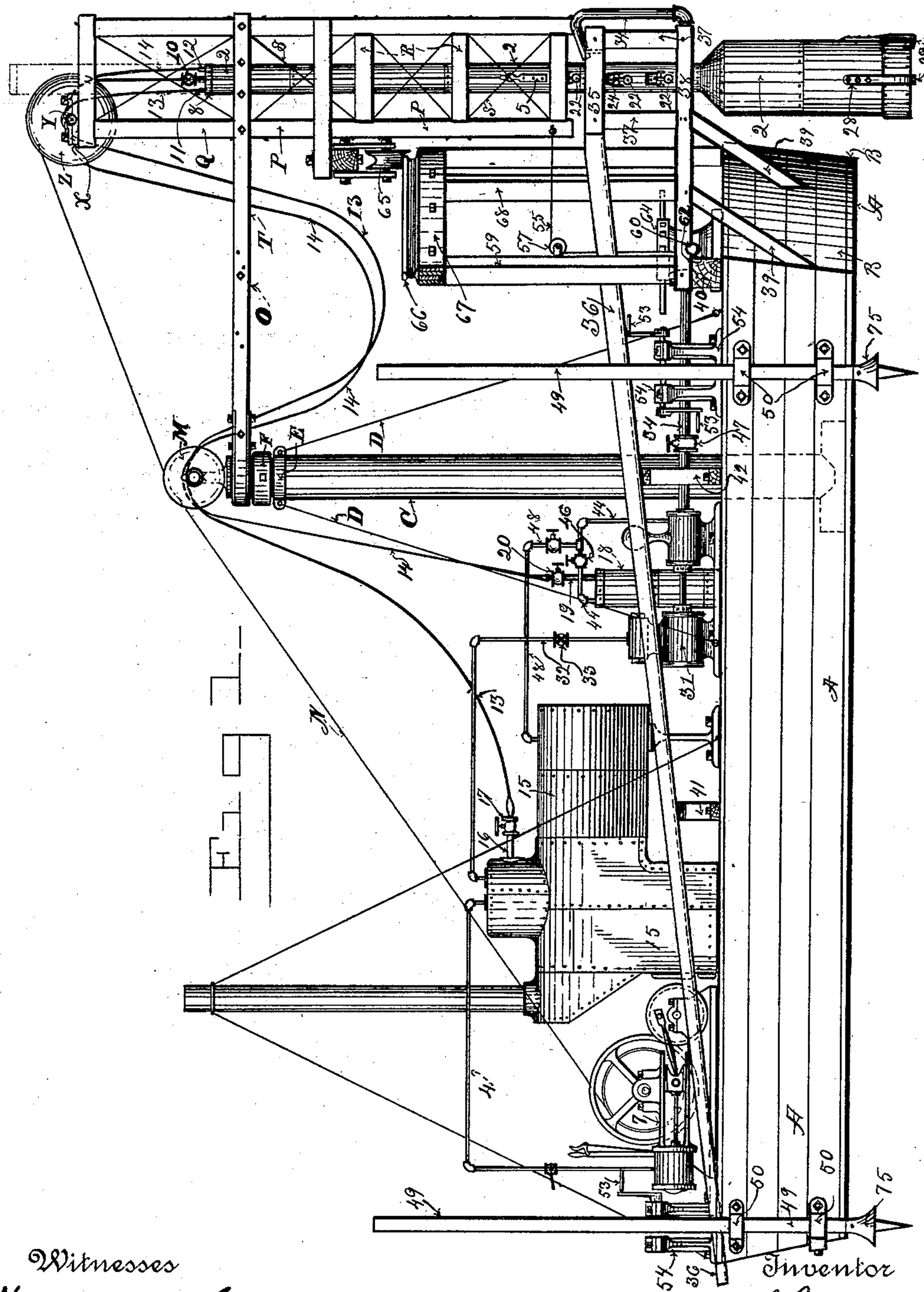
No. 623,111. Patented Apr. 11, 1899.

A. J. SEVERANCE.

DREDGE.

(Application filed Mar. 22, 1898.)

(No Model.) 3 Sheets—Sheet 1.



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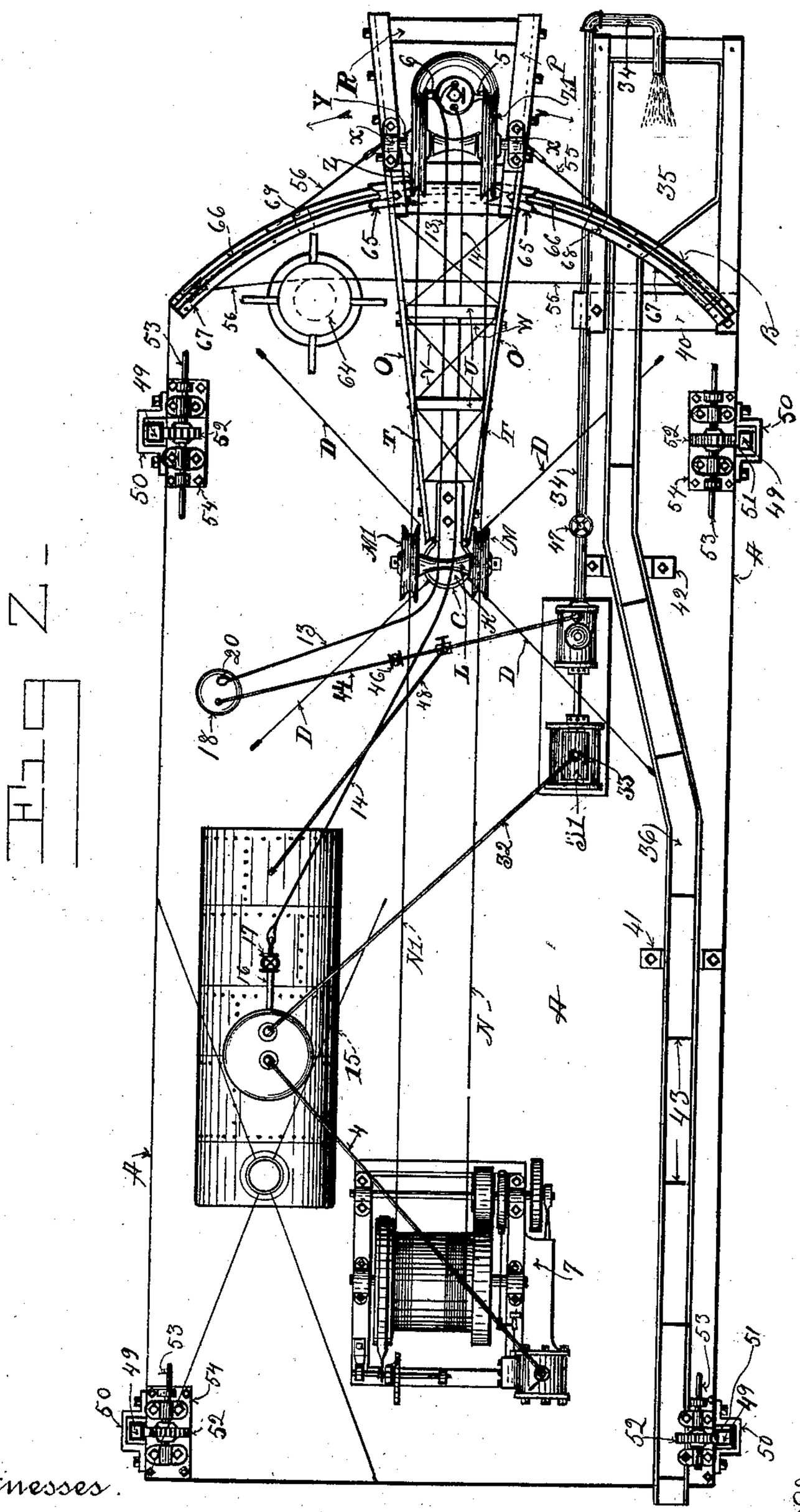

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(No Model.) 3 Sheets—Sheet 3.

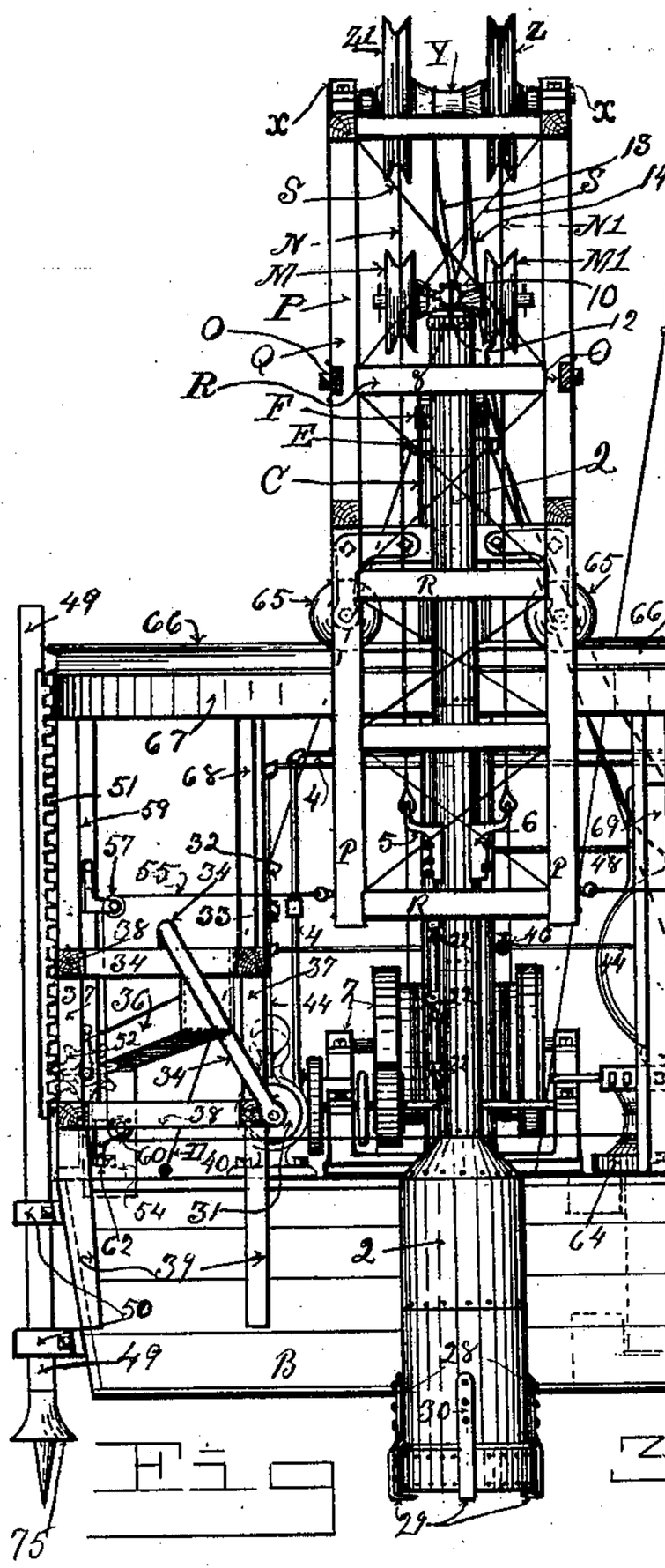

Fig. 3.

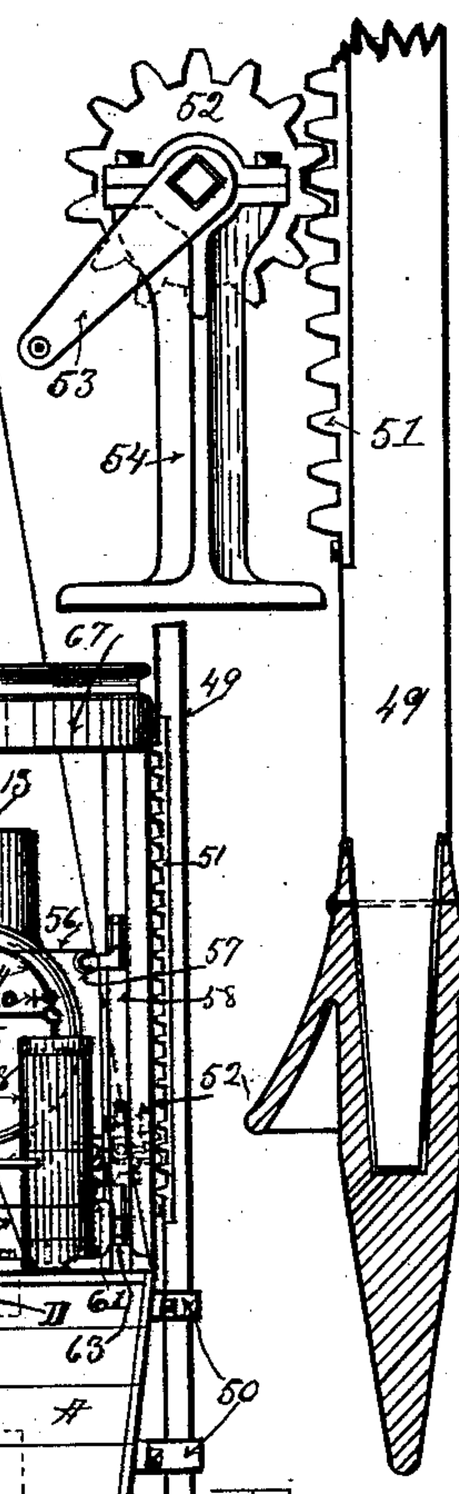

Fig. 4.

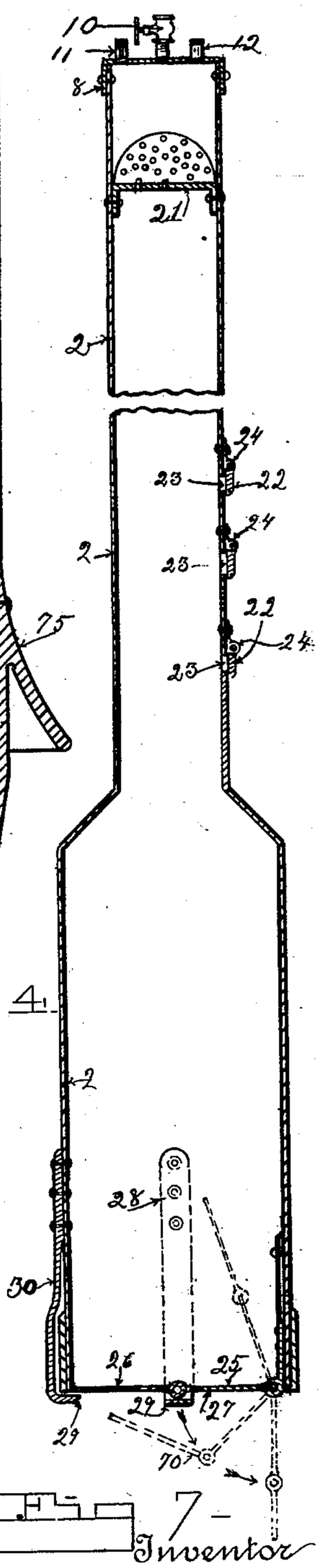

Fig. 5.

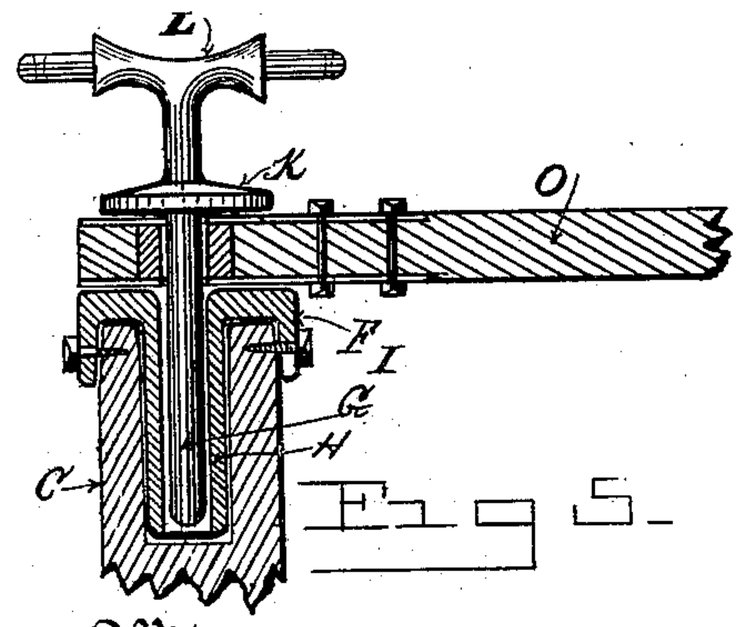

Fig. 6.

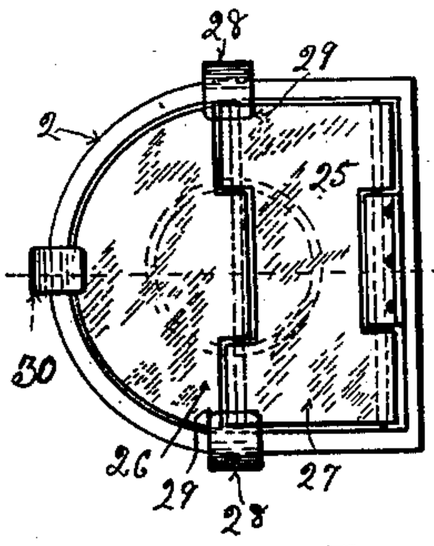

Fig. 7.

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UNITED STATES PATENT OFFICE.

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DREDGE.

SPECIFICATION forming part of Letters Patent No. 623,111, dated April 11, 1899.

Application filed March 22, 1898. Serial No. 674,788. (No model.)

To all whom it may concern:

Be it known that I, ASAHEL J. SEVERANCE, 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 Dredges; 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 improvements in dredges; and the objects of my invention are, first, to provide a vacuum suction lifting-dredge especially adapted to take up the gold and gold-carrying gravel and sand lying on the bed-rock of rivers; second, to provide a dredge that can be operated in rapid-flowing rivers and that will take up and retain, by means of a vacuum suction-lift, all the loose rocks, gravel, sand, and gold lying on the bed of rivers; third, to provide a dredge that can be operated in rivers of any reasonable depth without losing the fine flour-gold and fine gold-bearing sand while raising a load from the bed-rock of a river through the water to the deck of the dredge-boat, and, fourth, to provide a simple, durable, positively-operating dredge in which the gravel-lifting member is entirely free from finished moving machinery or operating mechanism, and consequently cannot get out of order, and in which the operating machinery can be safely housed and secured on the deck of the dredge-boat where it can be kept free from contact with and from the wear of sand and gravel. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a dredge embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is an end elevation of the front or vacuum-lift-tube end of the dredge. Fig. 4 is a side elevation, partially in section, of one of the anchors of the dredge-boat. Fig. 5 is a sectional view of the pivotal supporting-shaft for the cage and sweep-beam of the vacuum-tube and of the sheaves that support the tube hoisting and lowering ropes. Fig. 6 is a bottom plan view of the suction end of the vacuum lift-tube, showing the double door controlling the entrance to the tube. Fig. 7 is a vertical sectional view of the vacuum lift-tube.

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

Referring to Fig. 1, A designates a suitable boat for supporting the various pieces of machinery and elements which make up the dredge. The front end B of the boat is curved concentric to a pivotal post C, that is rigidly fixed to the boat in any suitable manner. This post stands vertically several feet high, and its top end is supported by the guy-ropes D. These guy-ropes are secured to the ring E, which is secured adjacent to the top end of the post, and the ropes extend to the deck of the boat. At the top of the post I secure a cap F, which is adapted to form a journal for the pin G. Cap F comprises a hood-shaped flange portion which is adapted to fit over the end of the top of the post (see Fig. 5) and a long depending sleeve portion H, which is extended into the center of the post. The casting is secured to the post by suitable lag-screws I. The sleeve portion of this casting is adapted to form a suitable pivotal bearing for the pin G, which is extended and formed above its head K into a horizontal cross-arm portion L, the opposite ends of which are each equidistant from the center of the pin and are adapted to support revolubly the sheaves M and M′. The pin and sheaves are free to turn in the sleeve of the cap of the post and the sheaves' support, which allows the sheaves to adjust themselves to the constantly-changing position of the hoisting-ropes N and N′, which they support, as the sweep-beam and cage swing around its curved track. To cap and pin I pivot one end of sweep-beam O. This sweep-beam extends to and is rigidly secured in any suitable manner to the cage P. This cage comprises a substantially square trestle-frame of vertical timbers Q and cross-timbers R, suitably framed together and braced by diagonal rods S. The sweep-beam also comprises a suitable trestle-frame comprising the side pieces T and cross-pieces U, braced by diagonal rods V and a clamping-bolt W. The side pieces of the sweep-beam, as illustrated, are bolted to cross-pieces of the frame. Upon the top of the cage

I mount in boxes X, which are secured to the cage, a shaft Y, upon which I mount two sheaves Z and Z', spacing them far enough apart to allow the top of the vacuum lift-tube 2 to pass freely between them. The vacuum-tube 2 is suspended from these sheaves by two wire ropes N and N', which are attached to suitable brackets 5 and 6, riveted to opposite sides of the tube at substantially the central portion of its length. These ropes rest on the sheaves M and M' on the post C and extend to a hoisting-engine 7, which is set on the deck of the boat and is connected to the boiler by the pipe 4. This hoisting-engine may be of any suitable type. As illustrated it represents a single-cylinder friction hoisting-engine. The vacuum lift-tube is held by the cage and ropes in a substantially vertical position at all times and is lowered or raised through the cage and to and from the bed of a river by the hoisting-engine. The vacuum lift-tube comprises a straight round tube throughout the greater portion of its length, of from one to several feet in diameter and with an enlarged lower terminal end of a substantially semicircular form at and immediately adjacent to its end, which preferably blinds into a round tube before it converges into the smaller upper portion. Across the top end of the tube I rivet a cap 8, in which I thread a valve 10, which is adapted to be opened at the proper time to admit air and destroy the vacuum. I also thread two nipples 11 and 12 to the cap, to which I secure the ends of two lines of hose 13 and 14, both of which extend up over and rest on the shaft Y, from which they extend over and rest on the cross-arm L of the pin G on the post C, from which the hose 13 extends and is connected to a steam-generating boiler 15, which is set on the deck of this boat. A suitable nipple 16 and a valve are connected to the end of the hose and to the boiler. The hose 14 extends to and is connected to a water-pressure-storage tank 18, which is also set on the deck of the boat, and is connected to a suitable nipple 19 and valve 20, which are connected to the top of the tank. At a short distance from the top of the vacuum-tube I secure across it a diaphragm 21, which I perforate with numerous small holes, so that when water is admitted into the top of the tube it will be divided by this perforated diaphragm into a shower of fine jets. Adjacent to the junction of the enlarged end with the upper body portion I place one or more clapper-valves 22, over holes 23, formed through the shell of the tube. These valves are pivoted to suitable cleats 24, secured to the tube, and are adapted to fit closely over the holes. At the bottom end of the tube I hinge in any suitable manner to its straight side a door 25, which I make in two independent parts, hinging them together so as to form a door, one half, 26, of which is hinged to the other half, 27, to fold in both directions upon it. The whole door is also hinged to swing either up into the tube or downward away from it, as shown by the dotted lines in Fig. 7. The door is held in position to close the end of the tube by the spring-keepers 28, which are constructed of strips of resilient steel which extend a short distance along the opposite sides of the tube in diametrical alinement with the hinge-joint that pivots the two parts of the door together. These strips are riveted to the tube at their upper end, but the greater portion of their length depends freely along the tube, and at its end an inverted toe 29 is formed that is adapted to project over the edges of the two parts of the door at the joint, and thus support both parts at this joint. A third keeper 30 is secured to the tube on the opposite side of the tube from the main hinge, which is similar in construction to the keepers 28. It normally supports the free curved end of the door and prevents its swinging down when the door is extended straight across the entrance and its edge rests upon the top of the keeper. The boiler 15 is connected to a pump 31 by a steam-pipe 32, in which is placed a valve 33. The main discharge-pipe 34 of the pump is extended to and over the forward end of the boat and is carried up around and over and is arranged to dump into the dumping-box 35. This dumping-box is the head of a sluice-box 36. It is constructed of planks and is supported by a suitable trestle-work, which, as illustrated, consists of the vertical timbers 37 and horizontal timbers 38 and the struts 39 and the block 40, these several parts being strongly framed and secured together and to the end of the boat. From this dump-box the sluice-box 36 continues along the deck of the boat to and over its opposite end. The sluice-box is supported by suitable trusses 41 and 42 and is constructed with a continuous downward pitch that will enable the water flowing from the pump to properly wash all the gravel, sand, and rock that may be dumped into the dumping-box through the sluice-box and discharge it over the opposite end of the boat. At suitable intervals in the sluice-box I place riffles 43 to catch and hold any gold the gravel may contain. I also place a metal tank 18 upon the deck of the boat, which I preferably connect by small valved pipe 44 to the water-cylinder of the pump. I pump this tank full of water and keep the water under a pressure of from fifty to two hundred pounds per square inch in order that the pressure may force the water through the hose 14 to the top of the vacuum-tube whenever the valve 20 in the hose-line is opened by an operator. A suitable valve 46 is placed in the pipe 44, and also a valve 47 is placed in the pipe 34, to allow the operator to close either one at will and feed the full pressure of the pump through the other, as the case might be. Thus if it was necessary or desirable to use the full force of the pump to fill the tank it could be done in a very few seconds by closing the valve 47 in the main discharge-pipe and allowing the full pres-

sure of the pump to pass into the tank, when the valve 46 could be closed until the pressure and water in the tank are exhausted; but the pump would under proper conditions supply the tank with water under sufficient pressure and also the sluice-box while running steadily with both pipes being kept open to the tank and sluice-box; but if preferred and under same circumstances a separate pump could be used to supply the tank. I also extend a valved pipe 48 from the pipe 44 to the boiler to supply it with water. The boiler, however, if preferred may be supplied with water by any of the commonly-known methods.

In order to firmly anchor the dredge-boat in a river while lifting the deposits of gravel, sand, and gold from its bed-rock, I place at each corner of the boat a rigid anchor which consists of a heavy vertical post 49, slidably mounted in staples 50, secured to the sides of the boat, and in order to raise and lower these anchors I preferably provide their inner faces with a toothed rack 51 and mount a pinion 52 and a rotating operating-crank 53 in a suitable supporting-frame 54 in operative engagement with the rack, which enables one or more operators to readily raise the anchors. The lower end of each anchor I preferably provide with a metal tip 75, which I preferably construct with a projecting bell-shaped hood to better enable it to bed itself in the bottom of a river and hold the boat against displacing movements. To the opposite sides of the cage I secure the ends of two ropes 55 and 56, which extend to pulleys 57, that are secured to the posts 58 and 59. From these pulleys the ropes extend to pulleys 60 and 61, which are also supported in suitable brackets 62 and 63, which are secured to the post 58 and to the block 40, upon which the post 59 rests. From these pulleys the opposite ends of the ropes extend to and are secured to a capstan 64, which is operatively mounted on the deck of the boat. The ropes are arranged on said capstan, so that when one rope is wound on it the opposite rope is unwound, and the cage is thus drawn in either one direction or the other across the bow of the boat, rolling freely upon sheaves 65, which are suitably journaled to the frame of the cage and are adapted to run on a track 66, which is preferably mounted on a chord 67, placed above the heads of the operators and suitably supported by posts 58, 59, 68, 69, and 70. The capstan may also be used to draw the boat up a river by throwing off the cage-ropes and securing a tow-line to it. The chord may be built up of narrow planks bolted together, and the track should be set exactly concentric to the pivotal center of the sweep-beam. The track and chord may be extended a short distance over the side edges of the boat if it is desired to work the tube over a more extended surface than the width of the boat.

The operation of my vacuum suction-dredge is as follows: After anchoring the boat in a river where it is desired to dredge the door of the tube is first closed and also the air-valve in its cap. The tube is then lowered through the water until it rests on the gravel or sand lying on the bed-rock of the river. Steam is then admitted to the top of the tube through the hose 13 from the boiler by opening the valve 17 of sufficient pressure to drive out all the air and water through the valves 22 at the lower part of the tube that there is in the tube above and adjacent to the valves. It is not necessary to drive out all the air and water down to the door, and when steam is seen to freely escape from the lower valve the tube is sufficiently charged with it for operation, and the steam is shut off by closing the valve 17. Water is instantly admitted from the water in the tank by opening the valve 20, which allows the water to flow through the hose 14 into the top of the tube and, being forced through the diaphragm, falls in a shower on the steam and instantly condenses it, creating a vacuum instantly of great power. The valves 22 are instantly closed by the suction of the vacuum, which draws the door up instantly and with it enough gravel, sand, rocks, and all the gold contained therein to fill the lower end of the tube from four to twelve feet deep. Rock of any size that are not larger in diameter than the area of the inlet into the tube are sucked up quickly and instantly. The forming of the vacuum and filling of the tube require but a second, after which the water is shut off from the tank. An operator then starts up the hoisting-engine and raises the tube through the cage until its lower end is lifted above the top of the dumping-box. The cage and tube are then drawn over the dumping-box by turning the capstan to roll the cage and tube along the curved track. The air-valve 10 is then opened to admit air into the top of the tube and break the vacuum, and the door is opened by prying the keepers that support the center of the door at the joint simultaneously back far enough to allow the center of the door to drop, as shown in dotted lines 70 in Fig. 7. The dropping of the center will pull the end off of the end keeper and the door will swing downward wide open and discharge its load of gravel into the dumping-box, where it is worked through the sluice-box by the water from the pump. The door of the vacuum-tube is then again closed and the cage and tube drawn by the capstan away from it to the desired part of the bow of the boat and again lowered and the operation repeated. It requires but three minutes to obtain and dump each load in from thirty to forty feet of water, and with a tube with a mouth and lower end about four feet in diameter and a body portion about two feet in diameter from three to five tons can be raised at each lift. I construct the door to fold at its center both ways, as it is more flexible as a whole and is not so liable to be wedged in the tube by coarse gravel as a door con-

structed in one piece. In fact, a door constructed in one piece will frequently be wedged in the tube by gravel. The double door being more flexible and having less continuous edge surface is better adapted to maintain an operative fit in the mouth of the tube even should it become slightly bent.

My improved vacuum lift-dredge has been constructed and used upon a scale that would lift from three to ten tons of gravel, sand, and boulders at a lift, and in from twenty to twenty-five feet of water from fifteen to twenty lifts per hour have readily been made. I secure in actual practice ten pounds suction per square inch of area at the mouth of the tube and fourteen hundred and forty pounds per square foot. The bed of a river can be cleaned of gravel, sand, and gold under the water as clean as though it was done by hand above water. The tube is entirely void of coacting rotating or sliding machine elements or parts, and consequently it is almost impossible for it to get out of order.

I am aware that various modifications and changes in the construction and arrangement of my vacuum-dredge can be made without departing from the spirit and scope of my invention. Consequently I do not wish to be limited or to be understood as limiting myself by positive expression in the description to the exact construction shown.

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

1. The combination in a dredge of the supporting-boat, the pivotal post mounted thereon, a sweep-beam pivoted to said pivotal post, a track curved concentric to said pivotal post across the bow of said boat, a cage comprising a trestle-framework attached to said sweep-beam and mounted to roll on said curved track, a vacuum suction lift-tube substantially as herein shown and described freely supported and confined in vertical operative position by said cage and means including a hoisting-engine for raising and lowering said vacuum-tube in said cage, substantially as described.

2. The combination in a dredge of a supporting-boat, a vacuum suction lift-tube operatively supported by said boat and adapted to be raised and lowered to and from the bottoms of rivers and comprising a long tube having an enlarged suction end provided with a door adapted to swing both inward and outward and having said door divided by a hinged joint into two parts, the outer or free part of which is adapted to fold in either direction upon the other, means including an alternate supply of both steam and water for forming a vacuum in said tube; means including one or more self-closing valves for detecting the presence of an operative volume of steam in the lower portion of said tube, and an air-inlet valve in the upper portion of said tube, substantially as described.

3. The combination in a dredge of the supporting-boat having a curved dredging end, a curved track supported above the deck of said boat; a pivotal post rigidly stationed on said boat concentric to said boat, a cage arranged to project over the curved end of said boat and adapted to roll on said track, a sweep-beam extending from said cage to said post, a vacuum suction lift-tube loosely inclosed and confined in an operative vertical position by said cage; hoisting-ropes arranged to support said tube in said cage; rope-sheaves mounted on said cage and supporting said tube-supporting ropes, a pivotal pin arranged to secure said sweep-beam to said pivotal post and provided with an upward extension containing a cross-arm, a rope-sheave mounted on each end of said cross-arm and supporting said tube-supporting ropes and arranged and adapted to swivel and be turned by said ropes as the said cage and sweep-beam are moved along said curved track and a hoisting apparatus on said boat to which said ropes are connected for raising and lowering said tube, substantially as described.

4. The combination in a dredge of a supporting-boat, a curved track thereon, a cage mounted to roll on said track and projecting beyond the boat, a pivotal support concentric to said curved track, a sweep-beam connecting said cage to said pivotal support, a vacuum suction lift-tube suspended in said cage and confined thereby and controlled by a suitable hoisting apparatus and means including oppositely-disposed ropes and a power device to which said ropes are attached for moving said cage and vacuum-tube along said curved track, substantially as described.

5. The combination in a dredge of the supporting-boat, the curved track mounted thereon; the pivotal post concentric to said track, the cage projecting over said boat, the wheels mounted on said cage and track, the vacuum suction lift-tube and the hoisting apparatus, with the steam-generating boiler the water-pressure tank, the steam and water supply pipes connecting said boiler and tank to said tube, the pump, the dumping-box and sluice-box and the capstan and ropes for operating said vacuum-tube, substantially as described.

6. The combination in a dredge of the vacuum suction lift-tube consisting of a tube having a long body portion containing an enlarged suction or mouth portion, the water and steam flexible supply pipes, the steam and the compressed-water supplies, the air-inlet, a door hinged to said mouth to swing both in and out and arranged to fold upon itself in either direction at substantially the center of its width and one or more self closing valves adjacent to the mouth end of said tube, spring-keepers arranged to support said door across the mouth of said tube positioned on opposite sides of said tube to engage the parts of said door at their pivotal hinge, an introverted lip or toe on said keepers adapted to extend under said hinge and a third spring-keeper arranged to support the free end of

said door across the mouth of said tube, substantially as described.

7. A dredge for raising gold-bearing gravel from the bottoms of rivers comprising, a vacuum suction lifting-tube having a door at its suction-mouth and adapted to swing both inward and outward, means for locking said door across said mouth, said tube having its upper end closed, a supply of steam arranged to be fed at will into the top portion of said tube, a perforated diaphragm in the top portion of said tube, a supply of water under pressure arranged to be delivered to the top of said tube above said diaphragm, an air-inlet valve on said tube, one or more self-opening and self-closing valves near the lower end of said tube and suitable means including a supporting-boat, steam-generating, hoisting and pumping machinery, and supporting and operating mechanism for operating said vacuum suction lifting-tube, substantially as described.

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

ASAHEL J. SEVERANCE.

Witnesses:

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SIDNEY WILLIAMS.