March 21, 1939. L. D. WRIGHT 2,151,671

METHOD FOR CLEANING WATER MAINS

Filed July 21, 1936 2 Sheets-Sheet 1

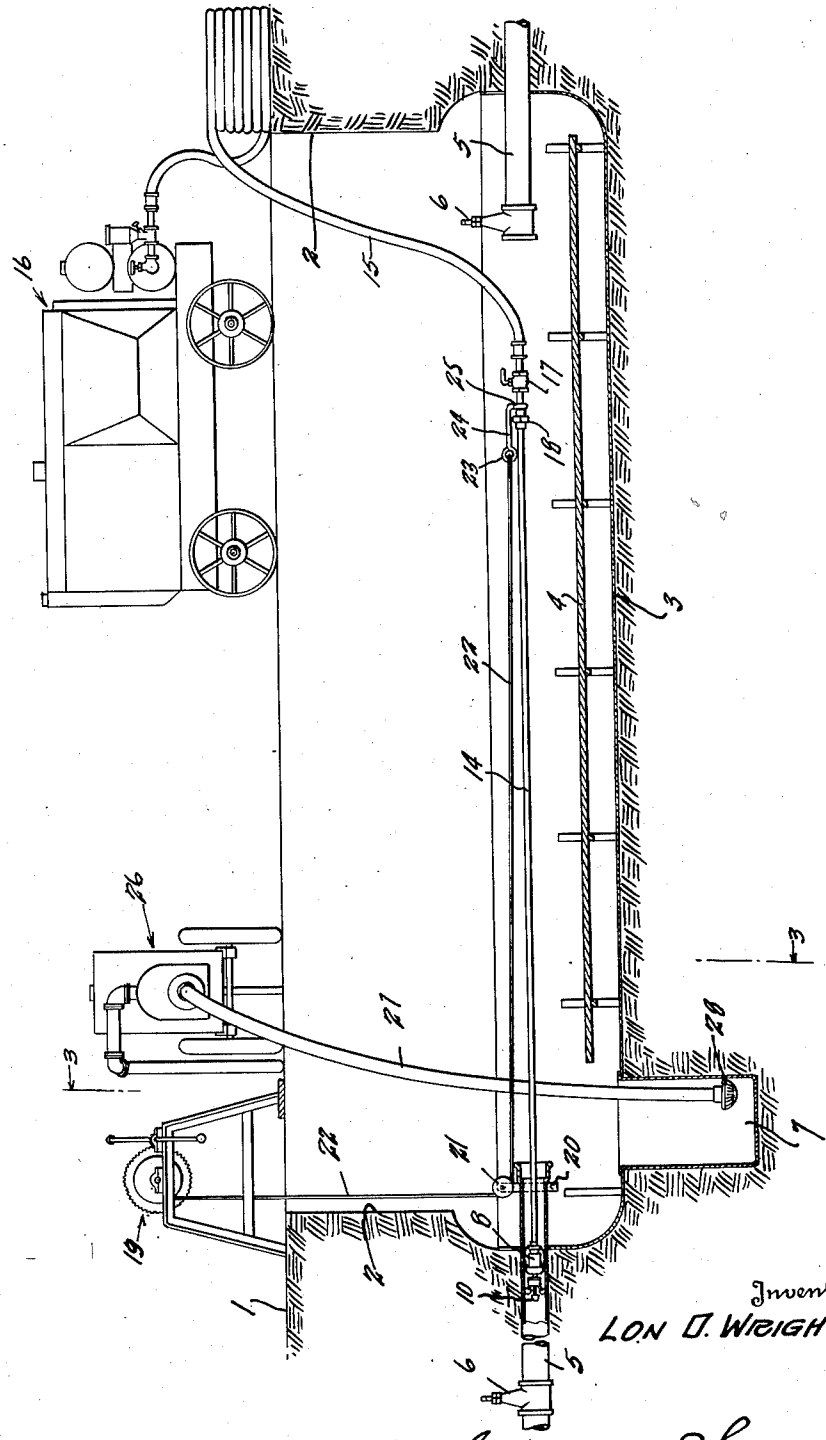


FIG. 1.

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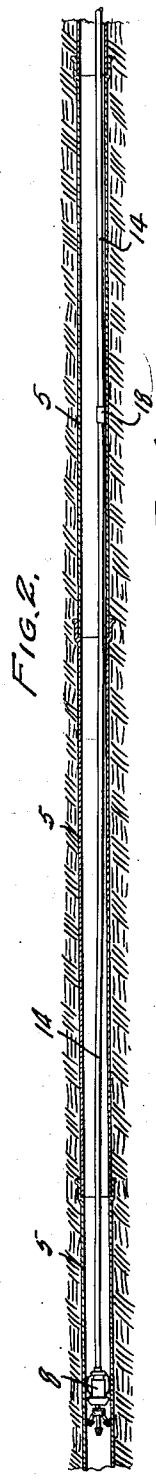


FIG. 2.

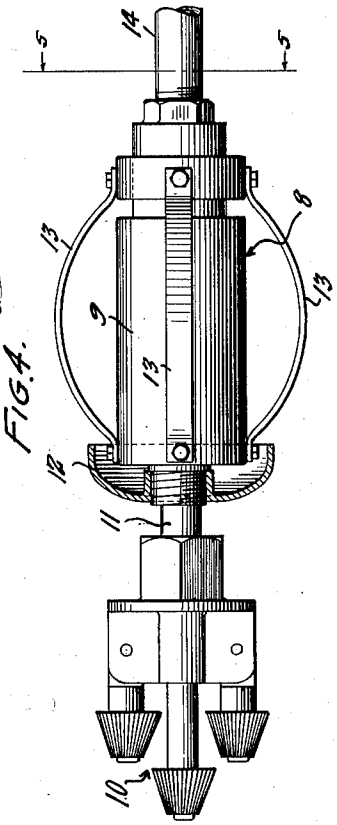


FIG. 4.

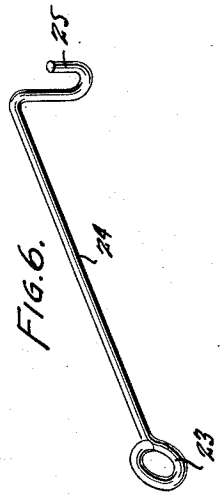


FIG. 6.

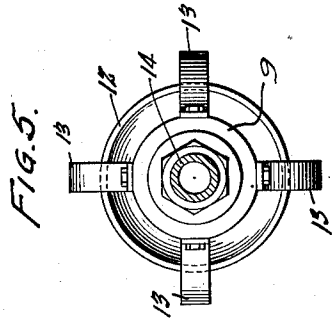


FIG. 5.

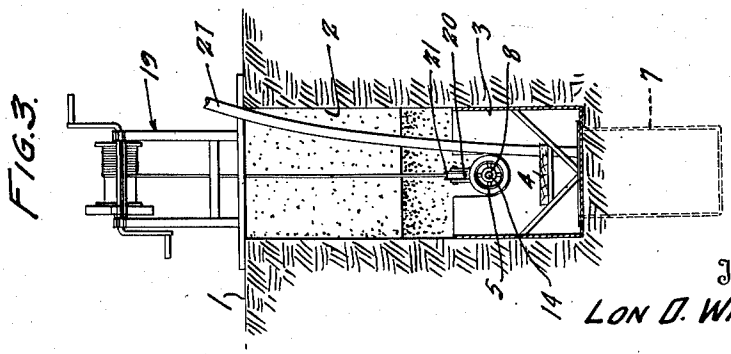


FIG. 3.

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UNITED STATES PATENT OFFICE

2,151,671

METHOD FOR CLEANING WATER MAINS

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Application July 21, 1936, Serial No. 91,752

9 Claims. (Cl. 15—269)

This invention relates to the cleaning of water mains, and more particularly has reference to a method and apparatus for removing deposits or incrustations from the interior of water mains.

As is well known, due to certain characteristics of the water supply in nearly all cities, the cast iron water mains are subject to incrustations of one kind or another. These deposits of minerals and sediments in the mains have materially reduced the efficiency of the water systems, and the capacity of the mains likewise has been greatly cut down. It is necessary, therefore, to maintain a higher pressure at the plant in order to keep up the volume and pressure for the convenience of the consumers and to comply with the regulations for fire protection. Obviously, the necessity of resorting to such a procedure is most undesirable in view of the great expense involved.

It will also be appreciated that, due to certain physical disturbances, these deposits in the mains often become loosened and mix with and contaminate the water supply, making it unfit for human consumption. It has been customary to flood the mains for a considerable period in order to remove the impurities. However, such a flooding is not particularly efficacious, in that but an insignificant portion of the incrustations is removed and hardly warrants the expense incurred.

The method heretofore proposed for cleaning water mains requires the opening of water mains at two points, and requires a cable being drawn through the portion of main to be cleaned. This cable is used for the purpose of pulling the mechanism through the water main.

An object of my invention is to overcome the disadvantages now present in the art of cleaning water mains.

Another object of my invention is to provide a method for cleaning water mains which greatly reduces the time during which the main must be out of service.

Still another object of my invention is to provide a method for removing the incrustations from the interior of water mains by accelerating the counterflow of water so as to periodically expel quantities of water and sediment with great force.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangement, without departing from the spirit and scope of the appended claims.

In order to make my invention more clearly understood, I have shown in the accompanying drawings means for carrying the same into practical effect without limiting the improvements in their useful applications to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the drawings:

Figure 1 is a longitudinal section of a cut showing the location of the various elements constituting my invention.

Figure 2 is a longitudinal section of a water main showing the manner in which the turbine is propelled therethrough.

Figure 3 is a transverse sectional view along the line 3—3 of Figure 1, looking in the direction of the arrows.

Figure 4 is an elevational view partly in section showing my air turbine.

Figure 5 is a view along the line 5—5 of Figure 4, looking in the direction of the arrows.

Figure 6 is a perspective view of the hook for pulling the pipe into the main.

Referring to the drawings, in which like numerals designate similar parts, there is depicted in Figure 1 a road or street surface 1. A cut or ditch is made at the point where it is desired to open the main, as shown at 2. The floor of the ditch 2 is provided with a metallic trough or the like 3 for preventing caving or washing in of the ditch. A plank runway 4 is suitably supported in the ditch for providing a dry surface for the men to work on.

The water main to be cleaned is designated generally by the numeral 5. As is clearly shown, a section or a sufficient portion of the main is removed so that the cleaning mechanism may be inserted therein and propelled therethrough. Suitable water gate valves 6 for regulating the flow of water through the main are provided in the main.

A metallic barrel or the like 7 is embedded below the floor of the ditch and is positioned so as to lie beneath the opened end of the main. As will hereinafter become apparent, this barrel serves as a trap for receiving the sediment and water discharged from the main.

The apparatus which I prefer to employ for removing the incrustations and deposits from the main is an air driven turbine shown generally at 8. I have found that better results are obtained if the turbine is of a type which will permit the use of various types of cutting tools.

Referring to Figure 4, it can be seen that the turbine is composed of an air motor 9. A cutting mechanism 10 is adapted to be driven by the motor through the shaft 11.

Suitably secured to the turbine and positioned rearwardly of the cutting mechanism 10 is a deflector or the like 12. The deflector 12 turns the exhaust air into the direction of the counterflow of water in the main. This feature is of paramount importance, due to the fact that it will enable the entire circumference of the main to be thoroughly cleaned. The purposes and operation of this structure will later be described more fully.

A plurality of spring members 13 are suitably secured to the turbine. These spring members hold the turbine in place within the main so that it gets the proper location for cutting. I have found that the use of four such members adequately serves for the purpose.

The turbine is moved through the main by the employment of sections of rigid hollow pipe 14. The pipe 14 not only permits the pushing of the turbine through the main, but also provides a suitable duct for the air pressure necessary for the proper operation of the turbine.

The manner in which the main is cleaned is best shown in Figure 1. The turbine 8 is suitably secured at its rear end to a section of pipe 14. The other end of the pipe is attached to a flexible air hose 15 which in turn is connected to an air compressor 16. The air compressor is of such capacity as to continuously supply pressure to the turbine for properly operating the cutting mechanism.

The end of the hose 15 which is secured to the pipe section 14 is provided with a suitable stop valve 17. The valve 17 will permit the cutting off of the air hose from the pipe section while another section of pipe is added for enabling the turbine to be pushed farther into the main.

I have found that the turbine can be moved through the main by the use of the principles of leverage. However, it is to be understood that I do not restrict myself to such means. A winch mechanism 19 is located adjacent the ditch for pushing the pipe sections through the main. This mechanism may be of any suitable construction. It is preferable that this device be operated manually, as the person operating the same can, by the sound and feel of the progress of the turbine, control it more readily and procure better results, than where it is pushed through at an exactly uniform rate, as would be the case if operated by machinery.

A sheave 20 carrying a pulley 21 is detachably secured to the open end of the main 5. The cable 22 secured to the winch 19 is guided over the pulley and is attached to an eye 23 of a pulling hook 24. The other extremity of the pulling hook 24 is bent downwardly and upwardly into a substantially U-shaped section 25. The section 25 fits over pipe section 14 and abuts against the end of the union 18. It is believed to be readily apparent that, by turning the winch 19, the turbine 8 will be pushed through the main by the pipe sections 14.

As heretofore pointed out, the turbine is moved through the main in counterdirection to the flow of water. By regulation of the water gate valves on the end of the main, a sufficient amount of water is allowed to pass over and around the turbine. This water will carry off the sediment removed by the cutting device.

As has been hereinbefore pointed out, the turbine is provided with a deflector 12 for turning the exhaust air from the motor into the direction of flow of the water. Through extensive experiments I have found that the exhaust air greatly accelerates the counterflow of water behind the turbine, which results in periodical expulsions of large quantities of sediment and water with great force. In other words, the exhaust air will form pockets and from time to time these pockets will build up sufficient pressure to expel all of the water and the sediment from the main.

The exhaust air in these pockets apparently operates on the principle by which natural geysers accumulate pressure in pockets in their channels and when this pressure reaches a certain point the water is blown out with great force.

The above expulsions of water and sediment have proven of invaluable assistance, as the discharge of the water in this manner carries all of the sediment with it, and has removed all doubt as to the manner in which the solid material cut from the mains would be removed.

The water and sediment removed from the main will of course be discharged into the barrel 7. Any overflow of material from the barrel will be trapped in the metallic trough 4.

A suitable water pumping apparatus 26 having the usual hose 27 and strainer 28 is employed for removing the water from the ditch.

The advantages of my invention are believed apparent from the foregoing description. In past experiments, it has, with my method, been possible with a single opening in the main to clean several hundred feet of the main in both directions from the opening. Furthermore, there is no doubt that the cleaning of the main in each direction could have been at least twice the distance actually accomplished. In my experiments, it has also been possible to clean 100 feet per hour, which is a distinct advance over the prior methods.

Due to the employment of an air driven turbine which is pushed through the main by sections of pipe, the mains can be cleaned very efficiently by two men. This material reduction in the labor necessary to clean the mains is still another advantage obtained by my process over the processes heretofore used.

Moreover, deflecting the exhaust air from the motor into the flow of the water, positively insures a thorough cleaning of all of the sediment from the circumference of the main.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. In a method of cleaning a pipe, the steps of establishing a relatively free exit at one point in the pipe, establishing a relatively closed condition at another point in the pipe, introducing a liquid under pressure to the pipe at a point thereof removed from the relatively free exit, and continuously introducing a gas under pressure into the pipe between the said last mentioned point and the relatively free exit, said liquid and gas being introduced in quantities and at pressures sufficient to develop slugs of liquid separated by gas pockets, which slugs travel with explosive action toward the relatively

free exit of the pipe whereby the slugs will remove sediment from the interior of the pipe.

2. In a method of cleaning a pipe open at one end and closed at the other, the steps of introducing a liquid to fill the pipe for at least a portion of its length, and continuously introducing a gas under pressure into the pipe at a point removed from the open end, said gas and liquid being introduced at sufficient pressures and in such quantities as to develop slugs of liquid separated by gas pockets which slugs travel toward the open end of the pipe with explosive action, whereby the slugs will remove sediment from the interior of the pipe.

3. In the method of cleaning a pipe closed at one end, the steps of introducing a liquid under pressure in the vicinity of the closed end in sufficient volume to fill said pipe for a portion of its length, said point of introducing said liquid being removed from a low pressure area, and continuously introducing a gas under pressure into the pipe between said point and the low pressure area, said gas and liquid being introduced at such pressures and in such quantities as to develop slugs of liquid separated by gas pockets which slugs travel toward the low pressure area in the pipe with explosive action, whereby the slugs will remove sediment from the interior of the pipe.

4. A method of removing deposits and incrustations from the interior of a pipe which is open at one end and closed at the other end comprising introducing a liquid into the pipe in the vicinity of the closed end, introducing an air driven cutting mechanism into the open end and propelling it toward the closed end, and controlling the introduction of the liquid and the exhaust air from the mechanism as to quantity and pressure so as to develop intermittent slugs of liquid and air which travel with explosive action toward the open end of the pipe carrying therewith such incrustations and deposits as are removed from the pipe wall by said mechanism.

5. In a method of cleaning a pipe the steps of establishing a relatively free exit at one point in the pipe, establishing a relatively closed condition at another point in the pipe, introducing a liquid under pressure to the pipe at a point thereof removed from the relatively free exit and continuously introducing a gas under pressure into the pipe concomitantly with the introduction of liquid and also at a point removed from the relatively free exit, said liquid and gas being introduced in quantities and at pressures sufficient to develop slugs of liquid separated by gas pockets, which slugs travel with explosive action toward the low pressure area of the pipe whereby the slugs will remove sediment from the interior of the pipe.

6. In a method of cleaning a pipe, the steps of establishing a relatively free exit at one point in the pipe, establishing a relatively closed condition at another point in the pipe, introducing a liquid under pressure to the pipe at a point thereof removed from the relatively free exit to fill a portion of the pipe, introducing a gas under pressure to the liquid within the pipe concomitantly with the introduction of liquid and also at a point removed from the relatively free exit, both the liquid and gas being introduced for a substantial period of time, and agitating the liquid at the point where the gas is introduced thereto, said liquid and gas being introduced in quantities and at pressures sufficient to develop during the above mentioned period of time a series of slugs of liquid separated by gas pockets, which slugs travel with explosive action toward the relatively free exit, whereby the slugs will remove sediment from the pipe.

7. A method of cleaning a pipe comprising mechanically dislodging incrustations from the interior of the pipe, establishing a relatively free exit at one point in the pipe, establishing a relatively closed condition at another point in the pipe, introducing a liquid under pressure to the pipe at a point removed from the relatively free exit, and introducing a gas under pressure to the pipe concomitantly with the introduction of liquid and also at a point removed from the relatively free exit, both the liquid and gas being introduced for a substantial period of time, said liquid and gas being introduced in quantities and at pressures sufficient to develop a series of slugs of liquid separated by gas pockets during the above mentioned period of time, which slugs travel with explosive action toward the relatively free exit whereby the slugs will remove the dislodged incrustations from the pipe.

8. A method of removing deposits and incrustations from the interior of a water main having an open end and a closed end comprising introducing a regulated quantity of water at one point in the main, propelling an air-driven cutting mechanism through the main, and introducing the water and discharging the exhaust air from the mechanism in such quantities and at such pressures as to develop intermittent slugs of water and air which travel with explosive action toward the open end carrying therewith such incrustations and deposits as are removed from the main wall by said mechanism.

9. A method of removing deposits and incrustations from the interior of water mains in which one end of the main is open comprising introducing water at the opposite end of the main, propelling air-driven cutting mechanism through the main in counterdirection to the flow of water therethrough, deflecting the exhaust air from the cutting mechanism rearwardly and in the direction of flow of the water, and controlling the amounts and pressures of the introduced water and exhausted air to form intermittent slugs of water and air which travel toward the open end of the pipe carrying therewith the incrustations and deposits removed by the mechanism.

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