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HYDRAULIC SUBMARINE DITCHER

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2 Sheets-Sheet 1

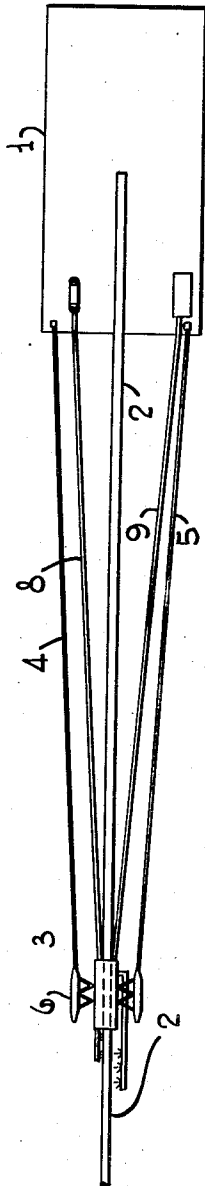


Fig. 1

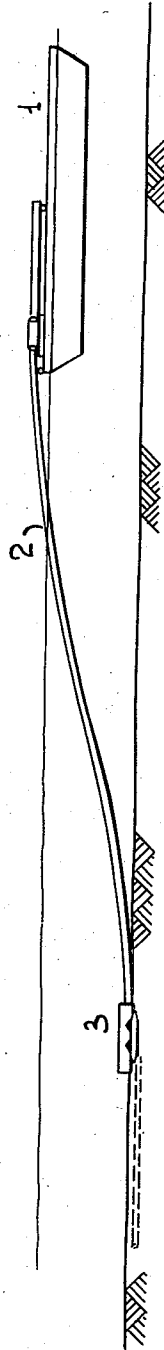


Fig. 2

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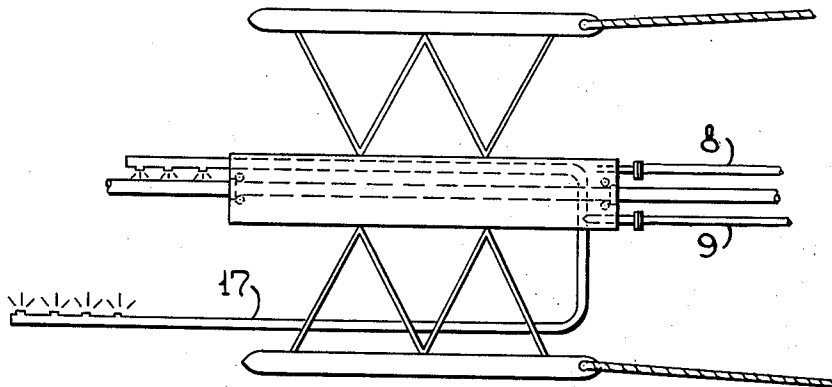


FIG. -3

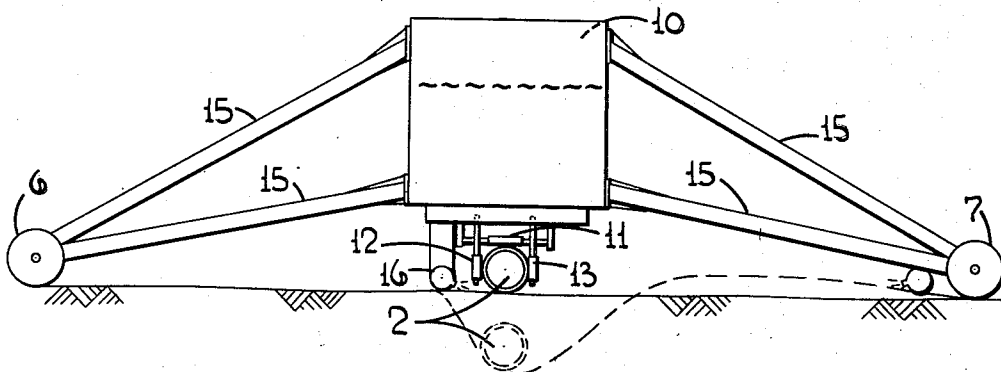


FIG - 4

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HYDRAULIC SUBMARINE DITCHER

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3 Claims. (Cl. 61—72)

This invention concerns a novel apparatus for providing a ditch or trench at the bottom of a body of water, for directing a pipe line into this trench, and for then backfilling or covering the pipe. In accordance with this invention, apparatus is provided to be towed behind a pipe laying barge. The apparatus is equipped with means to cause it to ride on the submerged pipe line being laid from the barge, with hydraulic jets operative to prepare a trench for the pipe line and to cover the pipe line when laid.

In the placement of pipe lines or cables at the bottom of a body of water, such as a lake or coastal waters, it is desirable to place the pipe line well below the bottom of the lake or ocean. By this means the attack of marine life on the pipe line is minimized. In addition, chemical and electrolytic corrosion of the pipe line is also minimized by virtue of the protection offered by mud and muck placed over the pipe line. Consequently, it is desirable to provide apparatus capable of digging a trench for a pipe line to be laid on the bottom of a body of water, while simultaneously covering the pipe line after it has been directed into the trench. While apparatus has been proposed for this purpose, the present apparatus is intended to overcome certain disadvantages of existing equipment in order to facilitate the economic burial of submarine pipe lines.

In accordance with this invention a submerged ditch digging apparatus is employed on which hydraulic jets are positioned to provide a suitable trench for the pipe line to be laid. This apparatus includes other hydraulic jets which are positioned to force mud and muck over the pipe line as soon as the pipe line is laid in the ditch provided by the first hydraulic jets. This entire apparatus is associated with a pipe laying barge by means of towing cables, and, if desired, by means of hydraulic lines to adjustably ballast the ditching apparatus, and to provide fluid flow to the hydraulic jets. Means are provided to cause the apparatus to ride on or to slide along the pipe line to be laid. The entire apparatus is stabilized on the pipe line and is maintained in operative position by means of skids or outriggers traveling on the bottom.

The nature of the apparatus of this invention, as well as the advantages of this apparatus may be understood by reference to the accompanying drawings in which:

Figure 1 diagrammatically indicates the utilization of the apparatus in combination with a pipe laying vessel as illustrated in a plan view;

Figure 2 is an elevation view of Figure 1;

Figure 3 is a plan view of the submersible trench digging and pipe covering apparatus of this invention; and

Figure 4 is an elevation view aft of the apparatus of Figure 2, looking along the axis of the pipe line.

Referring first to Figures 1 and 2 for a general appreciation of the invention, the numeral 1 designates a pipe laying barge or vessel of any desired type of the nature conventionally employed in laying submarine pipes or cables. Thus, vessel 1 includes means to assemble and lower pipe line 2 from the vessel 1. In accordance with this invention, a trench digging apparatus 3 is towed by vessel 1 as by means of towing cables 4 and 5, preferably attached to outriggers 6 and 7 of the trench digging apparatus. In addition, as will be understood, hose lines such as lines 8 and 9 may extend from the pipe laying vessel 1 to the submerged ditching apparatus 3. It is apparent from Figure 1 that as the pipe laying barge 1 moves forward, towing the ditching apparatus 3 at the bottom of the body of water, the apparatus 3 may be caused to provide a suitable trench for the pipe line 2,

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and to simultaneously cover the pipe line which has been laid.

The manner in which this is achieved is apparent from Figures 3 and 4, diagrammatically illustrating the nature of the submersible apparatus identified by numeral 3 in Figures 1 and 2. As illustrated in Figures 3 and 4, the ditching apparatus comprises a principal body portion 10 adapted to ride above and on the pipe line 2. Thus, beneath the body 10, rollers 11, 12, and 13 may be positioned so as to maintain the body 10 on the pipe line 2. For this purpose it is preferable to employ at least two sets of rollers 11, 12, and 13. Each of the sets of rollers may be positioned adjacent one end of the body member 10, so that alignment of the body member 10 with the pipe line 2 is insured. The rollers are preferably arranged on adjustable supports so that they may readily be positioned to accommodate any desired diameter of pipe line. As illustrated it is preferred that the body member 10 consist of or include a ballast tank. By connecting the ballast tank with a hose line 8 leading to the barge 1, it is possible to provide sufficient water in the tank to control the buoyancy of the body member 10 as desired. Thus by controlling the buoyancy of the apparatus in this manner, the apparatus may be caused to be sufficiently buoyant to travel along a bottom of any consistency encountered. It is a particular feature of this invention that outriggers 6 and 7 are associated with the body member 10 by suitable structural members 15 so as to stabilize the body member on the pipe line 2. Thus the outriggers 6 and 7 are sufficiently displaced from the principal axis of the body member 10 so as to maintain the body member directly above and on the pipe line 2. As illustrated in Figure 4, it is important that outriggers 6 and 7 be positioned in a horizontal plane below the center of gravity of body member 10 in order to secure the desired stability.

Suspended from the center portion of the body member 10 is a pipe line 16 provided with openings or jets along its length. Pipe line 16 is suspended below body 10 so as to be parallel with and in about the same horizontal plane as the pipe 2 to be submerged. The jets of line 16 are arranged to provide a multiplicity of hydraulic jets directed downwardly and towards the pipe line 2. Consequently by pumping water from the pipe laying vessel 1 through hose line 9 to the jets of pipe 16, mud, silt and muck directly below the pipe line 2 is forced beneath the pipe line 2 to one side of the apparatus. Thus, as illustrated, mud beneath pipe line 2 is undercut from the pipe line, and is forced to one side of the apparatus towards outrigger 7. A second jet pipe may be connected to hydraulic line 9 from the barge, or if desired may be connected to a separate hydraulic line. This second jet pipe 17 again is positioned so as to be parallel to the pipe line 2, but is well displaced from the pipe line 2 at the side of the apparatus towards which jet pipe 16 forces the mud in the undercutting operation described. Thus, jet pipe 17 may be fixed to outrigger 7 in a position adapted to permit hydraulic driving of mud back towards pipe line 2. In addition to these requirements, it is necessary that pipe line 17 be sufficiently long to extend aft of the ditching jets 16. By this arrangement as the apparatus is pulled along the water bottom, ditching jets 16 will force mud from beneath pipe 2 and towards outrigger 7 so as to permit the pipe 2 to drop into the trench thus provided. The back filling jets 17, as the apparatus is drawn along, will then force the displaced mud back towards the pipe line 2 so as to cover the pipe line at a time immediately after the pipe line has been placed in the trench.

The apparatus described possesses many characteristics ideally suiting it for its pipe burying duties. For example, the apparatus is fully stabilized on the pipe line during ditching operations, thus the skids or slides arranged as outriggers on either side of the apparatus below the center of gravity, eliminate any tendency of the apparatus to tip or roll from the pipe line along which it is pulled. This serves to maintain both the ditching and backfilling jets in the proper position at all times to undercut and cover the pipe line. The guide rollers positioned fore and aft of the body portion of the ditcher serve to maintain the apparatus in alignment with the

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pipe line. This is facilitated by employing a pair of towing lines which, as described, are attached to each of the outriggers and are attached to opposite sides of the towing vessel.

It is apparent that the general apparatus described is subject to many variations within the scope of this invention. Thus, for example, while the description given has indicated that the necessary hydraulic lines are supplied by pumps located on the pipe laying vessel, it is apparent that if desired, suitable pumps may be positioned directly on or in the submersible ditching apparatus. By this means it is possible to eliminate the hydraulic lines connecting the submerged apparatus to the towing vessel. For example, if desired, an electric motor and pump may be provided in the submersible portion of the apparatus supplied with electrical power through conductors arranged in one of the towing cables extending to the towing vessel. It is, therefore, to be understood that these and other variations of the apparatus disclosed are within the scope of the appended claims.

What is claimed is:

1. An apparatus for continuously ditching a pipeline as the pipeline is laid along the bottom of a body of water which comprises a body member, means for towing said body member along the pipeline, guide means on the body member for guiding the body member along the pipeline, outriggers connected to and laterally spaced from said body member to stabilize the body member on the pipe line, a first set of jets positioned on said body member in spaced relationship with one side of the pipe line, said first set of jets being adapted to direct fluid towards and below said pipeline and to provide a trench

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for the pipeline by displacing mud from beneath the pipeline, a second set of jets attached to the apparatus in spaced relationship with the opposite side of said pipeline, said second set of jets being spaced laterally from said body member a distance greater than said first set of jets, said second set of jets being inclined toward the water bottom at a lesser angle to the horizontal than said first set of jets and being adapted to direct fluid toward and above the entrenched pipeline and to cover the entrenched pipeline with the displaced mud, said second set of jets being positioned aft of said first set of jets with respect to said body member.

2. The apparatus defined by claim 1 including means to adjustably ballast said body member.

3. The apparatus defined by claim 1 in which the said outriggers are positioned below the center of gravity of the said body member.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
734,615	Roberts	July 28, 1903
1,152,326	Lewis	Aug. 31, 1915
1,852,796	Bennett	Apr. 5, 1932
2,602,300	Collins	July 8, 1952

FOREIGN PATENTS

Number	Country	Date
15,317	Great Britain	Nov. 24, 1886
692,251	France	of 1930
555,954	Germany	Aug. 3, 1932