A device for maintaining a pipe in straight and proper alignment in a pipe or rod-pushing machine which is used to push a pipe or rod under a finished surface such as a driveway or street. The device comprises, generally, an upper spring loaded roller guide and a lower adjustably fixed roller guide at the front and back ends of a conventional pipe pusher of the type generally attached to a standard tractor-mounted hydraulic backhoe.

9 Claims, 6 Drawing Figures
BACKGROUND OF THE PRESENT INVENTION

In routine procedure, operating and target trenches are dug on respective sides of a driveway or street, for example, under which a pipe is to be installed. A rod and pipe pusher device, replacing the bucket on a standard tractor-mounted hydraulic backhoe, is properly located in the operating trench by the boom mounted dipper stick of the backhoe. After the pusher device is properly positioned and braced for the pushing operation, a first length of rod is manually inserted through a pair of drive jaws and drivingly engaged thereby to push said first length under the street or driveway. The trailing end of the first rod is provided with a coupling to receive a second length of rod wherein the hydraulic drive means is reactivated to push the second rod forwardly toward the target trench. A sufficient plurality of rod lengths are similarly attached to preceding rods until the leading tip end of the first rod length emerges into the target trench.

The leading tip end is threadably provided with a pusher cap which is then removed and replaced with an adapter for attachment to the end of the pipe to be permenantly installed under the above surface; said pipe being so installed by reconditioning the bracing means and drive jaws to reverse the direction of movement to pull the pipe back through the hole formed by the rod until the end thereof, coupled to the rod, emerges into the opening trench.

While the above described operations are quite conventional, certain deficiencies and difficulties are often encountered because the rod or pipe is not accurately guided by the pusher device. For example, various obstructions such as rocks are sometimes encountered in the earth through which the rod or pipe passes causing a deflection in the direction, either upwardly, downwardly or laterally, until it pushed out of the guides conventionally provided on the pusher. Such a deflection, although very slight in its initial stage, becomes very great since the angularity of deflection is magnified as the distance increases. Devices of this type are often used to install underground pipes, as above described, for distances of up to several hundred feet and a slight initial deflection is magnified tremendously over such long distances.

The pipe guide means of the present invention provides front and back guide means, applicable to any conventional pipe pusher, which is more accurate in order to perform the below ground pipe installation job within acceptable limits.

To this end, front and back guide roller assemblies are fixed relative to a conventional pipe pusher. Each assembly comprises an upper and a lower guide roller providing aligned, rounded grooves; one of said rollers being adjustable fixed and the other being spring urged against the rod as it traverses the grooves during the pushing operation. The springs are quite heavy and provide for a minimal degree of movement of the roller, just sufficient to permit a coupling, connecting two push rod length, to pass between the rollers. Therefore, a push rod is restrained against vertical and lateral displacement as it is pushed between the rollers.

OBJECTS AND ADVANTAGES OF THE PRESENT INVENTION

One of the principal objects of the present invention is to provide upper and lower pairs of guide rollers, adjacent the front and back ends of a conventional pipe pusher used, for example, on a tractor-mounted hydraulic backhoe.

Another principal object of this invention is to provide one of each pair, such as the bottom roller, with adjustment means to accommodate the diameter range of rods and pipes commonly used for this purpose.

Yet another object of the instant invention is to provide one of each pair, such as the top roller, with a heavy spring loading, to permit a limited degree of movement thereof for the passage of couplings, between rod lengths, therebetween.

A still further object of this invention is to provide aligned, transversely rounded annular grooves in the rollers to embrace a rod or pipe in a manner so as to prevent vertical or lateral displacement thereof as it is pushed therebetween.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a standard tractor-mounted hydraulic backhoe with a pipe pusher, embodying the present invention attached to the dipper stick thereof;

FIG. 2 is a schematic view illustrating the pushing operation;

FIG. 3 is a schematic view illustrating a pipe attached to the leading end of a rod in position to be pulled back through the hole formed by the rod;

FIG. 4 is a perspective view of one form of pipe pusher with the pipe guide means of the present invention fixed thereto;

FIG. 5 is an elevational view of the front guide roller assembly, fixed to a pipe pusher; and

FIG. 6 is an elevational view of the back guide roller assembly, fixed to a pipe pusher.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to the drawings in which like reference characters designate like or corresponding parts throughout the various views, and with particular reference to FIG. 1, a standard tractor-mounted hydraulic backhoe machine is designated generally at 10 with a pipe pusher 12 pivotally attached at 14 to the end of the dipper stick 15 in a conventional manner. The pipe pusher 12 replaces the backhoe bucket and utilizes the backhoe bucket, and utilizes the backhoe hydraulics for movement into an operating trench 16 as well as in performing the pipe or rod pushing operation as hereinbefore briefly described. The front and back pipe guide means of the present invention are respectively designated at 18 and 20.

Briefly, a typical pipe pusher includes a generally channel shaped, main body member 22 comprised of a bottom 24 and a pair of upstanding side walls 26 and 28, pivotally attached at 14 to the end of the dipper stick 15. A power arm 30 is pivotally attached at 32 to the outer end of a piston rod 34 of a hydraulic cylinder 36 to impart reciprocating movement to a slide box 38, slidably engaged along the bottom 24. Two jaws 42 and 44, FIGS. 2, 3 and 4, carried by the slide box 38, engage a rod or pipe 44 to impart longitudinal movement thereto. Means such as the spring and lever arm 46 and

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48 are adapted to reverse the drive jaws to selectively impart a pushing or pulling movement to the rod or pipe 44. This is accomplished by selective attachment of the spring 46 to the bottom or top end of the lever arm 48, FIG. 4. The above described structure is conventional and is not illustrated in detail but is intended to supply sufficient background for the guide means of the present invention.

In use, the pipe pusher 12 is first positioned in the operating trench 16 as illustrated in FIG. 2. The pipe pusher 12 is braced for the push operation by a pair of side legs 50 fixed thereto by means of U brackets 52, pivotally attached to the respective side walls 26 and 28. A backing member 54 is engaged between the rear ends of the legs 50 and the rear wall of the operating trench 16.

A first length of rod 56, including a front pusher cap 58 is inserted into the slide box jaws 40 and 42 and the slide box is actuated by means of the hydraulic cylinder 36, piston rod 34 and power arm 30 to push the first rod section 56 into the soil. A second section of rod 60 is attached by a coupling 62 to the rear end of the first section 56 while the rear end of same is still clear of the back guide 20. This process is repeated until the pusher cap 58 emerges into the target trench 64.

After the rod section 56 has entered the target trench, the pusher cap 58 is removed and replaced by a suitable adapter 66 FIG. 3, to threadably receive the pipe 68 which is to be permanently installed beneath the span 70 between the trenches 16 and 64. This is accomplished by the connection of spring 46 to arm 48 as previously described to reverse the drive jaws 40 and 42.

Subsequent actuation of the power arm 30 by the piston 36 will withdraw the pipe 68 through the rod hole until it enters the operating trench 16 whereupon said pipe 68 will be properly installed.

The front guide means 18 is comprised, generally, of a pair of upper and lower guide rollers 74 and 76 providing annular, rounded grooves 78 and 80 conforming generally to the radius of rods or pipes to be engaged therebetween as seen in FIG. 5. The upper guide roller 74 is journaled on a rod 82 extending through and between opposed side blocks 84 and 86, the outer ends of which are slidable engaged in respective channel members 98 and 90, fixed as by welding to the side walls 26 and 28. Stop means 92 and 94 limits the downward movement of the side blocks 84 and 86 in the channels 88 and 90.

The lower guide roller 76 is journaled on a rod 96 extending through and between opposed side blocks 98 and 100 which stop short of the channels 88 and 90.

A pair of vertically extending screwthreaded shafts 102 and 104 extend freely through the pairs of side blocks 84, 98 and 86, 100 adjacent the respective side walls 26 and 28. The screwthreaded shafts 102 and 104 are threaded into nut means 106 and 108, at their lower ends, fixed as by welding to the bottom 24. Vertical adjustment means is provided for the lower guide roller 76 by nuts 110 and 112, carried on the screwthreaded shafts 102 and 104 against the bottom of the opposed side blocks 98 and 100. The upper ends of the shafts 102 and 104 terminate in integrally formed nuts 114 and 116 to facilitate engagement with the fixed nuts 106 and 108.

With further reference to FIG. 5, a pair of relatively heavy compression springs 118 and 120 are circum-

As illustrated in FIG. 5, the back guide means 20 is basically the same as the front guide means 18 with the exception that a U shaped, inwardly opening channel assembly 130, comprised of a bottom channel 132 and a pair of opposed, vertical channel members 134 and 136, serves as the mounting means therefor. All of the like elements are identified by primes. The channel assembly 130 is fixed as by welding to the back edge of the main body member 22.

In use, the lower rollers 76 and 76' are adjusted by the nuts 110, 110' and 112, 112' relative to the intermediate drive jaws 40 and 42 to accommodate the diameter of the rod or pipe being utilized, and the compression springs 118, 118' and 120, 120' are adjusted by the nuts 122, 122' and 124, 124' to accommodate said rod or pipe diameter in addition to the somewhat enlarged diameter of the couplings, connecting the adjoining sections thereof. However, the rod or pipe is restrained against both vertical and lateral movement to maintain same in the desired path of travel through the soil.

While the front and back guide means of the present invention has been illustrated as adapted to one particular type of pipe pusher, it will be obvious to anyone skilled in the art that they may be readily adapted to other types without departing from the true spirit of the invention as defined in the appended claims.

1. A pipe guide means for attachment to a rod and pipe pusher of the type which is used to push a rod or pipe under finished surfaces such as a driveway, street, etc., the pusher being reversely actuated by a conventional power means while positioned in an operating trench on one side of the finished surface with a target trench on the opposed side thereof, the rod or pipe being in coupled sections, said guide means comprising:

a. front and rear guide assemblies attached relative to the front and rear ends of the rod and pipe pusher, each including,

1. an upper roller provided with an annular groove,
2. a lower roller provided with an annular groove, said upper and lower annular grooves being laterally rounded in cross sections to generally conform with the radius of a rod or pipe passing therebetween;

b. means to journal said upper and lower rollers;
c. means to maintain said upper and lower rollers in alignment in a generally vertical plane;
d. means to adjust said lower roller upwardly and downwardly in said vertical plane;
e. compression means to normally maintain said top roller in a predetermined position and permitting a limited degree of upward movement thereof when a rod or pipe coupler passes therebetween.

2. The pipe guide means as defined in claim 1 wherein said means to journal comprises a journal rod extending through each of said rollers and a pair of side blocks extending outwardly from opposed ends of each of said upper and lower rollers.

3. The pipe guide means as defined in claim 2 wherein said means to maintain comprises a pair of vertically extending screwthreaded shafts extending freely through the respective pairs of side blocks.
4. The pipe guide means as defined in claim 3 wherein said means to adjust comprises a pair of nuts threadably engaged on the respective screwthreaded shafts in engagement with the bottoms of the pair of the lower side blocks.

5. The pipe guide means as defined in claim 3 including a pair of nuts, fixed relative to the bottom of said rod and pipe pusher, to threadably receive the bottom ends of the respective screwthreaded shafts.

6. The pipe guide means as defined in claim 2 including vertical channel guides fixed to and opening inwardly from the respective sides of the pipe pusher to slidably journal outward extensions from said upper side blocker.

7. The pipe guide means as defined in claim 6 including stop means fixed relative to said channel guides to limit the downward movement of said upper roller.

8. The pipe guide means as defined in claim 3 wherein said compression means comprises a compression spring interposed between the top of each of said upper side blocks, and a nut threaded onto each of said screwthreaded shafts.

9. The pipe guide means as defined in claim 1 including a U-shaped channel assembly fixed relative to the rear end of the rod and pipe pusher to support said rear guide assembly.

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