surface 6 to be treated can be transmitted from the outer run of the belts to the respectively associated inner run which cooperates with a forced guidance arrangement, here shown as an endless roller track 19 whose interior is filled by a rod 20 which is connected via bolts 21 with the outer wall 22 of the container 4, and also with an intermediate wall 23. That run of the endless roller track 19 which faces away from the run of the belt in sealing engagement with the surface, as well as the end portions of the roller track where the two runs merge, are embraced exteriorly by a guide 24 which may for instance consist of metal or a stiff synthetic plastic material or the like. Sealing strips 25 and 26 are provided between the container wall and the respective sealing rollers as well as the belt, in order to provide proper sealing effectiveness.

Reference numeral 27 identifies the nipple through which the container 4 can be evacuated to the desired extent.

Ball bearings 28, 29 and 30 are provided at the upper end portion of the mast 2 and via these a slide 31 is connected with the upper end portion of the mast 2, and is slidably mounted on guide rods 32; it carries the container 4. Because of this the latter can perform a relative movement with reference to the upper end portion of the mast 2 as well as the vehicle 1, a relative movement which is held within limits by the provision of a synchronous control arrangement providing for synchronous operation of the drive motor of the container 4 and the prime mover of the vehicle 1.

Inner walls 34 may be provided for reinforcing and stiffening the container 4 and reference numeral 33 identifies an exemplary hose or conduit which supplies treating medium from the vehicle 1 to the spray nozzles 8 and 9.

FIG. 5 shows particularly how the sealing rollers 10 and 11 are constructed. It will be seen, also, that the oil hydraulic motor 14 for driving the sealing roller 10 is connected to one side wall of the container 4 and that a block 35 is provided between the flange of the motor 4 and the side wall which are connected with one another; with a roller bearing 36 being provided in the block 35 for a cylindrical projection of the roller core 37 into which the drive shaft 38 of the oil hydraulic motor engages. The drive shaft and the projection are connected with one another as is clear from the drawing.

The outer covering of the rollers is here provided in form of a double-conically shaped body of rotation 39 and an outer jacket 40. Two spirally arranged hoses 41 and 42 are provided intermediate the roller core and the elastic portion of the respective roller and serve for curvilinear movement of the container. The hoses of a roller may alternately be filled with oil under pressure and the control 43 associated therewith is so configured and constructed that it will always be the hoses of one side of the two rollers 10 and 11 which are filled with oil under pressure, or which are connected with the outflow conduit. The hoses at the right side in FIG. 1 are filled with oil under pressure and those at the left side are emptied. Conduits 44 and 45 are provided for filling and emptying of the hoses and the degree to which the hoses can be filled can be regulated by regulating the length of time for which oil is admitted into them; by regulating the degree of filling the curvature radius of the curvilinear movement of the container 4 can be controlled.

It is emphasized that such features as the oil hydraulic motor, the synchronous control, the drive motor for the container 4, the prime mover for the vehicle 1, and other such features which have not been disclosed in detail are well known in the art and that because of this, and because they do not in themselves constitute the invention, they are not described in detail. The essence of the invention, which has been fully disclosed, is the fact that by evacuating the container 4 to a desired extent, and by making it adhere in this manner to the surface 6 to be treated, I assure that the container 4 will move along the surface 6 at a constant speed—so that the surface portion registering with its open side will be provided with a layer of treating medium of constant thickness—in that the container 4 is insulated from vibrations which potentially could be transmitted to it via the mast 2 and which cause in the prior art the difficulties which the present invention seeks to and does overcome.

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 arrangement for treating upright surfaces, 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:

1. An arrangement for treating substantially upright surfaces, particularly outer surfaces of ship's hulls, comprising a vehicle movable along and spaced from a surface to be untreated; a mast on said vehicle extending upwardly along said surface and having an upper

end portion, said mast being extensible and retractable; evacuable container means provided on said upper end portion displaceable at least with reference to and along said surface, and having an open side facing a portion of said surface, said container means including sealing means for sealing the juncture of said open side and said surface, including sealing rollers provided at edge portions of said open side which respectively lead and trail relative to the direction of displacement of said container means and extending substantially across the entire width of said edge portions, and belts of sealing material at the remaining edge portions of said open side for sealing the latter; nozzle means arranged on said container means and operative for dispensing a treating medium onto said surface; and evacuating means communicating with the interior of said container means to substantially evacuate the same when said open side abuts against said surface, whereby the pressure difference between the interior and the exterior of said container means causes the same to be forced against said surface.

2. An arrangement as defined in claim 1; and further comprising securing means securing said nozzle means in said container means.

3. An arrangement as defined in claim 1, said container means comprising at least one container.

4. An arrangement as defined in claim 1; and further comprising mounting means mounting said container means on said upper end portion tiltable relative thereto and for displacement relative to said upper end portion and said surface in parallelism with the latter.

5. An arrangement as defined in claim 4, said mounting means comprising ball-joint means connecting said container means with said upper end portion.

6. An arrangement as defined in claim 4, said mounting means comprising guide means mounting said container means for displacement relative to and along said surface, and ball-joint means mounting said guide means on said upper end portion.

7. An arrangement as defined in claim 1; further comprising first drive means for advancing said vehicle in said path, and second drive means for displacing said container means relative to said surface; and synchronizing means cooperating with said first and second drive means for synchronizing the advancement of said vehicle and the displacement of said container means.

8. An arrangement as defined in claim 1, said belts being endless belts each having an inner and an outer run, inner roller support means located between and supporting the inner and outer runs of the respective belts, and outer roller support means located between said container means and an outer side of the respective inner run for supporting the latter.

9. An arrangement as defined in claim 8, said roller support means having a plurality of supporting rollers all having respective parallel axes and said sealing rollers having rolling axes paralleling said axes of said supporting rollers.

10. An arrangement as defined in claim 8, said outer roller support means comprising a plurality of supporting rollers, and roller guide means guiding said supporting rollers in an endless path.

11. An arrangement as defined in claim 10, said roller guide means comprising a guide element exter-

nally embracing one of said runs and the junctures of the same with the other of said runs, and a rod member fixed to said container means and extending longitudinally of said runs and having opposite longitudinally extending faces on which said supporting rollers move.

12. An arrangement as defined in claim 1, said remaining edge portions including an upper and a lower edge portion; and sealing strips extending between said lower edge portion and the respective sealing rollers.

13. An arrangement as defined in claim 1, wherein said nozzle means are arranged for dispensing treating fluids onto said surface in the region but outside of said portion of said surface.

14. An arrangement as defined in claim 13, wherein said nozzle means includes a first nozzle arranged to dispense treating fluid forwardly of said leading edge portion and a second nozzle arranged to dispense treating fluid rearwardly of said trailing edge portion.

15. An arrangement for treating upright surfaces, particularly outer surfaces of ship's hulls comprising a vehicle movable along a surface to be treated, in a horizontal path; a mast on said vehicle extending up-

wardly along said surface and having an upper end portion, said mast being extensible and retractible; evacuable container means provided on said upper end portion displaceable at least with reference to and along said surface, and having an open side facing and adapted for contact with a registering portion of said surface, and evacuating means for evacuating said container means, said container means comprising sealing means for sealing the juncture of said open side and said surface, including sealing rollers provided at edge portions of said open side which respectively lead and trail relative to the direction of displacement of said container means, and belts of sealing material at the remaining edge portions of said open side, said sealing rollers each having a core portion, an elastic sleeve portion surrounding said core portion with clearance, and hollow bodies accommodated between said portions and adapted to be filled with a medium enabling their deformation under pressure; and nozzle means arranged within said container means and operative for dispensing a treating medium through said open side onto said portion of said surface.

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