

Nov. 15, 1960

K. C. CRIBLEY
PIPE LINE CLEANER

2,959,798

Filed March 24, 1958

2 Sheets-Sheet 1

Fig. 5.

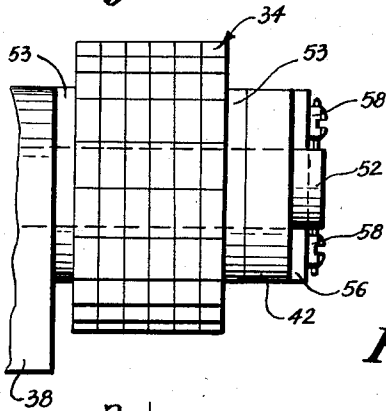


Fig. 6.

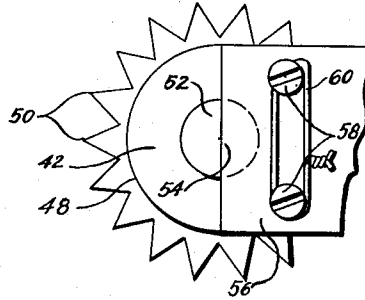


Fig. 1.

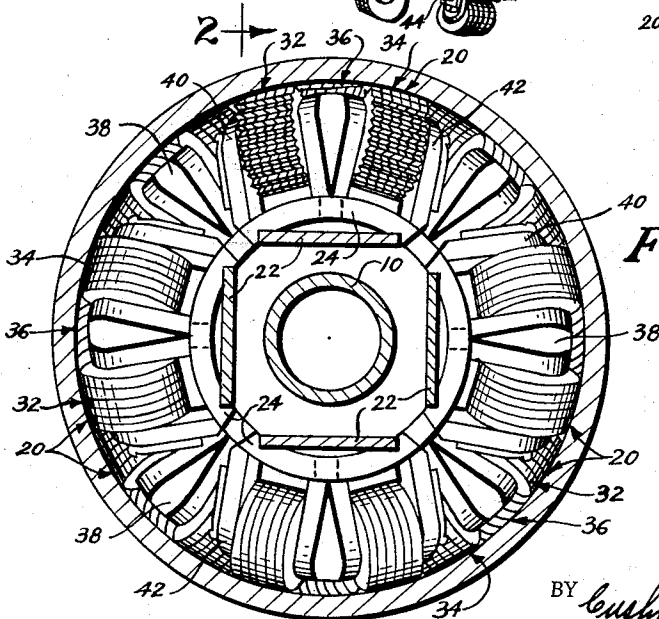
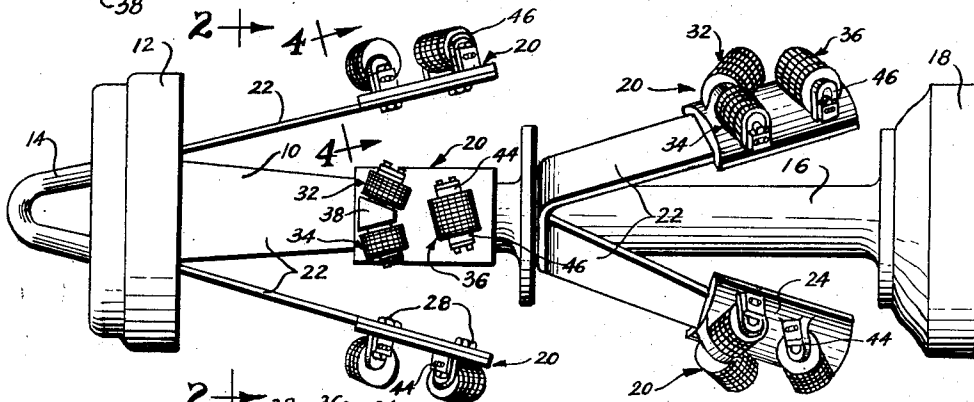


Fig. 2.

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Fig. 3.

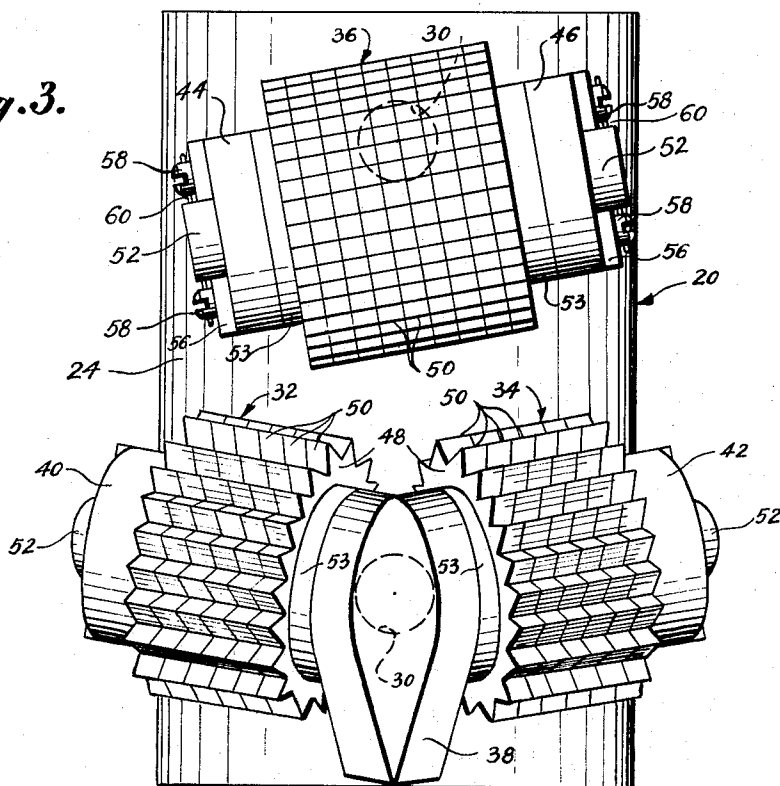
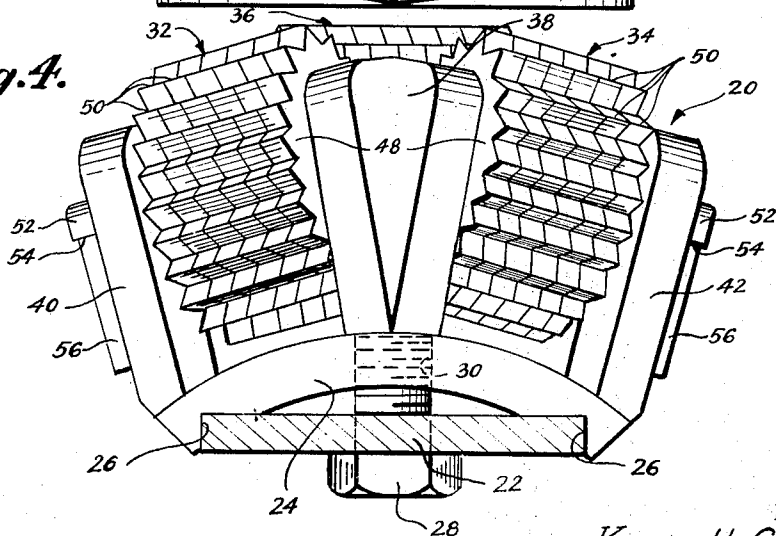


Fig. 4.



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PIPE LINE CLEANER

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Filed Mar. 24, 1958, Ser. No. 723,413

7 Claims. (Cl. 15—104.06)

This invention relates to the cleaning of the interior surface of pipe lines and more particularly to a pipe line cleaner having improved cutting means embodied therein.

In the normal operation of a product pipe line used for conveying gasoline, crude oil and other products, the interior surface of the line becomes rough from the formation of scale or rust. This is due to the gasoline or product absorbing moisture during refining or storage. During the travel of the product through the pipe line it cools causing the water to settle on the pipe wall. The water causes oxidation to take place so that formation of scale and rust occurs.

Moreover, after a pipe line is initially constructed it is necessary to clean the same of earth, rocks and other foreign material that may have become deposited therein during construction. In most new pipe line installations rust inhibitors are utilized. However, there are many thousands of miles of old product pipe lines still in existence which must be maintained in good condition so that a reasonable pumping capacity and fairly good flow characteristics are obtained. It will be understood that where considerable rust or scale formation has accumulated in a pipe line the pumping capacity of a pump feeding into such line is materially reduced and the flow characteristics are detrimentally affected. Also, excessive pressures are created which can cause pump failures.

Heretofore, pipe lines have been maintained in a clean condition by introducing a pipe line cleaner into the line, which cleaner is propelled to the discharge end by the flow of material therein. Such cleaners have, in past years, embodied "go devil" knives and blades of well known construction for scraping and otherwise removing the accumulation on the interior surface of the pipes, but without too great a success. In recent years, improved cleaners of the wear-compensating wire brush type have been advantageously used. The wire brush type of cleaner constitutes a considerable improvement over the "go devil" type knives and blades but have several inherent disadvantages. For example, it has been found that the bristles have a tendency to shear from the brushes leaving no bristles to clean or brush during the remainder of the cleaner trip. The loose bristles are picked up in the rubber cups of the cleaner causing undue wear and damage thereto. This condition frequently resulted in stoppage of the entire cleaner which necessitated removal thereof from the pipe by cutting out a section and replacing the same.

The present invention contemplates an improved pipe cleaner construction embodying toothed disk cutters which function to improve the cleaning efficiency and at the same time overcome the disadvantages noted above.

Accordingly, it is an object of the present invention to provide a pipe line cleaner having improved toothed disk cutter means arranged to contact a portion of the pipe line interior at least of the order of ninety-five percent of the entire periphery for cleaning scale and other deposits from the interior surface of a pipe line.

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Another object of the present invention is the provision of a cutter unit for use in a pipe line cleaner of the type described, which unit includes a cluster of toothed disk cutters arranged so as to obtain an efficient cleaning of the interior of a pipe line.

Still another object of the present invention is the provision of the cutter for a pipe line cleaner which can be simply installed and removed from the pipe line without danger of minor cuts and bruises to the operator in handling.

Another object of the present invention is the provision of a pipe line cleaner of the type described which is simple but rugged in construction, efficient and durable in operation, and economical to manufacture and maintain.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

Figure 1 is a side elevational view of a pipe line cleaner embodying the principles of the present invention;

Figure 2 is a cross sectional view of the cleaner taken along the line 2—2 of Figure 1, showing the same in its operative position within a pipe line;

Figure 3 is a plan view of one of the cutter units;

Figure 4 is an enlarged, fragmentary cross sectional view taken along line 4—4 of Figure 1;

Figure 5 is an enlarged, fragmentary, elevational view of one group of toothed disk cutters illustrating the manner in which the same are mounted; and

Figure 6 is an end view of the structure shown in Figure 5.

Referring now more particularly to the drawings, there is shown in Figure 1 a pipe line cleaner embodying the principles of the present invention. The cleaner includes a forward frame section 10 having a guide cup or disk 12 of flexible material, such as rubber, neoprene or the like, mounted on the forward end thereof. The cup 12 is secured between the forward end of the frame section 10 and a rigid nose structure 14 extending forwardly of the cup which serves to resist impact during the travel of the cleaner through a pipe line. Preferably, the nose structure is secured directly to the forward end of the frame section 10 as by a threaded connection or the like (not shown), which connection also serves to secure the guide cup 12 in position. Mounted in alignment with the forward frame section 12 is a rearward frame section 16 of substantially identical construction having its forward end detachably connected, as by a threaded connection or the like (not shown), to the rearward end of the frame section 10. Suitably mounted on the rear end of the rearward frame section 16 is a rearward guide cup or disk 18 of rubber, neoprene or the like.

Each of the frame sections 10 and 16 carries a series of circumferentially spaced cutter units, generally indicated at 20. Each cutter unit is mounted on the rear end of a leaf spring 22 or the like, the forward end of which is suitably secured to the forward end of the associated frame section. In general, the arrangement described above is conventional in wire brush cleaners and forms no part of the present invention except insofar as the same is combined with the novel cutting units hereinafter described to form an operative whole.

Referring now more particularly to Figures 3—6, each cutter unit includes an arcuate base plate 24 which preferably is formed from a section of pipe or the like. The concave surface of the plate is provided with grooves 26 which receive the rear end of the leaf springs 22. The latter is suitably secured to the base plate, by any suit-

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able means such as bolts 28 threadedly engaged within apertures 30 formed in the base plate 24. Mounted on the convex surface of the base plate are three groups of rotary cutters 32, 34 and 36, forming a cluster of such cutters. The cutter groups 32 and 34 are mounted in side by side relation on the forward portion of the base plate between a central lug 38 and spaced end lugs 40 and 42 respectively, which lugs are rigidly secured to the base plate by any suitable means, such as welding or the like.

The cutter group 32 is mounted for rotation about an axis which, in operation, is inclined an angle of the order of 10° with respect to a plane perpendicular to the axis of the pipe line being cleaned. The opposite cutter group 34 is mounted for rotation about an axis inclined at a similar angle of the order of 10° in the opposite direction with respect to a plane perpendicular to the axis of the pipe line. The axes of the two cutter groups intersect in a plane passing through the axis of the pipe line and are further inclined with respect to said plane an angle of the order of 74° on opposite sides thereof.

The cutter group 36 is mounted in trailing relation to the cutter groups 32 and 34 in the central portion of the base plate rotation about an axis inclined an angle of the order of 10° with respect to a plane perpendicular to the axis of the pipe line and disposed in a plane perpendicular thereto passing through the intersection of the axes of the cutter groups 32 and 34, by spaced lugs 44 and 46 rigidly secured to the base plate by any suitable means, such as welding or the like.

Each of the groups of cutters are preferably of identical construction and each embodies a plurality of thin disks 48 having V-shaped teeth 50 formed on the periphery thereof. The individual toothed disks of each group are mounted for independent rotation about a shaft 52 journaled in appropriate apertures formed in the associated lugs of the group, with washers 53 preferably being interposed between the outer toothed disks and the associated lugs. Each shaft 52 is detachably mounted within its associated apertured lugs by any suitable means. As shown the exposed shaft ends which, in the case of the cutter groups 32 and 34 include only one, are preferably formed with semi-circular cut outs 54 which receive plates 56 removably secured to the associated lugs as by bolts 58 or the like. The bolts 58 are locked into position to thereby secure the plate 56 within the cut out portion 54 of the associated shaft, by any suitable means, such as a wire 60 extending through suitable apertures formed in the bolts 58. While the number of toothed disks utilized in each group may be varied, as shown, the forward groups 32 and 34 include six toothed disks while the rearward group 36 includes nine similar disks.

In operation, the cleaner is inserted in a pipe line with the nose structure 14 foremost. As the cleaner is inserted, the forward cup 12 fits tightly within the interior surface of the pipe line and the cutter units carried on the leaf springs 22 are deflected generally radially inwardly so that when they are disposed within the pipe, the leaf springs 22 serve to resiliently urge the same into engagement with the pipe interior. The rearward cup 18 also tightly engages the interior surface of the pipe. The cups center the cleaner in the pipe line and the resilient engagement of the cutters with the pipe line insure an even peripheral wearing of the cups.

When flow has been established in the line, the cleaner will be moved therethrough by and at the rate of flow established. It will be noted that the forward frame section has mounted thereon four circumferentially spaced cutter units 20 and the rearward frame section 16 has a similar number of cutter units, the latter being staggered with respect to the cutter units of the forward frame section. In this way, a portion of the interior periphery of at least of the order of ninety-five percent of the entire periphery is contacted by the toothed disk cutters of all the units. It will be noted that the forward cutter

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groups of each unit are spaced apart and the rearward group spans the spacing between the forward groups. The inclination of the rearward group of cutters serves to impart a slight rotary movement to the entire cleaner during its longitudinal movement through the pipe line. It will be understood that where such rotary movement is not desired, alternate cutter groups 36 in the circumferential series can be oppositely disposed so that the cleaner will travel in a straight line through the pipe.

Tests have shown that the present cleaner has obtained a much more satisfactory cleaning of a line in 13 trips therethrough than was previously obtained by 300 trips through a line with the cleaners heretofore known. This superiority is primarily due to the use of rotary toothed disk type cutters and to their arrangement whereby a portion of the interior periphery of the pipe line at least of the order of ninety-five percent of the entire periphery is contacted during operation. The particular angulation of each cutter group and the relative disposition of the groups of each unit in clusters and the ultimate staggering of the clusters achieves the above contact in a simple and efficient manner.

Moreover, the tests have shown that rotary toothed disk type cutters are not subject to wear to the same degree as the cutting elements previously used such as the "go devil" blades or wire brushes. Cutters of the present invention are also more readily handled by the operator without danger of minor cuts and bruises which sometimes occur in handling "go devil" blades and wire brushes.

It will thus be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. In a pipe line cleaner of the type including frame means, a plurality of circumferentially spaced arms carried by said frame means resiliently biased substantially radially outwardly with respect to the axis of the pipe line during operation, and cutter units on said arms; the improvement comprising each of said cutter units comprising a base plate, two groups of rotary cutters mounted on said base plate in circumferentially spaced relation with respect to the axis of the pipe line being cleaned, a single group of rotary cutters mounted on said base plate in axial alignment with the space between said two cutter groups and in axially spaced relation thereto, each of said cutter groups including a plurality of toothed disks mounted in side by side relation for independent rotation about a common axis.

2. A cutter unit as defined in claim 1 wherein the axis of each group, in operation, is inclined with respect to a plane perpendicular to the axis of a pipe line being cleaned.

3. A cutter unit as defined in claim 2 wherein all of said cutter groups are inclined at substantially equal angles with said two cutter groups being inclined in opposite directions.

4. A cutter unit as defined in claim 1 wherein the axes of said two cutter groups are angularly related and intersect at a point disposed, in operation, in a plane containing the axis of said single cutter group and disposed parallel to the axis of the pipe line being cleaned.

5. A cutter unit as defined in claim 4 wherein the axes of said two cutter groups are further inclined substantially equal angles on opposite sides of a plane passing through said point of intersection and the axis of a pipe line being cleaned.

6. In a pipe line cleaner of the type including frame means, a plurality of circumferentially spaced arms

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carried by said frame means resiliently biased substantially radially outwardly with respect to the axis of the pipe line during operation, and cutter units on said arms; the improvement comprising each of said cutter units comprising a base plate, two groups of rotary cutters mounted on said base plate in circumferentiary spaced relation with respect to the axis of the pipe line being cleaned, a single group of rotary cutters mounted on said base plate in axial alignment with the space between said two cutter groups and in axially spaced relation thereto, each of said cutter groups including a plurality of toothed disks mounted in side by side relation for independent rotation about a common axis, the axis of each of said cutter groups being inclined at an angle of the order of ten degrees from a plane perpendicular to the axis of a pipe line being cleaned, the axes of said two cutter groups being oppositely inclined and intersecting at a point disposed in a plane containing the axis of said single cutter group and disposed parallel to the axis of the pipe line being cleaned, the axes of said two cutter groups being further inclined on opposite sides of a plane passing through said intersection point and the axis of the pipe line being cleaned an angle of the order of seventy-four degrees.

7. In a pipe line cleaner of the type including frame means and resilient cup means carried by said frame means for engagement with the interior surface of a pipe line to guide the cleaner therein and effect movement of the same along the pipe line in response to a fluid flow therein, the improvement comprising cutter means mounted on said frame for resiliently biased substantially radially outwardly engagement with the in-

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terior surface of the pipe line during movement of the cleaner therethrough, said cutter means including a plurality of groups of rotary cutters positioned circumferentially to contact a portion of the interior periphery of a pipe line at least of the order of ninety-five percent of the entire periphery, each of said groups including a plurality of toothed disks mounted in side by side relation for independent rotation about a common axis, the common axis of each rotary cutter group being disposed, in operation, at an angle with respect to a plane perpendicular to the axis of the pipe line, certain of said rotary cutter groups having their axes disposed at an angle inclined in a direction opposite from the inclination of the angle of the axes of other of said rotary cutter groups.

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