

No. 624,472.

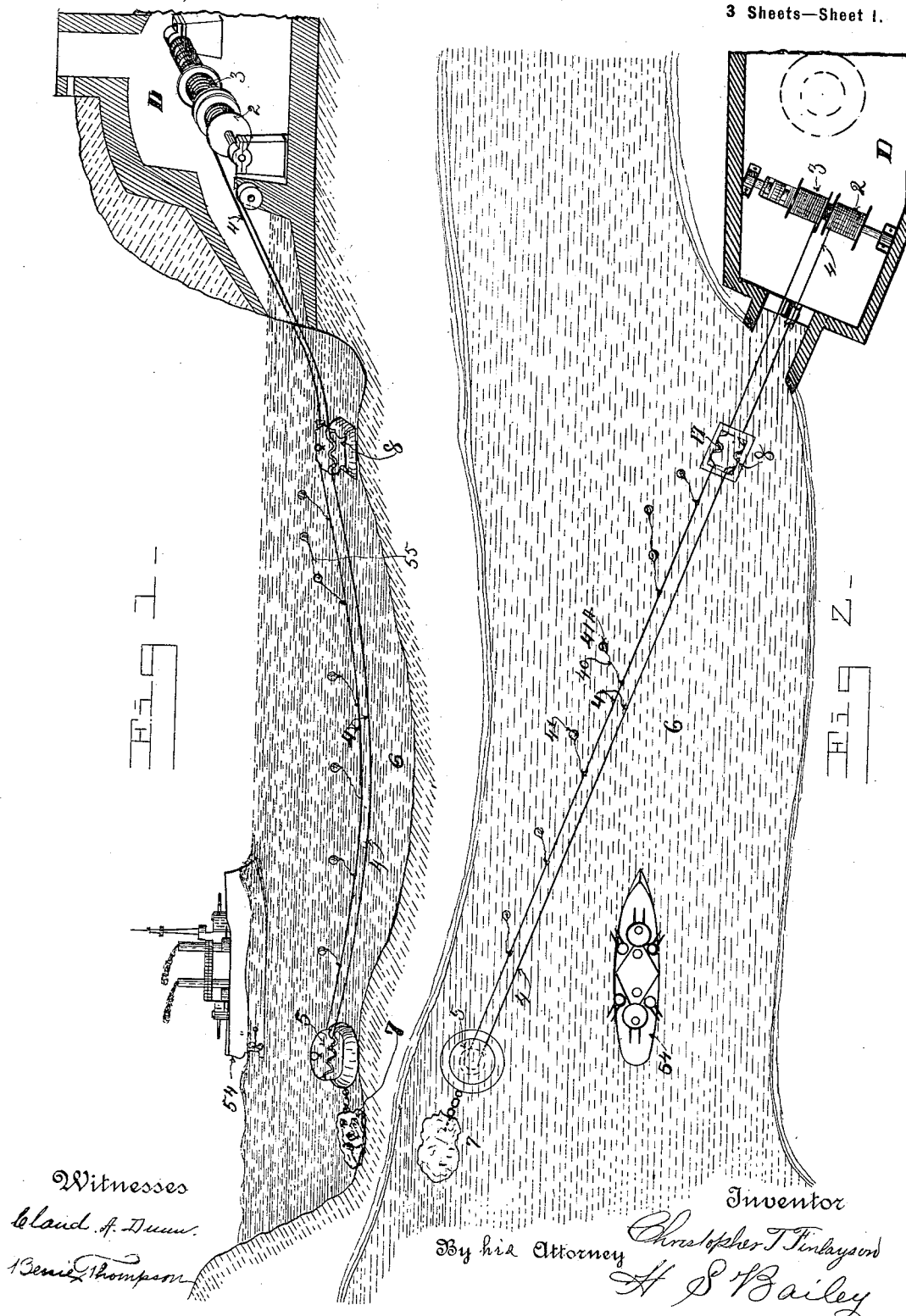
Patented May 9, 1899.

C. T. FINLAYSON.
SUBMERGED TORPEDO TRAMWAY.

(Application filed June 28, 1898.)

(No Model.)

3 Sheets—Sheet 1.



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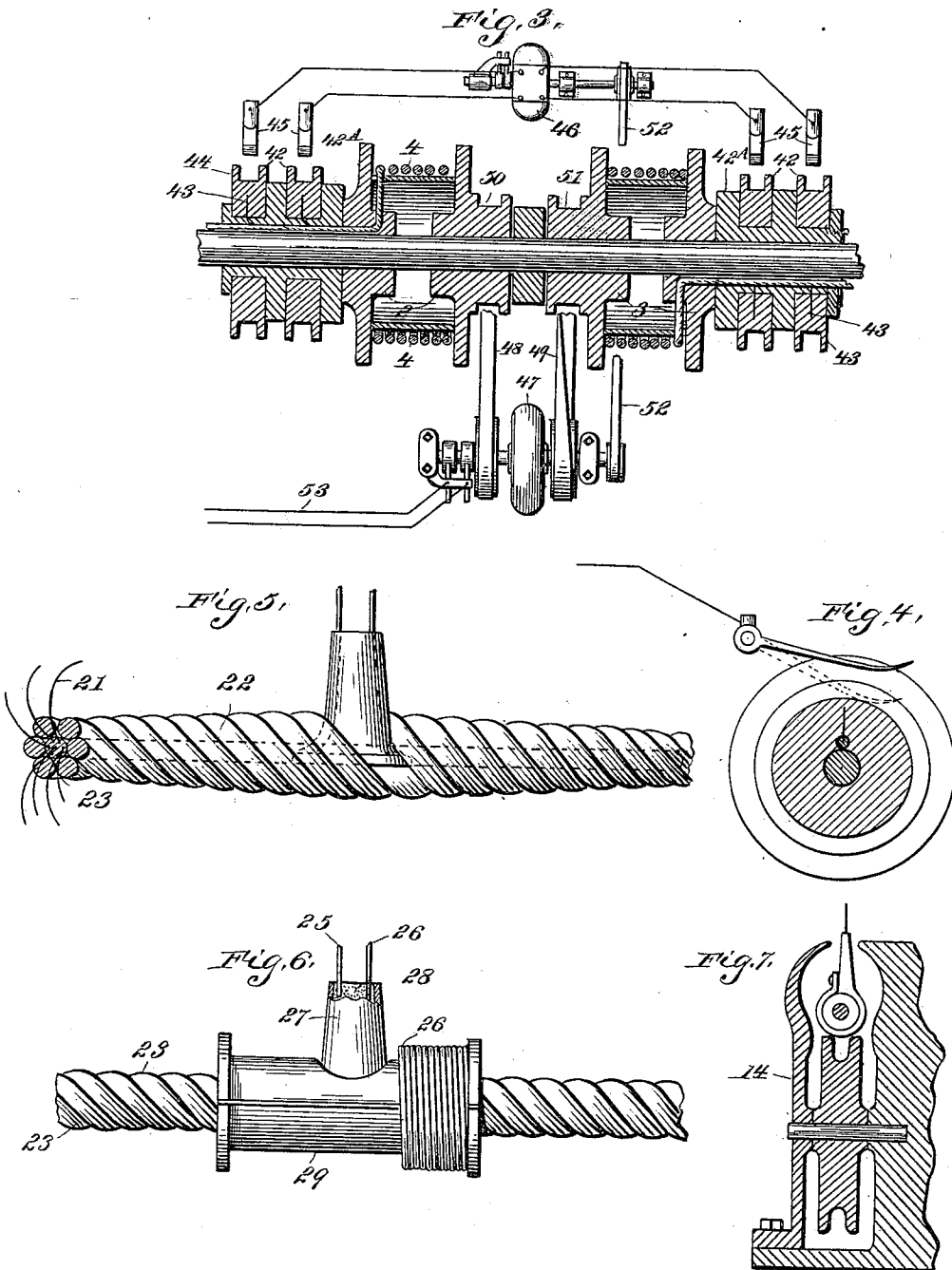
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3 Sheets—Sheet 2.



Witnesses:

Claude A. Dunn.

Mel Emerson Peters.

Inventor:

Christopher T. Finlayson

By his Attorney

A. S. Bailey.

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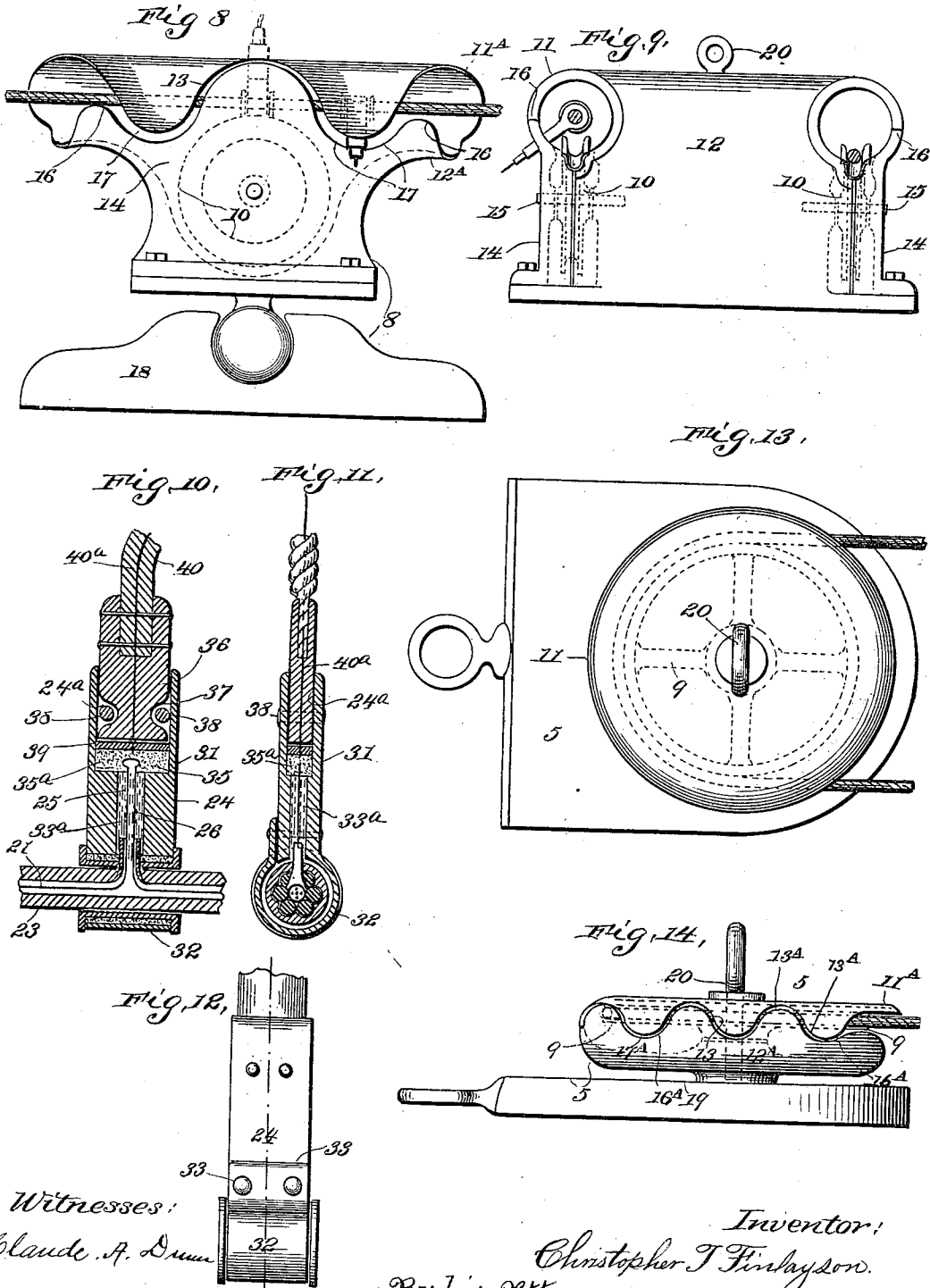
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UNITED STATES PATENT OFFICE.

CHRISTOPHER T. FINLAYSON, OF DENVER, COLORADO.

SUBMERGED TORPEDO-TRAMWAY.

SPECIFICATION forming part of Letters Patent No. 624,472, dated May 9, 1899.

Application filed June 28, 1898. Serial No. 684,681. (No model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER T. FINLAYSON, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Submerged Torpedo-Tramways; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to a submerged torpedo-tramway for harbor defense; and the objects of my invention are, first, to provide a wire-rope submerged tramway adapted to be extended across the channels of harbors from a suitable land station to convey and discharge torpedoes at any desired point in its length; second, to provide a submerged tramway for harbor defense that will convey a plurality of torpedoes at predetermined distances apart across a harbor and electrically detach them when desired; third, to provide a submerged torpedo harbor-defense tramway by which a plurality of torpedoes can be run out and cut loose under passing war vessels and with which any particular torpedo can be cut loose and its time-fuse be ignited and with which the torpedoes can be quickly run back out of the harbor into the station and in which the outer tramway-terminal can be quickly moved from one position to another in a harbor and the position of the tramway thus kept secret from an enemy. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 represents a sectional view of a harbor, showing my torpedo-tramway in operative position therein. Fig. 2 is a plan view of the harbor and my torpedo-tramway. Fig. 3 is a plan view, partially in section, of the tramway's supporting and winding drums and operating mechanism. Fig. 4 is an end sectional view of one of the commutator-rings of Fig. 3 and a side view of one of the brushes. Fig. 5 is a side view of a fragment of the cable, showing the thimble that protects the wires leading to the torpedoes. Fig. 6 is a

fragment of the cable and thimble and showing the spool that is used to bind the thimble to the cable. Fig. 7 is a cross-section of an intermediate support for supporting the cables of the tramway. Fig. 8 is a side elevation of the intermediate support for the cable. Fig. 9 is an end elevation of the intermediate support shown in Fig. 8. Fig. 10 is a section of the torpedo-holding clip on a plane parallel with the cable. Fig. 11 is a section of the clip on line A of Fig. 12. Fig. 12 is a side elevation of the clip. Fig. 13 is a plan view of the outer terminal-support of the tramway. Fig. 14 is a side elevation of the same.

Similar letters and figures of reference refer to similar parts throughout the several views.

Referring to Fig. 1, upon one shore of the harbor a suitably-inclosed station D is constructed of any suitable material to protect the shore terminal end of the tramway and its operative machinery. In this station I mount upon suitable supports a cable-supporting drum capable of supporting both ends of a tramway-cable and arranged to wind up one end and at the same time unwind the other end, or I may preferably use two independent drums 2 and 3, as shown in Fig. 3, in which arrangement one end of the cable is secured to one drum and the opposite end is fastened to the other drum. The cable 4 extends from the drums to the opposite terminal end 5 of the tramway, which is located on the opposite side of the channel 6 of the harbor and may be located at any operative distance from the main terminal up to three or four or more miles and, if necessary, may be anchored to a rock 7, as shown. Intermediate of the main terminals I place intermediate supports 8 at necessary points, only one being shown in Figs. 1 and 2, and owing to the buoyancy of the water on the rope it is believed that these supports can be located as far apart as two thousand to three thousand feet, except where the profile of the harbor requires them to be placed closer together in order to clear upward-projecting rocks, reefs, or sharp ridges in the bottom of the harbor.

The tramway may be run transversely across a harbor or obliquely, as shown in Fig. 2, which is preferable, as it brings more torpedoes in the path of a passing vessel or fleet than if laid transversely across the harbor.

The intermediate support is provided with two vertically-supported sheaves 10, that support the cables. In order to prevent any possibility of the cables running off from the sheaves, especially when the clips which connect the torpedoes to the cable pass over them, I form a hood 11 over the sheaves. This hood preferably forms an integral part of the ends 12 of the support. This hood portion extends from the ends in a circle over the tops of the sheaves and down the outside of them to a point at substantially right angles to the top of the sheaves, thus forming the upper portion of the sides of the supports that hold and encircle the vertical sheaves. In the overhanging side edges of this hood I form a scallop or wave-shaped corrugation 13, which extends from the edge to about the top of the curve of the hood, as shown plainly in Figs. 7, 8, and 9. A plate 14, which acts as a removable support for one end of the axle 15 of each sheave, is formed at its upper end in a curve which forms a continuation of the curve of the hood. The upper edge 16 of the plate 14 is also corrugated to match and fit into the corrugations of the hood; but the edges of the corrugations are positioned a short distance apart in order that a wave-shaped slot 17 may be formed between them, through which it is impossible, owing to its irregular contour, for the rope to pass if it should get off from the sheaves. 18 designates the base of the intermediate supports. It may be connected to the sheave-supporting part in any suitable manner, but is preferably connected to it by a universal joint, as shown. The outer terminal 5 comprises a base 19, which rests on the bottom of the harbor, a sheave-supporting portion 12, and a hood 11^A. The sheave-supporting portion is provided at its center with a vertical shaft, on which is mounted a horizontal sheave 9. The sheave-supporting portion 12 and the hood 11^A are preferably round. They may be formed integrally together at the end between the cables, or the hood may be independent of the sheave-supporting part and be supported in any convenient manner to the vertical sheave's axle. A wave-shaped corrugation 13^A is also formed in the edge of the hood, and a similar wave-shaped corrugation 16^A is formed in the upper edge of the sheave-supporting portion, which matches into the corrugations of the hood; but a space 17^A, which forms a wave-shaped slot, is formed between them. This form of slot operates as in the intermediate supports to keep the cable from becoming displaced from the sheave and terminal. The wave-shaped slot 17^A extends around the terminal from where the rope enters it to where it leaves it, as shown in Figs. 13 and 14. The clips to which the torpedoes are attached extend from the cables through the slots in the terminal and intermediate support, and they follow the wave-shaped slots as they pass over the sheave of the supports and the outer terminal. The sheave-

supporting portion of the terminal may be secured to the base by any suitable joint; but I preferably use some form of a universal joint that will permit the sheave-supporting portion to adjust and hold itself in a substantially horizontal plane regardless of the irregularity of the surface on which the base rests, as such an arrangement enables the outer terminal and also the intermediate supports to be lowered and stationed wherever desired in a harbor without previous preparation, such as leveling a place for them, and they can also be raised and moved about and lowered at will when thus arranged, as each is provided with a ring 20, to which may be attached hoisting blocks and tackle.

My tramway requires a cable containing a plurality of insulated and protected electric conductors so arranged that any one may be taken out at any desired point in the length of the cable and connected to a torpedo. I preferably carry out this feature of my invention in the following manner: I select a number of insulated copper wires 21, seven being shown in Figs. 5 and 6, and arrange them in a suitable core, using the most suitable method for this purpose and arranging them so that they each can be conveniently reached, and then lay around the core 22 several strands 23 of wire, preferably using the flat strand or Lang lay, as the cable will not twist if they are used. The torpedoes are connected along the cable at safe distances apart by means of clips 24, which are arranged to release the torpedoes and at the same time fire a time-fuse of the torpedoes by an electric charge manipulated by an operator from the main station through the electric wires of the cable. I preferably construct these clips and make and break the connection with the torpedoes and also fire the time-fuse of the torpedoes in the following manner: At the several points in the length of one cable of the tramway where it is desired to place torpedoes—say every fifty to seventy-five feet—I open up the strands of the cable and cut one of the electric wires and splice short pieces of wire 25 and 26 on each of the ends and run them through a thimble 27, which I insert in the strands over the core to protect them. I then fill this thimble full of liquid rubber 28 or some other material suitable for insulation and for a bed for them to lie in. Around the rope and this thimble I place a spool 29, which I make in two parts, preferably forming each part with spiral grooves that will fit nicely over the strands of the rope. I then bind the two parts of the spool together rigidly on the rope with wire 30, thus firmly securing the thimble to the cable. Around the thimble I clamp the clip 24. This clip comprises a rectangular-shaped stem portion 31, having a thin flat band portion 32, that extends from the lower edge of one side and wraps around the spool and overlaps the opposite side of the stem and is secured to it by rivets 33. Centrally in the end of the

stem portion that is adjacent to the band of the clip 33^A is provided for a portion of the length of the stem, which will allow the stem portion to fit down nicely over the top end of the thimble, and the spliced ends of the electric wire are continued through the hole in the stem, which is filled with rubber to form a supporting-bed for the wires. The top portion of the stem is hollowed out to form a chamber 24^A, which connects with the hole in the lower end and into the lower part of which the electric wires extend, where their ends are connected with a fuse 35. The bottom of the chamber is then filled for a short distance with a suitable explosive 35^A—such as fulminate of mercury or powder—enough being used to blow out a plug 36, that is fitted with a waterproof joint into the end of the stem of the clip. In order to secure this plug in the clip tight enough to prevent accidental displacement and ready detachment when the explosive is fired to release it, I provide it near its inner end with notches 37 in its opposite sides, which materially weakens it at that point. I also insert two rivets 38 in the clip in position to pass through the notches and which key the plug to the clip. Between the bottom of the plug and the explosive a suitable wadding 39 is placed. When the explosive is fired, the plug breaks below the pins and is blown out of the clip. The plug has a flexible connection 40 attached to it, which connects it to a torpedo 41^A. A time-fuse 40^A extends through the flexible connection from the torpedo and depends from the plug into the explosive and is ignited by the discharge of the explosive. The ends of the cables extend from their respective drums to commutator-rings 42, which are mounted on the shaft of the drums and are insulated from one another and from the shaft by the sleeves and rings 42^A. Each electric wire in the cable is taken out and connected to a ring at each drum. Thus if one end of the wire 43 is connected to the ring 44 of the drum 2 the opposite end of the same wire, which extends throughout the cable, is connected to a ring 44 on the opposite winding-drum, and both rings should be numbered or lettered with the same characters, so that the operator will know just where the terminal of each electric wire in the cable is. The clip on the wire 43 out on the cable should also be numbered to correspond with the numbers of the terminals. Electric brushes 45 are then arranged in operative relation with each registering pair of rings, so that a circuit may be established and a current sent over the attached core-wire at the will of an operator. The electric current can be supplied by an electric-current generator, such as a dynamo 46, being connected with the brushes. The brushes are normally held out of contact with the rings and are arranged to be moved into engagement with them by an operator by means of any of the various suit-

able electrically operating and controlling devices in common use for manipulating and sending an electric current through an electric circuit. The winding-drums may be also operated by any suitable motive power, an electric motor 47 being shown belted to rotate the drums in opposite directions by means of the straight and cross belts 48 and 49, which extend from the motor to pulleys 50 and 51. A belt 52 also extends from the motor to the dynamo. The motor is connected by wires 53 to any suitable current-supply.

The operation of my torpedo-tramway is as follows: A suitable station having been constructed for the protection of the operating machinery on one shore of a harbor, the tramway is extended across the harbor in the desired position, and as many clips are attached to one of the cables extending between the drums and the outer terminal as it is desired to attach torpedoes to or as many as will cover the width of the harbor-channel at safe distances apart, the cable being supplied with electric core-wires enough to allow as many clips to be used as can be placed to bring the torpedoes as close together as safety will permit. An operator knowing the exact width of the channel and the length of the tramway can by winding one end of the cable and unwinding the other place the line of torpedoes across a harbor and always know the exact location of each clip and torpedo. The torpedoes are attached to the clips in the station one by one as the cable is paid out. When a hostile vessel, as 54, enters the harbor, the operator is able by the use of any of the well-known systems of observation lines and points common to naval science to locate the exact course and position at all times of the approaching vessel relative to the position of the tramway, and when the vessel crosses the tramway he makes an electric circuit by means of any suitable method or apparatus, which is connected to the terminal ends of each electric wire of the cable and on the particular wire that leads to the clip and torpedo over which or nearest to the passing vessel and sends a current of electricity from a source of supply, such as the dynamo 46, which, passing through the fuse in the loop of the wire that extends into the explosive-chamber, lights the wire and explodes the explosive in the clip. This explosion breaks the plug of the torpedo and blows it out of the clip and releases the torpedo and at the same time ignites the time-fuse of the torpedo. The torpedo then rises toward the surface of the water and explodes as soon as its time-fuse has burned to reach its explosives and will rise and explode directly under or close to the passing vessel. Should the vessel pass directly between two torpedoes, the operator can quickly wind or unwind the cable to move a torpedo under or very close to the passing vessel, or if the operator desires he can free and ignite the two torpedoes

nearest to the passing vessel. Two or more torpedoes can be arranged in tandem order, as shown at 55 in Figs. 1 and 2, if desired.

My torpedo-tramway possesses superior advantages for harbor defense in the following essential features: First, the torpedoes need not be run out into the harbor until an enemy is known to be in the vicinity or is expected; second, that any one or two or all of the torpedoes on the cable can be cut loose and ignited at any moment; third, that where a fleet starts in to countermine a harbor the torpedoes on the cable can be withdrawn into the station until the countermining ceases and can then be quickly run out in position to be used in case the fleet should enter the harbor; fourth, that where it is suspected an enemy knows the position of the tramway suitable boats can lower tackle and engage the liftings in the caps of the intermediate supports and outer terminal and move and change the position and direction of the whole line of tramway without injury to it, as the outer terminal and supports should be constructed in such a manner that they can be lowered anywhere in a harbor without preparing a site for them and should be constructed to form ample supports in themselves for the cable, and their bases should also be heavy enough to firmly anchor them when set.

While I have described a preferred method of construction of the main features of my torpedo-tramway, I do not wish to be limited to them, as there are many ways in which the tramway may be constructed and arranged without departing from the spirit and the scope of my invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a torpedo-tramway, an endless cable arranged and adapted to be moved to and fro across the harbor from a suitable station, means for supporting said cable at its terminal end and at desired points intermediate of its terminal end and said station, means for attaching torpedoes to said cable, means for releasing any one or more torpedoes from said cable and for igniting them at the will of an operator, substantially as described.

2. In a torpedo-tramway the combination of an endless cable, means for winding one end of said cable and at the same time for unwinding the opposite end, a terminal-sheave for said cable, a suitable support for said sheave, supporting-sheaves for said cable intermediate of said terminal-sheave and winding terminals and suitable supports therefor, clips attached to said cable at suitable distances apart, means for releasably securing a torpedo to each clip, an independent electric wire in said cable extending into each clip, a time-fuse extending from each torpedo into its holding-clip and means for sending an electric current from said winding terminal end to each individual clip and torpedo and for igniting the time-fuse of said

torpedo and for releasing each torpedo from its clip, substantially as described.

3. The combination in a torpedo-tramway of the winding-drums, the cable provided with electric wires, the clips secured thereto, the outer terminal and the cable-supporting stations, with means for securing torpedoes to said clips and means for releasing said torpedoes at will and igniting them, substantially as described.

4. The combination in a torpedo-tramway of the shore station, the cable-operating drums, the outer terminal and the supporting-supports intermediate of said terminals, with a cable endless from said drum and containing a plurality of independent, insulated electric-current-transmitting wires extending throughout its length, means for securing a plurality of clips to said cable at suitable distances apart, means for connecting each clip with some one individual electric wire of the cable, means for designating the wire each clip is in circuit with at the said station, a chamber in each of said clips containing an explosive charge, a fuse in each individual wire embedded in said explosive charge in each clip, a torpedo having a plug depending therefrom arranged to be detachably secured to said clip in such relation to said explosive-chamber that it will be blown out and separated from said clip at the firing of said explosive, a time-fuse extending from said torpedo through said plug and extending into the midst of said explosive, and means for closing the circuit between the ends of each individual electric wire of said cable in said station and for sending a current of electricity over a wire to any particular clip and its torpedo or to any one or more clips and their torpedoes at the same time at the will of the operator, whereby said explosive is exploded and said plug is blown out and the torpedo is released from said clip and its time-fuse is ignited, substantially as described.

5. The combination in a torpedo-tramway of a cable containing a plurality of electric wires, a thimble adapted to be inserted in the strands of said cable over its core, a cut in said wire under said thimble, wires spliced to the ends of said cut wire extending through said thimble, a fuse-wire connecting said ends together and a suitable filling or bed around said wires in said thimble, substantially as described.

6. The combination in a torpedo-tramway of a cable containing wires, a loop cut out at a predetermined point in said cable, a suitable tube or thimble adapted to fit over said looped cut-out, a suitable bed around said loop in said tube, a fuse-wire in the end of said loop and a spool or divided sleeve arranged and adapted to clamp said tube or thimble to said cable, substantially as described.

7. The combination in a torpedo-tramway, of a cable containing a plurality of electric

wires, the loops in said wires, the thimble over said loop, the spool, and the clip surrounding said spool and thimble, substantially as described.

5 8. The combination in a torpedo-tramway, of a cable provided with a plurality of electric wires, a clip adapted to be clamped to said wires, an explosive-chamber in said clip, a loop extending from one of the electric wires
10 of said cable to said explosive-chamber, a fuse-wire in said loop in said explosive-chamber, an explosive in said chamber, a torpedo having a depending member temporarily secured to said clip and positioned over said ex-
15 plosive, a time-fuse depending from said torpedo into said explosive-chamber and means for electrically exploding said explosive and igniting said torpedo's time-fuse and for releasing said torpedo from said clip, substan-
20 tially as described.

9. The combination of the drums, the cable and the clips, of the outer terminal and the intermediate supports having said outer terminal and intermediate supports provided
25 with cable-supporting sheaves, a cable-protecting hood in said terminal and intermediate supports and a wave-shaped slot in said hood adapted for a passage of said clip, substantially as described.

30 10. The combination of the drums, the cable, the terminal and the intermediate support with the clips, the torpedo temporarily secured thereto and means for electrically releasing said torpedo from said clip at the will
35 of an operator from said drum end of said cable, substantially as described.

11. In a torpedo-tramway for harbor defense suitable drums for operating an endless tramway, an endless cable operatively connected to said drums and arranged to be
40 moved to and fro across a harbor and around a pivotal terminal, sheaves for supporting said cable intermediate of said pivotal terminal and said drums operatively mounted
45 in a suitable supporting-cap, a base block or support for said sheave-supporting cap and a universal joint between said base and cap adapted to allow said cap and sheaves to au-

tomatically adjust themselves and maintain a substantially horizontal plane, regardless
50 of the position of said base, substantially as described.

12. The combination of the drums, the endless cable, attached at its ends thereto, the sheaves, the electric contact-rings and brushes,
55 the intermediate supporting-sheaves, the sheave-supporting caps provided with cable-protecting hoods, the wave-shaped slots and the base jointed to said cap with a suitable universal joint, substantially as described. 6c

13. The combination in a submerged torpedo-tramway for river and harbor defense, of the drums, the electric contact-rings, brushes and an electric-current supply, with
65 a cable containing a plurality of electric wires and endless from said drums and adapted to be extended across a harbor along its bottom, a pivotal turning-sheave terminal, a cap supporting said sheave and jointed to a suitable
70 base in a manner to allow said cap to adjust and maintain itself under the buoyancy of the water in a substantially horizontal plane, supporting-sheaves mounted in a supporting-cap
intermediate of said terminal and said drums, an anchoring and supporting base jointed to
75 said cap with a suitable universal joint, clips secured to said cable at predetermined distances apart, a torpedo attached to each clip and provided with a time-fuse extending into
80 said clip, a loop extending from some one individual electric wire of said cable into said clip, a fuse-wire in said loop arranged close to said torpedo's fuse and means for indicating what electric wire of said cable each individual clip and torpedo is connected with
85 and means for sending at the will of an operator a current of electricity to any individual clip and torpedo for igniting its time-fuse and releasing its torpedo from it, substantially as described. 90

In testimony whereof I affix my signature in presence of two witnesses.

CHRISTOPHER T. FINLAYSON.

Witnesses:

CLAUDE A. DUNN,

BESSIE THOMPSON.