(54) Title: WELL CLEANING APPARATUS AND METHOD

(57) Abstract: A pressurized cannister or sealed vessel is filled with a disinfectant agent, for example chlorine. A discharge jet is either attached to the vessel or to a hose attached to the vessel, and the discharge jet delivers the disinfectant agent evenly throughout the entire body of water within the well casing. In the case of dug wells or shallow wells, the entire vessel is lowered down into the well, the vessel being connected to a pressurized water supply via a hose. With drilled wells or deep wells, the disinfectant agent is delivered by means of a discharge jet at the end of a hose connected to the vessel. In this way, it is ensured that the disinfecting agent comes in contact with the entire contents of the well and guarantees that the disinfectant will be drawn into the water intake of the well and into the water supply pipes.
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WELL CLEANING APPARATUS AND METHOD

TECHNICAL FIELD

The invention relates to a method and apparatus for cleaning dug or drilled wells using a disinfectant, and more specifically treating water wells by the spraying of the disinfectant.

BACKGROUND ART

In the past, different approaches have been tried to cleaning wells. Treating contamination caused by human activity is often done by so called superchlorination or shock treatment, to eliminate bacterial contamination. Shock treatment of a well generally comprises the following steps:

1) Add a pre-determined amount of unscented bleach (depending upon the size of the well) to the bottom of the well followed by agitation of the water. Flush down water along the inside wall of the well to mix the chlorine and the water in the well.

2) Start well pump and bleed air from pressure tank. Open taps and allow water to run until a smell of chlorine is detected, then turn off taps. If a strong smell is not detected, add more bleach to the well.

3) Allow water to sit in well for 12 to 24 hours.

4) Start pump and run water through outside hose away from grass etc. until the strong smell of chlorine disappears. Make sure the water does not enter any watercourse. Open indoor taps until the system is completely flushed.

An apparent drawback with this method is that by simply pouring the disinfecting agent into the well, there is no guarantee that it will reach all portions of the well and especially the bottom of the well. It is also very difficult to agitate a body of water such as is found in a well (10 m deep or more in dug wells and 80 m deep or more in drilled wells). The success of the superchlorination method relies upon achieving sufficient contact time with the microorganisms to kill them. The method described above cannot guarantee this necessary contact time in all portions of the well water.
Different methods have been tried to treat wells other than with a chlorine solution as described above.

US 3,482,636 (Crowe) shows a method of injecting an aqueous solution of a hypohalite, for example sodium hypochlorite, and an inhibitor, for example sodium hydroxide and/or sodium silicate, into a well for removal of organic substances, for example a polymer used to treat the well at an earlier time. This method relates especially to oil wells. No specific detail is given as to how the injection takes place.

US 3,547,194 (Morine) shows a method of cleaning and treating wells, in which the screened bottom end of the well is flushed with water from a pipe in both horizontal and vertical directions. The well is treated with a mixture of hydrochloric acid and hydroxyacetic acid, which is left for a certain time after which the well content is pumped out. The treatment solution is introduced into the well and a pipe is lowered into the well to assist in agitating the water. Discs on the pipe direct the flow also in a horizontal direction.

US 3,729,054 (Yokoyama) shows a method of cleaning a well by inserting a pipe and introducing an aqueous solution of a washing agent and high pressure air. The agitation caused by the air helps remove any scales from the well. The solution/air mixture is released at the bottom of the pipe through a vaned turbine wheel head.

US 4,441,557 (Zublin) shows a jet carrier having a plurality of jet nozzles spaced along its length. The jet carrier is lowered into a well and a pressurized fluid is let into the jet carrier, causing a fluid stream to flow from each jet nozzle. The jet carrier is rotated and moved in a vertical direction at a high speed, making the fluid streams from the jet nozzles clean the well liner surface.

US 6,065,541 (Allen) shows a well cleaning device for cleaning a well bore, the device having a cylindrical body with side perforations. The device attaches to a drill string and
permits the flow of a cleaning fluid to exit from inside the hollow drill string/cleaning
device through the side perforations to clean the well bore.

**DISCLOSURE OF INVENTION**

The prior described treatment methods either do not lend themselves to chlorination of a well, or are too complicated and/or use relatively expensive equipment. A need was identified for an easy to use and inexpensive method for thorough superchlorination of a well, ensuring that the entire body of water is treated.

It is an object of the invention to provide an improved well cleaning apparatus and method, which overcomes all or most of the apparent drawbacks associated with the cited prior art.

A pressurized cannister or sealed vessel is filled with a disinfectant agent, for example chlorine. A discharge jet is either attached to the vessel or to a hose attached to the vessel, and the discharge jet delivers the disinfectant agent evenly throughout the entire body of water within the well casing. In the case of dug wells or shallow wells, the entire vessel is lowered down into the well, the vessel being connected to a pressurized water supply via a hose. With drilled wells or deep wells, the disinfectant agent is delivered by means of a discharge jet at the end of a hose connected to the vessel. In this way, it is ensured that the disinfecting agent comes in contact with the entire contents of the well and guarantees that the disinfectant will be drawn into the water intake of the well and into the water supply pipes where bacteriological contaminants can be harbored as well. Either embodiment of the invention will disperse the disinfecting agent evenly throughout the well, especially below the suction line where the water is drawn into a house, for instance, via a water supply system. The water will furthermore be agitated by the action of the nozzle, to ensure sufficient contact time between the disinfectant and the contaminants in the well to kill substantially all the contaminants. The water with the disinfecting agent is also drawn up the well intake, through the water pump and further into the water supply lines to disinfect the entire water supply system (well, pump...
and water lines). The well water so treated is left to "stand" over night, after which the well water/disinfectant is flushed out of the well.

In the invention, a first embodiment of a well cleaning apparatus is described which has a sealed vessel with a top, a bottom and sides defining a pressurizable interior which sealingly communicates with an exterior via a removable filling cap and a water inlet. The vessel has a check valve arranged at the bottom and a spray nozzle arranged on the check valve. A hose is attached to the water inlet of the vessel at a first end of the hose and to a pressurized water means at a second end of the hose. The sealed vessel is raisable and lowerable within the well to be cleaned using the hose. The check valve opens when the sealed vessel is filled to a pre-set pressure of pressurized water via the hose and the water inlet, and the spray nozzle is arranged to discharge fluid substantially horizontally during operation. Preferably, the fluid is discharged in a 360 degree arc.

Advantageously, the hose is attached to a winch. The winch is preferably installed on a vehicle, for increased mobility of the well cleaning apparatus.

A second embodiment of a well cleaning apparatus according to the invention has a sealed vessel having a top, a bottom and sides defining a pressurizable interior which sealingly communicates with an exterior via a removable filling cap and a water inlet. The vessel further has an outlet arranged at the bottom, a hose attached to the outlet at a first end of the hose and a spray nozzle attached at a second end of the hose. The spray nozzle is raisable and lowerable within the well to be cleaned using the hose. The spray nozzle is arranged to discharge fluid substantially horizontally during operation. The fluid is preferably discharged in a 360 degree arc.

Advantageously, the hose is attached to a winch. Preferably, the sealed vessel and the winch are installed on a vehicle, for increased mobility of the well cleaning apparatus.
BRIEF DESCRIPTION OF DRAWINGS

In order that the invention may be more clearly understood, the preferred embodiment thereof will now be described in detail by way of example, with reference to the accompanying drawings, in which:

5  Fig. 1A  is a schematic diagram showing the operation of a well cleaning apparatus according to a first embodiment of the invention, showing manual operation of the device;

Fig. 1B  is a schematic diagram showing the operation of a well cleaning apparatus according to the first embodiment of the invention, showing machine operation of the device;

10  Fig. 2  is a schematic perspective view of a sealed vessel according to the first embodiment of the invention;

Fig. 3  is a schematic detailed view of a nozzle according to the first embodiment of the invention;

15  Fig. 4  is a schematic plan view of the sealed vessel according to the first embodiment of the invention;

Fig. 5  is a schematic end view of the sealed vessel according to the first embodiment of the invention, seen from a nozzle end;

Fig. 6  is a schematic end view of the sealed vessel according to the first embodiment of the invention, seen from a hose attachment end;

20  Fig. 7  is a sectioned schematic view of the sealed vessel according to the first embodiment of the invention;
Fig. 8A is a schematic diagram showing the operation of a well cleaning apparatus according to a second embodiment of the invention, showing manual operation of the device;

Fig. 8B is a schematic diagram showing the operation of a well cleaning apparatus according to the second embodiment of the invention, showing machine operation of the device;

Fig. 9 is a schematic perspective view of a sealed vessel according to the second embodiment of the invention;

Fig. 10 is a schematic plan view of the sealed vessel according to the second embodiment of the invention;

Fig. 11 is a schematic end view of the sealed vessel according to the second embodiment of the invention, seen from a nozzle end;

Fig. 12 is a schematic end view of the sealed vessel according to the second embodiment of the invention, seen from a hose attachment end; and

Fig. 13 is a sectioned schematic perspective view of the sealed vessel according to the second embodiment of the invention.

**BEST MODE FOR CARRYING OUT THE INVENTION**

A well cleaning apparatus 1 according to a first embodiment of the invention is shown in Figs. 1A to 7. The apparatus is intended to be used for cleaning relatively wide wells W, for example dug wells. The well has a bottom B and a shaft S. A sealed vessel 2, which is pressurizable and has a filling cap 3 at a first end 4, is arranged to be lowered into the well, either via a winch 5 or by hand by an operator O. The winch is preferably of the hose reel type, and can advantageously be arranged on a vehicle or cart. The vessel further has a pressurized water attachment 6 at the first end, for attaching an
end of a hose 7 from a pressurized water supply 8, for instance a common garden hose. At a second end 9, opposite the first end 4, the vessel 2 has a discharge nozzle 11, in fluid communication with the inside of the vessel. The nozzle has a plurality of holes (not shown) arranged to direct a fluid flow generally perpendicularly to a longitudinal axis of the vessel and in substantially a full 360 degree dispersion circle. Between the nozzle 11 and the vessel 2 is a check valve 10 arranged, which opens the communication between them at a pre-determined pressure. The vessel can withstand a pressure of at least 80 lbs per inch. In operation, the vessel 2 is filled with a pre-determined amount of disinfectant by removing the filling cap 3 and pouring the disinfectant into the vessel. The cap is replaced, and the hose 7 attached to the vessel at the water attachment 6. The entire vessel is then lowered into the well to a desired depth and the pressurized water supply is turned on (for example via a valve (not shown) associated with the pressurized water supply). The incoming water presses the disinfectant out through the nozzle 11 when the water pressure reaches the opening pressure of the check valve 10. The depth of the vessel into the well can then be regulated, so that the vessel is raised slowly in the well, all the while discharging disinfectant. Alternatively, the discharging operation can be started at a water surface in the well and the vessel slowly lowered to the bottom of the well during disinfectant discharge. By releasing the disinfectant agent below the suction line (not shown) of the well, much of the disinfectant is drawn into the water intake (not shown) and passes into the water supply lines (not shown), thereby killing contaminants found both in the well and the associated plumbing.

A well cleaning apparatus 1' according to a second embodiment of the invention is shown in Figs. 8A to 13. The apparatus is intended to be used for cleaning relatively narrow wells W', for example drilled wells. The well has a bottom B' and a shaft S'. A sealed vessel 2, which is pressurizable and has a filling cap 3 at a first end 4, is arranged to be lowered into the well, either via a winch 5 or by hand by an operator O. The vessel further has a pressurized water attachment 6 at the first end, for attaching an end of a hose 7 from a pressurized water supply 8, for instance a common garden hose. At a second end 9, opposite the first end 4, the vessel 2 has an extension hose
7' attached to an extension hose coupling 12. A discharge nozzle 11' is attached at an end of the extension hose opposite where the extension hose is attached to the vessel. The nozzle has a plurality of holes (not shown) arranged to direct a fluid flow generally perpendicularly to a longitudinal axis of the vessel and in substantially a full 360 degree dispersion circle. To ensure that the nozzle securely can be lowered all the way to the bottom of the well, the nozzle may be weighted i.e. extra weight is added to the nozzle.

The vessel can withstand a pressure of at least 80 lbs per inch. In operation, the vessel 2 is filled with a pre-determined amount of disinfectant by removing the filling cap 3 and pouring the disinfectant into the vessel. The cap is replaced, and the hose 7 attached to the vessel at the water attachment 6. The extension hose 7' with the nozzle 11' is also attached to the vessel and is then lowered into the well nozzle first, preferably via the well seal, until the nozzle is at a desired depth and the pressurized water supply is turned on (for example via a valve 6' associated with the pressurized water attachment 6). The incoming water presses the disinfectant out through the nozzle 11'. The depth of the nozzle into the well can then be regulated, so that the nozzle is raised slowly in the well, all the while discharging disinfectant. Alternatively, the discharging operation can be started at a water surface in the well and the nozzle slowly lowered to the bottom of the well during disinfectant discharge. By releasing the disinfectant agent below the suction line (not shown) of the well, much of the disinfectant is drawn into the water intake (not shown) and passes into the water supply lines (not shown), thereby killing contaminants found both in the well and the associated plumbing.

The second embodiment of the invention may, of course, be used for wide wells, as well as using the first embodiment of the invention with narrow wells, as long as the vessel can be lowered into the well.

For all embodiments of the invention:
The vessel is made of a water resistant material, for instance plastic or stainless steel. The preferred material is plastic, because it is a cheaper alternative at this time. A preferred plastic material is PVC. For injection molding or blow molding, other materials
may be more suitable. The “Jet Chlorinator (TM)”, as the device is called, is assembled from mostly off-the-shelf parts, with a few custom made parts, keeping the total cost low.

The nozzle may be configured in different ways, for example as a rotating nozzle, as long as a thorough dispersion of the treatment fluid is achieved.

A pressurized air source may be used, such as an air compressor, to either add extra pressure to the water used to flush the treatment fluid from the pressure vessel, or to replace the water as a dispersion aid, i.e. the treatment fluid would be dispersed in the well using only pressurized air. A further advantage of using pressurized air, either alone or in combination with water, is the extra stirring of the well water caused by air bubbles rising through the well water from the nozzle. The extra stirring enhances the mixing of the well water with the treatment fluid.

The use of the well treatment devices according to the invention may also be automated to a small or large degree. A device would typically be permanently stationed at a well, and an operator would trigger a well treatment sequence as described above by using some type of triggering means, for example a timer, a push-button or similar. During an automated operation, whether it is with an operator standing by or a remote operation, it is imperative that the water lines and other parts of the water system are flushed sufficiently to prevent the treatment fluid from sitting too long in the system to thereby cause corrosion of the system, for instance.

It will be appreciated that the above description relates to the preferred embodiments by way of example only. Many variations on the invention will be obvious to those knowledgeable in the field, and such obvious variations are within the scope of the invention as described and claimed, whether or not expressly described.

**INDUSTRIAL APPLICABILITY**

The invention provides a well cleaning device and method.
CLAIMS:

1. A well cleaning apparatus, characterized in that it comprises:
   a sealed vessel having a top, a bottom and sides defining a pressurizable interior
   which sealingly communicates with an exterior via a removable filling cap and a water
   inlet; and
   a hose attached to the water inlet of the vessel at a first end of the hose and to
   a pressurized water means at a second end of the hose,
   the sealed vessel raisable and lowerable within the well to be cleaned using the hose,
   and the spray nozzle arranged to discharge fluid substantially horizontally during
   operation.

2. The well cleaning apparatus according to claim 1, characterized in that the
   vessel further has a check valve arranged at the bottom and a spray nozzle arranged
   on the check valve, and the check valve opens when the sealed vessel is filled to a pre-
   set pressure of pressurized water via the hose and the water inlet, and the spray nozzle
   is arranged to discharge fluid substantially horizontally during operation.

3. The well cleaning apparatus according to any of the preceding claims,
   characterized in that the fluid is discharged in a 360 degree arc.

4. The well cleaning apparatus according to any of the preceding claims,
   characterized in that the hose is attached to a winch.

5. The well cleaning apparatus according to claim 4, characterized in that the winch
   is installed on a vehicle, for increased mobility of the well cleaning apparatus.

6. A well cleaning apparatus, characterized in that it comprises:
   a sealed vessel having a top, a bottom and sides defining a pressurizable interior
   which sealingly communicates with an exterior via a removable filling cap and a water
   inlet, the vessel further having an outlet arranged at the bottom;
a hose attached to the outlet at a first end of the hose;

a spray nozzle attached at a second end of the hose,

wherein the spray nozzle is raisable and lowerable within the well to be cleaned using
the hose, the spray nozzle arranged to discharge fluid substantially horizontally during
operation.

7. The well cleaning apparatus according to claim 6, characterized in that the fluid
   is discharged in a 360 degree arc.

8. The well cleaning apparatus according to any of claims 6 or 7, characterized in
   that the hose is attached to a winch.

9. The well cleaning apparatus according to claim 8, characterized in that the
   sealed vessel and the winch are installed on a vehicle, for increased mobility of the well
   cleaning apparatus.

10. A well cleaning apparatus method, characterized by the steps of:

a) filling a vessel with a pre-determined amount of disinfectant.

b) attaching one end of a hose to the vessel, the hose being attached to a pressurized
    water supply at an opposite end.

c) lowering the vessel into the well to a desired depth.

d) turning on the pressurized water supply to thereby press the disinfectant out of the
    vessel and out through a nozzle arranged at a lower end of the vessel.

e) regulating the depth of the nozzle in the well.

11. A well cleaning apparatus method, characterized by the steps of:

a) filling a vessel with a pre-determined amount of disinfectant.

b) attaching one end of a hose to the vessel, the hose being attached to a pressurized
    water supply at an opposite end.

c) attaching and extension hose having a nozzle at a free end of the extension hose to
    the vessel.
d) lowering the nozzle into the well until the nozzle is at a desired depth.
e) turning on the pressurized water supply to thereby press the disinfectant out of the vessel and out through the extension hose and out via the nozzle.
f) regulating the depth of the nozzle in the well.
FIG. 1A
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E03B3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E03B E21B B08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>DE 198 43 292 A (SPITZNER LOTHAR; STEINBRECHER ALEXANDER (DE)) 13 April 2000 (2000-04-13) column 1, line 51 - column 2, line 9 figure</td>
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Further documents are listed in continuation of box C.

Date of the actual completion of the international search 26 February 2002

Date of mailing of the international search report 05/03/2002

Name and mailing address of the ISA European Patent Office, P B 5818 Patentlaan 2 NL-2280 HJ Rivierenbuurt Tel. (+31-70) 540-2000, Tx. 31 651 apo nl, Fax (+31-70) 540-3018
Authorized officer Urbahn, S

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*"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*"X" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is taken alone
*"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents
*"S" document member of the same patent family

Patent family members are listed in annex.
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