March 11, 1969 R. L. FRANDSEN 3,431,573

PRESSURIZED-WATER-OPERATED CLEANING APPARATUS

Filed June 27. 1966

FIG. 1

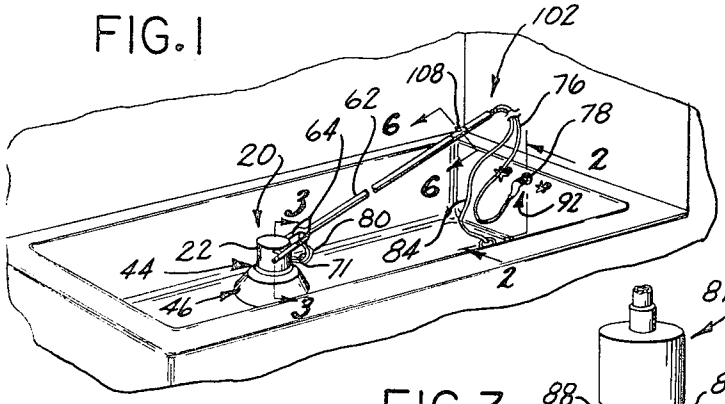


FIG. 2

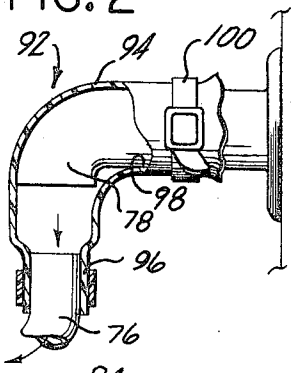


FIG. 3

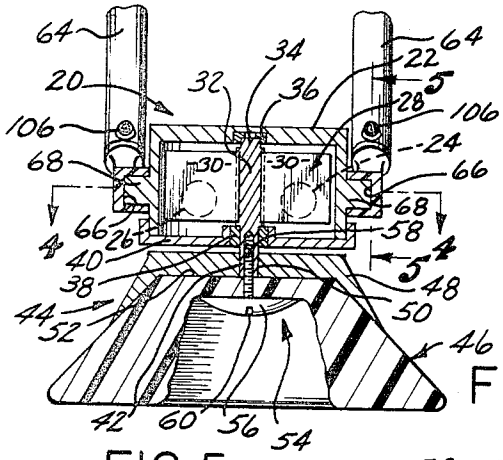


FIG. 2A

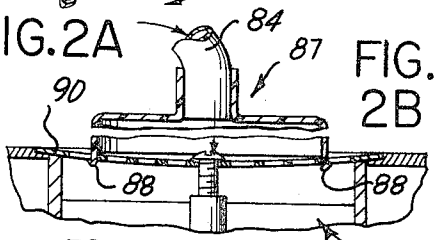


FIG. 2B

FIG. 4

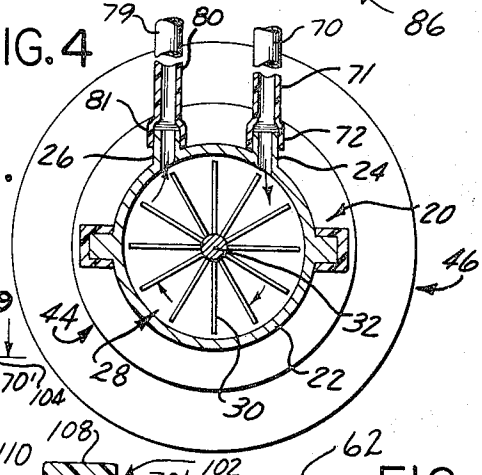
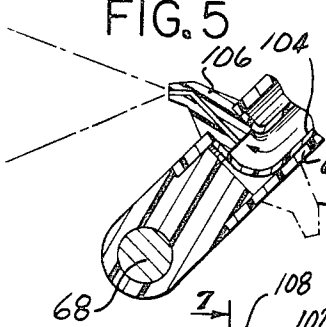


FIG. 8



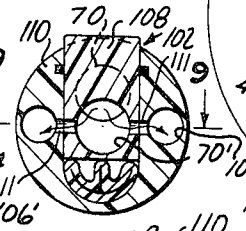


FIG. 5

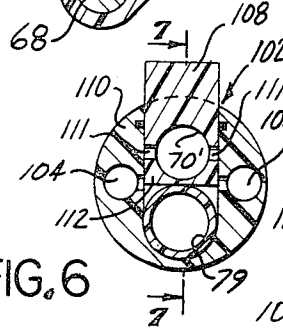


FIG. 6

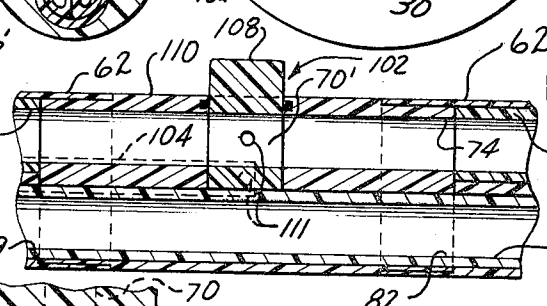


FIG. 7

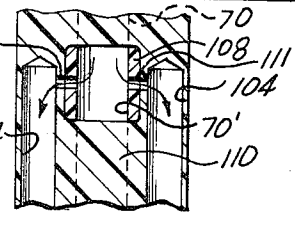


FIG. 9

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PRESSURIZED-WATER-OPERATED CLEANING APPARATUS

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U.S. Cl. 15—98 9 Claims
Int. Cl. A47l *11/282*; G03d *1/08*

ABSTRACT OF THE DISCLOSURE

A water pressure operated cleaning apparatus including a hydraulic motor driving a rotor which is removably provided with a cleaning applicator means, such as a sponge, for cleaning bathtubs, etc. The motor and cleaning means are carried by a housing at the forward end of a longitudinal handle means in a movable manner which allows the sponge to clean all surfaces of a bathtub, etc. Pressurized water flow is controlled by a reciprocating valve which cuts off the outflow conduit simultaneously as it diverts inflow from motor to spray nozzle.

Generally speaking, the present invention relates to cleaning apparatus, and, more particularly, to cleaning apparatus adapted to be operated by pressurized water in a manner such as to power-drive a cleaning applicator means, such as a sponge, brush, or the like, which may be applied to a surface to be cleaned, such as any of the various surfaces of a bathtub and/or adjacent wall surfaces and/or effective shower stall surfaces for suitably cleaning same. Of course, it should be understood that the inside surfaces of an effective shower stall may comprise the inside wall surfaces, floor surfaces, ceiling surface, or the like, of a built-in separate shower stall or may comprise merely wall portions adjacent to and extending upwardly from a conventional bathtub, since many showers comprise a shower head positioned over such a conventional bathtub and the effective shower stall comprises such wall portions and, in some cases, a surrounding shower curtain enclosing any sides of the bathtub which do not lie against an upwardly extending wall surface.

It should also be noted that the novel apparatus of the present invention, in one preferred exemplary form wherein it is intended primarily for such bathtub and/or shower stall cleaning purposes, is usually adapted to have the cleaning applicator means made of a material such as to be of a compressible water-penetrable, water-absorptive and water-holding type such as a piece of sponge or foam material of an elastomeric type, such as sponge rubber, foam plastic, or the like, of the multiple interconnecting-cell type adapted to have a suitable cleaning agent, such as soap, detergent, scouring cleanser, or any other suitable cleaning agent applied thereto in addition to water so that when water pressure power-drives said applicator means while it is in contact with a bathtub or shower stall surface, a very effective cleaning action will occur, and this will not require a conventional electric motor for driving same, as is customarily employed in all household appliances of the power-driven type, since electric power is generally conveniently available.

The above-mentioned feature is particularly important because of the fact that the handle of the cleaning apparatus, and adjacent wall and floor portions, may become wet with water during a bathtub-cleaning and/or a shower-stall-cleaning operation, and this would provide a very hazardous and dangerous condition if the apparatus were power-driven by an electric motor, since any electrical insulation breakdown would, in all probability, lead to the likelihood of substantial electric current flow through

the body of a person holding the handle, which might severely injure or even kill said person.

It is quite obvious that, since only pressurized water, which usually is supplied from a bathtub tap, or the like, is employed for operating the novel cleaning apparatus of the present invention, there is no hazard or danger of the above-mentioned type.

Additionally, the novel pressurized-water-operated motor means of the present invention is considerably simpler, less expensive, and less likely to require maintenance and/or repair than would be the case with an electric motor.

The novel pressurized-water-operated motor means of the present invention is effectively supplied with inlet, or inflow, pressurized water for operating same, supplied through inflow means adapted to be flexibly connected to a source of pressurized water, such as a bathtub water tap, or the like; and outflow water from the outflow side of said pressurized-water-operated motor means is adapted to be exhausted through flexible means directly to the drain of a bathtub or shower. This provides a very convenient arrangement for operating the motor and also provides a plentiful supply of exhaust or drain water if such is needed for application to, or rinsing of, the cleaning applicator sponge means, or the like.

Additionally, it should be noted that the novel cleaning apparatus of the present invention is provided with rinsing spray nozzle means adapted to be controllably connected to the pressurized water by a manually operable valve means carried by a longitudinal handle means of the apparatus at a convenient location for operation thereof, thus making it possible to power-drive the cleaning applicator sponge means when desired and, whenever it is desired to provide a rinsing spray, to manually operate said valve means, and to direct said rinsing spray upon a region which has been previously scoured by the cleaning applicator means, and normally some cleaning agent such as soap, or the like, carried thereby.

It should also be noted that, in a preferred form of the invention, the pressurized-water-operated motor means and the cleaning applicator sponge means, or the like, adapted to be power-driven thereby, are effectively mounted relative to a longitudinal handle means of the apparatus at a forward end of said handle means in a rotatively attached manner for effective rotation relative thereto around a horizontal axis transverse to the longitudinal direction of said handle means and also in a direction substantially perpendicular to an output shaft of the pressurized-water-operated motor means, thus allowing the cleaning applicator sponge means to be moved along and in cleaning or scouring contact with inside surfaces of a bathtub and/or shower stall at orientations ranging through substantially 180 degrees of angular rotative displacement of said cleaning applicator sponge means around said horizontal axis of rotation thereof.

With the above points in mind, it is an object of the present invention to provide a novel pressurized water-operated cleaning apparatus of the character referred to herein, generically and/or specifically, and which may include any or all of the features mentioned herein, either individually or in combination, and which is of relatively simple, inexpensive, foolproof, maintenance-free, and non-dangerous or non-hazardous construction adapted for ready mass manufacture of either plastic or metal, or various combinations thereof, at a relatively low cost per unit whereby to be conducive to widespread manufacture, distribution, and use of the invention in a form intended primarily for use as a bathtub and/or effective shower stall cleaning apparatus, although it may be modified for window cleaning purposes, wall-scrubbing and/or cleaning purposes, floor and/or ceiling scrubbing and/or

cleaning purposes, or for cleaning virtually any desired surface.

Further objects are implicit in the detailed description which follows hereinafter (which is to be considered as exemplary of, but not specifically limiting the present invention), and said objects will be apparent to persons skilled in the art after a careful study of the detailed description which follows.

For the purpose of clarifying the nature of the present invention, one exemplary embodiment of the invention (including a slight modification of the spray nozzle portion thereof) is illustrated in the hereinbelow-described figures of the accompanying single drawing sheet and is described in detail hereinafter.

FIGURE 1 is a greatly-reduced-size, fragmentary, partly-broken-away perspective view illustrating one exemplary embodiment of the invention in an operative, mounted, use relationship with respect to a bathtub and with the inlet flexible duct means shown coupled to the bathtub tap for supplying pressurized water and with the flexible outlet duct means coupled to the bathtub drain for exhausting water.

FIG. 2 is an enlarged fragmentary, partly-broken-away view, partly in elevation and partly in vertical section, taken substantially along a plane such as that indicated by the arrows **2**—**2** of FIG. 1 and clearly illustrates one exemplary form of universal connection means carried at the remote end of the flexible inlet or inflow duct means and shown in water-tight connection with respect to a pressurized water-supplying tap comprising the conventional bathtub water tap.

FIG. 2A is a fragmentary perspective view drawn to a smaller scale than FIG. 2 and shows a connection member carried by the remote end of the flexible outlet or outflow duct means, which is adapted for temporary connection with respect to a bathtub outlet drain in a manner such as is more clearly shown in FIG. 2B.

FIG. 2B is an enlarged fragmentary cross-sectional view of one exemplary typical type of bathtub drain having a perforated screen lying across the top thereof and having the novel connection member of FIG. 2A (which is shown fragmentarily) connected thereto whereby to effectively place the outlet or outflow flexible duct means in communication with the bathtub drain.

FIG. 3 is an enlarged fragmentary view, partly in elevation and partly in vertical section, taken substantially along a central plane substantially as indicated by the arrows **3**—**3** of FIG. 1.

FIG. 4 is a view partly comprising a top plan view and partly comprising a cross-sectional view taken substantially along the plane indicated by the arrows **4**—**4** of FIG. 3.

FIG. 5 is an enlarged fragmentary view taken substantially along the plane indicated by the arrows **5**—**5** of FIG. 3 and with all portions of the apparatus lying behind the plane of the section being eliminated from this view for reasons of drawing simplicity and clarity. This view also illustrates in phantom a supplementary or alternate position of the spray nozzle means which will differently direct a spray of rinse water, and it should be understood that this view is intended to provide a disclosure of either the solid line spray nozzle arrangement of FIG. 5, the phantom line arrangement of the spray nozzle of FIG. 5, or a composite thereof including both types of spray nozzle means.

FIG. 6 is an enlarged cross-sectional view taken substantially along the plane indicated by the arrows **6**—**6** of FIG. 1 and illustrates one exemplary form of controllably operable multiple valve means for shifting a controllable amount of pressurized inflow water from the pressurized-water-operated motor means to the rinse water spray nozzle means, and vice versa. This view shows said multiple valve means in its normal unoperated relationship where the pressurized water is connected in both inflow and outflow directions relative to the pressurized-water-operated motor means of the apparatus wherein the rinsing spray nozzle means are not connected to the pressurized inflow water.

FIG. 7 is a fragmentary vertical sectional view taken substantially along the plane indicated by the arrows **7**—**7** of FIG. 6.

FIG. 8 is a view similar to FIG. 6, but shows the multiple valve means in manually operated relationship such as to constrict the outflow conduit means from the motor means while simultaneously diverting the major portion of pressurized inflow water from the motor means to the rinse water spray nozzle, side-positioned, longitudinal apertures for supplying pressurized rinse water to the spray nozzles.

FIG. 9 is a fragmentary sectional view taken substantially on the plane indicated by the arrows **9**—**9** of FIG. 8.

Generally speaking, the novel cleaning apparatus of the present invention, in the exemplary form thereof illustrated, comprises a pressurized-water-operater motor means, the exterior of which is generally designated by the reference numeral **20** and which comprises a housing **22** provided with a presurized-water inlet **24** and a water outlet **26** and which has a rotor means, generally designated at **28**, comprising a plurality of substantially radially arranged rotary blade means **30** (which, in some cases, are canted or slightly inclined) which are centrally connected to an upstanding centrally-positioned shaft **32**, which has an upper end **34** rotatively mounted in a bearing aperture **36** and which has a lower end which extends through a bearing collar or sleeve **38** into a position projecting downwardly below the lower end cap **40** of the housing **22** and which may be said to effectively comprise a rotary output shaft **42** of the motor **20**.

The rotary output shaft **42** is provided with an applicator attachment means, one form of which is generally designated by the reference numeral **44**, which is cooperable for effectively attaching a cleaning applicator means, one form of which is generally designated at **46**, for rotation with the rotary output shaft **42** of the motor means **20** when rotated by supplying pressurized water to the water inlet **24** whereby to power-rotate the rotor means **28** thereof.

In the exemplary form of the invention illustrated, the above-mentioned applicator attachment means **44** takes the form of an outwardly or downwardly effectively concave holder cup means **48** having a central aperture **50** and being press-fit or otherwise firmly mounted on the lower extended end of the rotary output shaft **42** and adapted to receive a central base portion **52** of the applicator means **46**, which is shown as comprising a sponge, or the like, and adapted to be pulled into the centrally compressed and collapsed and firmly mounted position best shown in FIG. 3 by a centrally positioned fastening screw means, generally indicated at **54** and having an enlarged head **56** abutting the lower surface of the central portion **52** of the sponge applicator means **46** and also having an exteriorly-threaded, upwardly-directed screw shaft **58** extending upwardly axially into the interiorly threaded lower end of the rotary output shaft **42** and tightened upwardly into the relationship best shown in FIG. 3 by means of the screw adjustment slot **60**. However, various other types of attachment means may be employed in lieu of the specific structural arrangement best illustrated in FIG. 3 and just described in some detail.

The housing **22** of the pressurized-water-operated motor means **20** is effectively provided with longitudinal handle means **62** having a bifurcated yoke means designated at **64** at the forward end thereof and rotatively attached to corresponding side parts of the housing means **22** for effective rotation relative thereto around a horizontal axis extending through the housing means **22** in a direction substantially perpendicular to the rotary output motor shaft **42**. The location of the horizontal axis just referred to can best be understood from a careful examination of FIG. 3, where it will be noted that the phantom

or broken line indicating the plane of the sectional view comprising FIG. 4 lies substantially on said horizontal axis of rotation. The rotative mounting of the yoke means **64** with respect to the housing means **22** is provided by having inwardly directed recessed end portions **66** carried at the lower end of the yoke means **64** and rotatively receiving a pair of correspondingly outwardly directed projection members **68** integral with side wall portions of the housing **22**, thus effectivey providing a rotative mounting of said horizontally aligned projections **68** of the housing **22** in the corresponding aligned bearing recesses **66** carried at the lower end of the yoke means **64**.

The longitudinal handle means **62** is provided with pressurized water inlet or inflow conduit means **70** having a forward end portion **71**, in the form of a flexible over-length tubing loop, effectively connected, as shown at **72**, to the previously-mentioned pressurized-water inlet **24** of the motor housing **22** and having an effective rear end **74** effectively connected to and provided with flexible inflow or inlet duct means **76** adapted to be connected to a source of water under pressure such as the conventional bathtub water tap **78**. Said longitudinal handle means **62** is also provided with an outflow or outlet conduit means **79** having a forward end portion **80**, in the form of a flexible over-length tubing loop, effectively connected to the previously-mentioned outlet **26** of the motor housing means **22**, as shown at **81**, and having an effective rear end **82** provided with an outflow or outlet flexible duct means **84**, which is adapted to be placed in communication with a drain means, such as a conventional bathtub drain means of the type generally designated at **86** in FIG. 2B, for example. Actually, in the exemplary form of the invention illustrated, the rear end **82** just referred to as being provided with said outflow or outlet flexible duct means **84** is merely a figure of speech, or an effective rear end, since the outflow or outlet conduit means **79** is actually shown as being continuous with the outflow or outlet flexible duct means **84**. However, they might comprise two different members connected together at the rear location **82** of the handle means **62** in certain modifications of the invention, and the arrangement illustrated in FIG. 7 is the functional equivalent thereof.

In the exemplary form of the invention illustrated, the effective connection of the flexible outflow or outlet duct means **84** with respect to the bathtub drain **86** is accomplished by providing the remote end of said flexible outflow or outlet duct **84** with a connection member, one exemplary form of which is generally designated at **87** in FIGS. 2A and 2B, and which includes a pair of opposed hook means **88** adapted for temporary connection with respect to a screen **90** overlying the bathtub outlet drain **86** whereby to provide a positive connection of said connection member **87** with respect to the bathtub outlet drain **86** for as long as desired. It should be noted that the opposed hook means **88** are of a resiliently deflectable nature, thus making it possible to force them into resiliently engaged relationship with the screen **90** and to forcibly resiliently disengage them therefrom, when desired.

It should also be noted that connection member **87** may be slipped over the type of vertically movable drain stopper which is employed in certain bathtub drains, and, in general, is adaptable for connection with respect to a variety of different types of bathtub drains. However, the invention is not limited to the specific type of connection member illustrated at **87**, and various other suitable connection means may be employed in lieu thereof within the broad scope of the present invention.

The previously-mentioned connection of the rear or remote end of the inflow or inlet flexible duct means **76** with respect to the bathtub tap **78** is preferably provided through the use of a substantially universal type of connection means, one exemplary form of which is illustrated at **92**, as best shown in FIG. 2, and which effectively comprises a flexible water-tight, oversize sleeve **94** having one end **96** in effectively sealed communication with the previously-mentioned flexible inflow or inlet duct means **76** and which has an enlarged hole **98** at the other end adapted to be slipped over the water tap **78** and which is provided with constriction fastening means **100** (which, in the example illustrated, is shown as a belt or strap but is not specifically so limited in all forms of the invention), which is adapted to be constricted and fastened around the water tap **78** in a water-tight manner such as is most clearly illustrated in FIG. 2. It should be understood that the specific type of universal connection means **92** illustrated in FIG. 2 provides an advantageous arrangement for this purpose, but that the invention is not specifically limited thereto in all forms thereof and that various other functional and/or structural equivalents may be employed in lieu thereof.

The longitudinal handle means is provided with a digitally or manually operable multiple valve means, such as is best shown in FIGS. 6–9, which is generally designated by the reference numeral **102**, and which is adapted, when in one position, to provide unimpeded flow of pressurized water from the water tap **78** to the water inlet **24** to the motor **20** and corresponding outlet flow from the motor outlet **26** to the bathtub drain **86** and to thus provide full-scale operation of the motor means **20** and the scrubbing or scouring applicator sponge **46**. This position of the multiple valve means **102** is illustrated in FIGS. 1, 6, and 7. Said multiple valve means **102** is adapted to be manually or digitally operated from the normal position just described, and illustrated in FIGS. 1, 6, and 7, into a second position such as is illustrated in FIGS. 8 and 9, which results in effectively reducing or limiting the flow of pressurized water through the water motor means **20** and in diverting the pressurized water into side bore holes (or tubes, if desired) **104** of the handle means **62**, which extend downwardly and into the bifurcated yoke members **64**, as is best shown with respect to one of same in FIG. 5, for directly supplying pressurized rinse water to the two spray nozzle means **106** whereby to cause pressurized rinse water to be sprayed therefrom onto desired portions of a surface, usually a surface which has been previously scoured by the scouring sponge **46**, which normally has soap, detergent, scouring cleanser, or the like, applied thereto. In other words, the rinse water sprayed from the nozzles **106** is primarily adapted to rinse off the remnants and debris (comprising soap, detergent, scouring cleanser, and any loosened dirt) resulting from a scouring and cleaning operation performed by the power-rotated sponge **46** previously applied to a surface which is to be cleaned.

If desired, the spray nozzle means **106** may be rearwardly directed, such as the one shown in phantom at **106'** in FIG. 5, or each yoke member **64** may have both a forwardly and rearwardly directed spray nozzle **106** and **106'**. Additionally, if desired, it should be noted that said spray nozzles may be positioned in directions other than those specifically illustrated and just described or may be positionally adjustably mounted for this purpose, and all such arrangements are intended to be included and comprehended within the broad scope of the present invention.

The previously-mentioned controllably operable multiple valve means **102** actually comprises a digitally operable pushbutton or reciprocatable member **108** mounted in a valve sleeve portion **110** carried in the handle **62** and having an upper bore hole or aperture **70'** aligned with the previously-mentioned inflow conduit means **70** when in the normal position shown in FIGS. 6 and 7, but controllably downwardly digitally deflectable substantially out of alignment therewith, as is best shown in FIGS. 8 and 9, so that side openings **111** will communicate the pressurized water with the previously-mentioned side bore holes (or tubes, if desired) **104**, which feed water to the spray nozzles **106**. At the same time that this occurs, the bottom surface **112** of the slider or pushbutton element **108** compresses, constricts, and effectively collapses the previously-mentioned flexible outflow conduit means **79** so as to con-

strict or virtually eliminate the outflow of water therethrough

Of course, it should be understood that the controllably operable multiple valve means **102** illustrated in FIGS. 6–9 inclusive is one exemplary type of valve and the invention should not be construed as being specifically limited to the particular multiple valve arrangement illustrated at **102** and described in detail hereinbefore. Actually, various functionally equivalent valve structures may be employed in lieu thereof for the purposes of the present invention, and all such modifications are intended to be included and comprehended within the broad scope of the present invention.

It should be understood that the figures and the specific description thereof set forth in this application are for the purpose of illustrating the present invention and are not to be construed as limiting the present invention to the precise and detailed specific structure shown in the figures and specifically described hereinbefore. Rather, the real invention is intended to include substantially equivalent constructions embodying the basic teachings and inventive concept of the present invention.

I claim:

1. A pressurized-water-operated cleaning apparatus comprising: pressurized-water-operated motor means having a housing, a pressurized water inlet and a water outlet connected to said housing, and a rotor means rotatively mounted in said housing in a flow path of said pressurized water effectively between said pressurized water inlet and said water outlet in a pressure-dropping manner whereby to effectively convert a drop in pressure of pressurized water flowing from said inlet to said outlet into torque effectively applied to said rotor means and positively causing rotation thereof, said motor having a rotary output shaft extending axially outwardly into a position exterior of said housing and there being provided with applicator attachment means cooperable for attaching a cleaning applicator means for rotation with said rotary output shaft of said motor means; said housing being provided with longitudinal handle means having means at a forward end thereof rotatively attached to said housing for effective rotation relative thereto around a horizontal rotation axis extending through said housing in a direction substantially perpendicular to said rotary output motor shaft, said longiudtinal handle means being provided with pressurized water inflow conduit means having a forward end effectively connected to said pressurized water inlet of said motor housing and having a rear end effectively provided with inflow flexible duct means adapted to be connected to a source of water under pressure, and said handle means having an outflow conduit means having a forward end connected to said outlet of said motor housing and having a rear end effectively provided with outflow flexible duct means adapted to be placed in communication with a drain means, said longitudinal handle means being provided with manually operable multiple valve means movable, when operated into one extreme position, to effectively reduce normally unrestricted outflow of water through said outflow conduit means on the downstream outflow side of said motor means and to simultaneously place said inflow conduit means on the inflow side of said motor means in direct motor-bypassing communication with forwardly directed spray nozzle means provided on and carried adjacent to the forward end of said handle means and directed into a region other than that adapted to be occupied by a rotating cleaning applicator means during a scrubbing operation for temporarily spraying rinse water thereinto.

2. Apparatus as defined in claim **1**, wherein said flexible outflow duct means is provided at a remote end thereof with a connection member cooperable for temporary connection with respect to an outlet drain for directly communicating outlet water therewith after having passed through and imparted torque and rotation to said motor means and the rotary output shaft thereof.

3. Apparatus as defined in claim **1**, wherein said flexible inflow duct means is provided with universal connection means at a remote end thereof cooperable for water-tight connection with respect to a pressurized-water-supplying tap of virtually any conventional size or shape.

4. Apparatus as defined in claim **3**, wherein said connection means comprises a flexible, water-tight, oversize sleeve having one end in effective sealed communication with said pressurized water inflow flexible duct means and having an enlarged hole at the other end adapted to be slipped over a water tap and provided with constriction fastening means adapted to be constricted and fastened therearound in a water-tight manner with respect thereto.

5. Apparatus as defined in claim **2**, wherein said flexible inflow duct means is provided with universal connection means at a remote end thereof cooperable for water-tight connection with respect to a pressurized-water-supplying tap of virtually any conventional size or shape.

6. Apparatus as defined in claim **1**, wherein forward portions of said inflow and outflow conduit means extend from said handle means to said motor housing and are flexible and of sufficient length to allow said motor housing, said applicator attachment means, and an applicator means adapted to be attached thereby to said motor output shaft to freely rotate around said rotation axis extending through substantially 180 degrees whereby to make it possible to apply a cleaning applicator means to surfaces which vary in angular orientation and disposition through substantially 180 degrees and to do so with respect to surfaces ranging from near to far and at a variety of levels relative to a user of the apparatus holding the longitudinal handle means.

7. Apparatus as defined in claim **1**, wherein said applicator attachment means comprises an outwardly effectively concave holder cup means adapted to receive a central base portion of a cleaning applicator means therein, and a centrally positioned headed fastening screw means adapted to be threaded into the outer end of said rotary output shaft and to collapse, compress, and constrict a central portion of a cleaning applicator means toward a central base part of said concave holder cup means.

8. Apparatus as defined in claim **1**, including in attached relationship to said applicator attachment means, a cleaning applicator means effectively comprising a compressible water-penetrable, water-absorptive, and water-holding member.

9. Apparatus as defined in claim **1**, including a cleaning applicator means effectively comprising a compressible water-penetrable, water-absorptive, and water-holding sponge member of a multiple interconnecting-cell type, said applicator attachment means comprising an outwardly effectively concave holder cup means receiving a central base portion of said sponge member therein, and a centrally positioned headed fastening screw means threaded into the outer end of said rotary output shaft and collapsing, compressing, and constricting a central portion of said sponge member toward a central base part of said concave holder cup means.

References Cited

UNITED STATES PATENTS

847,060	3/1907	Gamache	15—29
1,617,838	2/1927	Fennell	15—230.18
1,696,835	12/1928	Burnett	15—29
2,019,705	11/1935	Hubert	15—29 X
2,285,865	6/1942	Lowe et al.	15—24
2,599,911	6/1952	Haines	15—29
3,121,897	2/1964	Lambrich.	

(Other references on following page)

9

UNITED STATES PATENTS

2,471,623	5/1949	Hubbell	137—625.18
2,841,170	7/1958	Kalsey	137—625.18 X
3,136,336	6/1964	Priesmeyer	137—625.48 X

FOREIGN PATENTS

192,081	9/1957	Austria.
5,951	4/1915	Great Britain.

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LEON G. MACHLIN, *Assistant Examiner.*

15—29; 137—625.48; 251—7

U.S. Cl. X.R.