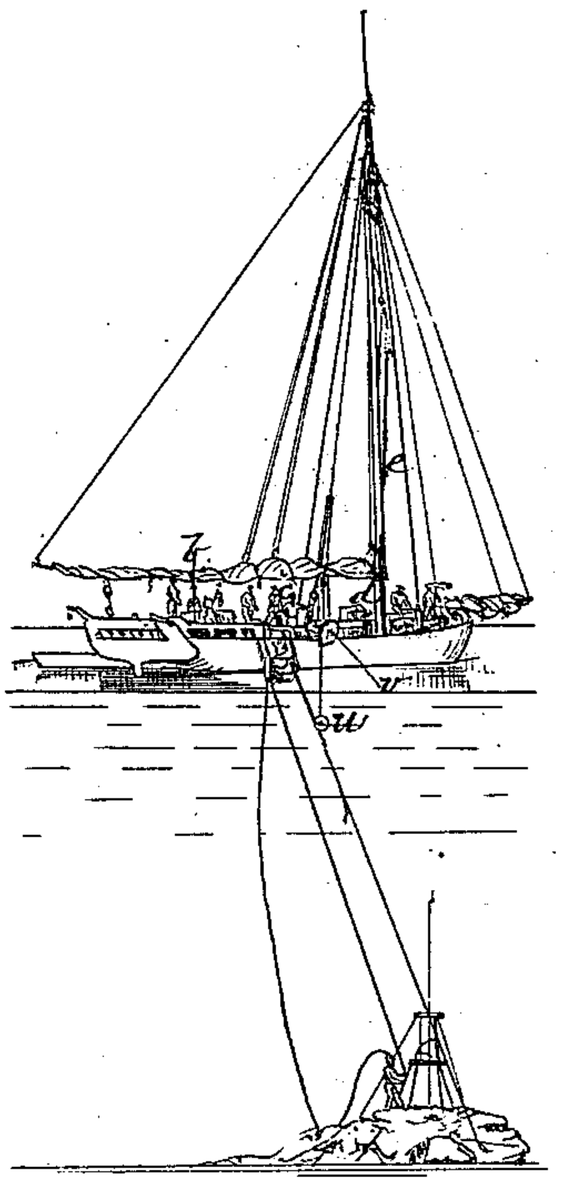
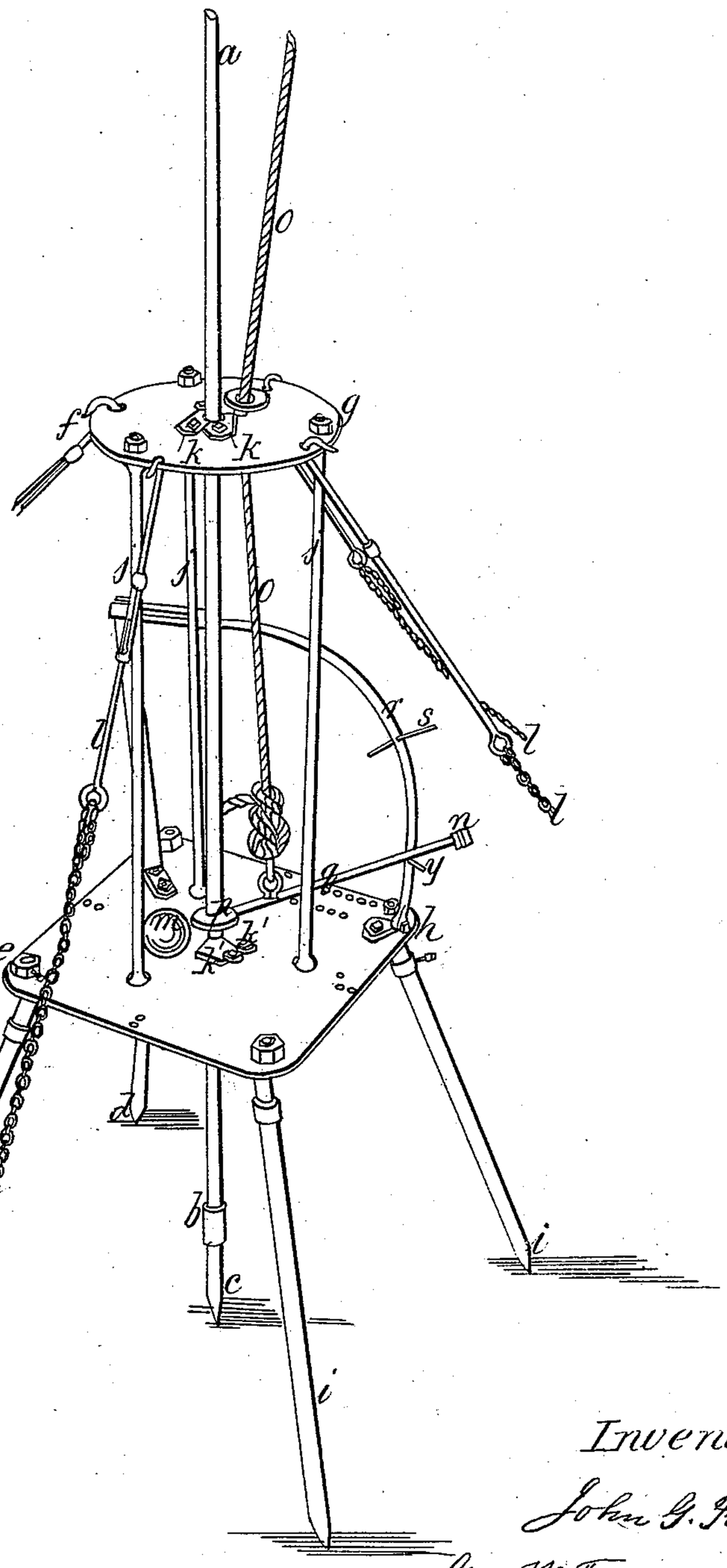
Sheet 1, 4 Sheets.

Foster & Townsend.

Rock Drill.

No. 93,610. Patented Aug. 10, 1869.





Witnesses;
Chas. F. Wilson
E. H. Young

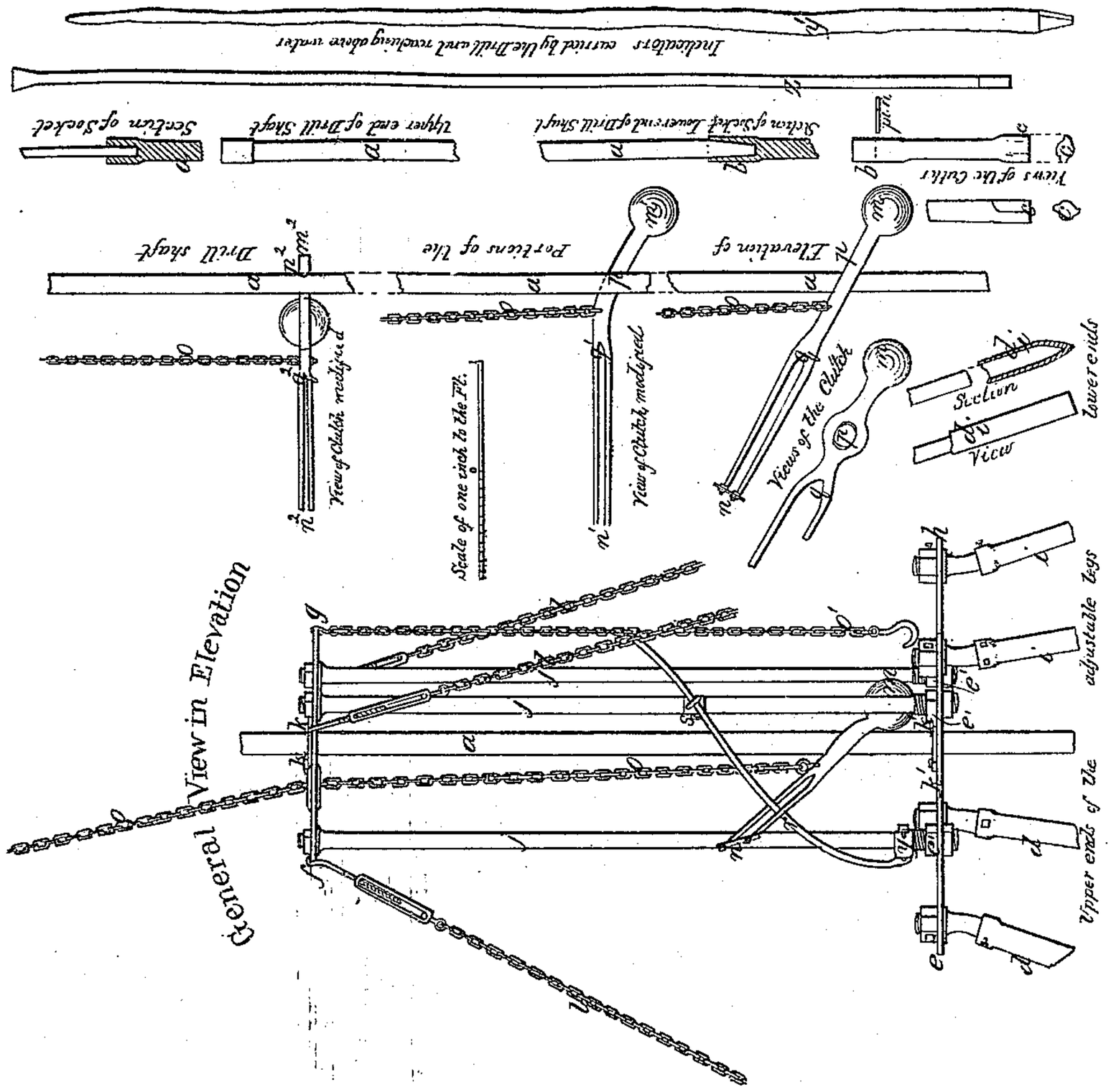
Inventors;
John G. Foster
Geo. W. Townsend
By their attorney
G. C. Robbins

Sheet 2, 4 Sheets.

Foster & Townsend.

Rock Drill.

No. 93,610. Patented Aug. 10, 1869.



Witnesses
Chas. F. Wilson
H. H. Young

Inventors
John G. Foster
Geo. W. Townsend
By their Attorney
J. C. Robbins

Sheet 3, 4 Sheets.

Foster & Townsend.

Rock Drill.

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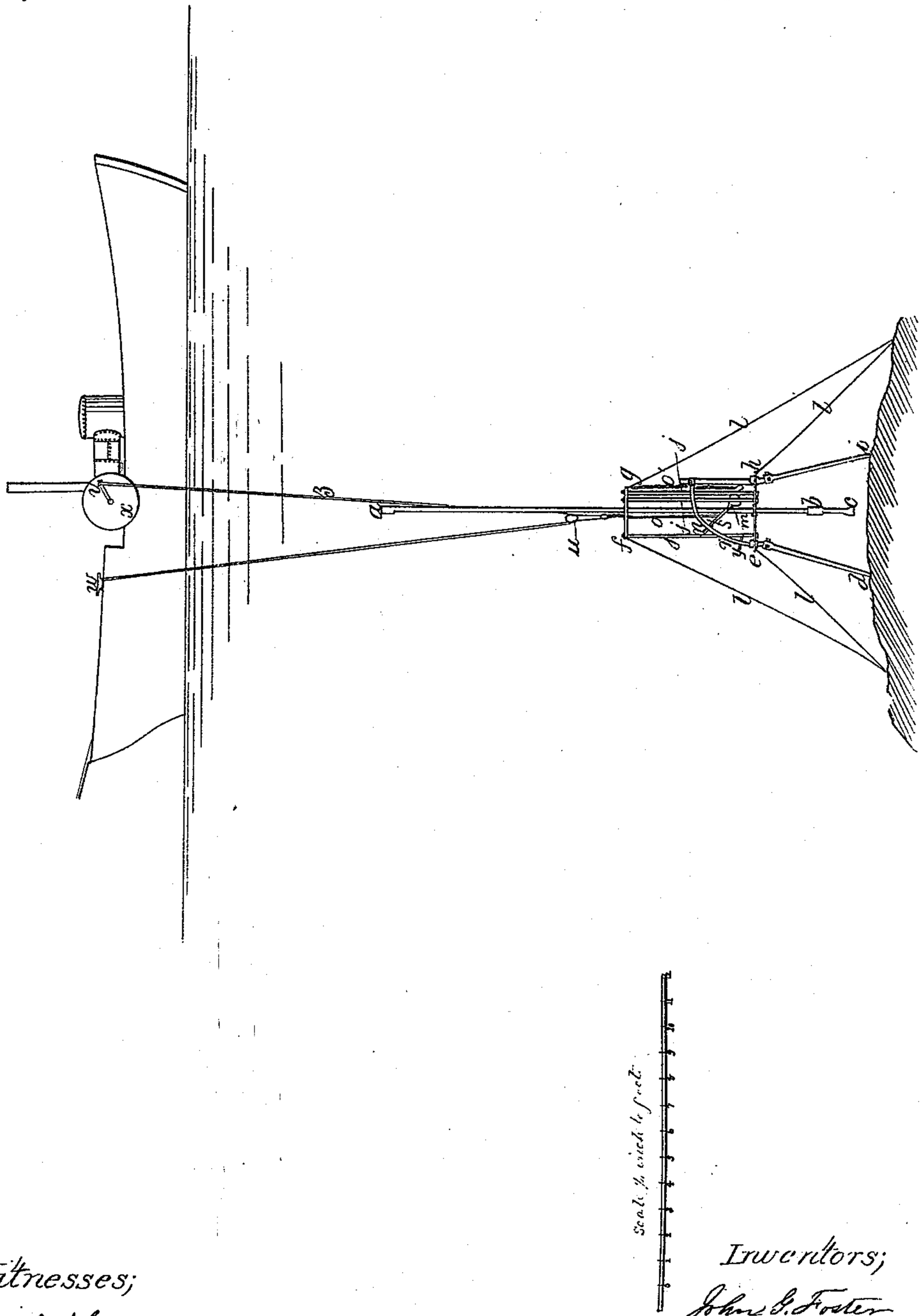


Witnesses;
Chas. G. Wilson
Ho. H. Young

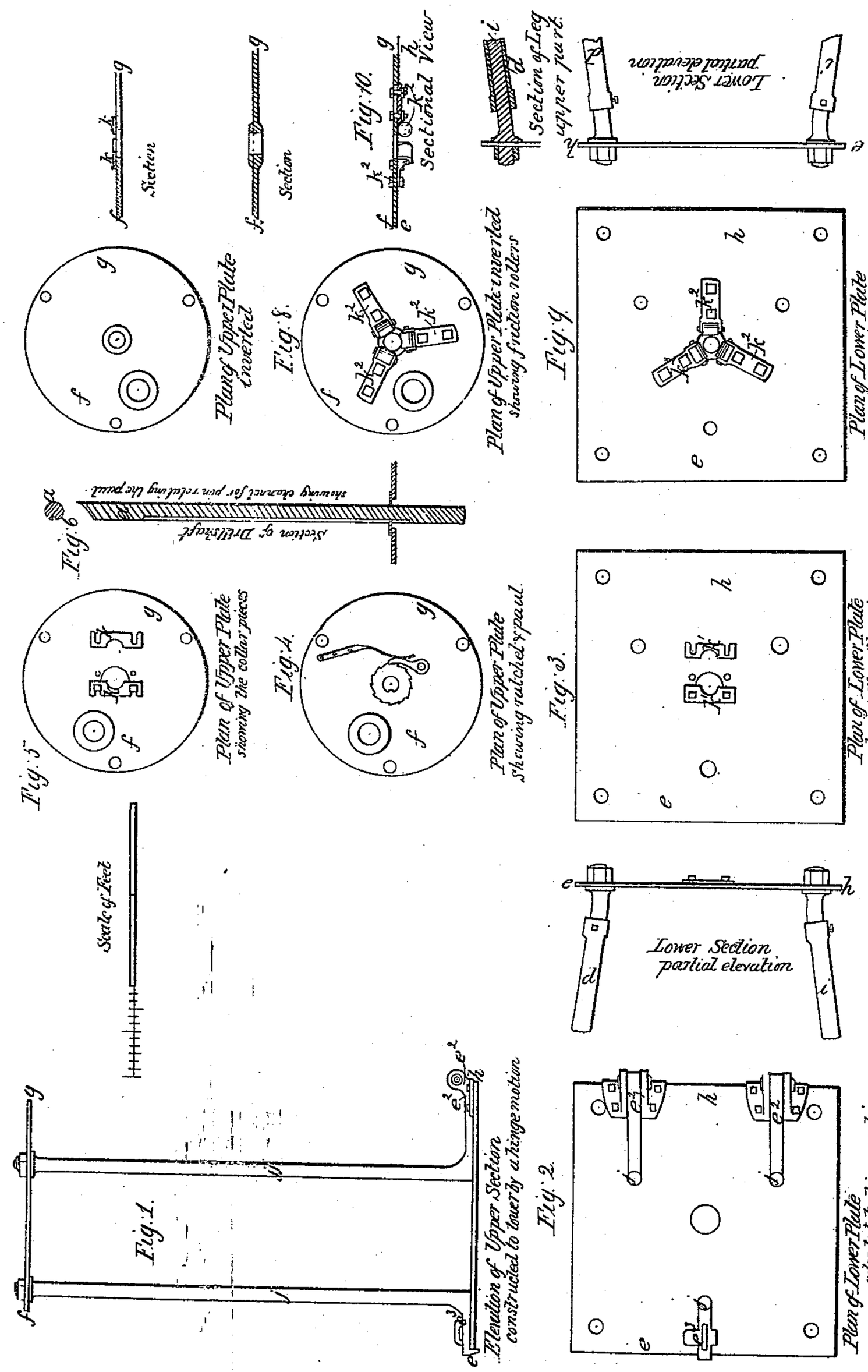
Inventors;
John S. Foster
Geo W. Townsend
By their Attorneys
J. C. Robbins

Sheet 4, 4 Sheets

Foster & Townsend.

Rock Drill.

No. 93,610. Patented Aug. 10, 1869.



Witnesses;

Chas. F. Wilson

F. H. Young

Inventors;

John G. Foster

Geo. W. Townsend

By their Att'y

J. Reed

United States Patent Office.

JOHN G. FOSTER AND GEORGE W. TOWNSEND, OF BOSTON, MASSACHUSETTS.

Letters Patent No. 93,610, *dated August* 10, 1869.

SUBMARINE ROCK-DRILLING MACHINE.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that we, JOHN G. FOSTER and GEORGE W. TOWNSEND, of Boston, in the county of Suffolk, and State of Massachusetts, have invented a new and improved Submarine Drilling-Apparatus; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying four sheets of drawings, which form a portion of this specification.

The said drilling-apparatus consists of three general parts, to wit, the drill, the frame, and the appliances for operating the drill.

The drill *a b c*, (see sheet 2,) consists of an iron shaft, *a b*, and a cutter-head, *c*, the latter being secured to the former in any suitable manner.

The cutting-edge of the drill-head *c* is of a peculiar shape, viz, that of a continuous curve, similar in form to the letter **S**, and the said edge being contained in a plane at right angles to the axis of the drill-shaft.

We are aware that the cutting-edges of drill-heads have been of a continuous curved shape, but such cutting-edges have, in every case, deviated more or less from a plane at right angles to the axis of the drill-shaft; and we have ascertained by experience, that the said class of drill-head cutters does not work as freely, does not cut as rapidly, and is not as durable as our said improved drill-head cutter, the edge of which is a continuous plane curve, as above described.

The drill-frame consists of two horizontal iron platform-plates, *f g* and *e h*, connected by uprights, *j j j*, and supported by longitudinally-adjustable legs, *d i*. (See sheets 1 and 2 of the drawings.)

The lower ends of the uprights *j j j* are so arranged as to allow the upper plate *f g* to be lowered to the level of the lower plate *e h*.

This may be done by means of screw-threads cut on the enlarged lower ends of the uprights *j j j*, and nuts working upon said screws above and below the lower platform-plate *e h*, so that by turning the upper series, e^1 e^1, of said nuts, upward on to the diminished shank of said uprights, they will instantly slide down through the holes in the bottom plate, until the top plate *f g* rests upon the said bottom plate. Or, the same result may be produced by having two of the uprights *j j* connected with the bottom plate *e h* by hinges, (see e^2 e^2, figs. 1 and 2, sheet 3,) and the third fastened by a clamp. (See e^3, same figures.)

By unloosing the said clamp e^3, the top plate *f g*, and the uprights *j j j*, can be at once turned over and hang below the lower plate *e h*.

The drill plays up and down through holes in the centre of the plates or platforms *f g* and *e h*, between collars *k k k' k'*, figs. 8 and 9, sheet 3.

These collars should be furnished with friction-rollers whenever the supporting-frame is to be located in an inclined position, for the purpose of enabling the drill to be obliquely operated.

When the drill is vertically operated, two collars, *k k* and *k' k'*, figs. 3 and 5, sheet 3, need only be used.

The aforesaid collars *k k'* are secured to the plates or platforms in such a manner that they can be readily adjusted to any desired position, or be entirely removed from said plates or platforms.

The drill-frame is kept firmly in any desired position by means of guys, *l l l*, (sheet 2,) descending from their connection with the upper plate or platform *f g*, or from both platforms, to eye-bolts or pins secured in small holes drilled into the surface of the submerged rock by a submarine driver; the legs of the said drill-frame having been first so adjusted as to bring its platform-plates to the desired horizontal or oblique position.

The drill is operated by means of a forked and slotted clutch, *m n*, (sheet 1,) the curved and winding guide *r*, the stops *y s*, in the said guide *r*, and any suitable lifting-power connected with said clutch.

The forked end of the clutch *m n* embraces the guide *r*, and traverses freely thereupon.

The slot *p*, in the clutch *m n*, (which receives the drill-rod,) is near to its solid and heaviest end, and the parallel oblique ends of said slot are of such a shape and angle, that when the said clutch is lifted by an attachment to its lifting-chain or cord *o*, the sharp angles of the said slot will instantly seize hold of the drill-rod and carry it upward to the point where the position of the clutch is changed by its forked end being brought in contact with the stop *s*, in or upon the guide *r*, just before the moving-power attains its maximum height.

The next instant the clutch descends with its lifter *o*, the weighted end thereof causing the clutch to slide freely down to its starting-position, with its forked end resting on the stop *y*, when the returning reciprocating movement of the actuating-power will again lift the clutch *m n*, and again carry up and let fall the drill-rod.

The curved and winding guide *r*, (sheets 1 and 2,) causes a partial revolution to be imparted to the drill during its upward movement; and as the obliquity of the winding shape of said guide *r* increases from its lower to its upper extremity, by shifting the positions of the stops *y s*, upon the said guide, more or less rotary movement will be imparted to the drill by each of its lifting-movements.

The tendency of the drill to "bounce back," or to strike repeatedly in the same place, is resisted by a

ratchet-wheel and spring-pawl attached to the upper platform-plate *f g*, (fig. 4, sheet 3;) the said ratchet-wheel being operated by a lug projecting from its inner periphery into a vertical groove in the drill-rod, as shown in the aforesaid drawing.

The manner of applying the lifting-power to the drill is clearly represented by the drawings on sheet 4.

A disk, *x*, or its equivalent, on the end of a properly-supported rotating shaft, projects beyond the side of a boat moored above the submerged drilling-apparatus. The lifting-chain or cord *o*, which rises from the clutch *m n*, passes through an aperture in the upper platform-plate *f g*, and a short distance above the same, where it is connected to a block which carries a pulley, *u;* and this pulley *u* is connected to the crank-pin *v*, that projects from the disk *x*, by means of the rope *z*, which descends from its connection with the said crank-pin, and after passing around the said pulley, rises to the boat above, and is there secured to a belaying-pin, or is so secured that it can be readily let out or drawn in, as circumstances may require, thereby enabling the apparatus to be adapted to the varying depth of the water, and the varying position of the boat, without interrupting the working of the submerged drill; and should a storm come on suddenly, the boat can be unmoored, the operating-rope or chain *z* can be instantly detached from the lifting-chain *o*, and the boat be taken to a place of safety, and when the danger is past, the boat can return, and as speedily be connected with the drill again.

The shaft which carries the disk *x* may be rotated by a steam-engine, or by any other suitable motive-power.

Whenever it may be necessary to hoist out the drill-shaft *a*, (sheet 2,) or to place the same originally in a working-position, the loaded end of the clutch *m n* is supported by the terminating-hook of the chain *o'*, which descends from the upper platform-plate *f g*, (sheet 2.)

Generally, an iron rod, *z*, (sheet 2,) is fitted to the top of the drill-shaft *a*, and to the upper end of the said iron rod *z*, a wooden pole, *y'*, is fitted; the said wooden pole being of sufficient length to extend above the surface of the water, and thus afford a constant index to the movements of the drill.

The slot in the clutch *m n* is so proportioned that it has sufficient play upon the drill-shaft to compensate for any vertical motion of the vessel containing the operating-machinery, that may be caused by the swell of the sea. For example, if the vessel be raised at the moment the crank-pin *v* (sheet 4) is at its highest point, the clutch will, as a matter of course, be raised higher than usual, but the stop *s* will disengage the drill-shaft at the proper height, after which the drill-shaft will easily slide through the clutch by reason of the oblique form of the ends of the slot in said clutch. To prepare for the highest possible rise of the waves or swell in exposed situations, it is only necessary to lengthen the forked stem of the clutch, and give it the angular form shown on sheet 2. If, on the contrary, the vessel be in the trough of the sea, at the time the crank-pin *v* is at its highest point, it may happen that the clutch will not be raised sufficiently high to disengage the drill-shaft, and in that case the drill will not descend with its usual velocity. This, however, rarely occurs, and is an unimportant disadvantage when compared with the almost insurmountable obstacles that are presented under similar circumstances, in the usual modes of drilling.

The advantages claimed for this drilling-apparatus are as follows, viz:

First, the simple arrangements of the frame for supporting the drill, and the facilities afforded for the submarine driver to place it in position, by means of the adjustable legs and the holding-guys, as also for disengaging said frame from the rock, and hoisting it upon the deck of the working-vessel at the time of blasting.

Second, operating the drill by means of a clutch and its auxiliaries, so arranged as to turn the drill as it rises, and automatically disengage it at the proper height, in such a manner as to permit it to fall clear and direct; also, to instantly catch the drill and lift it again without less of time.

Third, facility of giving a greater or less turn to the drill during each lifting-movement, by means of the increasing and adjustable inclination of the guide *r*, and of the adjustable stops *s y*, combined with said guide.

Fourth, the extended cutting-edge of the drill, and the unusual durability of said edge, caused by giving it the shape of the letter **S**.

Fifth, facility of adapting the drilling-apparatus to the rise and fall of the tide without interrupting the working of the drill.

Sixth, adaptation of the drilling-apparatus to the waves of the sea; the oblique slot in the clutch *m n* so harmonizing with the length and shape of the forked shank of said clutch as to cause the movements of the drill to be nearly perfect at all times.

Seventh, the arrangement of the respective parts of the drilling-apparatus with each other and with the motive-power, which enables the working-vessel to lie at a convenient distance, and not necessarily vertically over the drill.

Eighth, facility of detaching the working-vessel from the drilling-apparatus when in danger of collision, or upon the sudden approach of a storm, for the purpose of seeking a place of safety, and as quickly renewing connection with the said drilling-apparatus when the danger is past.

Ninth, capacity of being left in position upon a rock for a considerable length of time, without material danger, after the removal of the drill-shaft and the lowering of the upper platform-plate *f g*.

Tenth, the arrangement for preventing the drill from "bouncing back," or striking continuously in the same place.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The improved supporting-frame of our drilling-apparatus, the said frame being composed of double platform-plates, upper columnar supports, and oblique adjustable legs, arranged with each other substantially in the manner herein represented and described.

2. The connection of the upper platform-plate *f g* of our improved drilling-apparatus, with the lower platform-plate of said apparatus, by means of hinges and a clamp or clamps, or the equivalents thereof, substantially in the manner and for the purpose herein set forth.

3. Operating the drill by means of the forked and slotted clutch *m n*, substantially in the manner herein set forth.

4. The arrangement of the winding-guide *r* with the lifting-clutch *m n*, substantially in the manner and for the purpose herein set forth.

5. Our peculiar mode of applying power to the lifting-clutch *m n*, from a rotating or reciprocating first mover, located in a suitable floating vessel, to wit, by means of the connection of the said first mover above, with the lifting-clutch below, by means of the readily-adjustable line *z*, the direct lifting-chain or line *o*, and the pulley-block *u*, substantially in the manner herein set forth.

6. When a drill is operated by means of a lifting-clutch, substantially in the manner herein set forth,

combining a ratchet-wheel with the drill-shaft, and a spring-detent for said wheel, with one of the plat forms of the supporting-frame of the drilling-apparatus, or other suitable support, substantially in the manner and for the purpose herein represented and described.

In testimony that the aforegoing is a full and exact description of our improved submarine drilling-machine, we do hereby sign our names.

JOHN G. FOSTER.
GEORGE W. TOWNSEND.

Witnesses:
GEORGE STEARNS,
D. KOPPMANN.