March 3, 1959 T. R. LITTLE 2,875,585

MARINE PIPE TRENCHER

Filed July 10, 1956 2 Sheets-Sheet 1

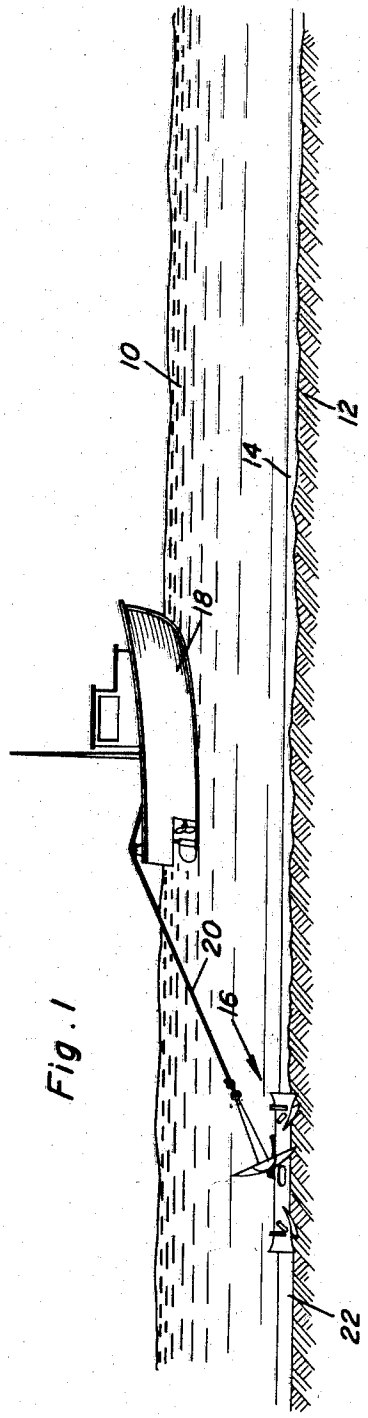


Fig. 1

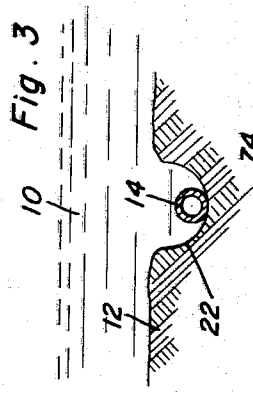


Fig. 3

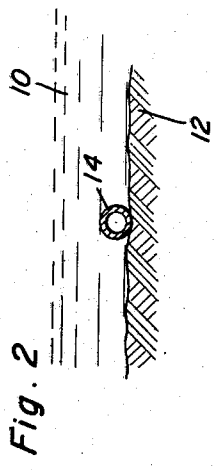


Fig. 2

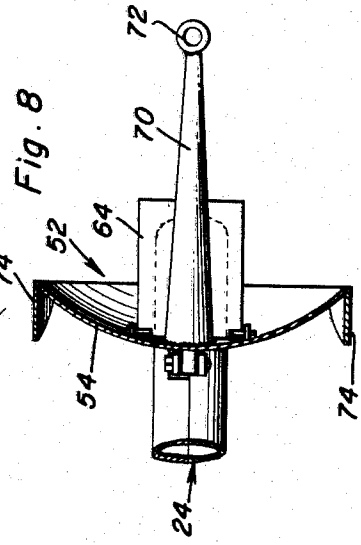


Fig. 8

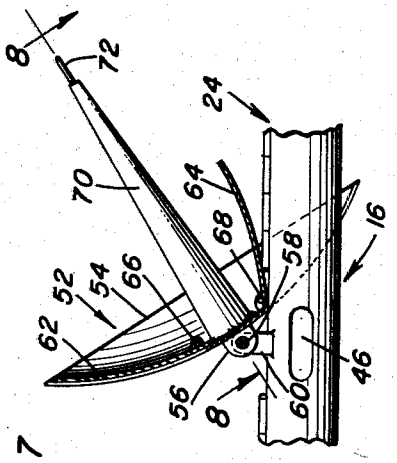


Fig. 7

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MARINE PIPE TRENCHER

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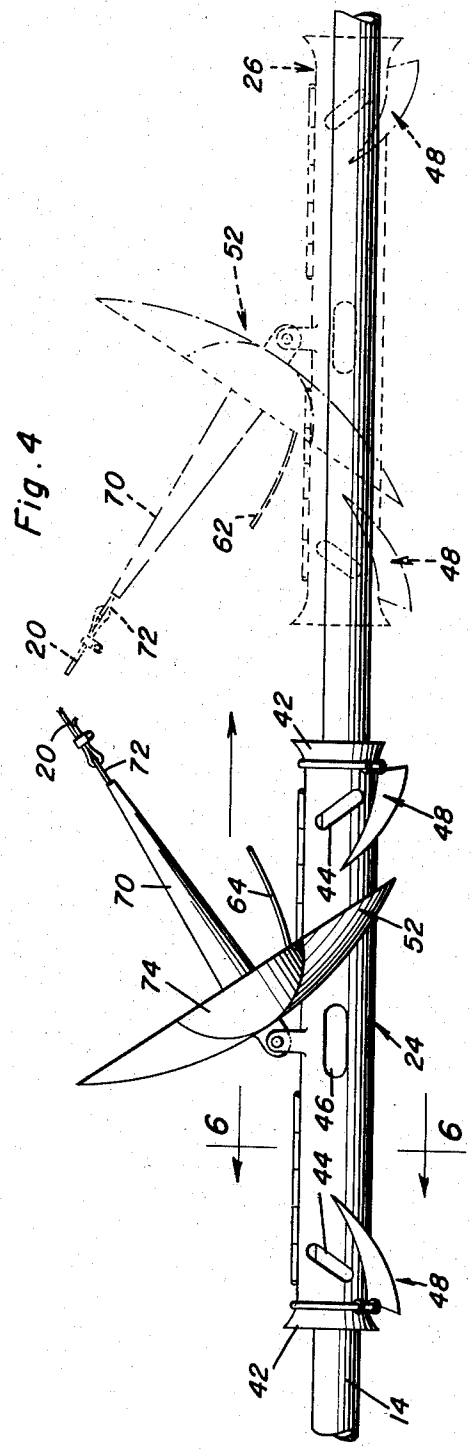


Fig. 4

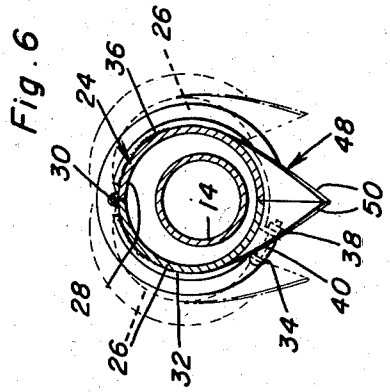


Fig. 6

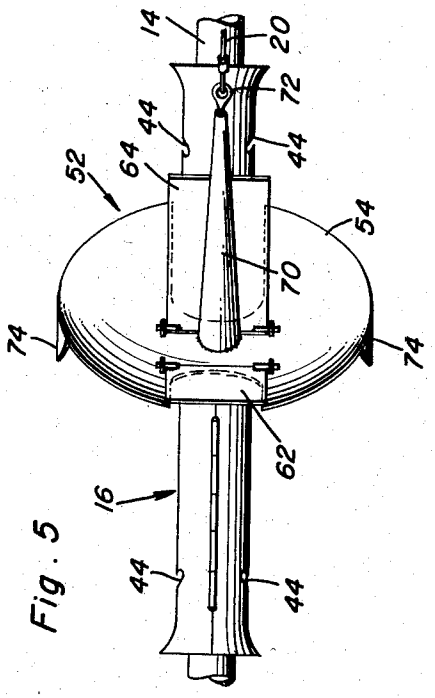


Fig. 5

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MARINE PIPE TRENCHER

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Application July 10, 1956, Serial No. 596,963

7 Claims. (Cl. 61—72)

This invention relates in general to new and useful improvements in pipe laying mechanisms, and more specifically to an improved marine pipe trencher.

At the present time there has arisen a large demand for suitable equipment for laying pipes in trenches beneath the water. This is particularly true in the off shore oil field areas where pipes are being laid from the wells to the shore or to other suitable points whereby the oil may be pumped into tankers. Inasmuch as the water is relatively shallow it is necessary that the pipes be disposed within trenches in order to prevent damage from wave action. Also, in other instances where ships' anchors and the like may engage the pipes it is highly desirable that they be placed in trenches.

It is therefore the primary object of this invention to provide an improved pipe trencher which is suitable for marine use and which may be actuated by towing a pipe trencher for the tug or the like and requiring no control other than the alignment of the towing tug with the general direction of the pipe which is being laid in the trench, the marine pipe trencher being of such a construction whereby it may be mounted on the pipe being laid and guided thereby.

Still another object of this invention is to provide an improved pipe trencher for marine operations, the pipe trencher being in the form of a simple sleeve which may be readily mounted on a pipe for movement therealong with the pipe guiding the sleeve, and a plow carried by the sleeve for digging into the earth and forming a trench simultaneous with the laying of the pipe in said trench.

Still another object of this invention is to provide an improved marine pipe trencher which is so constructed whereby repeated passes may be made on a pipe so that the depth of the trench in which it is being laid may be increased to that desired and the pipe is laid into the lower part of the trench after each pass of the pipe trencher.

A further object of this invention is to provide an improved marine pipe trencher which includes a plow for forming a trench, the plow being pivotally mounted on a guide sleeve of the pipe trencher whereby the direction of movement of the pipe trencher may be controlled and a trench may be formed in either direction of movement without removing a supporting sleeve from the pipe being laid, the plow having connected thereto tow means for the pipe trencher whereby the plow is automatically positioned with respect to the sleeve by the direction of pull on the sleeve.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a sectional view taken through a body of water in which a pipe is being laid and showing a tug towing the marine pipe trencher in a trench forming and pipe laying operation;

Figure 2 is an enlarged fragmentary sectional view taken through the lower part of the body of water and shows the pipe normally resting upon the bottom of the body of water in its initial position;

Figure 3 is an enlarged fragmentary sectional view similar to Figure 2 and shows a trench having been dug in the bottom of the body of water and the pipe lowered therein, the trench having been formed by the marine pipe trencher which is the subject of this invention;

Figure 4 is an enlarged elevational view of the pipe removed from the body of water and shows mounted thereon in solid lines the marine pipe trencher with the plow thereof positioned for movement from the left to the right, the marine pipe trencher also being shown in dotted lines and positioned for movement from right to left;

Figure 5 is an enlarged fragmentary plan view of the pipe and shows further the details of the pipe trencher;

Figure 6 is an enlarged fragmentary sectional view taken substantially upon the plane indicated by the section line 6—6 of Figure 4 and shows the specific details of the sleeve of the pipe trencher and the relationship thereof with respect to the pipe, and also being shown the general outlines of a ground breaking plow mounted at opposite ends of the sleeve;

Figure 7 is an enlarged fragmentary longitudinal sectional view taken through the marine pipe trencher which shows the specific details of a main plow thereof and the relationship of such plow with respect to the sleeve; and

Figure 8 is an enlarged fragmentary sectional view taken substantially upon the plane indicated by the section line 8—8 of Figure 7 and shows further the details of the main plow.

Referring now to the drawings in detail, it will be seen that there is illustrated in Figure 1 a body of water **10** having a bottom **12**. Initially resting upon the bottom **12** is a pipe **14** to be laid. Engaged on the pipe **14** for movement therealong is the marine pipe trencher which is the subject of this invention, the marine pipe trencher being referred to in general by the reference numeral **16**. The marine pipe trencher **16** is being towed by a tug **18** through the means of a suitable line **20** and is forming a trench **22** in which the pipe **14** is being laid.

The marine pipe trencher **16** includes an elongated sleeve which is referred to in general by the reference numeral **24**. The sleeve **24** is of the split type and includes a pair of sections **26** and **28** which are pivotally connected together along upper edges by a longitudinal hinge **30**. In order that the halves **26** and **28** of the sleeve **24** may be retained in a sleeve forming position, there is carried at each end of the section **26** a strap **32** which terminates in an ear **34**. Also carried at each end of the half **28** is a strap **36** which terminates in an ear **38**. The ears **34** and **38** are connected together by a suitable fastener **40** which is removable to permit pivoting of the halves **26** and **28** away from each other to the dotted line positions of Figure 6 to facilitate removal of the sleeve **24** from the pipe **14**.

In order to facilitate the sliding movement of the sleeve **24** over the pipe **14**, the sleeve **24** is provided at opposite ends with conical portions **42**. The conical portions **42** facilitate the entry of the pipe **14** into the sleeve **24**. In order that dirt and other foreign matter entering into the sleeve **24** may be removed therefrom, the halves **26** and **28** are provided with suitable openings **44** at opposite ends thereof and a central opening **46**.

In order to facilitate the breaking of the ground beneath the pipe **14** in the initial plowing operation, there is secured to the underside portion of the sleeve **24** at opposite ends thereof ground breaking plows which are referred to by the reference numeral **48**. The ground

breaking plows 48 face in opposite directions and are generally V-shaped in configuration, as is best illustrated in Figure 6. The ground breaking plows 48 are formed in sections 50 with one of the sections of each plow 48 being carried by one of the sleeve halves 26 and the other of the sections 50 being carried by the other of the sleeve halves 28. Thus the ground breaking plows 48 may be mounted at the bottom of the sleeve 24 for the most effective operation and at the same time permits the opening of the sleeve 24 for positioning over and removal from the pipe 14.

The marine pipe trencher 16 also includes a main plow which is referred to in general by the reference numeral 52. The main plow 52 is of the disk type and is concaved, as is best illustrated in Figures 7 and 8. The main plow 52 includes a disk-like body portion 54 which is provided at its center and on its underside with a depending ear 56. The ear 56 is pivotally carried by a transverse pivot pin 58 which is in turn carried by a pair of ears 60 projecting upwardly from one of the halves of the sleeve 24. Thus, the main plow 52 is mounted on the sleeve 24 for pivotal movement.

Referring now to Figure 7 in particular, it will be seen that there is provided a pair of longitudinally disposed trap doors 62 and 64 which are mounted on opposite sides of the center of the body member 54 and which are pivotally connected thereto by pivots 66 and 68, respectively.

Disposed intermediate the trap doors 62 and 64 is a tow arm 70. The tow arm 70 is aligned with the ear 56 and projects away from the body portion 54. The tow arm 70 terminates at the end thereof remote from the body member 54 in an eye 72 through which the line 20 passes whereby the marine pipe trencher 16 may be connected to the tug 18 for towing.

In Figure 7, the marine pipe trencher 16 is positioned for towing movement from left to right. When a towing force is placed upon the towing arm 70 it will assume the position of Figure 7, the angle of the towing arm 70 varying slightly depending upon the depth of the water 10. As the body member 54 pivots with respect to the sleeve 24, the sleeve 24 will engage the trap door 64 and swing it to an open position. At the same time, the trap door 62 is urged to a closed position by the pressure of water and earth thereupon. As the marine pipe trencher 16 is towed from the left to the right in Figure 4, the right hand ground breaking plow 48 will break the ground and advance the main plow 52 and the main plow 52 will then form a trench of the desired width, such as the trench 22 of Figure 3.

Normally one pass of the marine pipe trencher 16 will not provide a trench of the desired depth. Rather than remove the marine pipe trencher 16 from the pipe 14, which operation would require a diver, and start the trenching operation all over again, the tug 18 is merely turned around so as to tow the marine pipe trencher 16 in the opposite direction. When the pull on the tow arm 70 is shifted, the tow arm 70 and the main plow 52 will pivot from the solid line position of Figure 4 to the dotted line position of the same figure. At this time the sleeve 24 will engage the trap door 62 and move it to an open position. At the same time, the pressure of water and earth on the trap door 64 will move it to a closed position, continued movement of the marine pipe trencher 16 to the left will result in the deepening of the trench 22. The process is repeated back and forth over the pipe 14 until such time as the trench 22 of the desired depth is dug. As each trench forming pass is made, the pipe 14 will be lowered into the trench.

In certain instances it may be desired to dig a trench 22 which is of a greater depth than the half height or the main plow 52. In order that the main plow 52 may be guided in the trench which has already been formed, there is secured to the outer edge of the body member 54 a pair of vertically disposed, parallel guide

plates 74. The guide plates 74 are connected to the body member 54 along the horizontal diameter thereof. Thus as the main plow 52 moves downwardly into the trench 22, the guide plate 74 will engage the walls of the trench 22 and prevent the transverse shifting of the main plow 52 and the rest of the marine pipe trencher 16.

From the foregoing description of the present invention, it will be readily apparent that there has been devised a marine pipe trencher which is of a simple construction and which is so formed whereby it may be repeatedly towed back and forth over a pipe with each pass of the marine pipe trencher being in the form of a trench forming pass so that trenches of the desired depth may be formed without removing the marine pipe trencher from the pipe.

It is pointed out at this time that the ground breaking plows 48 may be of various configurations depending upon the type of bottom 12 in which the trenching operation is being performed. However, only one type of ground breaking plow has been illustrated inasmuch as the ground breaking plows 48 will vary greatly depending upon the bottom.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A machine for forming trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a ground breaking plow on the under side of said sleeve, and a main plow secured to said sleeve, said main plow projecting down on opposite sides of said sleeve and above said sleeve, and tow means for moving said sleeve, said ground breaking plow and main plow as a unit, said main plow being pivotally secured to said sleeve, said tow means being connected to said main plow for positioning said main plow relative to said sleeve during a trench plowing operation, said main plow having guide means at opposite sides thereof to guide said main plow in a trench being dug during subsequent plowing operations.

2. A machine for forming trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a ground breaking plow on the under side of said sleeve, and a main plow secured to said sleeve, said main plow projecting down on opposite sides of said sleeve and above said sleeve, and tow means for moving said sleeve, said ground breaking plow and main plow as a unit, said main plow being pivotally secured to said sleeve, said tow means being connected to said main plow for positioning said main plow relative to said sleeve during a trench plowing operation, said sleeve being longitudinally split to facilitate engagement of said sleeve on a pipe.

3. A machine for forming a trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a plow, means pivotally mounting said plow on said sleeve for movement between oppositely directed operative positions, said plow projecting down on opposite sides of said sleeve below said sleeve, said plow also extending above said sleeve, and tow means connected to said plow for moving said plow to and retaining said plow in that operative position corresponding to the direction of movement of said sleeve imparted thereto by said tow means during a trench plowing operation.

4. A machine for forming a trench under water and simultaneously positioning a pipe in the trench, said ma-

chine comprising an elongated sleeve for guided movement over a pipe, a plow, means pivotally mounting said plow on said sleeve for movement between oppositely directed operative positions, said plow projecting down on opposite sides of said sleeve below said sleeve, said plow also extending above said sleeve, opposite trap doors in said plow in alignment with said sleeve facilitating clearance of said sleeve in both positions of said plow and at the same time providing a generally uninterrupted plow surface, and tow means connected to said plow for moving said plow to and retaining said plow in that operative position corresponding to the direction of movement of said sleeve imparted thereto by said tow means during a trench plowing operation.

5. A machine for forming a trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a plow, means pivotally mounting said plow on said sleeve for movement between oppositely directed operative positions, said plow projecting down on opposite sides of said sleeve below said sleeve, said plow also extending above said sleeve, and tow means connected to said plow for moving said plow to and retaining said plow in that operative position corresponding to the direction of movement of said sleeve imparted thereto by said tow means during a trench plowing operation, said plow having guide means on opposite sides thereof to guide said plow in a trench having been dug during subsequent plowing operations.

6. A machine for forming a trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a plow, means pivotally mounting said plow on said sleeve for movement between oppositely directed operative positions, said plow projecting down on opposite sides of said sleeve below said sleeve, said plow also extending above said sleeve, oppositely directed ground breaking plows on the underside of said sleeve, said first mentioned plow being disposed intermediate said ground breaking plows, and tow means connected to said plow for moving said plow to and retaining said plow in that operative position corresponding to the direction of movement of said sleeve imparted thereto by said tow means during a trench plowing operation.

7. A machine for forming trench under water and simultaneously positioning a pipe in the trench, said machine comprising an elongated sleeve for guided movement over a pipe, a ground breaking plow on the underside of said sleeve, and a main plow secured to said sleeve, said main plow projecting down on opposite sides of said sleeve and above said sleeve, and tow means for maving said sleeve, said ground breaking plow and main plow as a unit, said main plow being pivotally secured to said sleeve, said tow means being connected to said main plow for positioning said main plow relative to said sleeve during a trench plowing operation, said main plow having opposite trap doors facilitating clearance of said sleeve in both positions of said main plow and at the same time providing a generally uninterrupted plow surface.

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