May 14, 1935. A. F. JOHNSON 2,001,576

UNDERWATER DRILLING APPARATUS

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Fig. 1

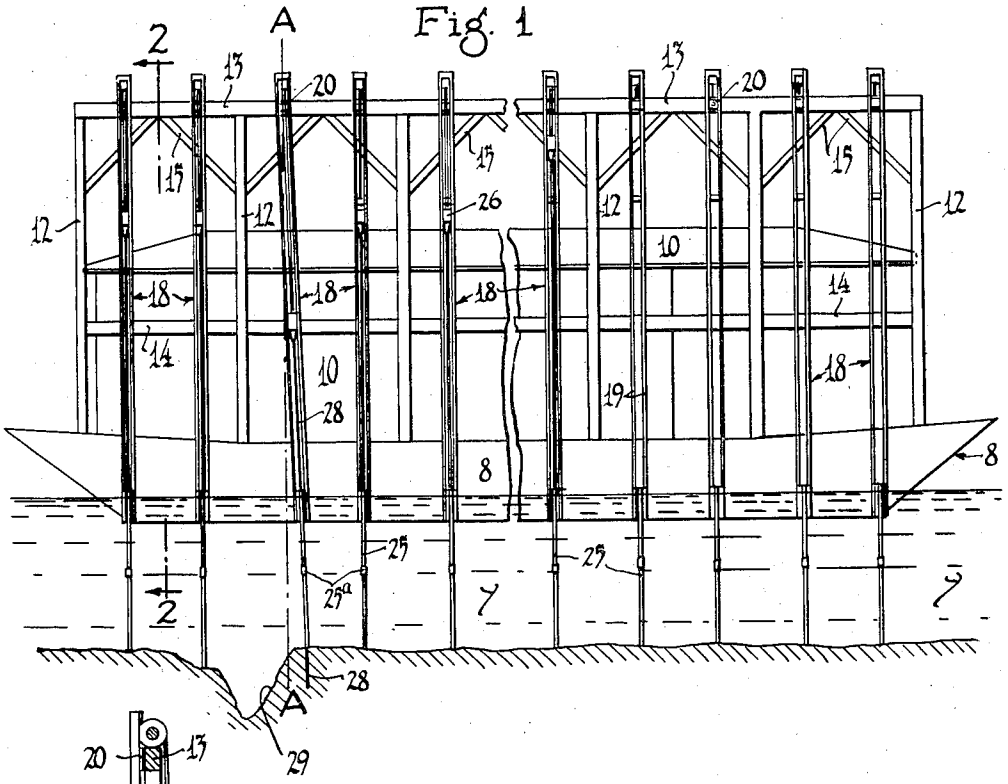
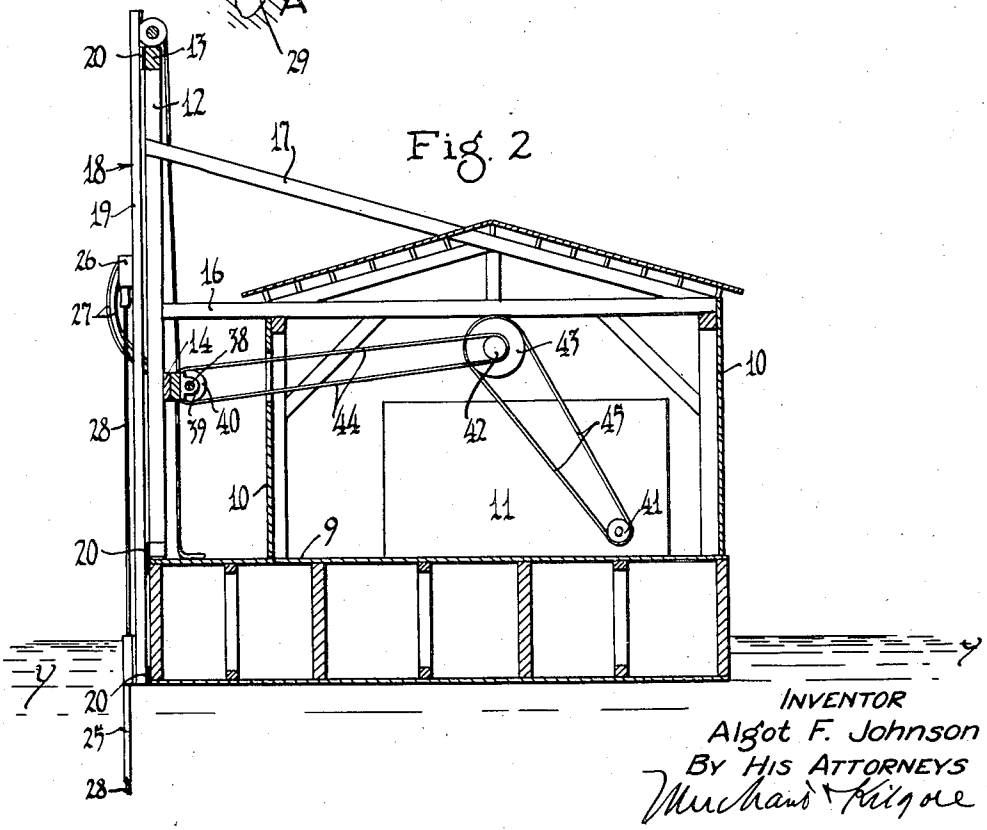


Fig. 2



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Fig. 6

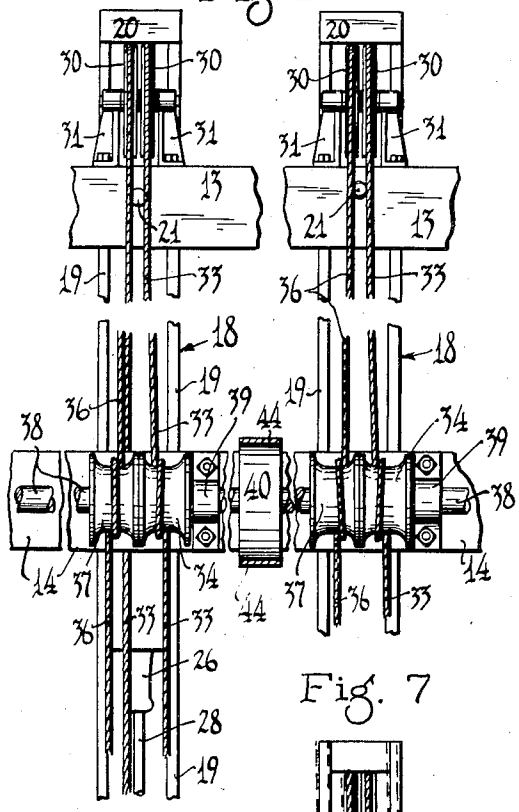


Fig. 7

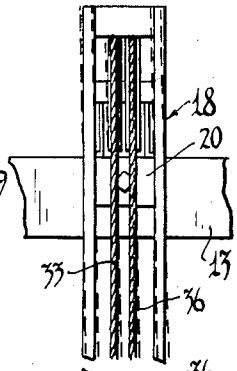


Fig. 4

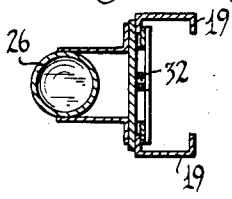


Fig. 5

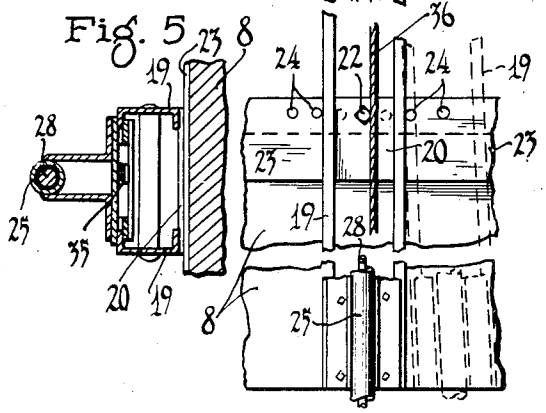
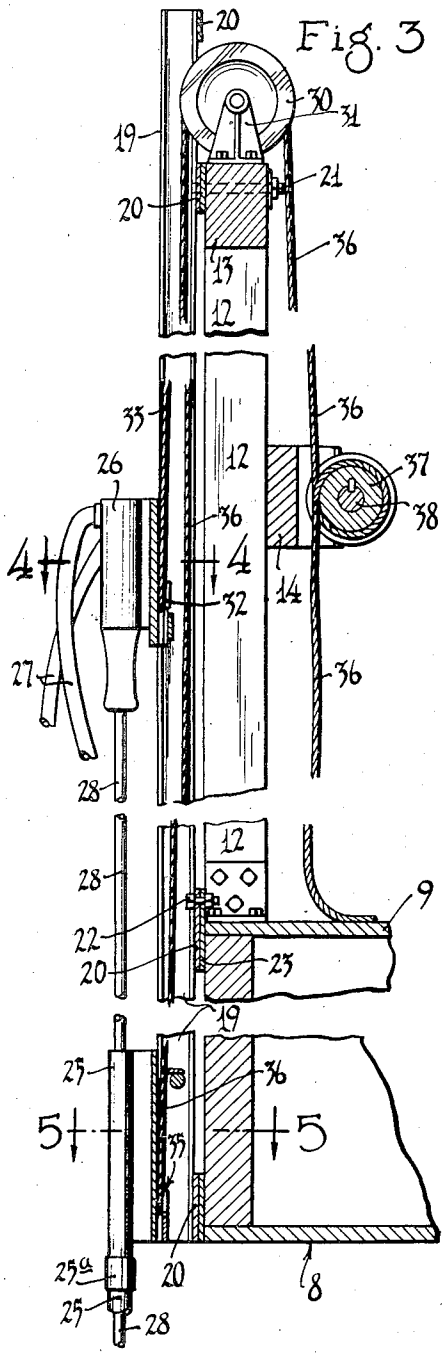


Fig. 3



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Patented May 14, 1935 2,001,576

UNITED STATES PATENT OFFICE

2,001,576

UNDERWATER DRILLING APPARATUS

Algot F. Johnson, Minneapolis, Minn.

Application February 6, 1935, Serial No. 5,243

5 Claims. (Cl. 255—51)

My present invention relates to improvements in underwater drilling apparatus of the type used for drilling and loading, with explosive substance such as dynamite, underwater blasting holes.

The apparatus of my invention is, in accordance with customary practice, mounted on a barge that can be moved about as desired.

Among the important objects of the invention is the provision of a simple apparatus of the character set forth that is more flexible of operation, easier of manipulation, capable of drilling and loading more holes with a given size crew of men, and is otherwise more efficient than hitherto employed apparatus. The barge and associated apparatus herein illustrated has been successfully employed over a considerable period of time in the Mississippi River for deepening and otherwise improving navigation and has satisfactorily demonstrated its superiority for this class of work.

Other objects and advantages of the apparatus will be made apparent from the following specification and claims.

To the above end, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a view in side elevation of the barge and associated apparatus with some parts broken away;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged view taken on the same line as Fig. 2 but having some parts broken away;

Fig. 4 is a detail sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a detail view taken on the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary view in elevation looking outwardly from the barge of Fig. 1, or from left to right in respect to Fig. 3, some parts being broken away and some parts being shown in section; and

Fig. 7 is a fragmentary view in elevation with some parts broken away looking toward the barge as in Fig. 1, or from right to left in respect to Fig. 3.

The barge is indicated as an entirety by 8 and has a deck 9 upon which is a machine house or cabin 10. The motivating engine of the barge is indicated diagrammatically at 11. The novel apparatus is mounted on a vertically disposed frame work made up of laterally spaced vertical beams 12, upper and intermediate horizontal stretcher beams 13 and 14, respectively, and suitable diagonal braces 15. This entire frame work is mounted parallel wtih one longitudinal edge of the barge and is rigidly supported by braces 16 and 17.

Mounted in laterally spaced relation on the outer side of the supporting frame work is a plurality of substantially vertically disposed guide-ways 18 which extend from just above the top of the said supporting frame work approximately to the bottom of the barge, and hence, somewhat below the normal water line. The water floating the barge is indicated by *y* and the bottom of the lake, river or the like, is indicated by *z*. The guide-ways 18 each comprise a laterally spaced parallel pair of opposed channels 19 that are tied together at their ends and intermediate portions by plates 20 that may be assumed to be welded thereto. Near their upper end portions the several guide-ways 18 are anchored to the stretcher beams 13 for pivotal movements in the underlying longitudinal edge of the barge and the frame work by heavy nut-equipped bolts 21 that extend through the beams 13 and adjacent guide-way tie-plates 20. Near their lower intermediate portions the several guide-ways 18 are normally anchored against pivotal or other movements by nut-equipped bolts 22 that extend through intermediate tie-plates 20 and adjacent steel plate 23 which is, by means not shown, anchored to and projects above the upper edge of the barge. This plate 23 is provided with a series of bolt holes 24 for each of the guide-ways 18, these holes 24, of each series thereof, being spaced apart on the arc of a circle struck from the anchoring bolts 21 of the associated guide-way. This permits pivotal adjustments of the guide-ways and anchoring thereof at their lower portions in either vertical or angularly disposed positions. By reference to Fig. 1 it will be noted that all of the guide-ways 18, except the one third from the left, are vertically disposed, the said guide-way third from the left is disposed at a considerable angle in respect to the others. Such angular adjustment of a guide-way is also indicated by dotted lines in Fig. 7.

Vertically slidably mounted on each guide-way 18 is a sand pipe 25. These sand pipes 25 are guided in the manner shown by the guide-ways for true longitudinal movements in respect thereto and held thereby in true longitudinal alignment therewith. Similarly mounted on each of

the guide-ways 18 above and in co-axial alignment with the sand pipe 25 thereof is a pneumatic drill mechanism 26. These drill mechanisms are conventional in character and therefore are not shown and described in detail, it being sufficient to state that they are supplied with compressed air from a suitable compressor or the like preferably driven from the motivating engine 11, but not herein illustrated, through flexible hoses 27. These pneumatic drills are equipped with long drill rods 28 which work axially through the sand pipes 25 and may be assumed to be provided, at their extreme lower ends, with suitable drills.

In practice the barge is moved to a desired spot and then staked, pinned, or otherwise anchored against any and all movements. The vertically slidable sand pipes 25 are then dropped into contact with the bottom *z*. Here it is important to note that the sand pipes 25 are made up of relatively short sections coupled together by conventional pipe couplings 25*a* and are for each location made of sufficient length to extend to the vicinity thereof, to wit: just below or above the water line when in contact with the bottom. The sand pipe guides are preferably provided with stops which will limit downward movement of the sand pipes to approximately the water line. The pneumatic drills 26, which may be assumed to have been held in suspension relatively high up on the guide-ways during the location of the sand pipes, are now lowered until the drill-equipped ends of their drill rods come into contact with the bottom *z* and the drill mechanisms may be set in operation and continue to operate until they have drilled holes of satisfactory depth, after which they may be again elevated to their maximum or near maximum elevated positions, this usually being sufficient to completely withdraw the drill rods from their co-operating sand pipes.

With the holes thus drilled and the drill rods removed from the sand pipes, holes may be loaded with a suitable charge of dynamite or other explosive through the sand pipes and then, of course, the barge will be moved to a new location. It is oftentimes found that someone or more of the drills primarily extended in a true vertical position to the bottom will contact an angular surface, such as the projecting edge of a rock, which will cause deflection of the drill and make it difficult or impossible to drill a hole at that point and when such conditions are encountered, it is often desirable to pivotally swing the guide-way and parts carried thereby pivotally so as to shift the position of the drill until a new and more desirable surface is encountered, this being accomplished by removing the lower anchoring bolt 22 and aligning and inserting the same through a new one of a series of holes 24. An example of a condition such as above noted is illustrated quite clearly in Fig. 1, wherein the bottom *z*, which may be assumed to be solid rock, is shown as formed with an abrupt drop-off at 29. In this instance it will be noted that the drill, third from the right in respect to Fig. 1, would strike the surface 29 and be deflected thereby if the drill rod were projected in a true vertical plane, as indicated by broken line A—A on Fig. 1. However, it will be seen that by only slightly pivotally moving the guide-way in the manner described, the drill-equipped end of the drill rod has been shifted to encounter a sufficiently flat surface.

The guide-ways and their co-operating parts are spaced so that when all thereof are in vertical positions drill holes will be spaced properly for average conditions. Obviously, however, the spacing may be varied considerably by pivotally adjusting some of the guide-ways in respect to the others thereof.

As a means for independently elevating each of the sand pipes and drilling mechanisms there is provided, near the top of each guide-way 18, a pair of independently rotatable sheaves 30. Each pair of sheaves is journaled between a pair of bearing brackets 31 that are mounted fast on the upper frame member 13. Anchored to each of the drill mechanisms at 32 is a rope or cable 33 which runs over a sheave 30 thereabove and is wound around and hangs loosely from a gypsy spool 34. Likewise anchored at 35 to each sand pipe 25 is a rope or cable 36 that passes over a sheave 30 and is wound around and extends loosely from a gypsy spool 37. The gypsy spools 34 and 37, of which there are a pair for each guide-way, are mounted fast on a line shaft 38 which is journaled in suitable bearings 39. The several spools 34 and 37 are, in practice, preferably continuously driven from the motivating engine 11 through connections including a pulley 40 on the line shaft, a motor-driven pulley 41, intermediate pulleys 42 and 43, and belts 44 and 45. With this arrangement any drill mechanism or any sand pipe may be elevated to desired position by merely pulling the free end of a co-operating rope 33 or 36 sufficiently to cause the rope to grip and wind on its co-operating gypsy spool 34 or 37. It will usually be desirable to provide some means for temporarily locking the drill mechanisms and sand pipes in elevated positions, but this may be accomplished in any well-known manner and is not illustrated herein.

In actual operation it has been found that one man can easily operate three drilling mechanisms, in fact, the barge illustrated was equipped with eighteen complete drilling mechanisms and it was found that all of these could be maintained in operation by six men, each man operating three drills and loading the drilled holes.

What I claim is:

1. In an underwater drilling apparatus, the combination with a barge, of a guide-way vertically disposed in laterally offset relation to an edge of the barge, means for anchoring the guide-way to the barge for limited pivotal adjusting movements in the plane of the said edge of the barge, a sand pipe mounted for vertical sliding movements on the guide-way, and a drill operating mechanism mounted for vertical sliding movements on said guide-way above the sand pipe and having a drill rod extending therefrom and normally through the sand pipe but being removable from the sand pipe by sliding the drill mechanism on the guide-way in respect to the sand pipe.

2. In an underwater drilling apparatus, the combination with a barge, of a plurality of light guide-ways substantially vertically disposed in laterally spaced relation to one another and in outwardly offset relation to an edge of the barge, means for anchoring the several guide-ways to the barge for pivotal adjusting movements in the plane of the said edge of the barge, a sand pipe mounted for vertical sliding movements on each guide-way, and a drill operating mechanism mounted on each guide-way above the sand pipe and for sliding movements in respect to the sand pipe, said drill mechanism having a drill rod that is extensible through the sand pipe under sliding

movements of the drill mechanism on the guide-way in respect to the sand pipe.

3. In an underwater drilling apparatus, the combination with a barge, of a long guide-way laterally offset from an edge of the barge, said guide-way being normally substantially vertically disposed, means anchoring the upper end portion of the guide-way to the barge for pivotal movements in a plane longitudinally of the barge, means for locking the guide-way in pivotally adjusted positions, a sand pipe mounted for vertical sliding movements on the guide-way, and a drill operating mechanism mounted on the guide-way above the sand pipe for sliding movements on the guide-way in respect to the sand pipe, said drill mechanism having a drill rod extending therefrom in co-axial alignment with the sand pipe and being extensible through the sand pipe under sliding movements of the drill mechanism in respect to the sand pipe.

4. In an underwater drilling apparatus, the combination with a barge, of a plurality of long guide-ways laterally offset from an edge of the barge, said guide-ways being normally substantially vertically disposed in laterally spaced relation to one another, means anchoring the upper end portions of the several guide-ways to the barge for independent pivotal adjusting movements in the plane of the said edge of the barge, means for locking the said guide-ways in pivotally adjusted positions, a sand pipe mounted for vertical sliding movements on each guide-way and being extended longitudinally thereof, and a drill operating mechanism mounted on each guide-way above the sand pipe thereof for sliding movements on the guide-way independent of the sand pipe thereof, said drill mechanisms each having a drill rod extending axially therefrom in co-axial alignment with the co-operating sand pipe and said drill rods being extensible through the sand pipes by sliding movements of the drill mechanisms in respect to the sand pipes.

5. The structure defined in claim 2 in further combination with means for independently raising the several sand pipes and drill mechanisms, said means comprising a pair of sheaves near the top of each guide-way, flexible cable means extending from each sand pipe and from each drill mechanism over a different one of said sheaves, a horizontally disposed line shaft extending past the several guide-ways, means for continuously driving the said line shaft, a plurality of gypsy spools fixedly mounted on the line shaft, there being one thereof for each sand pipe and one thereof for each drill mechanism, said flexible cable means of each sand pipe and each drill mechanism being wound loosely around a different one of said gypsy spools.

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