(No Model.) 5 Sheets—Sheet 1.

J. EDWARDS.

DREDGING MACHINE.

No. 399,251. Patented Mar. 12, 1889.

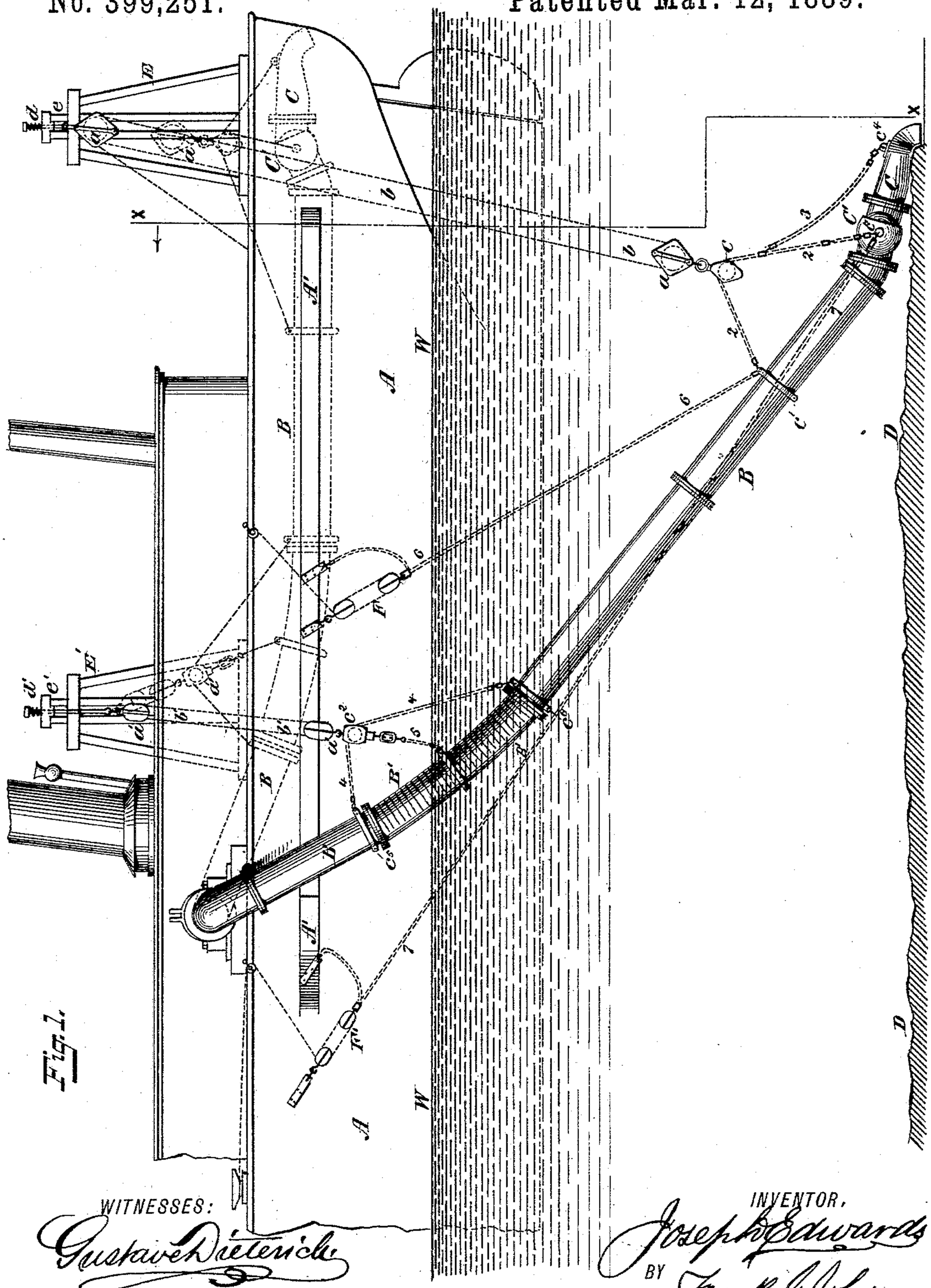

Fig. 1.

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Fig. 2.

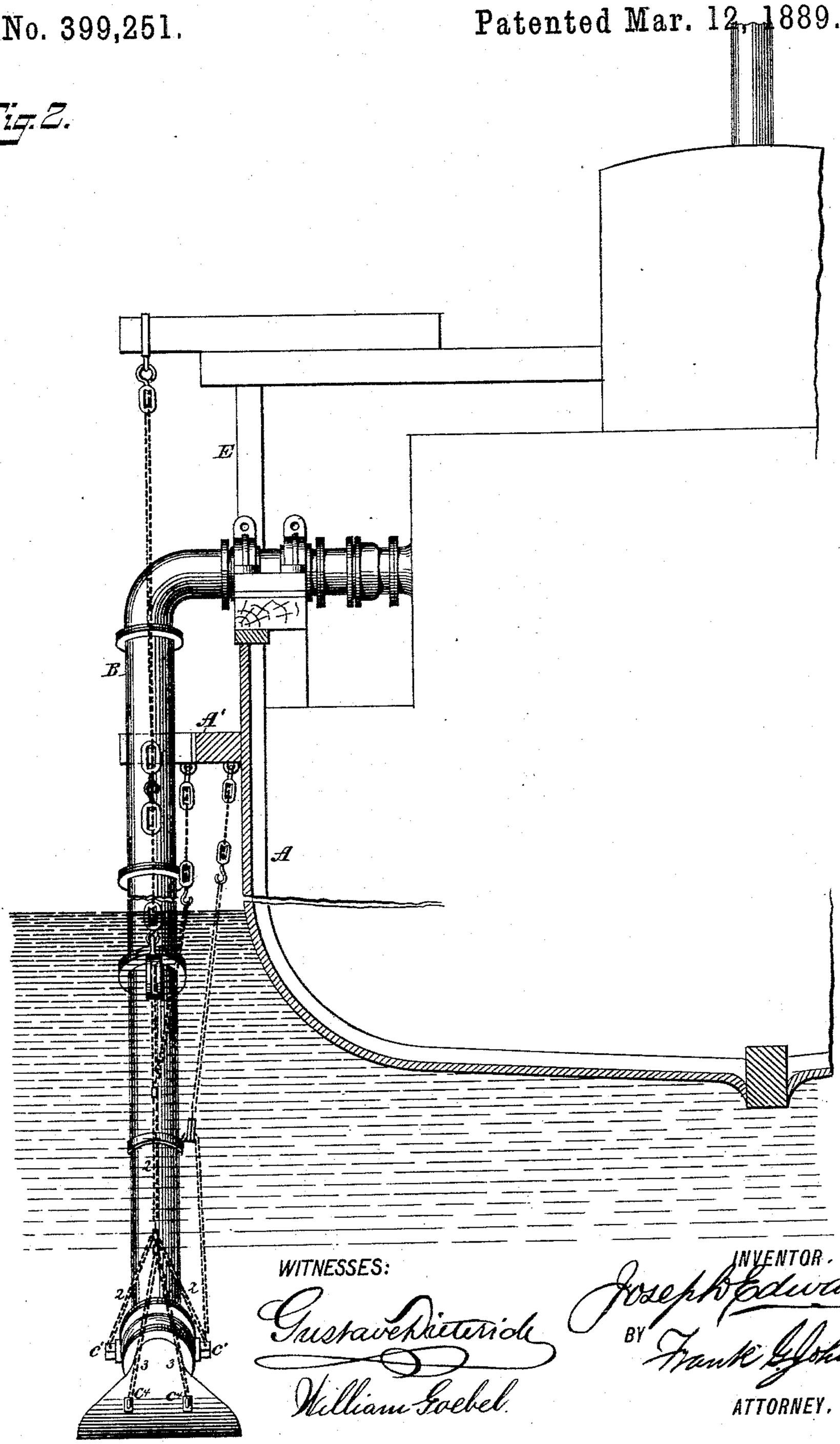

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Fig. 4.

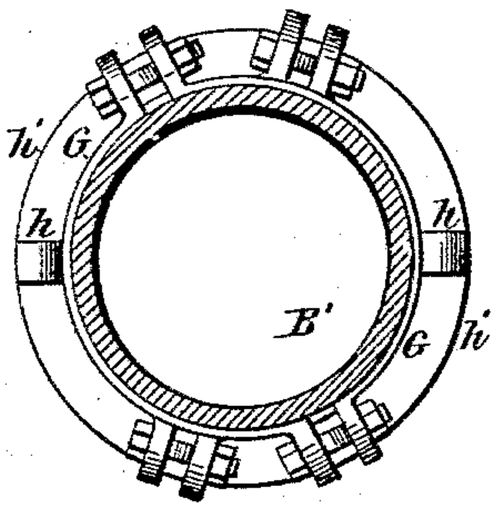

Fig. 5.

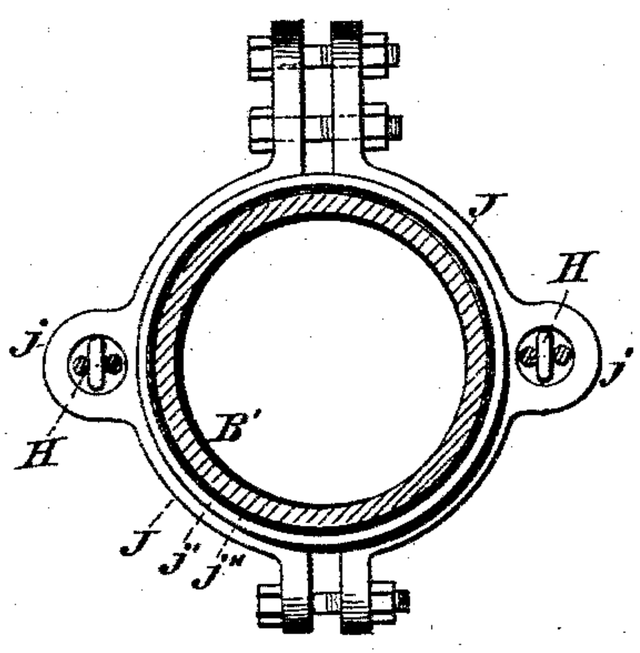

Fig. 6.

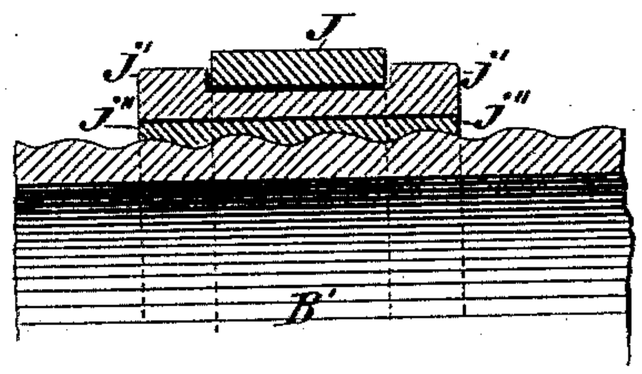

Fig. 3.

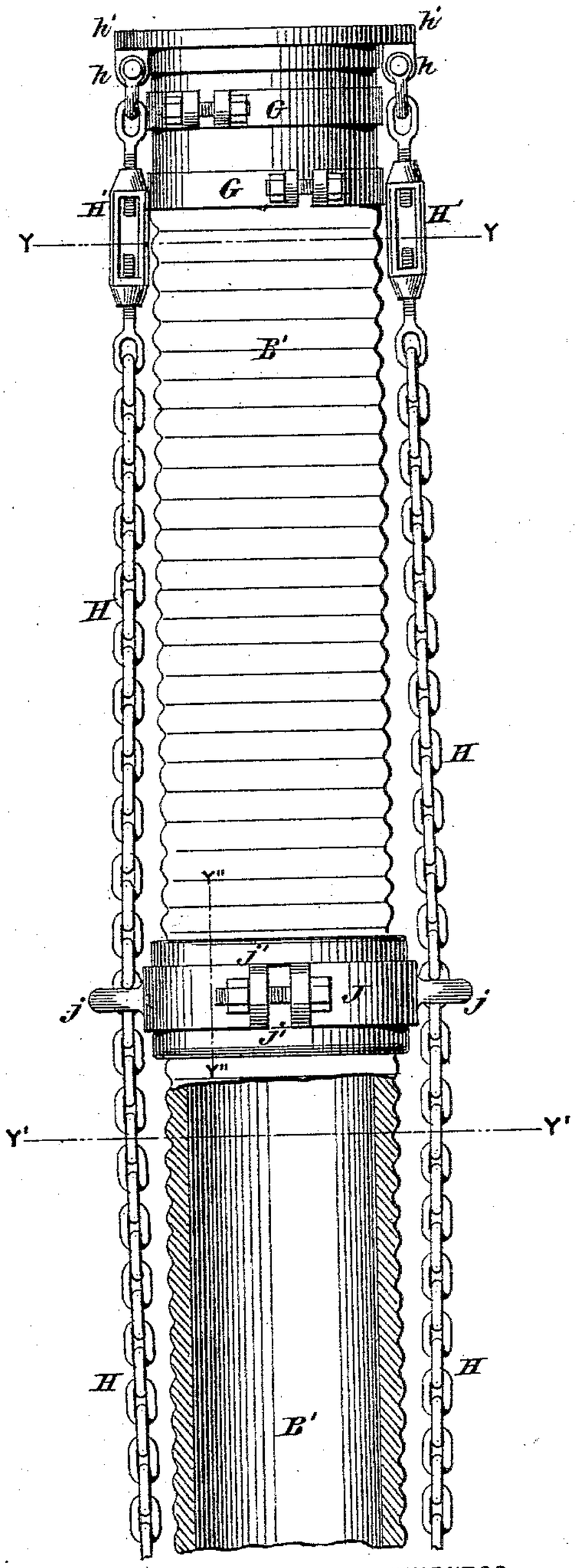

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Fig. 8.

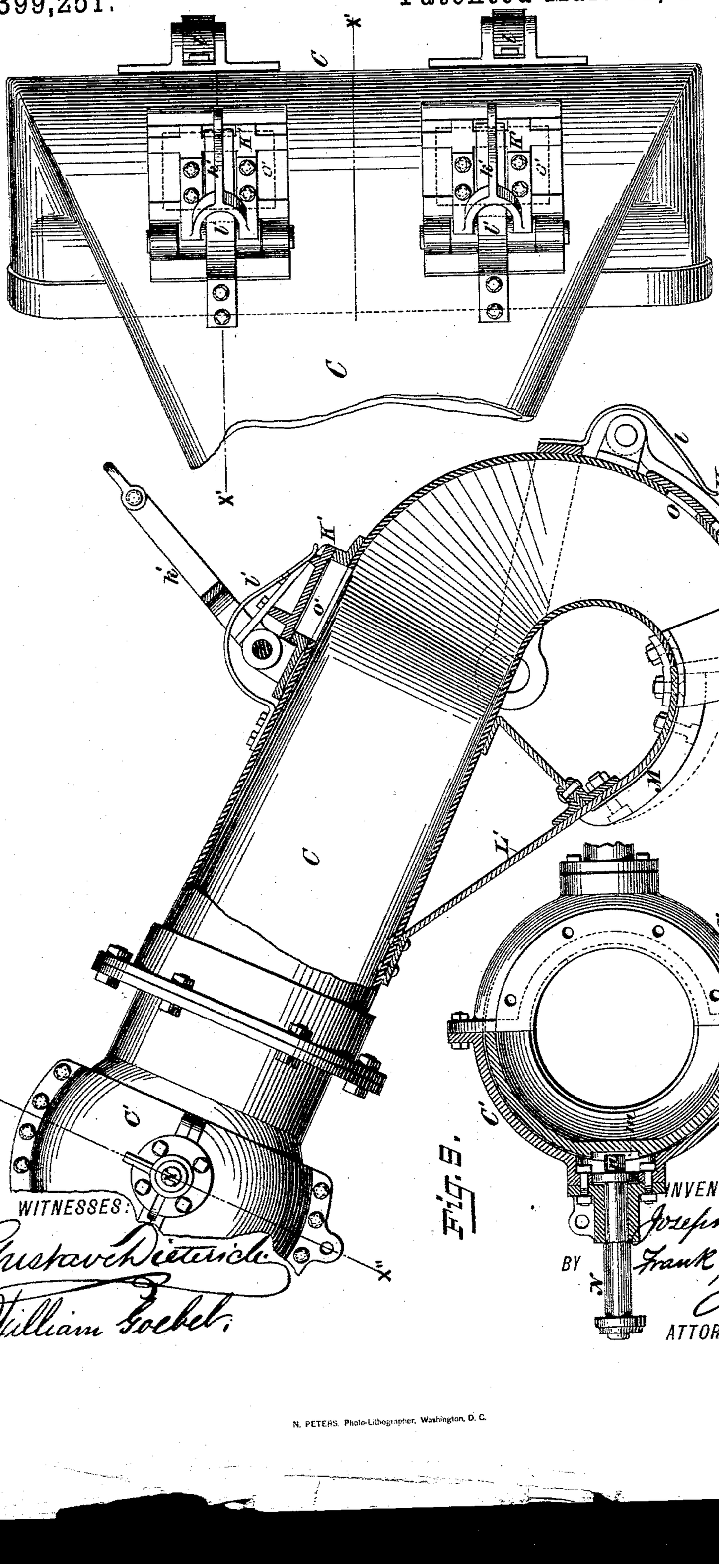

Fig. 7.

Fig. 9.

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Fig. 10.

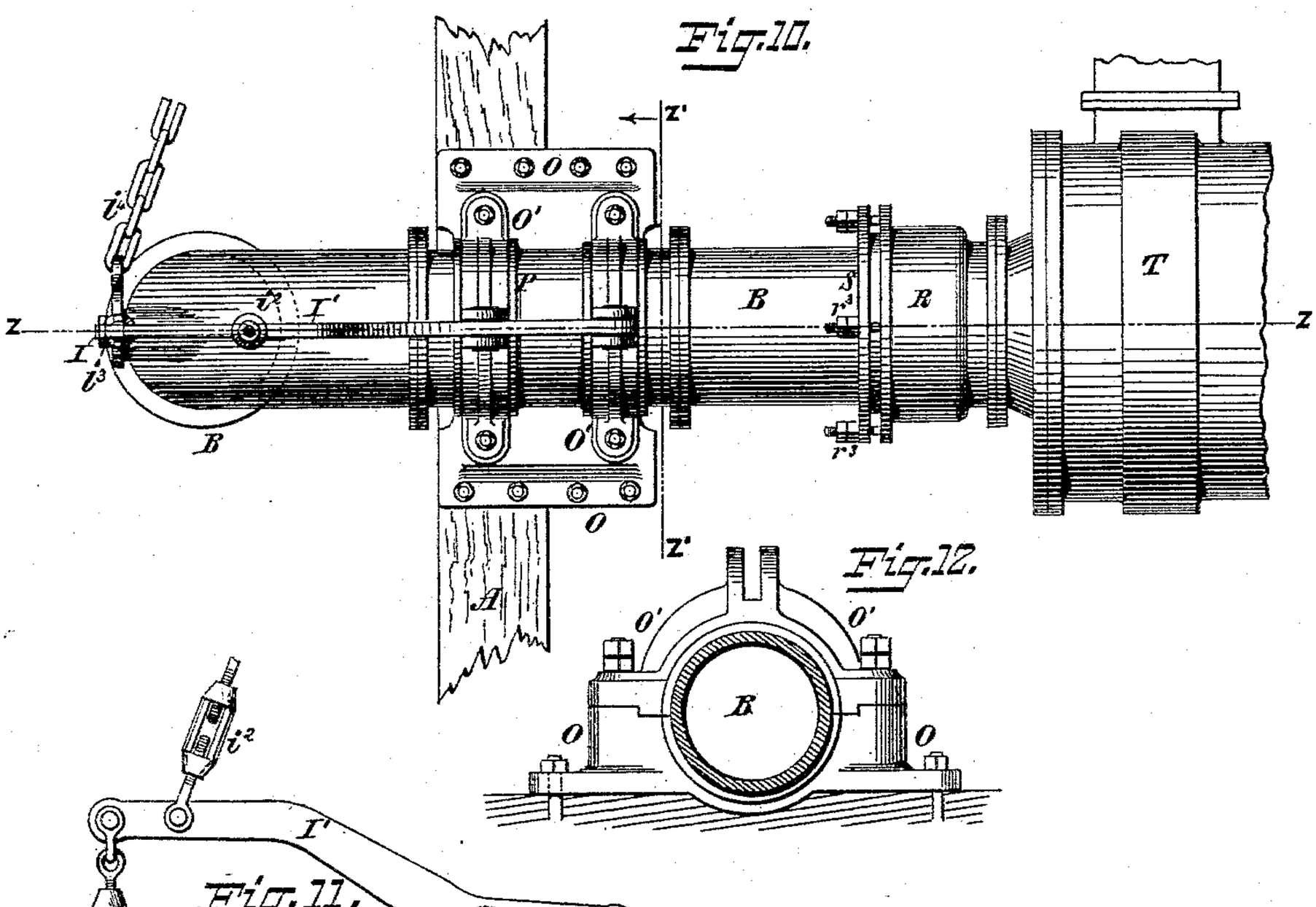
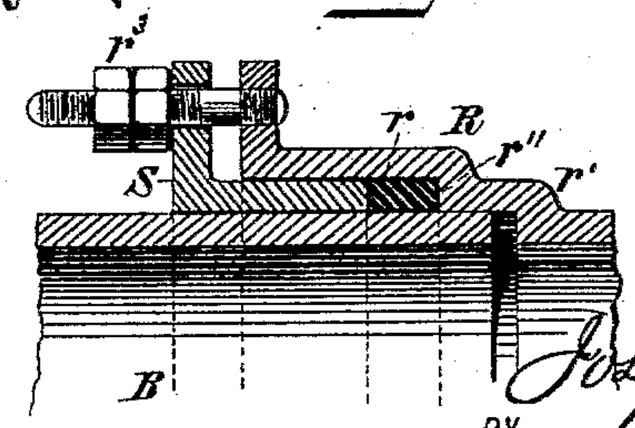


Fig. 12.

Fig. 11.

Fig. 13.



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UNITED STATES PATENT OFFICE.

JOSEPH EDWARDS, OF BROOKLYN, NEW YORK.

DREDGING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 399,251, dated March 12, 1889.

Application filed December 21, 1888. Serial No. 294,339. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH EDWARDS, a citizen of the United States, residing in the city of Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Dredging-Machines, of which the following is a specification.

My invention relates to improvements in that class of dredging-machines which are operated by rotary pumps and mounted on steam-propelled boats, and especially to such machines as are employed on sea-going steamships for dredging in rough and deep waters. In this class of dredging and dredging machinery great difficulties are encountered, especially in deep and rough waters, (which cause rolling and pitching of the vessel,) for instance, in controlling and protecting various parts of the necessary machinery, especially the suction-pipes through which the dredged materials are drawn by the pumps, and the drags at the lower ends of the said pipes, which catch hold of and receive the said materials, and the union between the said suction-pipes and ship, all of which said and other difficulties I obviate and overcome by the mechanism illustrated in the accompanying drawings, consisting of five sheets, in which—

Figure 1 represents a side view of the stern half of a dredging-steamer containing within it the necessary carrying-bins, engines, boilers, and pumps, and showing on the outside one of the suction-pipes and its drag and its relation to the ship, through the side of which it passes to connect with its pump, and the means of suspending, holding, lowering, hoisting, and otherwise controlling the said pipe and drag; Fig. 2, a transverse vertical section of the ship on the line $x\ x$ of Fig. 1, showing one of the suction-pipes and its drag and the entrance of the said pipe into the ship, and one of the outputs on the vessel to which the said pipe is in part suspended; Fig. 3, a longitudinal view of the flexible portion of one of the suction-pipes, shown partly in section, and representing protection-chains to longitudinally take the tensile strain off of this flexible portion of the said pipe; Fig. 4, a transverse section on the line $y\ y$ of Fig. 3; Fig. 5, a transverse section on the line $y'\ y'$ of Fig. 3; Fig. 6, a longitudinal section on the line $y''\ y''$ of Fig. 3; Fig. 7, a longitudinal vertical section of one of the drags on the line $x'\ x'$ of Fig. 8, showing the means of admitting a larger proportion of water, when required, into the suction-pipe; Fig. 8, a transverse horizontal view of the lower end of the drag, looking downward; Fig. 9, a transverse view of a ball-and-socket joint on the line x'' x'' of Fig. 7, which forms a flexible connection between the suction-pipe and drag; Fig. 10, a detail plan view of a portion of the suction-pipe and its connection with the pump and the side of the ship, showing the means of providing a rotary motion to this portion of the suction-pipe in the pump and in the side of the ship and yet have in both of said connections a perfectly air-tight joint; Fig. 11, a partial longitudinal section of the horizontal portion of the suction-pipe on the line $z\ z$ of Fig. 10, showing same parts as last-described figure; Fig. 12, a cross-section on the line $z'\ z'$ of Fig. 10; Fig. 13, an enlarged sectional view of the packed joint between the suction-pipe and the pump.

Similar letters refer to similar parts throughout the several views.

The ship is provided with a suction-pipe on both sides, each having its own pump, so that whatever is provided on one side of the vessel that relates to the work of dredging is also provided on the other; but in describing the several parts I will, for convenience, use the singular number.

Referring to Fig. 1, A A is the stern part of a steamer, in and on which is mounted the dredging apparatus, including bins in which to deposit the dredged materials; B B, the suction-pipe, which at its upper end is bent in the form of an elbow and passes through the side of the ship perpendicularly thereto and at right angles to itself. A′ A′ is a projecting guard-rail of the ship. This suction-pipe is shown by the plain lines in the working position and by the dotted lines in its position when the ship is going to and from the dumping-grounds.

C is the drag, attached to the lower end of the suction-pipe by means of a ball-and-socket joint, C′, which said joint and drag will hereinafter be further explained.

D D is the bed of the bay or river, upon wh'ch the drag rests and is at work about thirty-six feet below the surface of the water W W. Toward the upper end of the suction-

pipe B B is a flexible section, B′ B′, about twelve feet long, the construction and purposes of which will hereinafter be described.

E and E′ are frames built up from the deck of the vessel, transversely across which rest the outputs *e* and *e′*, to which are attached the sheave-blocks *a a* and *a′ a′*, having rove therein the wire rope *b* and *b′*, by means of which the suction-pipe B B is hoisted and lowered and properly adjusted to its work. It will be observed that these sheave-blocks *a a* and *a′ a′* are not attached directly to the suction-pipe, but that between them and the said pipe there is an intervening system of chains, 2 2 and 3 and 4 4 and 5, which are so arranged as in the one case to accommodate themselves to the support and protection of the flexible portion B′ B′ of the suction-pipe, and in the other case to control the action of the drag C and accommodate themselves to the motion thereof in the ball-and-socket joint C′. The chain 2 2, which attaches to the lower portion of the suction-pipe, is fastened at one end to the clamp-band *c′*, which is fastened around the suction-pipe at a considerable distance from its end and passes up over a sheave in the traveling sheave-block *c*, and thence down to the side centers, *c″*, of the ball-and-socket joint C′, this end of the chain being bifurcated to stride the said joint and attach to both sides of the same, as seen in Fig. 2. It will be seen that when the suction-pipe is raised by the wire rope this adjustable suspending-chain 2 2 will accommodate itself to the traveling sheave-block *c* in such a manner that an equal strain thereof will be applied to both ends of its attachment to the suction-pipe irrespective of the angle it (the said pipe) takes with the horizontal plane. The chain 3, as best seen in Fig. 2, is double, and at its upper end connects with the adjustable chain 2 2 at the point of its bifurcation. The lower end of this chain (or chains) connects to the top of the outer end of the drag, as best shown at c^4 c^4 in Fig. 2. It will be seen that by means of the ball-and-socket joint C′ and the suspending-chain 3 the outer end of the drag C can rise and fall to more or less adjust itself to its work, while the suction-pipe itself remains in a fixed position.

By means of the ball-and-socket joint and the above-described means of suspending the outer end of the drag I attain two other adjustable movements of the said drag besides the vertical adjustment, one a rotary and the other a lateral movement of its outer end, which allows it (the said drag) to accommodate itself in three different directions, irrespective of the fixed position of the suction-pipe, by which said three independent motions of the drag its mouth is not only always kept close to and adjusted to the materials to be dredged, but by these said independent movements the drag is kept constantly and closely fitted to its work irrespective of ordinary rolling of the ship or any very exact pitch or position of the suction-pipe.

The chains 4 4 and 5 are arranged in a peculiar manner for the purpose of safely holding and protecting the flexible or rubber portion B′ B′ of the suction-pipe B B. (Best seen in Fig. 1.) The upper end of the adjustable chain 4 4 is attached to the suction-pipe above and next to the flexible part of the same by means of a clamp-band, c^5, and the lower end by a similar band, c^6, below and next to the lower end of the flexible portion of the suction-pipe. This adjustable chain in its course passes over a sheave in the traveling sheave-block c^2, so that whatever strain is put upon this chain it is equally applied to both ends of the same. The chain 5 is attached at one end to the sheave-block c^2, and at the other end to a band (the subject of Fig. 5) clamped around the flexible portion of the suction-pipe at an equal distance from either end thereof. This chain 5 is of such length relative to the length of the chain 4 4 as to give the flexible rubber pipe a gentle bend. By this relative length and arrangement of these two chains (4 4 and 5) the rubber portion, B′ B′, of the suction-pipe retains the same gentle bend or curve irrespective of the angle formed by the latter with the horizontal plane.

Besides the chains above described for securing the suction-pipe B B, there are two others, 6 6 and 7 7, which I will term "staying" or "drawing" chains. The chain 6 6 is attached at the lower end to the clamp-band *c′* and at the other end to a set of sheave-blocks and wire rope F, which in turn are attached to the guard-rail A′ A′ of the ship. The other chain, 7 7, is fastened at the lower end to the side centers of the socket of the ball-and-socket joint C′ (this end of this chain being bifurcated) and the upper end to the said guard-rail with intervening sheave-blocks and wire rope F′. This latter chain 7 7 lies nearly in a line with the suction-pipe and the other, 6 6, somewhat in the same direction, the purpose of these two chains being to hold the suction-pipe in the longitudinal direction with itself to relieve the longitudinal strain thereon, as also to relieve the strain on its elbow and its union with the ship.

To further support the elbow of the suction-pipe and so relieve the lateral strain thereof on its bearing in the side of the ship and its attachment to its pump, and thereby to cause the same to more easily rotate, I provide a lug, I, Figs. 10 and 11, on the rotating center of the said elbow, and vertically over it a goose-neck, I′, secured to the said bearings, one of which is shown transversely by Fig. 12. Between the said lug and the outer end of the said goose-neck is provided a turn-buckle, *i*, to vertically adjust the support of the former by the latter, and to hold the said elbow from horizontal back-strain I provide a holding-chain, i^1, in front of the elbow. To assist in supporting the said goose-neck, I provide a turn-buckle, i^2, to connect with a chain which attaches to the ship.

In Fig. 1, *d* and *d′* are stiff spiral springs

above the outputs *e* and *e'*. These springs are placed under the heads of the rods that connect the hoisting and lowering sheave-blocks *a a* and *a' a'*, for the purpose of preventing the liability of breaking the wire ropes *b b* and *b' b'* when hoisting the suction-pipe B B to its horizontal position. (Shown by the dotted lines of the same.)

Fig. 3 illustrates the structure and longitudinal support of the flexible rubber portion of the suction-pipe, which consists of a very heavy transversely-corrugated rubber pipe about twelve feet long and of the same diameter as the iron portions of the suction-pipe, to which it is securely attached by means of suitable clamping-bands, G G, both ends being secured in a like manner. To relieve this rubber portion of the suction-pipe from longitudinal strain, I employ two heavy supporting-chains, H H, extending close to and parallel with two opposite sides of the rubber pipe, fastened at either end to the corresponding ends of the iron portions of the suction-pipe. These two supporting-chains H H are attached to lugs *h h*, provided on the flange *h' h'* of the connecting ends of the said pipe. The said chains are both provided with a turn-buckle, H' H', to adjust their length to that of the rubber pipe and make an unyielding longitudinal connection between the ends of the said iron pipe to protect the said rubber pipe from tensile strain. Around the longitudinal center of this rubber pipe is provided a heavy clamp-band furnished with two ears or lugs, *j j*, through which pass the supporting-chains H H, to keep them and the rubber pipe in the same line and afford lateral support to the latter. This band is not clamped directly to the rubber pipe, but upon a broader iron ring, *j' j'*, underneath which is placed suitable thick yielding felt covering, *j'' j''*, to protect the rubber from the iron band *j' j'* and to fill up the corrugations of the latter. (Best seen in Fig. 6.)

To further describe the details of the drag C, as illustrated by Figs. 7, 8, and 9, its lower end is broadened out, as shown by Fig. 8, and bent downward and forward, so as to bring its mouth L in front.

L' is a shield to prevent the bend or hook of the drag from fastening onto any unyielding object when it is at work.

M is a casting to be bolted to the shield L', to partially close or diminish the mouth L when the hardness or other quality of the materials dredged may require.

K is a door covering an opening, *o*, for admitting water to mix with the sand and mud to make them mobile, and so prevent the drag or any part of the suction-pipe from choking. This door is always more or less open and steadily held between the spring *l* and set-nut bolt *k*, and adjusted by the latter to let in more or less water, as may be required by the quality of the work to be performed. In dredging soft mud this door sometimes will not admit sufficient water to prevent the drag from choking; hence I provide another additional door, K', on the top of the drag, to be opened only when some part of the passage from the mouth of the drag to the pump becomes choked, and as soon as the obstruction is removed it is again allowed to close; hence I term this the "relief-door," which is opened at will by a cord being attached to its lever-handle *k'*. Of these relief-doors I provide one or two—two being shown in Fig. 8.

The ball-and-socket joint C', which connects the drag to the suction-pipe, acts to a sufficient extent in all directions by means of the circular socket *m*, Fig. 9, and the pin or post *n* working or projecting therein.

N is an extension of the post *n*, provided with a nut and washer to receive, when required by the materials dredged, either a wheel or sled, there being, of course, a corresponding post on the opposite side to prevent the drag from taking too rank a hold on its work.

Referring to Fig. 10, O O is the bottom portion of the box in the side of the ship, in which works the suction-pipe, and the caps O' O' of the said box are shown in Fig. 12. The peculiarity of this box O O is that it provides two separate bearings, P and P, located some distance apart, and in recesses *p p* and *p p*, formed on the suction-pipe by raised shoulders. The object of these two narrow bearings instead of one broad bearing is to avoid cramping of the pipe in the said box when laterally strained by the rolling of the ship, and yet to afford a stiff support of the pipe in the side of the ship; also, to furnish two sets of said shoulders on the pipe as an extra longitudinal support or hold on the said pipe. Another peculiarity of this box is that the cap is made in two separate parts, to further prevent the cramping of the pipe in said box and to make it possible to repair or renew the said caps without stopping work by removing but one of the same at a time.

Figs. 11 and 13 illustrate my method of attaching the suction-pipe B to the pump. R is a section of pipe, which at one end has a flange and opening that correspond with the same on the pump T, and which at the other end is enlarged and within has two shoulders, *r'* and *r''*, and surrounds the inner end of the suction-pipe, the extreme end of which enters the smaller diameter of the section R, formed by the shoulder *r'*. Between the larger diameter of the said section R and the said suction-pipe B is provided the gland S, between the pump end of which and the shoulder *r''* is the packing-space, which is filled with soft stuffing material, *r r*, and which is compacted around the said suction-pipe, between the end of the said gland and the shoulder *r''*, by means of the bolts and nuts *r³*. (Best seen in Fig. 13.) By this means I provide a long union between the suction-pipe and pump to further stiffen and more firmly hold the horizontal portion of the said suction-pipe against the straining action pro-

duced by the rolling of the ship in deep and rough water.

It is evident that the suction-pipes, one on each side of the ship, which are over fifty feet long, descending from the ship at an angle of some forty-five degrees with the horizon and large and heavy, besides being filled (when at work) with dirt and water, are necessarily subject to being wrenched off and broken in various ways by the rolling and pitching of the vessel, which often occurs in what is termed "outside work," or in unprotected localities. The object of my improvements is to so attach these suction-pipes and provide such means of hoisting and lowering the same and adjusting them to their work and to have such complete control over them as to not only keep them steadily at work, but, as far as possible, to protect them from damage liable to occur from the unsteady movements of the ship and other causes of injury thereto.

I am aware that suction-pipes attached to the sides and sterns of vessels for dredging purposes, and having at the lower end of said pipes somewhat adjustable drags, and in said pipes a flexible section made of rubber, and the said pipes with their drags, subject to be lowered and hoisted by means of sheave-blocks and ropes, have been employed. Therefore I do not of course claim, broadly, the use of such suction-pipes and drags or their attachment to ships or the hoisting and lowering of the same by ordinary means, or the use of a flexible rubber section in such pipes; but

What I do claim as new and useful, and desire to secure by Letters Patent, is—

1. In a pump dredging-machine mounted on shipboard, the combination of the flexible section B′ B′ of the suction-pipe B B, the supporting-chains H H, the iron portions of the suction-pipe B B, the clamp-band J, having the perforated ears *j j*, and suspending-chain 5, whereby the said chains H H and rubber section are kept in line with each other and from unduly sagging in the middle, as and for the purposes described.

2. In a pump dredging-machine mounted on shipboard, the combination of the rubber section B′ B′ of the suction-pipe B B, the suspending-chain 5, suspending-chain 4 4, traveling block and sheave c^2, and hoisting blocks and ropes *a′ a′ b′*, whereby the said rubber section of the suction-pipe is kept nearly in a straight line and prevented from deviating from a gentle curve irrespective of whatever angle the said suction-pipe takes with the horizontal plane, substantially as and for the purposes set forth.

3. In a pump dredging-machine mounted on shipboard, the combination of the suspending-chain 22, traveling-block and sheave *c*, drag-holding chain 3, suction-pipe B B, drag C, and hoisting blocks and ropes *a a b*, whereby the strain of the suspending-chain 2 2 is equally applied to two distant points of the said suction-pipe and the drag is held from falling below the line of the said pipe when lifted from its work, whatever be the angle formed by the suction-pipe with the horizontal plane, as and for the purposes set forth.

4. In a pump dredging-machine mounted on shipboard, the combination of the suction-pipe B B, drag C, and the universal ball-and-socket joint C′, having the circular socket *m* and stem *n*, whereby the said drag can adjust its mouth to its work in all directions, vertical, lateral, and rotary, substantially in the manner and for the purpose described.

5. In a pump dredging-suction-pipe, drag C, the set-nut and bolt *k*, and spring *l*, in combination with the water-door K, whereby the said water-door can be set and held at any open position that may be required to admit as much or little water as may be, according to the nature of the materials dredged, necessary to cause a free flow of the same through the said drag and its suction-pipe, as and for the purposes set forth.

6. In a pump dredging-machine mounted on shipboard, the suction-pipe box, Fig. 12, having two separate bearings, P P, in a single base, O O, and double separate caps O′ O′, said separate bearings and caps working in corresponding sunken seats around the suction-pipe B B, formed by raised shoulders *p p p p* on the said pipe, whereby a long stiff rotating bearing is provided for holding the said pipe without liability of being cramped by rolling of the ship, and whereby the caps can be repaired without detention by removing but one of the same at a time, and whereby the said pipe has a double lateral support in the longitudinal direction by means of a double set of shoulders on the said pipe striding the double bearings and double caps, in the manner and for the purposes set forth.

7. In a pump dredging-machine mounted on shipboard, the combination of the supporting elbow-lug I, having its center on the central horizontal line of the suction-pipe B, the goose-neck arm I′, caps O′ O′, and connecting holding-chain *i*, whereby the weight and strain of the said suction-pipe are greatly supported and corresponding vertical relief afforded to the bearing of the said pipe in the side of the ship, in the manner and for the purpose described.

8. In a pump dredging-machine mounted on shipboard, the combination of the supporting elbow-lug I, having its center on the central horizontal line of the suction-pipe B, the goose-neck arm I′, caps O′ O′, connecting holding-chain *i*, vertical arm-supporting chain i^2, and horizontal elbow-supporting chain i^4, whereby the elbow of the said suction-pipe is supported in a lateral forward and vertical upward direction, substantially in the manner and for the purposes described.

JOSEPH EDWARDS.

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