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INTERIOR PIPE CLEANER

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2 Sheets-Sheet 1

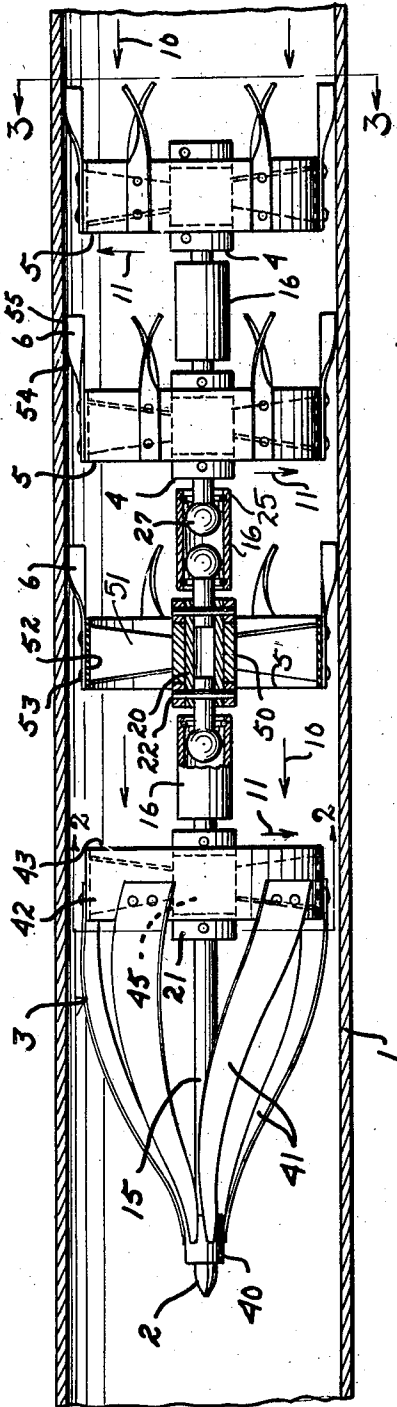


Fig. 1.

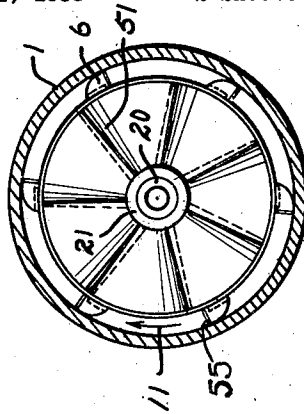


Fig. 2.

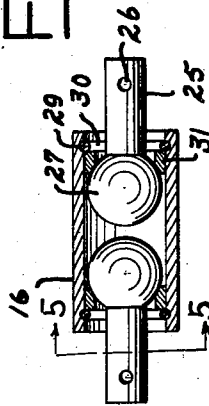


Fig. 3.



Fig. 4.

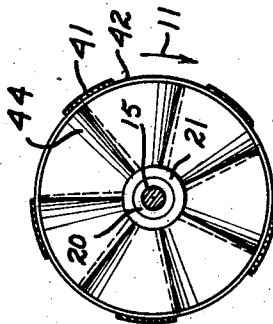


Fig. 5.

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2 Sheets-Sheet 2

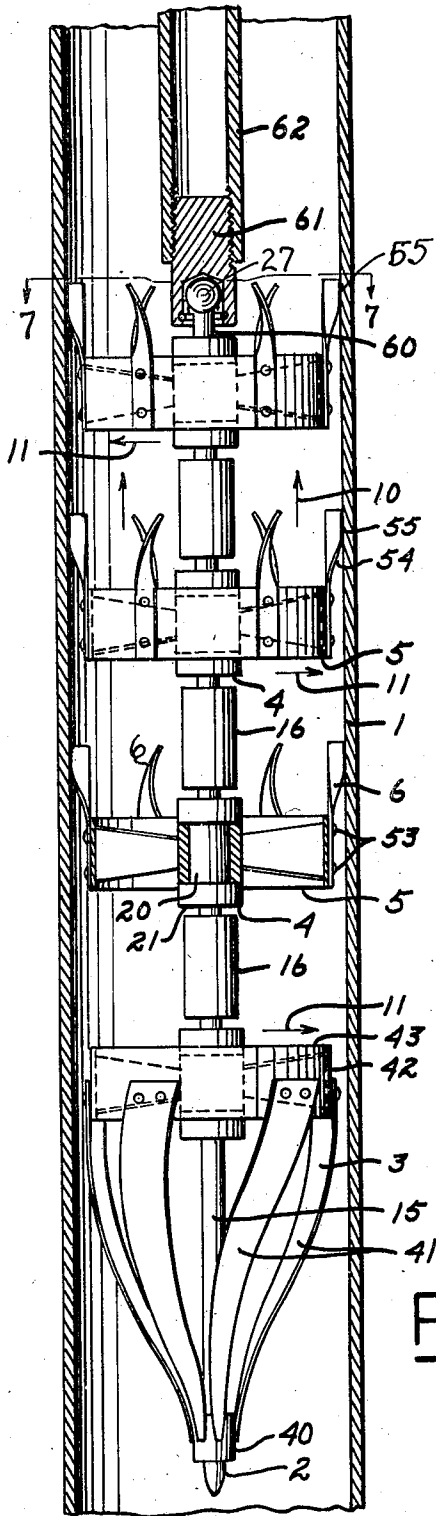


Fig. 6.

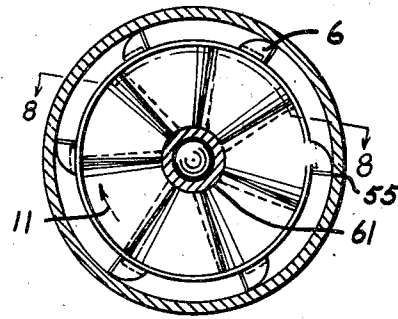


Fig. 7.

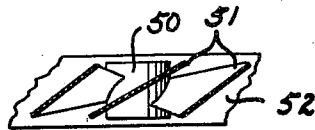


Fig. 8.

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# UNITED STATES PATENT OFFICE

2,201,680

## INTERIOR PIPE CLEANER

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Application May 21, 1938, Serial No. 209,218

4 Claims. (Cl. 15—104.06)

The invention relates to an interior pipe cleaner and more particularly to a device which is designed to travel axially through a string of pipe and to operate in a manner to release obstructing material from the inner walls of the pipe.

In pipelines which carry hydrocarbon fluids from point to point and in producing oil wells there is a gradual accumulation of paraffin upon the inner walls of the conducting pipe or tubing. This accumulation is minimized by modern production and pumping methods, yet there still remain difficulties which arise from the accumulation of paraffin.

It is therefore a primary object of the invention to provide a device which is both simple and efficient in the removal of paraffin from the walls of pipeline or tubing. While the disclosure of the device of the invention refers specifically to mechanism for the removal of paraffin, it is to be understood that the invention is of utility in any case where it is desired to remove material from the inner walls of pipe or tubing.

It is also an object to provide a device of the class described comprising a plurality of rotors having cutter blades thereon to remove the material from the pipe walls.

Another object is to provide a device in which rotors carrying cutting blades rotate in different directions in order to avoid the condition where the cutter blades of one rotor follow the path of the blades of a preceding rotor.

Another object is to provide a device having a pilot at its forward end to guide the device along a pipeline which is being cleaned thereby.

Still another object is to provide a device which is propelled by fluid moving through the pipe to be cleaned.

It is also an object to provide a device which may be lowered into a well on a tubing string or wire line or which may be allowed to move under gravity and later retrieved as by a spear.

Still another object is to provide a device of such construction that the curves in the pipe to be cleaned thereby may be readily negotiated.

Other objects, together with the foregoing will be apparent from the following description considered in connection with the drawings in which:

Fig. 1 is a side elevation of a device embodying the invention, the device being shown within a pipe to be cleaned and certain parts thereof being shown in section.

Fig. 2 is a sectional view taken on the line 2—2 in Fig. 1.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged sectional view showing the construction of the articulating joints in the mandrel of the device shown in Fig. 1.

Fig. 5 is a cross section taken on line 5—5 in Fig. 4.

Fig. 6 shows a modification of the construction shown in Fig. 1 as used in removing paraffin from the walls of tubing string in oil wells.

Fig. 7 is a sectional view taken on the line 7—7 in Fig. 6.

Fig. 8 is a section on line 8—8 of Fig. 7.

As best seen in Fig. 1 the device of the invention is a composite construction designed to pass through a pipe 1 having material, such as paraffin, adhering to the inner walls and which is to be removed from the walls so that fluid passing through the pipe may carry such material from within the pipe. The device comprises essentially an articulated mandrel generally designated as 2 having upon its forward end a pilot 3. Mounted upon rotor support sections 4 of the mandrel 2 rearwardly of the pilot 3 are a plurality of rotors 5, here shown as three in number, each of which is provided with peripheral blades 6 adapted to move in close juxtaposition to the inner walls of the pipe 1 and hence to remove accumulated material from these walls.

In order to more clearly illustrate both the construction and the operation of the device, attention is directed to the fact that the liquid in the pipe 1 is moving in the direction indicated by the arrows 10 and that the respective rotatable elements of the device normally rotate in the direction indicated by the arrows 11.

The mandrel 2 comprises the forward pilot shaft 15 and the rotor support sections 4 attached thereto by means of the articulating connectors 16. The rotor support sections 4 and the pilot shaft 15 each includes a sleeve 20 surrounded by spaced collars 21 secured thereto by pins 22. In this manner there is provided a journal for each of the rotating elements of the device.

In order to interconnect successive sections of the device stub shafts 25 extend into each of the sleeves 20 and have openings 26 through which pins 22 pass. The opposite end of each of these stub shafts has an enlarged head 27, preferably spherical in shape, extending into the connector 16 provided with spaced internal grooves 29 to receive snap rings 30 which serve to fix an annular block 31 within the collar and hence to hold the adjacent sections of the mandrel in assembled relation. This construction is simple and provides the desired flexibility in the device so that efficient operation accrues.

The pilot 3 mounted upon the pilot shaft 15 has a minimum diameter which is slightly less than the inside diameter of the surrounding pipe 1. The forward end of the pilot comprises a collar 40 rotatably surrounding the pilot shaft 15 and having attached thereto a plurality of curved blades 41 which flare outwardly from the collar 40 and have their rear ends attached to a rim 42 of the base member 43 of the pilot. The rim 42 is in turn secured to the outer ends of the webbed blades 44 attached to the hub 45 rotatably mounted upon the mandrel 2 in the manner already described.

Each of the rotors 5 is mounted upon the mandrel as above described and comprises a hub portion 50 from which web blades 51 extend outwardly for attachment to the rim 52. The blades 6 are spaced about the rim 52 and are attached thereto in any suitable manner as by rivets 53. These blades extend rearwardly from the rim 52 at 54 and are curved to provide a rigid construction and also to provide a blade having efficient cutting action. The peripheral edges of the blades have substantially straight portions 55 so that all portions of this edge will be in close cutting relation with the inner walls of the pipe.

As already indicated the respective rotatable elements rotate in the directions indicated by the arrows 11. It is to be noted that successive elements rotate in opposite directions as such mode of operation avoids the tendency of any series of cutter blades to follow the path cleaned by a preceding series. This mode of operation is brought about by providing the web blades 61 with such a direction of pitch that the desired direction of rotation is effected.

It should be noted that the web blades serve the function of providing a surface having a component which is transverse to the pipe 1 so that movement of fluid under pressure longitudinally of the pipe will propel the device along the pipe. At the same time these blades provide the desired turning effort by the movement or slip of the pressure fluid past the device.

The modification shown in Fig. 6 is designed for use in removing paraffin from tubing within a well bore, particularly where the fluid is flowing from the well under gas pressure. This form of the device is identical to that shown in Fig. 1 except that a stub shaft 60 extends rearwardly from the last rotor support section of the mandrel and is secured into a threaded plug 61 in the same manner that connection is made in each of the connectors. The plug 61 is threadably connected to a section of tubing 62. This tubing section may be the lower section of a string of tubing which is used for lowering the device within the pipe 1. On the other hand,

the tubing 62 may be only of such length as to provide sufficient weight to move the device downwardly within the pipe 1 at a sufficient speed as compared with the flow of liquid that efficient cutting action will take place.

With the mode of operation just described the device may be allowed to fall under gravity or its descent may be controlled by the use of a wire line for lowering the device. In either event the material released by the cutter blades will be carried upwardly by the flow of liquid as indicated by the arrows 10. It is believed apparent that the device may be thus lowered upon the tubing string, it may be allowed to move downwardly under gravity and to be thereafter retrieved as by means of a spear, or it may be lowered by means of a wire line.

What is claimed is:

1. An interior pipe cleaner assembly including a mandrel comprising a plurality of articulated sections, a conical pilot on one end section thereof, said pilot being adapted to guide the assembly through the pipe to be cleaned thereby, spaced rotors on other sections of the mandrel, cutter blades on said rotors positioned closely adjacent the inner wall of the pipe to be cleaned, and means on said pilot and each of said rotors for rotating each of said elements as the assembly is moved longitudinally within a pipe.

2. An interior pipe cleaning assembly including a mandrel comprising a plurality of articulated sections, a conical pilot on one end section thereof, rotors on other sections of the mandrel, cutter blades on said rotors for movement in close relation with the walls of the pipe to be cleaned, and driving blades on each of said pilot and rotors, said driving blades being so constructed and arranged that fluid passing through the pipe will advance the assembly through the pipe and rotate the pilot and rotors upon the mandrel.

3. In an interior pipe cleaner, a mandrel, a pilot on one end thereof, a plurality of rotors mounted on the mandrel rearwardly of the pilot, each of said rotors comprising a hub, an annular rim and interposed vane means inclined from a transverse plane, having a rim secured thereto, and cutter blades mounted on the rim and adapted to move closely adjacent the inner wall of pipe to be cleaned.

4. In an interior pipe cleaner, an articulated mandrel, a rotor mounted upon each section thereof, each of said rotors comprising a hub rotatably mounted upon the section, an annular rim and interposed vane means inclined from a transverse plane, and cutter blades secured to said rim and extending axially thereof for movement in close proximity to the walls of the pipe to be cleaned.

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