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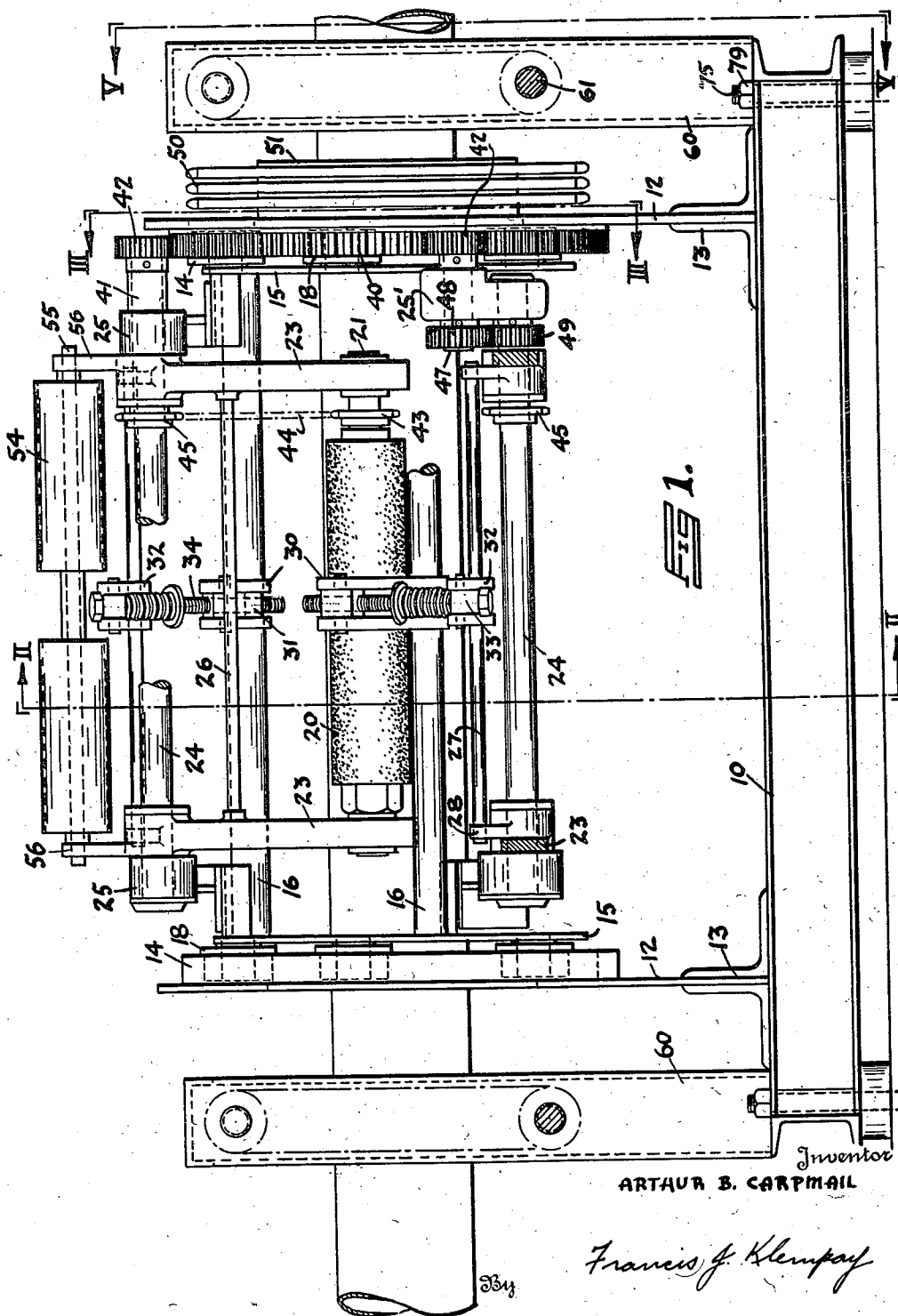
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2,307,449

PIPE CLEANING MACHINES

Filed Nov. 18, 1940

3 Sheets-Sheet 1



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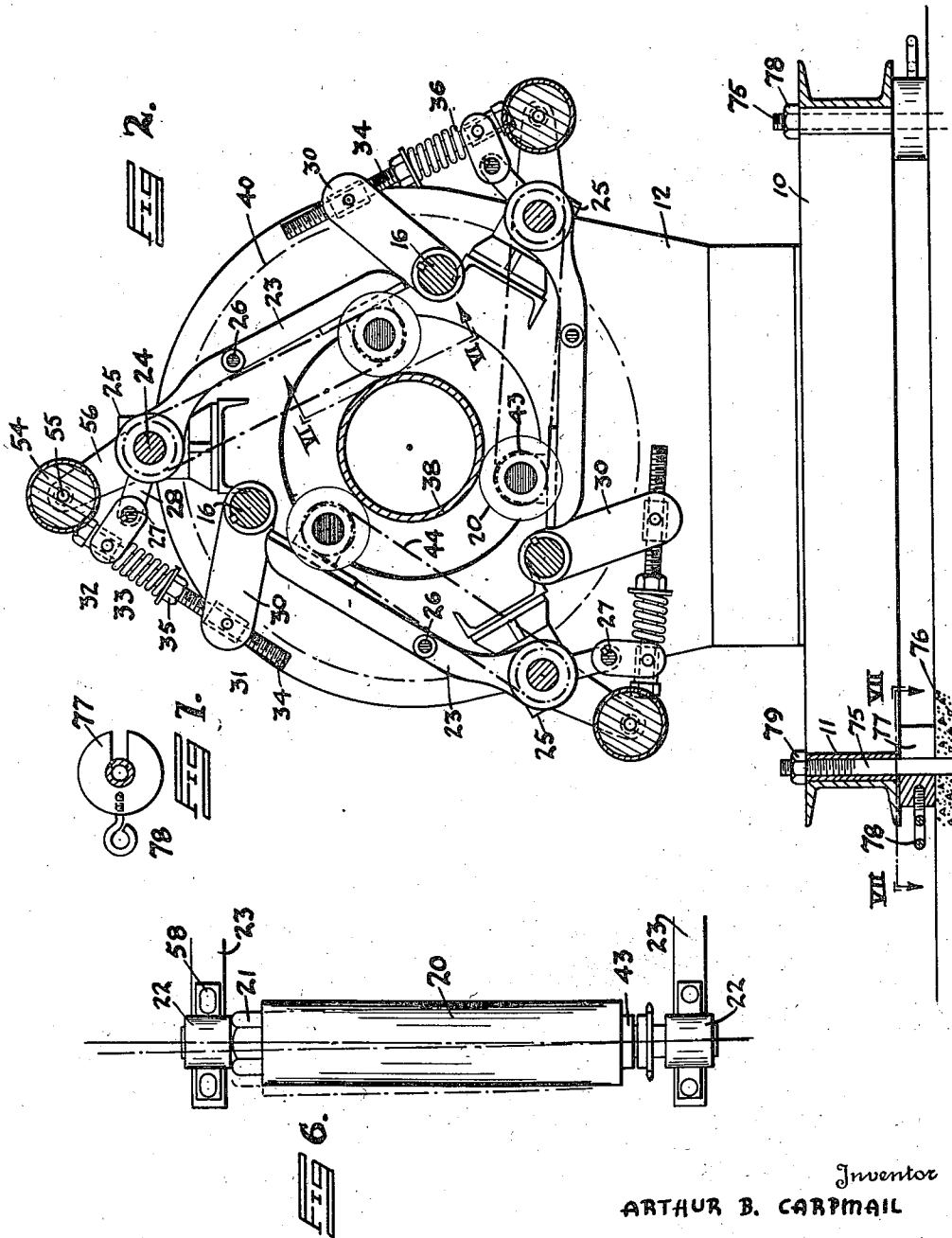
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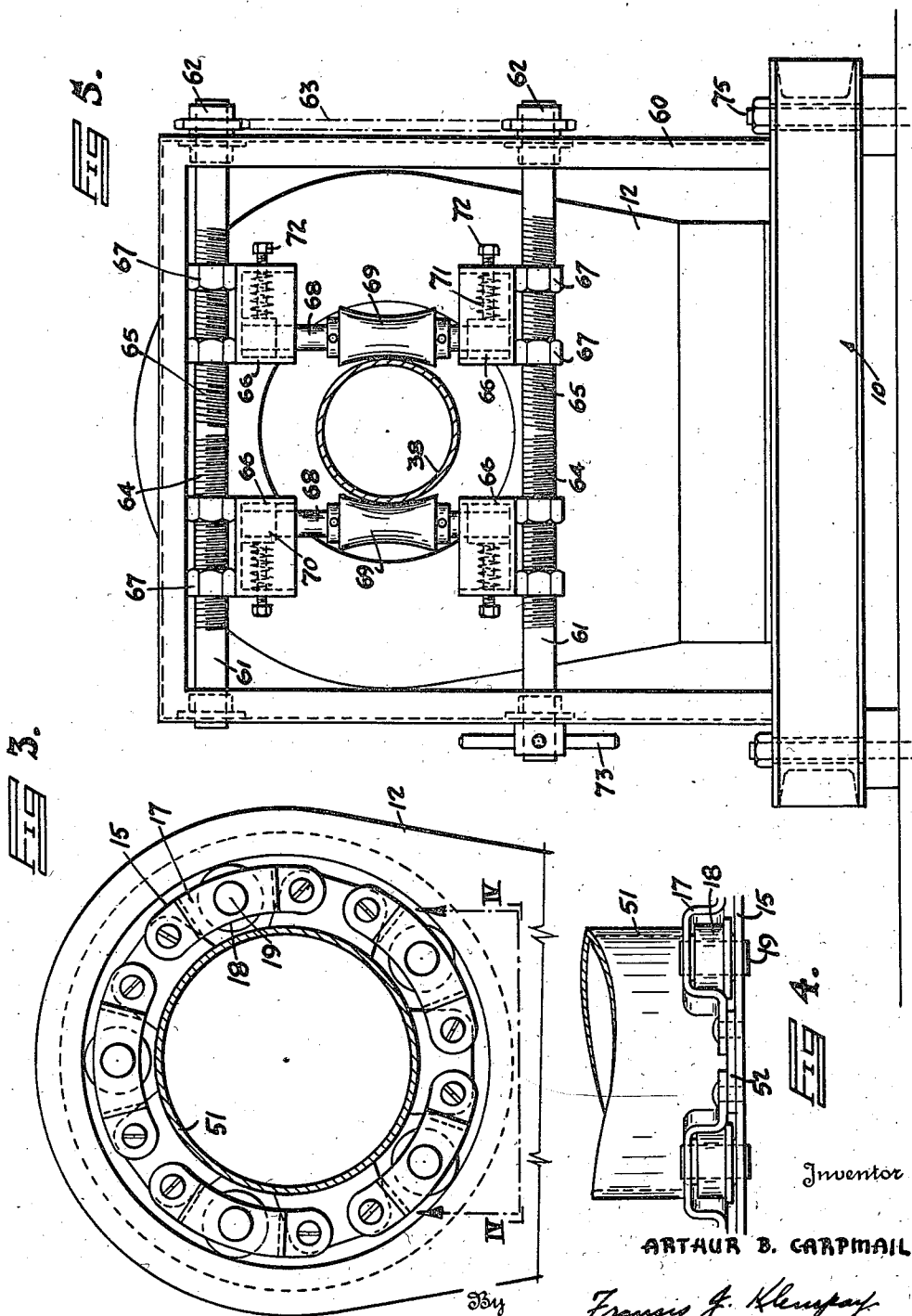
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PIPE CLEANING MACHINES

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3 Sheets-Sheet 3



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PIPE CLEANING MACHINE

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Application November 18, 1940, Serial No. 366,169

10 Claims. (Cl. 15—88)

This invention relates to a pipe cleaning machine and more particularly to improvements in the design and construction of the machine which is operative to rapidly and efficiently remove scale and other undesirable matter from the pipe preparatory to the coating of the pipe with preservative material.

An important object of the invention is the provision in an apparatus for the purpose stated of an improved brush arrangement whereby the scale and other undesirable matter on the surface of the pipe is attacked with much greater efficiency than in devices heretofore employed for the purpose whereby the pipe may be more thoroughly cleaned and at high speed, thus increasing the capacity of the cleaning station while insuring the maintenance of a high quality in the work.

A further object of the invention is the provision in an apparatus for the purpose stated and having the characteristic above pointed out of an improved arrangement for resetting the apparatus to operate on different diameters of pipe whereby the apparatus may be changed over from one to another diameter of pipe in a short length of time and without requiring any special tool or knowledge on the part of the operator.

Yet another object of the invention is the provision in an apparatus of the character described of an improved arrangement for insuring the alignment of the principal axis of the pipe passing through the machine with the axis of rotation of the various operative elements of the machine. This improved arrangement is of particular advantage when the machine is set up as a stationary machine in operative relation with pipe conveyors and other apparatus of the mill in which the machine may be situated.

Yet a further object of the invention is the provision of a machine of the kind described which in a single embodiment is very efficiently operative to clean the outer surface of the pipe although the pipe possesses wide variations in diameter. For example, it is possible by the use of a single machine to efficiently clean pipe ranging in size from three-fourths of an inch nominal to 24 inch O. D.

Other objects of the invention include the provision in a pipe cleaning machine employing cleaning means rotating about the axis of the pipe of a novel arrangement whereby the tendency of the rotating elements to rotate the pipe is materially reduced and in which the rotating elements may be so aligned that the travel of the pipe longitudinally through the machine is aided.

The invention consists further in certain novel features of construction and arrangement of parts in a pipe cleaning machine all to be hereinafter more particularly described. The above and other objects and advantages of the invention will become apparent from a consideration of the following detailed specification and the accompanying drawings wherein there is specifically illustrated a preferred embodiment of the invention.

In the drawings:

Figure 1 is a side elevation of a machine constructed in accordance with the teachings of the invention, certain of the parts being cut away to improve the showing of the view;

Figure 2 is a cross-section taken along the line II—II of Figure 1;

Figure 3 is a sectional view taken along the line III—III of Figure 1;

Figure 4 is a fragmentary view of a detail of construction of the machine of Figure 1;

Figure 5 is an end view of the machine;

Figure 6 is a fragmentary view of a brush supporting arrangement illustrating the manner in which the revolving brushes may be skewed with respect to the line of travel of the pipe through the machine, whereby the revolving brushes may aid in drawing the pipe through the machine; and

Figure 7 is a plan view of a shim used in aligning the machine with respect to pipe conveyors or other elements of a mill in which the machine may be placed.

Referring to the drawings which illustrate a preferred embodiment of the apparatus of the invention, reference numeral 10 designates a frame or base which may be fabricated of structural shapes and is preferably rectangular in plan with a vertically extending sleeve 11 welded or otherwise rigidly attached thereto at each of the four corners thereof. Extending upwardly from the base 10 in spaced parallel relation are the supports 12, each of which may consist essentially of a heavy plate of steel anchored at its lower end intermediate a pair of angle sections 13 spanning the base 10. As indicated in Figures 2, 3 and 5, the upper ends of the supports 12 are ring-shaped. A forged steel ring 14, having its inner cylindrical surface and its inner face accurately machined or ground, is bolted or otherwise suitably secured to the inner face of each of the supporting plates 12 concentric with the openings in the plates 12. Each of the rings 14 may, if desired, be provided with an axially extending flange to fit closely within the opening in the supporting plate 12.

In the apparatus of this invention the pipe is cleaned by bringing one or more elongated and relatively small diametered wire brushes into resilient engagement with the surface of the pipe to be cleaned, while revolving the brushes at high speed about their own axes, which are substantially parallel with the principal axis of the pipe being cleaned, and at the same time revolving said brushes at a much lower rate of speed about the principal axis of the pipe. These rotating elements are supported or carried by a revolving drum or carriage which, in a preferred embodiment of the invention, consists of a pair of spaced parallel rings 15 interconnected by three equi-circumferentially spaced bars 16 which are rigidly secured at their outer ends to the rings 15. Extending outwardly from each of the rings 15 are a plurality of circumferentially spaced U-shaped supports 17 (Figures 3 and 4) to form pockets for the accommodation of the drum or carriage supporting wheels 18. The latter are carried on antifriction bearings, not shown, supported in turn on the shafts 19 which pass through aligned apertures in the rings 15 and the central portions of the brackets 17. Each of the wheels 18 is provided with an integral radially extending flange and, when the parts are assembled as indicated in Figure 1 of the drawings, the principal outer cylindrical surfaces of the wheels engage and roll in the inner cylindrical surface of the forged rings 14, while the flanges of the wheels engage the inner machine faces of the forged rings. Thus the drum or carriage is supported for rotation about its longitudinal axis and means is provided to prevent axial movement thereof. The forces tending to move the drum axially may be considerable during the normal operation of the machine as when a heavy pipe is moved into the machine.

Each of the revolving wire brushes 20, of which there are three in the illustrated embodiment of the invention, are carried by and rotatable with a shaft 21 which is journaled in antifriction bearings carried within the pillow blocks 22. The latter in turn are individually carried by the inner ends of pivoted arms 23. Arms 23 are arranged in pairs, one pair to each brush, and each pair is rotatably mounted on a shaft 24 which is journaled in the widely separated bearings carried by the brackets 25 which in turn are rigidly connected with the rings 15 of the revolving carriage. Interconnecting the arms 23 of each pair is a rod 26 and a second rod 27, each of which is rigidly keyed at its ends to the arms 23 to prevent relative rotation between the arms. It should be noted that the rods 27 are connected with the arms 23 through the brackets 28 which are welded or otherwise suitably secured to the arms 23 proper. Brackets 28 and consequently rods 27 are on the opposite sides of the pivot afforded by the shafts 24 from the brushes 20 and it should be obvious that an outward thrust applied to the rods 27 will result in an inward movement of the brushes 20. This feature is relied on to move the brushes inwardly and outwardly to compensate for variations in the diameter of the pipe being worked on and the following arrangement is provided to enable the adjustment to be readily effected.

Extending outwardly from each of the rods 16 and securely fastened thereto to prevent relative rotation thereof is a pair of spaced parallel ears 30 between the outer ends of which is cradled a block 31 having a threaded aperture there-

through extending at right angles to the pivotal axis of the block. Keyed to each of the rods 27 and transversely aligned with the ears 30 is a pair of spaced links 32 cradling at their outer ends a block 33 having a smooth bore there-through extending at right angles to the pivotal axis of this block. A cap screw 34 passes through block 31. Intermediate the blocks 31 and 33 is a nut 35 in screw-threaded engagement with bolt 34 and between nut 35 and block 33 is a compression coil spring 36 which applies resilient pressure tending to move the brush 20 inwardly. When the machine is empty, springs 36 will of course keep the brushes in their innermost limiting positions as determined by the adjustment of the screws 34 relative to the blocks 31. If members 34 are screwed inwardly the brushes will be moved outwardly but it should be observed that this adjustment will not effect the setting or compression of the springs 36.

The brushes 20, being carried by the carriage or drum formed principally by the end rings 15 and spanning rods 16, will, of course, rotate about the axis of the pipe being cleaned (indicated by reference numeral 38) upon rotation of the carriage or drum. The means to rotate the brushes about their own axes will now be described. Shrunk on or otherwise suitably secured to one of the forged rings 14 or to one of the supports 12 is a large gear 40 having a pitch diameter greater than the diameter of the inner bore of the forged rings 14 and being mounted concentrically with respect to such bore. Gear 40 is, of course, withheld from rotation. Two of the shafts 24 are extended, as at 41, and to each of these extended ends of the shafts is keyed a small gear 42 which is adapted to mesh with the fixed gear 40. As stated above, shafts 24 are rotatable in the bearings of brackets 25 and are rotatable within the bores provided in arms 23 which provide the pivotal support for said arms. Keyed to each of the shafts 21 carrying the brushes 20 is a sprocket 43 adapted to be driven by a chain 44, which in turn is engaged over a sprocket 45 keyed on each of the shafts 24. In practice the sprockets 45 are considerably larger than the sprockets 43 and a multiplication of the speed in the drive is thus effected. This, together with the high ratio of the number of teeth in the gear 40 with respect to the number of teeth in the gears 42, may result in the brushes rotating at approximately 3000 R. P. M., while the drum or carriage rotates at only approximately 100 R. P. M.

To reduce the tendency of the revolving brushes 20 to spin the pipe 38 being cleaned, one of the brushes is rotated in a direction opposite to the direction of rotation of the other brushes and this is accomplished by inserting a reversing gear in the drive between gear 40 and one of the shafts 24. For this purpose one of the brackets 25 adjacent the gear end of the machine is modified, as indicated at 25' of Figure 1 of the drawings. Bracket 25' rotatably supports a short counter-shaft 47 to one end of which is keyed a gear 42 in mesh with the gear 40 and to the other end of which is keyed a gear 48 meshing with a gear 49 keyed onto the adjacent shaft 24. The insertion of the gears 48 and 49 in the driving train reverses the direction of rotation of the connected shaft 24.

The main drum or carriage is rotated by a multiple sprocket or pulley 50 which is operatively connected by belts or chains in any suitable manner with a power means, as for example

an electric motor (not shown). Sprocket or pulley 50 is rigidly connected with a sleeve 51 which in turn is securely fastened to the adjacent carriage ring 15 by means of the segmental flanges 52 extending radially outward from the inner end of the sleeve 51, as indicated in Figure 4 for example.

Each pair of arms 23 supporting one of the brushes 20 is provided with a counterweight 54 which may conveniently be carried by a rod 55 spanning projections 56 extending outwardly from each of the arms 23. Counterweights 54 are of substantial mass to statically balance the brush 20 with its shaft and sprocket together with the inner end of the arms 23. These counterweights have been found necessary not for the purpose of applying inwardly directed force to the brushes by reason of the centrifugal force acting on the counterweights 54, which action is relied on in certain of the devices of the prior art, but to compensate for the force of gravity acting on the relatively large mass of the brushes and the adjacent ends of the supporting arms 23. Without the counterweights, as a particular brush approaches the top of the pipe during the operation of the machine the weight of the brush, its shaft and sprocket, and the adjacent ends of the arms 23, would tend to force the brush into pressure engagement with the pipe in aid of the cooperating coil spring 35. Now as the brush moves to lowermost position, this weight tends to move the brush away from the pipe in opposition to the force exerted by the cooperating spring 36. It was found that this resulted in uneven cleaning of the pipe and that better results could be secured by balancing the pivotally mounted brush carrying assemblies both dynamically and statically.

As indicated more clearly in Figure 6, one or both of the pillow blocks supporting the anti-friction bearings, which in turn carries one of the brushes 20, may be provided with elongated openings 58 through which the cap screws extend to bolt the pillow blocks onto the arms 23. This enables the axes of rotation of the brushes 20 to be skewed slightly relative to the principal longitudinal axis of the machine and by skewing the brushes in the proper direction the revolving brushes may be made to aid in propelling the pipe being cleaned through the machine. This may be of particular advantage when short lengths of pipe are being cleaned or when the pipe conveying means associated with the principal cleaning machine is insufficient to move the pipe through the machine at a practicable rate.

The invention also contemplates an improved arrangement for guiding the pipe being cleaned through the machine and in the preferred illustrated embodiment of the invention the vertical position of the pipe is fixed and maintained by the supporting plane or line of the pipe conveyor system with which the present machine is associated and the machine is raised and lowered to compensate for the raising and lowering of the center of the pipe by reason of variation in diameter thereof while the horizontal position of the pipe is determined and maintained by the apparatus now to be described. Referring particularly to Figures 1 and 5 of the drawings, there is positioned at either end of the cleaning apparatus an upstanding frame 60 which carries the guide rolls and adjustment therefor and since both of these frames and the parts carried thereby are identical but one will be described in detail. The frame 60 may be conveniently supported in

upstanding relation from the base 10 at or adjacent the ends thereof. Journaled in vertically spaced parallel relation in each of the frames 60 are the shafts 61, each of which has keyed thereto a sprocket 62. Interconnecting the sprocket 62 is a chain 63 so that the two shafts 61 rotate in unison. Shafts 61 are each provided with right and left hand threads 64 and 65, respectively, on opposite sides of their middle points and bearing blocks 66 having attached nuts 67 are supported from each of the threaded sections of the shafts 61. Nuts 67 are in screw-threaded engagement with the threads 64 and 65 and it should be apparent that rotation of the shafts 61 in one direction will cause the block 66 to move outwardly in unison and rotation of the shafts in the opposite direction will cause the blocks to be moved inwardly. Journaled in the block 66 are the shafts 68 which carry intermediate their ends the guide rolls 69. The bearings for shafts 68 are blocks 70 slidable in recesses in the block 66 and the bearing blocks 70 are urged to inner position by the compression springs 71, the force of which may be adjusted by the screws 72. The purpose of spring 71 is to apply resilient pressure between the rolls 69 and the pipe 38 and to accommodate bell ends or couplings on the pipe. This also eliminates much chattering which would occur if the rolls 69 were mounted on a rigid support. One of the shafts 61, preferably the lower one, is provided with a hand wheel 73 to facilitate the inward and outward adjustment of the guide rolls 69.

To provide a ready vertical position adjustment for the apparatus of the invention the frame 10 is provided with the vertically extending tubes 11, one at each corner of the machine base or frame, and the tubes 11 are each adapted to receive a bolt 75 which has been previously cast in upstanding position in the concrete foundation 76 (Figure 2). The invention contemplates the provision of a multiplicity of U-shaped shims 77 which may be selectively positioned between the under surface of the frame 10 and the upper surface of the foundation or floor 76 to adjust the machine to a height dependent on the thickness of the shims employed. The shims may each be provided with a hook or eye bolt 78 to facilitate their withdrawal. See Figures 2 and 8. When shims of proper thickness are inserted, the nuts 79 threaded onto the projecting ends of the vertical bolts 75 are tightened down to hold the machine rigid. As stated above, the machine is normally used in conjunction with fixed conveyors of the mill or plant and, of course, different diametered pipe coming over the same conveyor will have a different center line elevation. Pipe sizes are standardized, as for example $\frac{3}{4}$ ", $1\frac{1}{4}$ ", 3", $4\frac{1}{2}$ ", 8", etc., and it is possible by providing various sets of shims 77 to adjust the vertical elevation of the machine to take care of the various standard sizes of pipe. Either a set may be provided for each pipe size or a chart may be provided directing the use of various combinations of the sets for the different pipe sizes. It has been found that this method of adjusting the elevation of the machine is rapid and satisfactory. Instead of having the shims come in contact with the concrete foundation, as illustrated, a steel plate may first be provided over the foundation or the spacing interval provided in other elements of the machine support.

The operation of the machine should be apparent from the above description. The elevation of the machine and the opening between

guide rolls 69 are first adjusted to fit the particular pipe to be cleaned and the brushes 20 are, by means of the cap screws 34, moved inwardly so that when free they will project about a quarter inch inwardly of the space to be occupied by the side wall of the pipe. If the machine is now operated and the pipe fit into it the brushes 20 will revolve at high speed about their own axis and at a much slower speed about the axis of the pipe and will be maintained at all times in pressure contact with the pipe by reason of the coil springs 36. Since the brushes rotate at a high rate of speed the cleaning is accomplished very thoroughly and expeditiously and the pipe may be moved through the machine by the conveyor aforesaid aided by the skewing of the brushes, if desired, at a substantial rate of travel. If it is desired to reset the machine to clean a different diametered pipe, the new required position of the brushes 20 may be attained simply by rotating the cap screws 34 a predetermined number of revolutions in the proper direction and the vertical position of the machine as well as the required adjustment of the guide rolls 69 may be readily accomplished in the manner outlined above. It has been found in practice that the apparatus of this invention may be changed over for different sized pipe in less than twenty minutes, while machines of the prior art require four hours or more of shut down for this purpose.

The invention contemplates the use of any number of revolving brushes 20 but there are advantages in the use of three in that this is the largest number (a large number being desired for high production purposes) that can be used while enabling the brushes to operate on pipe of widely varying diameters. In the commercial embodiment of the apparatus three brushes of approximately $4\frac{1}{2}$ " in diameter are so mounted that they are capable of cleaning pipe ranging in size from $\frac{3}{4}$ " I. D. to 24" O. D.

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. It is contemplated that novel features of the invention may be applied to a pipe line cleaning machine of the kind which is provided with means to travel along a continuous line of pipe which has previously been elevated from its permanent position. It is common practice to employ such machines preparatory to coating or recoating the pipe for preservative purposes. Reference should therefore be had to the appended claims in determining the scope of the invention.

What I claim is:

1. Apparatus for cleaning pipe comprising in combination a base, longitudinally spaced circular races on said base, a drum-like carriage having its ends journaled in said races, circumferentially spaced but longitudinally extending shafts mounted on said carriage, a pair of spaced arms pivotally mounted on each of said shafts, means interconnecting said arms of each pair whereby the same pivot in unison, a cleaning brush positioned between and journaled in the inner free ends of the arms of each pair, means to rotate said carriage, means to rotate said brushes about their own axes upon rotation of said carriage, and means to bias said arms in such direction that said brushes are yieldingly urged toward the axis of rotation of said carriage, said carriage being provided with a longitudinal opening there-through along its axis of rotation to allow the

pipe to be cleaned to pass longitudinally there-through.

2. Apparatus according to claim 1 further characterized in that said means to rotate said brushes about their own axes comprises a ring gear fixed with respect to said base, a pinion gear keyed to each of said shafts, and a driving connection between each of the shafts and the brush pivotally carried thereby.

3. Apparatus according to claim 1 further characterized in that said biasing means comprises an adjustable link for each of said pairs of arms, said links having one of their ends connected to said pairs of arms and the other of their ends anchored with respect to said carriage, said links each including a yieldable portion.

4. Apparatus for cleaning pipe comprising in combination a support, a carriage having an opening therethrough for the passage of the pipe revolvably mounted on said support, means to rotate said carriage about the longitudinal axis of said pipe, a shaft journaled on said carriage for rotation about an axis spaced outwardly from and substantially parallel with said pipe axis, a support pivotally mounted on said shaft, a brush revolvably carried by an end of said second mentioned support for rotation about an axis generally parallel with said pipe axis, a ring gear fixed to said first mentioned support concentric with and lying in a plane normal to the pipe axis, a pinion gear keyed to said shaft and meshing with said ring gear, a sprocket connected with said brush, a sprocket keyed on said shaft, an endless chain interconnecting said two sprockets, resilient means engaging said support and being operative to move said brush towards said pipe axis, a yoke rigidly connected with said carriage, a member having a threaded aperture pivotally supported in said yoke, a second yoke rigidly connected with said second mentioned support, a member having a smooth bore pivotally supported in said second yoke, a cap screw extending through said smooth bore and screw-threaded into said first mentioned member, and a nut threaded onto said screw intermediate said members, said resilient member being positioned between said nut and said member having the smooth bore.

5. Apparatus for cleaning pipe comprising in combination a support, a carriage revolvably mounted on said support, means to rotate said carriage, a brush revolvably mounted on said carriage for rotation about an axis spaced from and generally parallel with the axis of rotation of said carriage, resilient means to yieldingly urge said brush towards the axis of rotation of said carriage, means to rotate said brush about its own axis upon rotation of said carriage, and means associated with said brush mounting means whereby the axis of rotation of said brush may be skewed with respect to the axis of rotation of said carriage.

6. Apparatus for cleaning pipe comprising in combination a support, a carriage having an opening therethrough for the passage of the pipe revolvably mounted on said support, means to rotate said carriage about the longitudinal axis of said pipe, a support mounted on said carriage for pivotal movement about an axis spaced from and substantially parallel with said pipe axis, a brush revolvably carried by one end of said pivotal support for rotation about an axis generally parallel with said pipe axis, means to rotate said brush during rotation of said carriage, means to

vary the pivotal position of said second support with respect to said carriage whereby said brush may be moved towards and away from said pipe axis to compensate for variations in pipe diameter, and resilient means to yieldingly apply substantially the same pressure between said brush and pipe irrespective of the pivotal adjustment of said second mentioned support.

7. Apparatus for cleaning pipe comprising in combination a support, a carriage having an opening therethrough for the passage of the pipe revolvably mounted on said support, means to rotate said carriage about the longitudinal axis of said pipe, a support mounted on said carriage for pivotal movement about an axis spaced from and substantially parallel with said pipe axis, a brush revolvably carried by one end of said pivotal support for rotation about an axis generally parallel with said pipe axis, means to rotate said brush during rotation of said carriage, means to vary the pivotal position of said second support with respect to said carriage whereby said brush may be moved towards and away from said pipe axis to compensate for variations in pipe diameter, resilient means to yieldingly apply pressure between said brush and pipe irrespective of the pivotal adjustment of said second mentioned support, and a counterweight on said second support on the opposite side of the pivotal axis thereof from said brush whereby said brush supporting assembly is statically balanced.

8. Apparatus for cleaning pipe comprising in combination a support, a carriage having an opening therethrough for the passage of the pipe revolvably mounted on said support, means to rotate said carriage about the longitudinal axis of said pipe, a support mounted on said carriage for pivotal movement about an axis spaced from and substantially parallel with said pipe axis, a brush revolvably carried by one end of said pivotal support for rotation about an axis generally parallel with said pipe axis, means to rotate said brush during rotation of said carriage, means to vary the pivotal position of said second support with respect to said carriage whereby said brush may be moved towards and away from said pipe axis to compensate for variations in pipe diam-

eter, resilient means to yieldingly apply pressure between said brush and pipe irrespective of the pivotal adjustment of said second mentioned support, a shaft carrying said brush, a pair of spaced bearings carried by said second mentioned support for rotatably mounting said shaft, and means to adjust the position of one of said bearings with respect to said second mentioned support whereby the axis of rotation of said brush may be skewed with respect to the axis of rotation of said carriage.

9. Apparatus for cleaning pipe comprising in combination a support, a carriage rotatably supported on said support for rotation about the axis of the pipe being cleaned, means to rotate said carriage, a plurality of brushes mounted on said carriage for rotation about axes spaced outwardly from and generally parallel with said pipe axis, means to rotate said brushes during rotation of said carriage, means to hold said brushes in resilient engagement with said pipe, said means to rotate said brushes including means to rotate one of said brushes about its own axis in a direction opposite to the direction of rotation of another of said brushes.

10. Apparatus for cleaning pipe comprising in combination a support, a carriage having an opening therethrough for the passage of the pipe revolvably mounted on said support, means to rotate said carriage about the longitudinal axis of said pipe, a support pivotally mounted on said carriage for pivotal movement about an axis generally parallel with the axis of rotation of said carriage and spaced outwardly from said carriage axis, a brush revolvably mounted on said support for rotation about an axis spaced from said first and second mentioned axes, means to rotate said brush during rotation of said carriage, and a spring having one of its ends connected to a portion of said carriage and its other end connected to said support to yieldingly urge said brush toward the said carriage axis, the body of said spring being carried by a member movable with respect to said carriage whereby said brush may be positioned a pre-selected distance away from said carriage axis.

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