United States Patent [19]

Moore

[11] **3,851,342**

[45] **Dec. 3, 1974**

[54] **HYDRAULIC PULSE, SCALE-BLOCKED-PIPE CLEANER**

[76] Inventor: **Charles A. Moore,** 112 W. 193rd St., Mokena, Ill. 60448

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[21] Appl. No.: **361,574**

[52] **U.S. Cl.** ..... **4/256,** 134/169 C, 134/196

[51] **Int. Cl.** **E03d 11/00,** B08b 9/02

[58] **Field of Search** ..... 4/255, 256, 257; 134/22 C, 134/24, 166 C, 167 C, 168 C, 169 C, 195, 134/196, 197

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Primary Examiner—Robert L. Bleutge
Attorney, Agent, or Firm—Darbo, Robertson & Vandenburgh

[57] **ABSTRACT**

A cylindrical vessel has a multiple part bellows positioned axially therein. An axially positioned rod extends into the vessel and through the bellows from one end and is attached to the other end of the bellows. The end of the rod exterior of the vessel is connected to a crank driven by a variable speed motor. Piping connects the interior of the vessel with a hot water pipe to be cleaned of scale. By expanding and contracting the bellows, impulses are applied to the water which act to remove the scale from the pipe.

19 Claims, 4 Drawing Figures

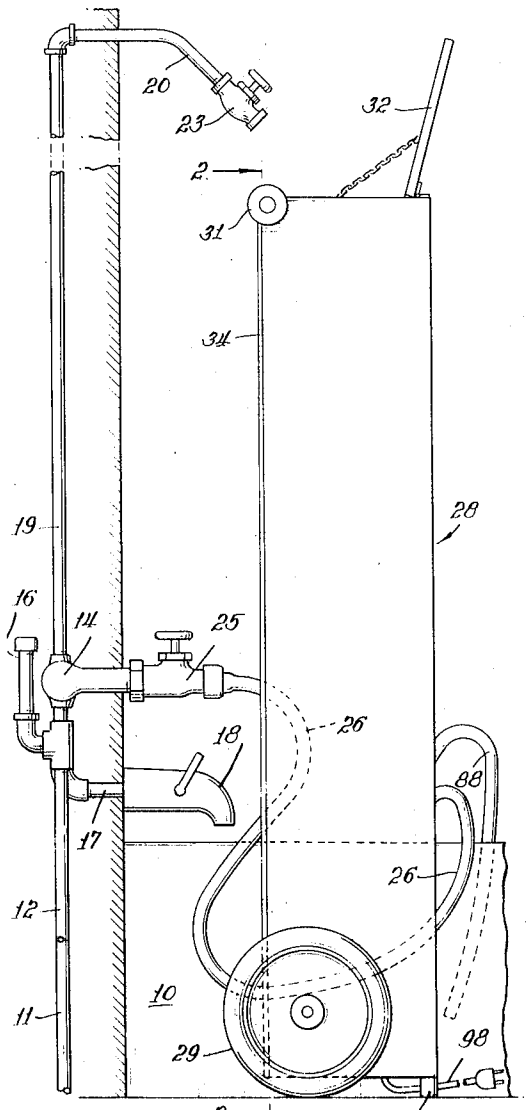


Fig. 1

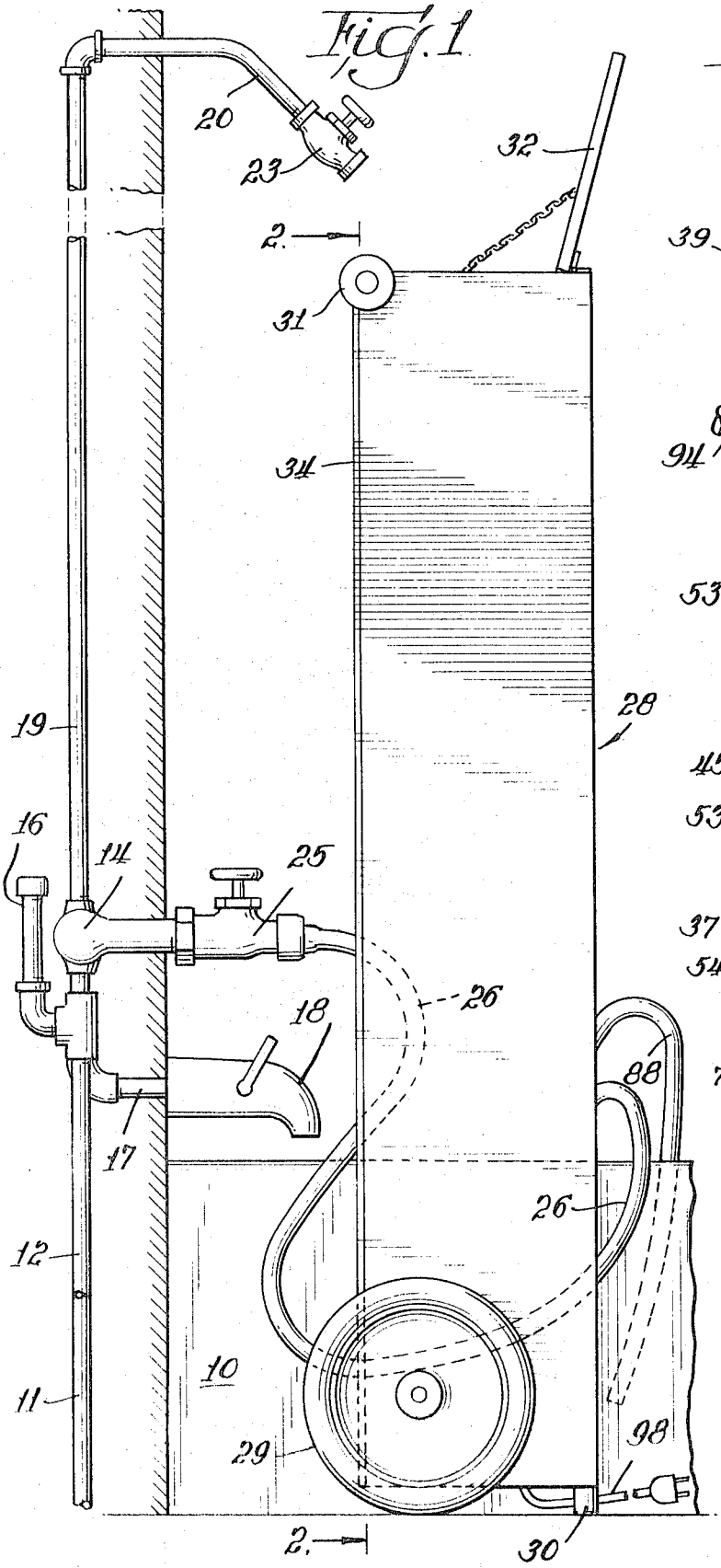

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Fig. 4

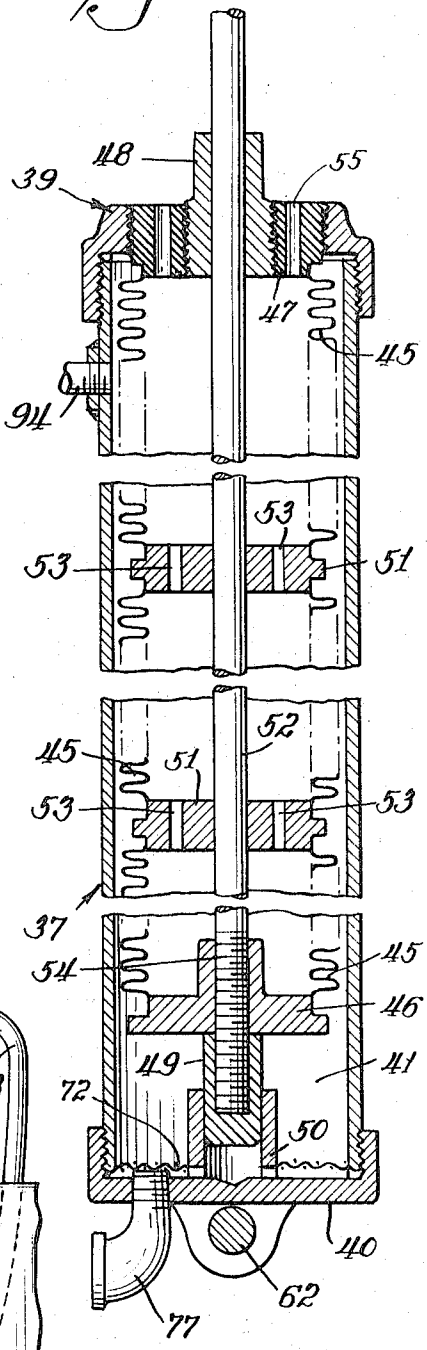

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Fig. 2.

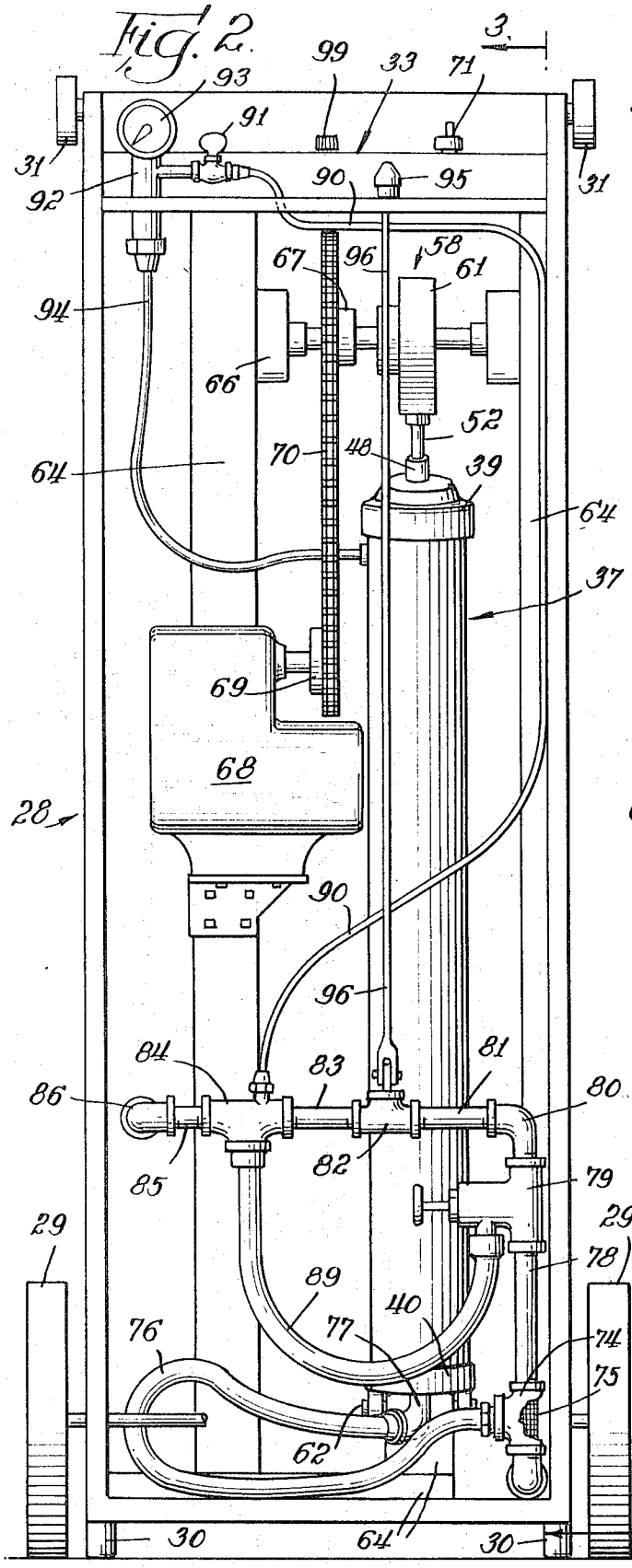
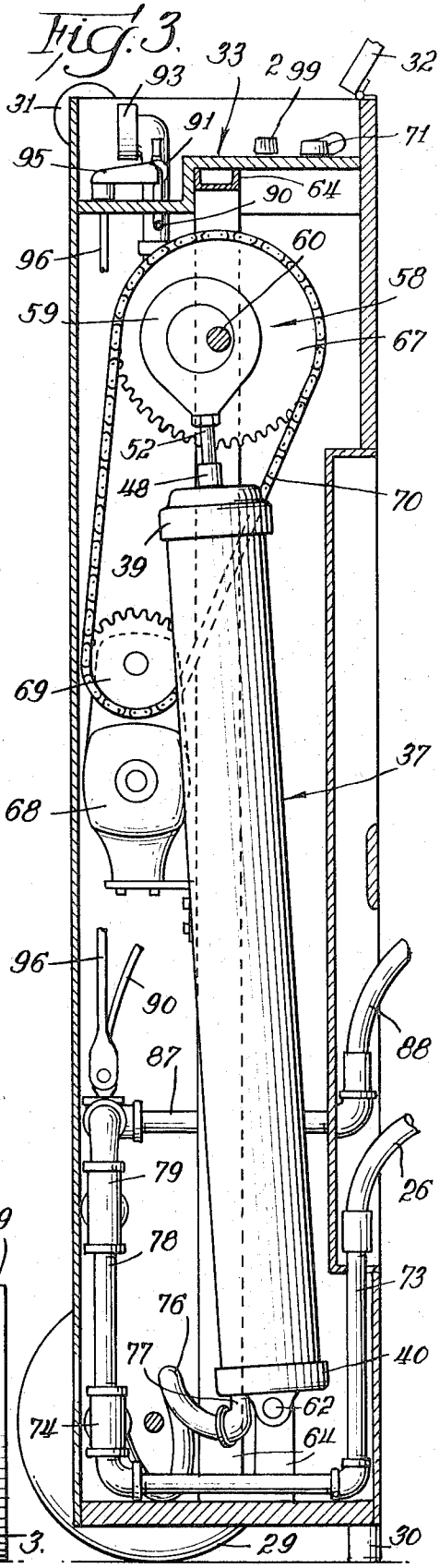

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Fig. 3.


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HYDRAULIC PULSE, SCALE-BLOCKED-PIPE CLEANER

BACKGROUND AND SUMMARY OF THE INVENTION

It is known to apply periodic impulses to a badly scaled hot water pipe or the like to remove the scale. The existing devices for performing this process are not particularly convenient, nor do they have a satisfactory operating life. An impulse generator of the piston type does not have a satisfactory operating life due to the abrasiveness of the scale, etc.

The principal object of the present invention is to provide an apparatus for performing this pipe cleaning method which is convenient to use and which will have a satisfactory operating life under the conditions involved.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of an embodiment of the invention being connected to a hot water pipe serving a bathtub;

FIG. 2 is a view taken at line 2—2 of FIG. 1 with the side cover removed;

FIG. 3 is a section taken at line 3—3 of FIG. 2; and

FIG. 4 is an enlarged longitudinal section through the impulse generator.

DESCRIPTION OF SPECIFIC EMBODIMENT

The following disclosure is offered for public dissemination in return for the grant of a patent. Although it is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements.

For purposes of illustration the embodiment is depicted in connection with a hot water line serving a bathtub **10.** The service piping of such a tub comprises a hot water line **12** and a cold water line **11.** Each of these connects to a respective end of a manifold **14** having valves at the end to control the water flow from the service pipes to the center of the manifold. Usually the water lines will be provided with air chamber **16.** At the center of the manifold there is a pipe **17** leading to a tank filling head **18.** There is also likely to be a pipe **19** which leads to a shower extension pipe **20,** in which event the filling head **18** has a diverter arm as illustrated.

Assuming that a hot water pipe **12** has become clogged with scale to an extent that only a trickle of water can flow therethrough, the cleaning operation as performed by me is to connect up to the clogged pipe. This can be performed by removing the hot water valve parts from manifold **14** and replacing them with an adapter and valve **25.** Alternatively spout **18** is removed, and a valve (like **25**) connected to the pipe **18** which had served the spout. The shower head is removed from pipe **20** and replaced with a valve **23.** The hot water valve on manifold **14** is opened. In either event, the hose **26** connects from the hot water connection, e.g. valve **25,** to an impulse generator by which periodic positive and negative impulses are applied to the water column extending through hot water pipe **12.**

Valve **23** is employed to remove air from the pipe **19.** It is desired to have as few air pockets as possible communicating with the water column being impulsed since these impair the ability to effectively impulse that water column. However I have found that one or two air columns **16** are not sufficient to materially impair the process. Initially the impulses applied to the water column are relatively slow, e.g., 30–60 cycles per minute. These commence breaking the scale loose and thus the passage through the badly scaled hot water pipe commences to open up. As this happens, the frequency of the impulses should be increased. It is desirable to have the impulses applied at the natural resonant frequency of the system being impulsed. These impulses, plus the abrasive action of the loosened scale in the pipe serve to dislodge further scale. The process is continued until the pipe is clean. While this takes time, it is a much less expensive process than attempting to remove and replace the piping. Also it is a much easier and more satisfactory process than attempting to clean the pipes with acid.

As thus far described the process is prior art. The following description relates to the novel apparatus I have devised for carrying out this process.

The illustrated embodiment comprises a housing, generally **28.** At the bottom end this housing is supported by a pair of wheels **29** and a foot **30.** At the upper end are a pair of small wheels **31** to facilitate moving the housing when it is necessary to have it positioned horizontally. At the top is a hinged cover **32** to provide access to a control panel **33.** One side **34** is removably affixed (as by means of screws) so that access may be had to the interior of the housing should servicing be necessary.

Within the housing is an impulse generator generally **37.** This impulse generator comprises a vessel formed by cylindrical tube **38** and top and bottom caps **39** and **40** threaded thereon using tapered pipe threads. Thus the vessel defines a chamber **41.** Within the chamber is a bellows device (serving as an expansile means) comprising a plurality of individual stainless steel bellows **45.** The bottom end of the lower bellows **45** is secured to a bottom cap member **46.** The upper end of the upper bellows **45** is secured to a top cap member **47.** This top cap member **47** is threaded into cap **39.** In turn it holds a bushing **48** to provide a bearing for shaft **52.** The bottom cap member **46** is threaded onto rod **52** as seen at **54.** This connection is a water tight seal. Also threaded onto the rod is a guide nose **49** which is journaled in a sleeve **50** forming a part of the lower cap **40** so as to axially align the bottom end of the bellows while permitting it to reciprocate.

Intermediate each of the individual bellows **45** is an annular connector member **51** which is secured to each of the adjacent bellows. These intermediate connector members are journaled on a rod **52** and have openings **53** therethrough so that fluid (air) can pass from the (otherwise closed) interior of each individual bellows to the (otherwise closed) interior of the next adjacent individual bellows. The upper cap member **47** has openings **55** from the interior of the bellows to the exterior of the vessel to permit fluid (air) to move freely in and out of the interior of the bellows. This also provides relief should a bellows fail and the interior thereof fill with water.

A crank mechanism generally **58** is secured to the upper end of rod **52** to reciprocate the rod. This mech-

anism comprises a circular disc **59** eccentrically mounted on shaft **60** and attached thereto. A hoop **61** encircles disc **59** and has the disc journaled therein. The rod **52** is threaded into the hoop. Thus as shaft **60** rotates, the disc serves as a cam to move the hoop (and thus the rod) up and down. This is not solely a vertical motion; therefore the lower cap **40** of the vessel is journaled on a pin **62.** Pin **62** is mounted on a metal frame **64** forming a part of the housing.

Shaft **60** is journaled in bearings **66** secured to frame **64.** A sprocket **67** is also attached to the shaft. A variable speed motor **68** is mounted on frame **64.** The output shaft of the motor carries a sprocket **69.** Sprockets **67** and **69** are connected by a chain **70.** The speed of the output shaft of the motor can be varied by means of a control **71** mounted on control panel **33.**

Conduit means are employed to connect the impulse generator **37** to the hot water pipe to be cleaned and to a drain. This conduit means includes a pipe **73** which connects to hose **26.** At the end of this pipe **73** (with several intermediate elbows) is a tee **74.** Extending from one side of the tee is a hose **76** which in turn connects to an elbow **77** on the impulse generator **37.** Within elbow **74** is a screen **75** which permits free flow vertically through the elbow but which screens the water flowing to hose **76.** Within chamber **41,** above elbow **77,** is a second screen **72.** From the other side of the tee a pipe **78** connects to a pressure relief valve **79.** The relief valve is set so that it does not open during normal operation. From the other side of the pressure relief valve (the two sides being in direct communication) there is an elbow **80** and a pipe **81** leading to a drain valve **82.** At the downstream side of the drain valve is a pipe **83,** a tee **84,** a pipe **85,** an elbow **86,** a pipe **87** and a drain hose **88.** From the relief outlet of the relief valve **79** a conduit **89** connects to tee **84.** A tube **90** extends from tee **84** to an air bleeding valve **91.** This valve has a handle accessible above the panel **33.** The air bleeding valve connects to a body **92** on which there is a pressure gauge **93.** The body **92** also has a tube **94** extending from the body to the top portion of the chamber **41** of the impulse generator **37.**

There is an operating handle **95** for drain valve **82.** This handle is connected to the valve by a rod **96.** An electrical cord **98** is provided to plug into a convenient electrical outlet to supply the electricity for motor **68.** In the electrical circuit leading to motor **68** is a switch **99** by which the motor may be turned on and off. The electrical circuit is of a grounded type so that the motor **68,** etc., is grounded.

As previously described herein, the impulse generator is connected to the hot water line to be cleaned by means of hose **26** and such other suitable plumbing fittings as may be required for the particular connection. The hose **88** is directed to a suitable drain (in the illustrated embodiment it is merely dropped into the bathtub). Electrical cord **98** is plugged into an electrical outlet. The hot water supply for the pipe to be cleaned is turned on. The static water pressure should preferably be at least 10 lbs. per square inch and a more effective cleaning job is attained if the water pressure is greater than that. At 40 lbs./sq. in. (which oftentimes is the city supplied pressure) the cleaning is good and at 80 lbs./sq. in. it is better yet. The valve **23** in the shower head (if used) is opened briefly to discharge any air. Valve **82** is opened sufficiently long to remove any trapped air and then closed. Valve **91** is opened to remove any trapped air and then closed.

The motor **68** is then started whereupon the bellows apparatus in the impulse generator supplies periodic positive and negative impulses to the water in chamber **41.** That is, as the rod **52** descends (FIG. **4**) the bellows expands and a positive (increasing pressure) impulse is applied to the water in chamber **41** and as the rod **52** goes upwardly the bellows contracts and a negative (decreasing pressure) impulse is applied to the water in the chamber. These impulses are transmitted through the water in the conduit means to the hot water pipe to be cleaned. As the cleaning process proceeds the speed of the motor is periodically adjusted to obtain (as nearly as possible) resonant impulsing of the water column. By observing pressure gauge **93** and adjusting the speed so that the pressure variations are the greatest, the speed equating to resonance is obtained. It may be desirable to occasionally, particularly during the early stages, open air valve **91** to make sure that there is no trapped air in the system. When the hot water pipe has been adequately cleaned, valve **82** is opened to permit the water from the hot water pipe to flow out the drain hose **88.** The scale that was loosened during the cleaning process will be flushed out through hose **88** along with the water being discharged. Pressure relief valve **79** is employed to guard against damage in the event that loose scale in the pipe results in blockage.

I claim:

1. In an apparatus for cleaning scale from the inside of a water pipe having water therein, said apparatus comprising an impulse generator for producing periodic positive and negative water pulses, means for connecting the impulse generator to the pipe for free communication between the impulse generator and the water in said pipe so that the water in the pipe is pulsed positively and negatively whereby the pipe is cleaned by said pulses in conjunction with the abrasive action of the loosened scale in said pipe, the improvement wherein said generator comprises:

a closed vessel defining a chamber in communication with said pipe;

expansile means within said chamber for changing the volume of water within the chamber as said means expands and contracts, said expansile means defining an enclosed interior space having fluid therein, the exterior of the expansile means being in contact with the water in said chamber, means communicating with the interior space of the expansile means and the exterior of said chamber for permitting the fluid to flow in and out of said expansile means as the expansile means expands and contracts; and

power means connected to said expansile means to periodically expand and contract said expansile means.

2. In an apparatus as set forth in claim **1,** including control means connected to said power means for adjusting the rate at which said expansile means expands and contracts.

3. In an apparatus as set forth in claim **2,** wherein said chamber has an uppermost part, and including an air bleeding device connected to said vessel and communicating with said uppermost part for removing air accumulations from said part.

4. In an apparatus as set forth in claim **3,** including conduit means connected to said vessel and having a

portion extending from said vessel and adapted to be connected to said pipe for supplying said water communication therebetween, a drain connection, a drain valve, said conduit means extending from said portion to said valve and then from the valve to said drain connection, a pressure relief valve in said conduit means upstream of said drain valve and having a discharge connection, and a liquid conduit extending from said discharge connection to said conduit means downstream of said drain valve.

5. In an apparatus as set forth in claim **4**, including a pressure gauge connected in communication with the water in said apparatus to indicate the pulses in the water, said air bleeding device being connected to discharge into said conduit means downstream of said drain valve, said conduit means all being at a lower elevation than said uppermost part.

6. In an apparatus as set forth in claim **5**, including a housing, said vessel, said power means, and all of said conduit means except for said drain and pipe connections being within said housing, said control means and said gauge being exposed at the top of said housing, including operating means connected to said drain valve and having a handle exposed at the top of the housing, said air bleeding device including a valve having a handle exposed at the top of the housing, said housing having wheels on which it may be moved about.

7. In an apparatus as set forth in claim **6**, wherein said expansile means comprises a bellows device having two ends, one end bearing against a part of the vessel, said power means being connected to the other end to move said other end toward and away from said one end.

8. In an apparatus as set forth in claim **7**, wherein said power means includes a rod extending through the side of said vessel, said one end and the interior of said bellows device and being connected to the other end of the bellows device, and crank means connected to said rod at the end thereof externally of said vessel for reciprocating said rod.

9. In an apparatus as set forth in claim **1**, wherein said expansile means comprises a bellows device.

10. In an apparatus as set forth in claim **9**, wherein said bellows device has two ends, one end bearing against a part of the vessel, said power means being connected to the other end to move said other end toward and away from said one end.

11. In an apparatus as set forth in claim **10**, wherein said power means includes a rod extending through the side of said vessel, said one end and the interior space of said bellows device and being connected to the other end of the bellows device, and crank means connected to said rod at the end thereof externally of said vessel for reciprocating said rod.

12. In an apparatus as set forth in claim **11**, wherein said vessel is cylindrical about an axis, said rod being axially positioned, said bellows device comprising

a plurality of individual bellows and a plurality of annular connector members alternating with the individual bellows, said connector members being journaled on said rod, and an annular cap member at said other end and secured to said rod,

means interconnecting said cap member and the adjacent end of said vessel and guiding said cap for movement along said axis.

13. In an apparatus as set forth in claim **12**, wherein said chamber has an uppermost part, and including an air bleeding device connected to said vessel and communicating with said uppermost part for removing air accumulations therefrom.

14. In an apparatus as set forth in claim **12**, including conduit means connected to said vessel and having a portion extending from said vessel and adapted to be connected to said pipe for supplying said water communication therebetween, a drain connection, a drain valve, said conduit means extending from said portion to said valve and then from the valve to said drain connection, a pressure relief valve in said conduit means upstream of said drain valve and having a discharge connection, and a liquid conduit extending from said discharge connection to said conduit means downstream of said drain valve.

15. In an apparatus as set forth in claim **11**, wherein said one end of the bellows device is unitary with the adjacent end of the vessel, and said means for permitting fluid to flow in and out of said bellows device comprises an air passageway extending through said unitary end of the bellows and vessel.

16. In an apparatus as set forth in claim **9**, wherein said bellows device comprises a plurality of individual bellows and a plurality of annular connector members, with a connector member being positioned between two bellows, said bellows being formed of stainless steel.

17. In an apparatus as set forth in claim **1**, including conduit means connected to said vessel and having a portion extending from said vessel and adapted to be connected to said pipe for supplying said water communication therebetween, a drain connection, a drain valve, said conduit means extending from said portion to said valve and then from the valve to said drain connection, a pressure relief valve in said conduit means upstream of said drain valve and having a discharge connection, and a liquid conduit extending from said discharge connection to said conduit means downstream of said drain valve.

18. In an apparatus as set forth in claim **17**, including a pressure gauge connected in communication with the water in said apparatus to indicate the pulses in the water, and an air bleeding device connected to said vessel and to said conduit means downstream of said drain valve for bleeding air from said vessel to said drain connection, said conduit means all being at a lower elevation than said uppermost part.

19. In an apparatus as set forth in claim **18**, including a housing, said vessel, said power means, and all of said conduit means except for said drain and pipe connections being within said housing, said control means and said gauge being exposed at the top of said housing, including operating means connected to said drain valve and having a handle exposed at the top of the housing, said air bleeding device including a valve having a handle exposed at the top of the housing, said housing having wheels on which it may be moved about.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,851,342 Dated December 3, 1974

Inventor(s) Charles A. Moore

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Inventor's address should read --11206 West 193rd Street
Mokena, Illinois 60448--

Signed and sealed this 11th day of February 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
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