Sept. 9, 1947. D. A. FIELDS 2,427,129

EXTERIOR PIPE SURFACE BRUSHING MACHINE

Filed July 10, 1943 3 Sheets-Sheet 1

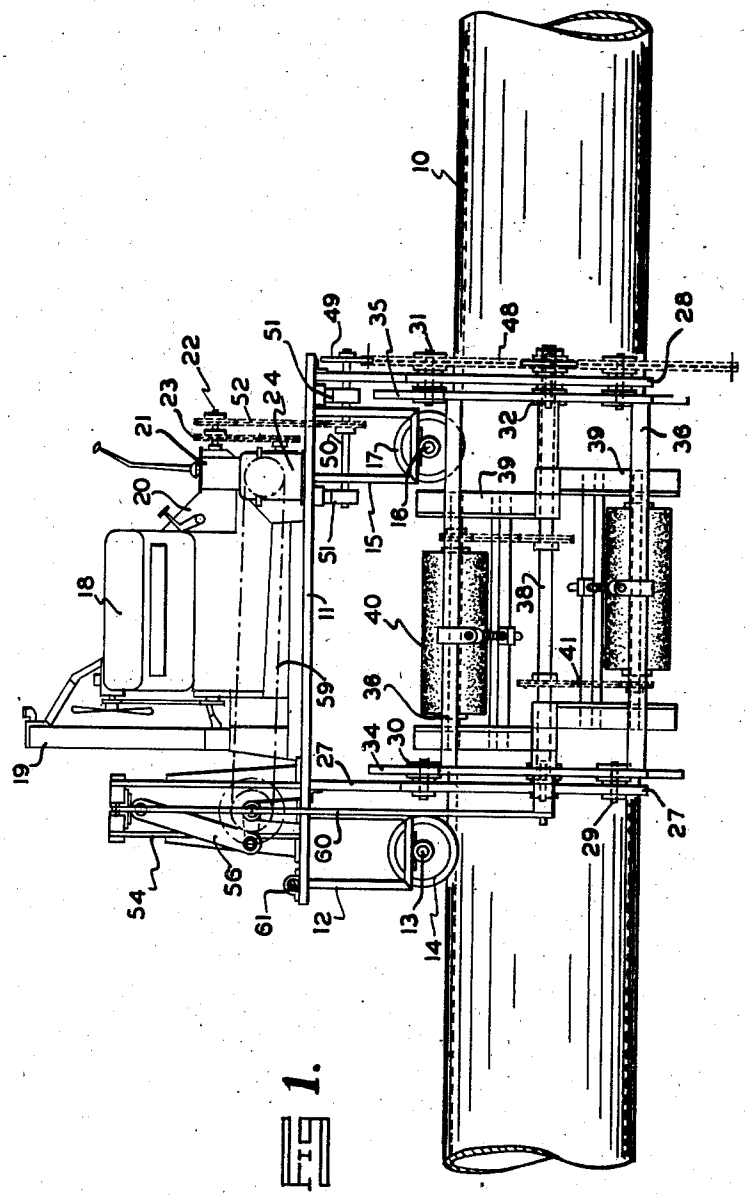


FIG. 1.

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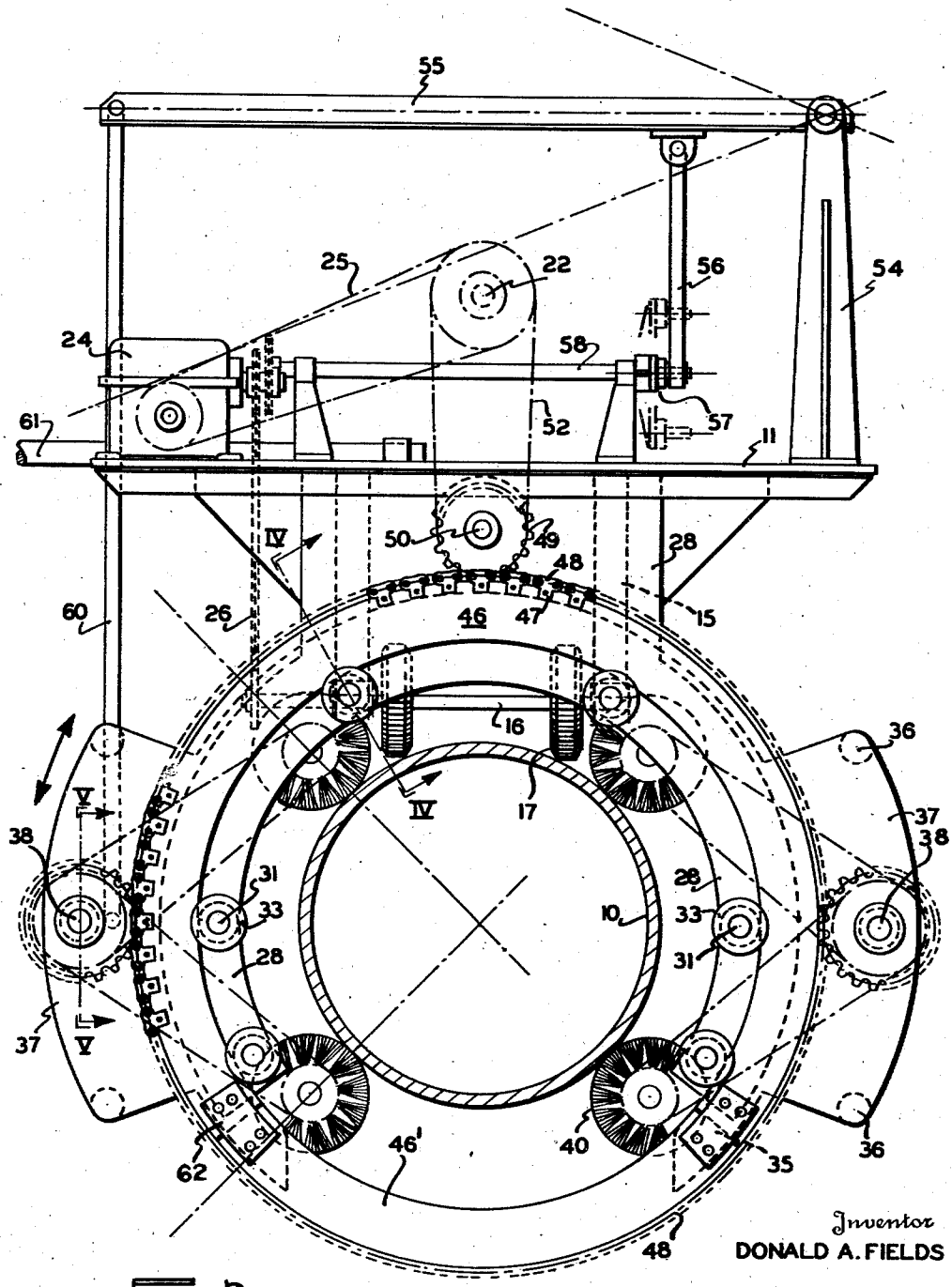


FIG 2.

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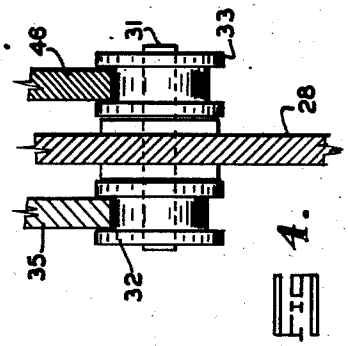


Fig. 4.

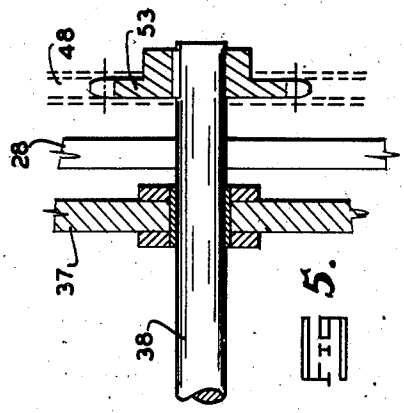


Fig. 5.

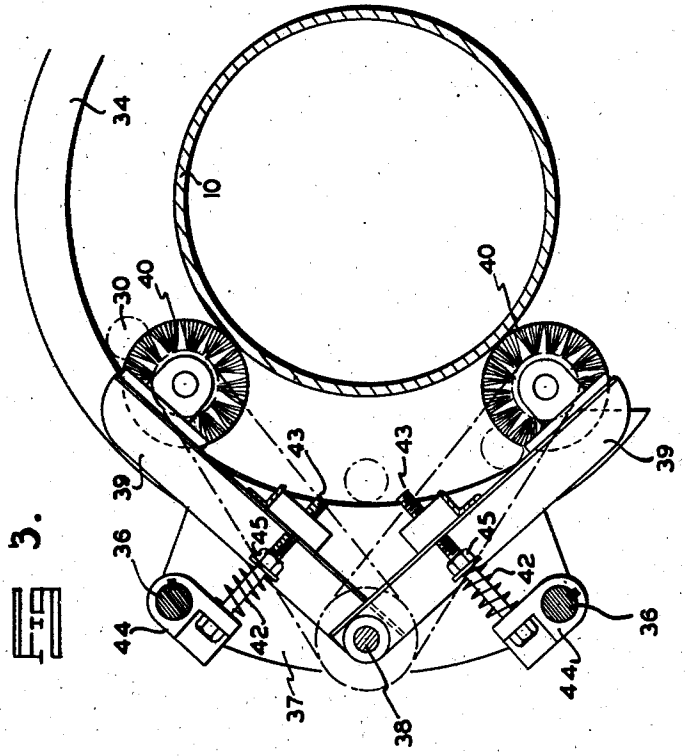


Fig. 3.

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UNITED STATES PATENT OFFICE

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EXTERIOR PIPE SURFACE BRUSHING MACHINE

Donald Albert Fields, Youngstown, Ohio

Application July 10, 1943, Serial No. 494,225

5 Claims. (Cl. 15—104.04)

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This invention relates to pipe cleaning machines and more particularly to apparatus of this character which is arranged to be supported on and to travel along the pipe to be cleaned. Such apparatus is of particular utility in the maintenance of pipe lines, for example, which requires the pipe to be lifted out of the ground, cleaned and recoated periodically to arrest deterioration of the metal side wall of the pipe line.

The primary object of the invention is the provision of an improved apparatus which is adapted to move along an elevated pipe line to thoroughly clean and scour the outer surface of the line so as to insure a good bond between the metal of the side wall of the pipe and the coating composition subsequently applied thereto. A more specific object of the invention is the provision of an apparatus for the purposes stated which is operative to effect, in an expeditious manner, a more thorough cleaning and scouring of the outer surface of the pipe than has heretofore been accomplished by machines developed and used for comparable purposes.

The above objects are accomplished, in accordance with the preferred embodiment of the invention, by employing one or more motor driven wire brushes or other cleaning tool of rugged character which are arranged to rotate about an axis or axes generally parallel with the longitudinal axis of the pipe line and which, in addition, are rotated about the longitudinal axis of the pipe line. Such brushes or tools are mounted on a framework which is arranged to be moved longitudinally along the pipe line and in this manner a very effective cleaning of the pipe is accomplished.

A further object of the invention is the provision of a machine having the characteristics enumerated above which is capable of operating on pipe lines of widely varying diameters and which may be readily adjusted to operate on a line of a different diameter. It is also an object of the invention to provide a traversing pipe cleaning machine which is of simple and economical construction but which nevertheless is light and compact and sufficiently rugged to withstand the extremely severe conditions of service which such machines normally encounter in use.

Another object of the invention is the provision in a machine of the character described of an improved cleaning action or principle whereby definitely superior results are attained in the cleaning operation. Upon the breakdown

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of the prior protective coating on the pipe small localized corrosion spots first appear which eat deeply into the metal leaving the surface of the metal deeply pitted. To remove the rust and scale from these spots vigorous abrasive action must be had. A strong rotating wire brush may be employed for this purpose but I have found that if the brush is moved only in one direction over the surface to be cleaned only about half of the rust and scale is removed from the bottom parts of the pits. This is apparently caused by the brush skipping over the first encountered ledge of the pit. By subjecting each part of the surface to a double brushing in opposite directions this deficiency is avoided and the pipe surface is left in a much cleaner and brighter condition. To accomplish this specific object I preferably actuate the carriage which rotatably supports the brush in a reciprocating or oscillatory manner whereby the brush is moved in opposite directions over the same surface to be cleaned.

The above and other specific objects and advantages of the invention will become apparent upon a consideration of the following detailed specification and the accompanying drawing wherein there is specifically disclosed a preferred embodiment of the invention.

In the drawing:

Figure 1 is a side elevation of a pipe cleaning machine constructed in accordance with the principles of the invention;

Figure 2 is an end view of the apparatus of Figure 1 with the motor of Figure 1 omitted;

Figure 3 is a detailed view, on an enlarged scale of a portion of the apparatus of Figure 1; and

Figures 4 and 5 are fragmentary sectional views along the lines IV—IV and V—V, respectively, of Figure 2.

Referring to the drawing, reference numeral 10 indicates a pipe length to be cleaned while reference number 11 indicates a platform forming a principal part of the frame of the machine illustrated. Attached to and depending from the platform 11 adjacent the front end thereof is a pair of transversely spaced brackets 12 journaling a shaft 13 on which is mounted a pair of spaced serrated wheels 14. A similar pair of brackets 15 extend downwardly from adjacent the other end of platform 11 and journal a shaft 16 on which is mounted the wheels 17 which are also serrated or toothed. As shown, wheels 14 and 17 support the frame or machine for longitudinal movement along the pipe and, in practice, the wheels are made adjustable along the

axes of the shafts 13 and 16 to accommodate pipes of different diameters.

Supported on the platform 11 is a motor 18 having a cooling radiator 19, a clutch 20 and change-speed gearing 21. This power unit has an output shaft 22 on which is keyed a sprocket 23 for driving a worm reducer 24 through the chain 25. The gear unit 24 is also mounted on the platform 11 and its output shaft is connected with at least one of the shafts 13 and 16 through the chain 26 whereby the frame of the complete machine may be propelled along the pipe 10 by power supplied by the motor.

Rigidly secured to and depending from the platform 11 in longitudinally spaced relation are the yoke-like members 27 and 28 the first of which mounts a plurality of arcuately spaced stud shafts 29 on which are journaled the double flanged rollers 30. Member 28 mounts a plurality of arcuately spaced double stud shafts 31 on each of which is journaled a double flanged roller 32 and a similar roller 33. It should be observed that the rollers 32 are on one side of the member 28 while the rollers 33 are on the opposite side thereof and that both the rollers 30 and 32 are on the inner faces of the members 27 and 28.

A carriage consisting of ring-like end plates 34 and 35 and interconnected struts 36 is rotatably mounted on the rollers 30 and 32, it being observed (Figures 1 and 4) that the members 34 and 35 are constructed of flat plate so that the flanges on the rollers 30 and 32 prevent longitudinal movement of the carriage. Each of the rings 34 and 35 is provided with a pair of diametrically opposed integral wings 37 to which the struts 36 are connected and journaled in these wings 37 is a pair of longitudinally extending but diametrically opposed shafts 38. On each shaft 38 there are pivotally mounted two arms 39 each journaling a rotatable wire brush or other suitable cleaning tool 40. It should be observed that the two arms 39 on each shaft 38 extend in opposite circumferential directions so that in the complete assembly there are four brushing or cleaning devices equidistantly spaced about the circumference of the pipe. Each brush shaft is provided with a sprocket which is connected with a sprocket on its carrying shaft 38 by means of a chain 41 so that rotation of the shafts 38 will result in rotation of the brushes 40. To hold the brushing or cleaning devices in resilient pressure engagement with the outer surface of the pipe there is provided for each of the arms 39 a spring 42 (Figure 3) which encircles a portion of the shank of a bolt 43 which extends through a block 44 keyed to one or the other of the struts 36 and having at its other end screw threaded connection with a rigid part of the arm 39. As shown, the heads of the bolts 43 are on the outside of the blocks 44 and are readily accessible to a suitable operating wrench while the springs 42 are confined between the inner faces of the blocks 44 and nuts 45 threaded onto the bolts. This construction enables the brushes 40 to be readily adjusted toward and away from the center axis of the pipe without disturbing the adjustment of the springs 42. Thus the resilient pressure exerted between the pipe and the brushes by the springs 42 may be more or less fixed regardless of the diameter of the pipe being cleaned.

Rotatably mounted on the rollers 33 is a ring 46 also constructed from plate thereby enabling the flanges of the rollers 33 to guide the same

and to the outer periphery of the ring 46 is secured, by means of special link sections 47, a chain 48 forming, in effect, a gear. This gear 48 is arranged to be driven by a sprocket 49 keyed to a shaft 50 journaled in pillow blocks 51 secured to and depending from the platform 11. Shaft 50 is driven from the output shaft 22 of the power unit by means of a chain 52. To each of the shafts 38 is keyed a sprocket 53 which has engagement with the gear 48 so that upon rotation of gear 48 the shafts 38 will be rotated. Because of the step-up ratio between gear 48 and sprockets 53 the shafts 38 will be driven at a fairly high rate of speed while gear 48 revolves at a relatively slow speed. There is thus established between the power unit and each of the cleaning tools 40 a positive driving connection which is operative while the carriage above described is either at rest or in motion and irrespective of the direction of movement of the carriage if the same is in motion.

Extending upwardly from one side of the platform 11 is a bracket 54 to which is pivotally connected a lever 55. Lever 55 is arranged to be rocked upwardly and downwardly by an arm 56 connected to a crank 57 which, in turn, is keyed to a shaft 58 arranged to be driven by the output shaft of gear 24 through chain 59. Interconnecting the outer end of lever 55 and the plate 34 of the carriage above described is a rod 60 so that upon rocking movement of lever 55 the carriage will be caused to oscillate about the center of the pipe being cleaned. In practice, the carriage is rotated through approximately 45° in either direction from its neutral position shown in the drawing so that the total circumferential coverage of each of the cleaning units 40 will be at least equal to or greater than 90° whereby the entire circumferential extent of the pipe will be cleaned. Also the length of the brushes is so correlated with respect to the speed of rotation of the carriage and the rate of movement of the machine along the pipe that each point on the surface of the pipe will be worked at least twice, once in one direction and once in the opposite direction, whereby the advantages resulting from this mode of operation as pointed out in the statement of objects above will be attained.

The machine described above is balanced on the pipe 20 and retained generally in horizontal position thereon by a bar 61 which is secured to the platform 11 and extends laterally of the machine a considerable distance where it is and may be held by a workman or secured to a suitable mobile mount.

It should now be apparent that I have provided an improved method and apparatus for cleaning the exterior surface of pipe which accomplishes the objects initially set out. First, the use of the elongated motor driven brushes extending parallel with the pipe results in a more thorough cleaning of the surface, particularly if the adjustments are such that each part of the surface is brushed in two directions as explained above, and enables greatly increased brush surface area to be built into the machine thus reducing the rate of wear of the brushes and allowing the machine to be operated continuously over long periods of time. Secondly, the machine is compact in design and may readily be economically and ruggedly built. Also the arrangement and construction enables the same machine to be applied to pipe lines of widely varying diameters and the pipe engaging elements thereof may be readily retracted to allow

the unit to pass over couplings and other enlargements in the line.

By referring to Figure 2, it will be noted that the bottoms of both the yokes 27 and 28 and both the end plates 34 and 35 of the carriage are open to allow the machine to be readily positioned on and removed from a length of pipe from above. For this purpose, the ring gear 46 is provided with a removable section 46' which is detachably connected to the principal part thereof by the splice plates 62. Thus, upon removal of the removable section of the ring gear 46 the machine may be readily removed from or applied to a pipe line. This feature is of distinct advantage since the presence of expansion couplings, valves, pumping stations, etc. in pipe lines has heretofore caused considerable difficulty in the manipulation of pipe cleaning machines along the line. The present construction enables the machine to be lowered onto the line by a crane which is normally available in pipe line operations and when the machine is so lowered only the removable section of the driving gear need be assembled in position to render the machine operative.

The above specifically described embodiment of the invention should be considered as illustrative only as obviously many changes may be made therein without departing from the spirit or scope of the invention. For example, brushes 40 may readily be replaced, if desired, with rattlers or other operable cleaning tools, the carriage supporting the same may assume varying physical forms and the same is true with respect to the means for rotating the carriage. Reference should therefore be had to the appended claims in determining the scope of the invention.

What I claim is:

1. Apparatus of the character described comprising in combination a frame, a carriage rotatably mounted on said frame for rotation about the longitudinal axis of a pipe length, an elongated wire brush journaled in said carriage for rotation about an axis substantially parallel with said first mentioned axis, power means to rotate said brush about said second mentioned axis, means to vary the interval between said axes and to apply resilient pressure between said brush and the outer surface of said pipe, and power means to oscillate said carriage about said first mentioned axis.

2. Apparatus of the character described comprising in combination a frame, a carriage rotatably mounted on said frame for rotation about the longitudinal axis of a pipe length, a rotatable cleaning tool journaled in said carriage, means

on said carriage to maintain said tool in resilient pressure engagement with the outer surface of said pipe, a ring gear mounted for free rotation about said axis, a motor on said frame, a driving gear connected to said motor and meshing with said ring gear, a driven gear meshing with said ring gear and connected to said tool for driving the same, said driven gear being journaled on said carriage, and a driving connection between said motor and carriage for rotating the latter.

3. In apparatus for cleaning pipe a carriage mounted for rotation about the longitudinal axis of the pipe to be cleaned, a ring gear mounted for free rotation about said axis, a shaft journaled in said carriage and having an axis of rotation substantially parallel with said pipe axis, an arm pivoted on said shaft, a rotatable cleaning tool on said arm adapted to have resilient pressure engagement with the outer surface of said pipe, a driving interconnection between said shaft and tool, a gear keyed to said shaft and meshing with said ring gear, and means to rotate said ring gear.

4. Apparatus according to claim 3 further characterized in that said tool comprises an elongated brush rotatable about an axis substantially parallel with said pipe axis, and further including power means to oscillate said carriage about said pipe axis.

5. Apparatus according to claim 3 further characterized in that said tool comprises an elongated wire brush rotatable about an axis substantially parallel with said pipe axis, and further including power means to oscillate said carriage about said pipe axis, and means to effect relative movement between said pipe and carriage in a direction longitudinal of said pipe.

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