(No Model.) 5 Sheets—Sheet 1.

R. STONE.

HYDRAULIC EXCAVATING MACHINE.

No. 316,497. Patented Apr. 28, 1885.

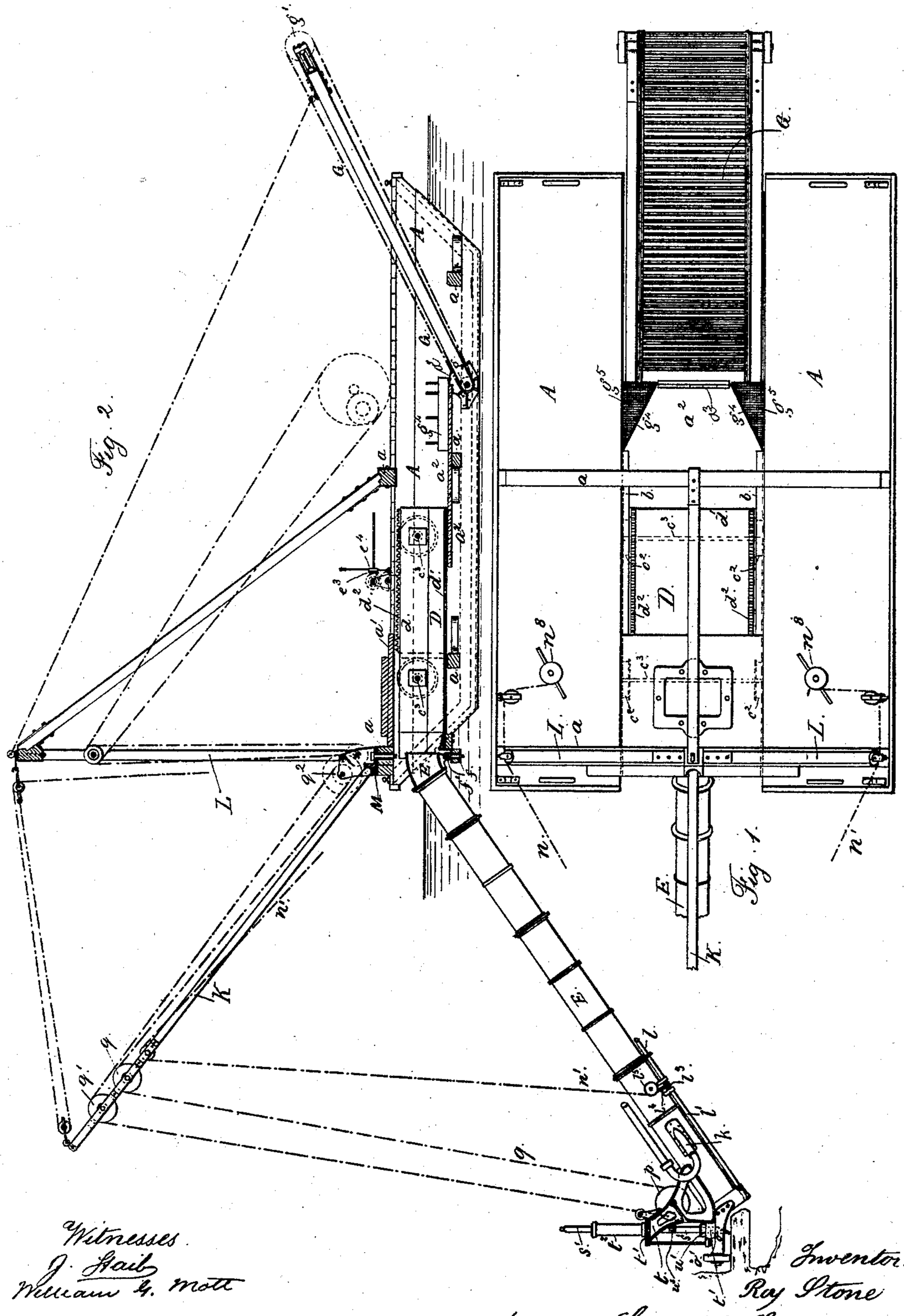


Fig. 2.

Fig. 1.

Witnesses.
J. Stail
William G. Mott

Inventor.
Ray Stone
per Samuel W. Serrell Atty

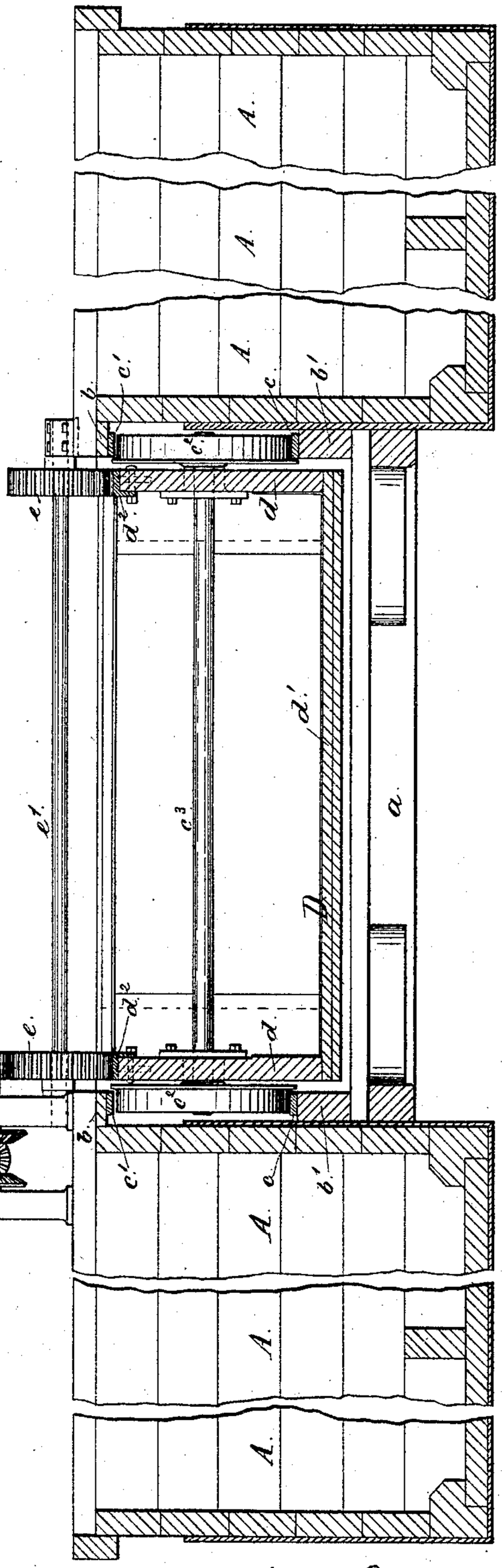
(No Model.) 5 Sheets—Sheet 2.

R. STONE.

HYDRAULIC EXCAVATING MACHINE.

No. 316,497. Patented Apr. 28, 1885.

Fig. 3.



Witnesses.
J. Stahl
William G. Mott

Inventor:
Roy Stone
per Lemuel W. Serrell. Atty

(No Model.)

5 Sheets—Sheet 3.

R. STONE.

HYDRAULIC EXCAVATING MACHINE.

No. 316,497. Patented Apr. 28, 1885.

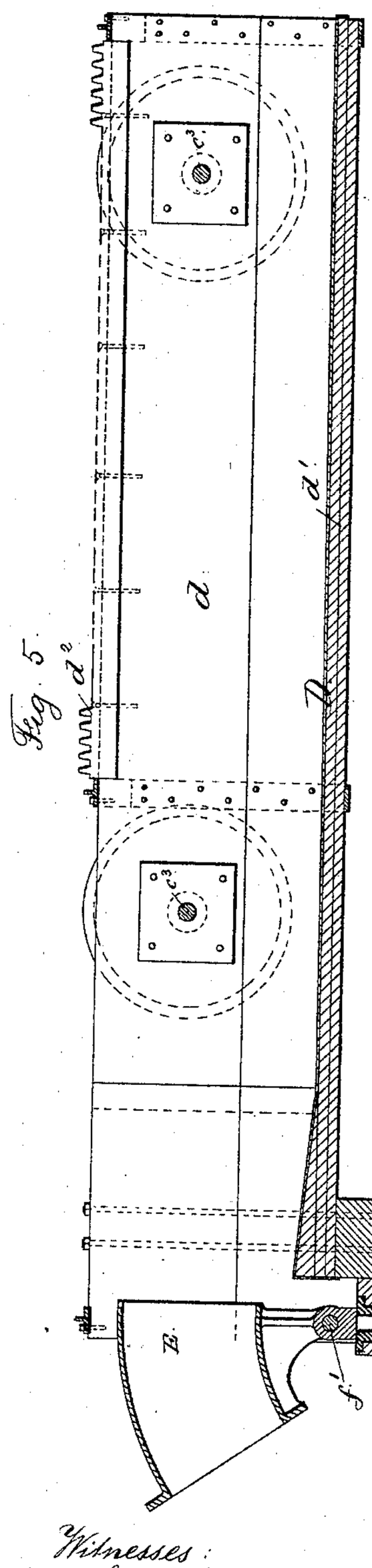


Fig. 5.

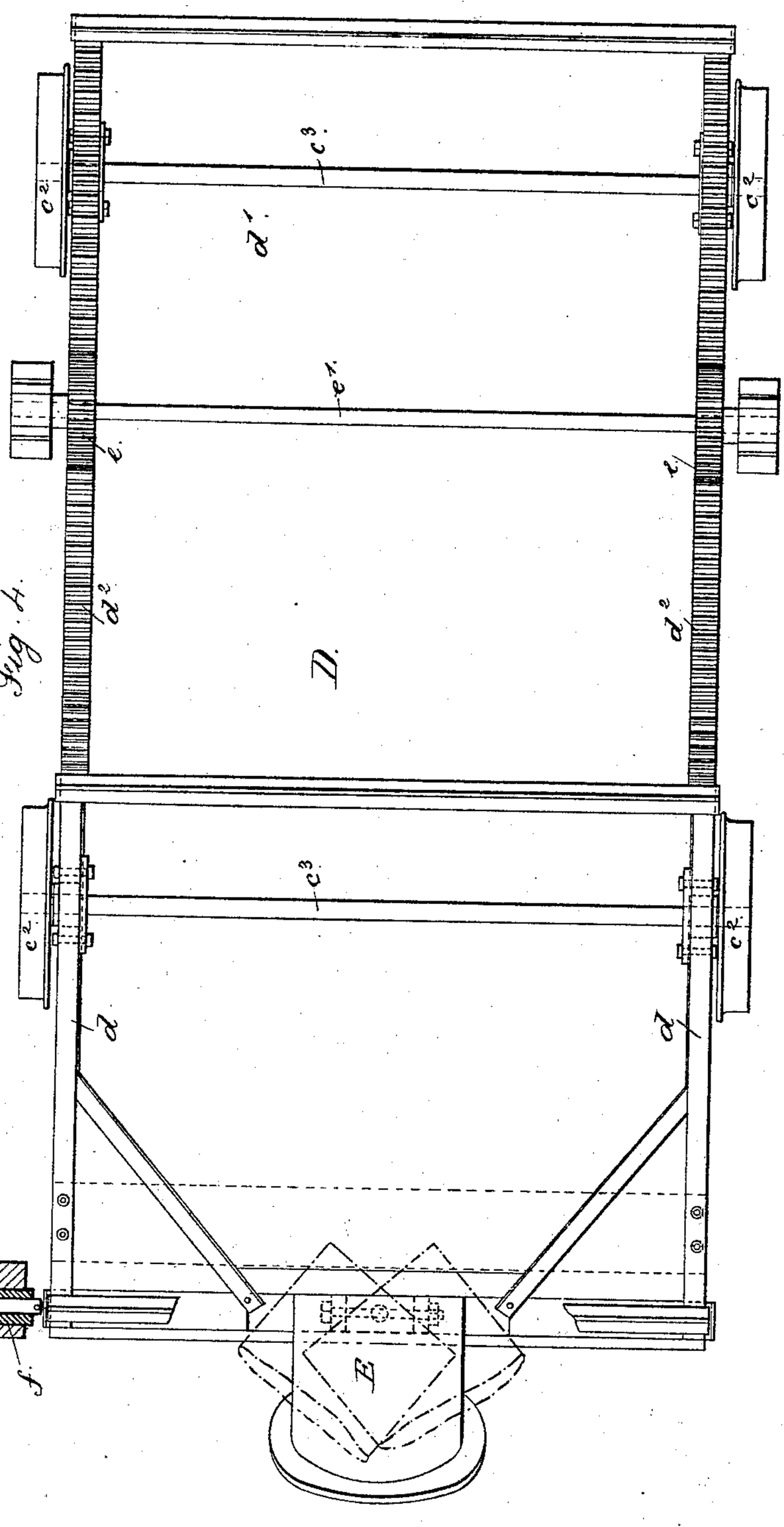


Fig. 4.

Witnesses:
J. Stail
William G. Motts

Inventor:
Roy Stone
per Lemuel W. Serrell atty

(No Model.) 5 Sheets—Sheet 4.

R. STONE.

HYDRAULIC EXCAVATING MACHINE.

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Fig. 20.

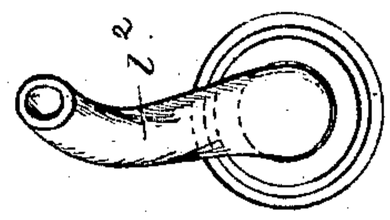


Fig. 15.

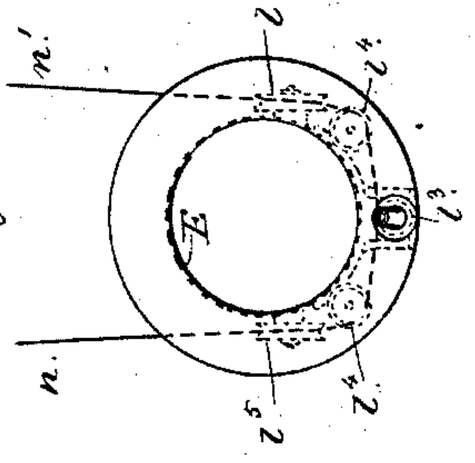


Fig. 16.

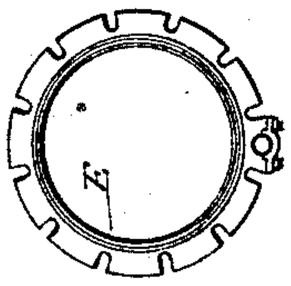


Fig. 17.

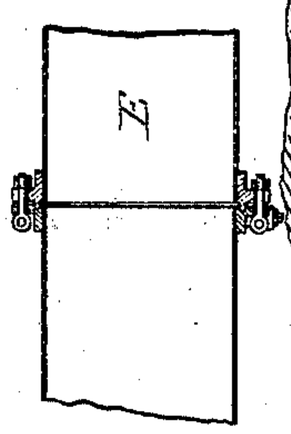


Fig. 19

Fig. 18.

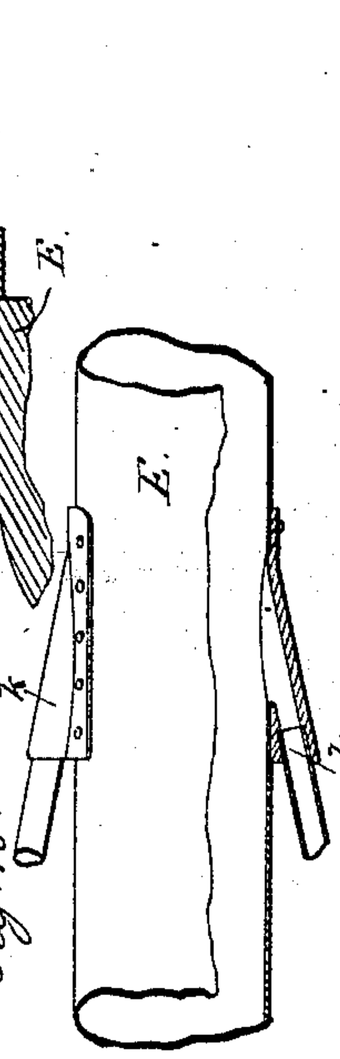


Fig. 6

Fig. 7.

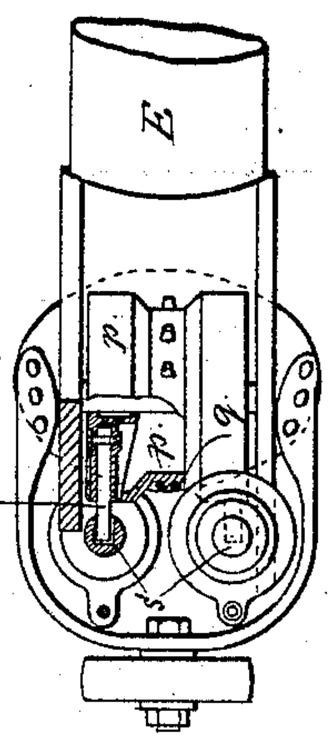
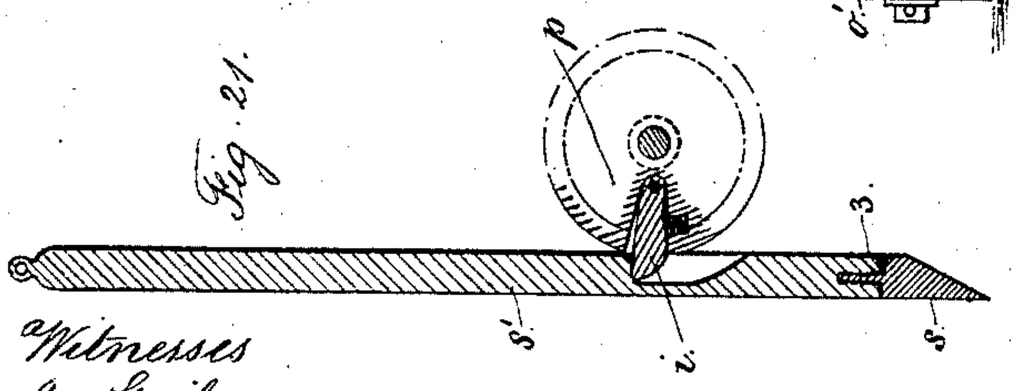


Fig. 21.



Witnesses
J. Hail
William G. Mott

Inventor.
Roy Stone.
per Lemuel W. Serrell Atty.

(No Model.)

5 Sheets—Sheet 5.

R. STONE

HYDRAULIC EXCAVATING MACHINE.

No. 316,497. Patented Apr. 28, 1885.

Fig. 9.

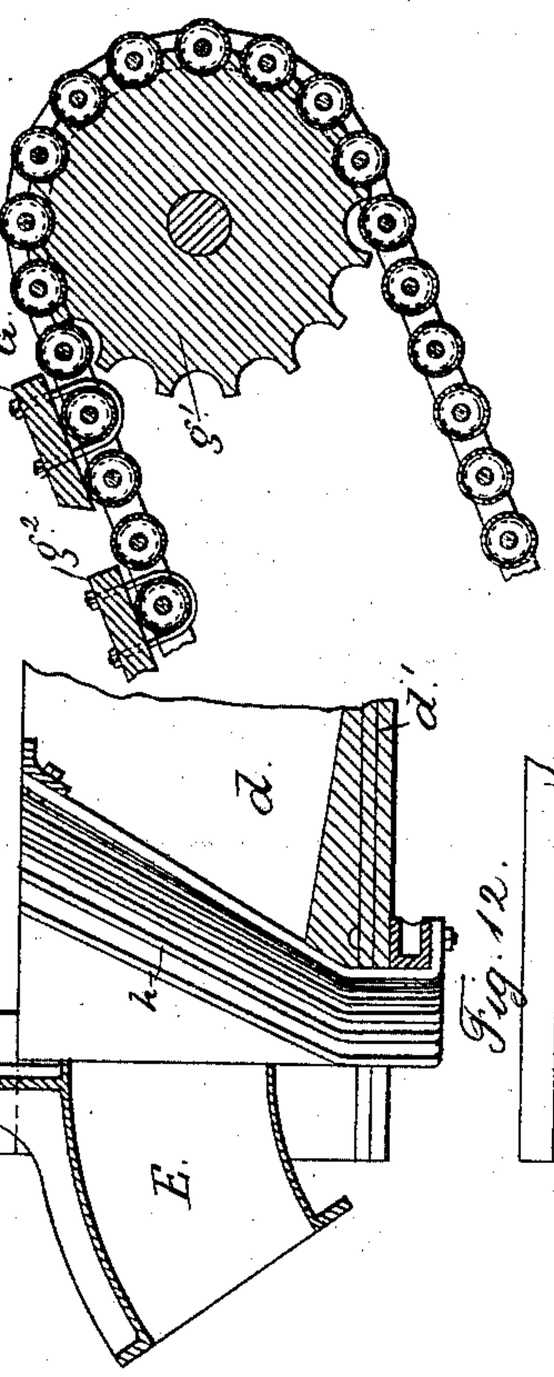


Fig. 10.

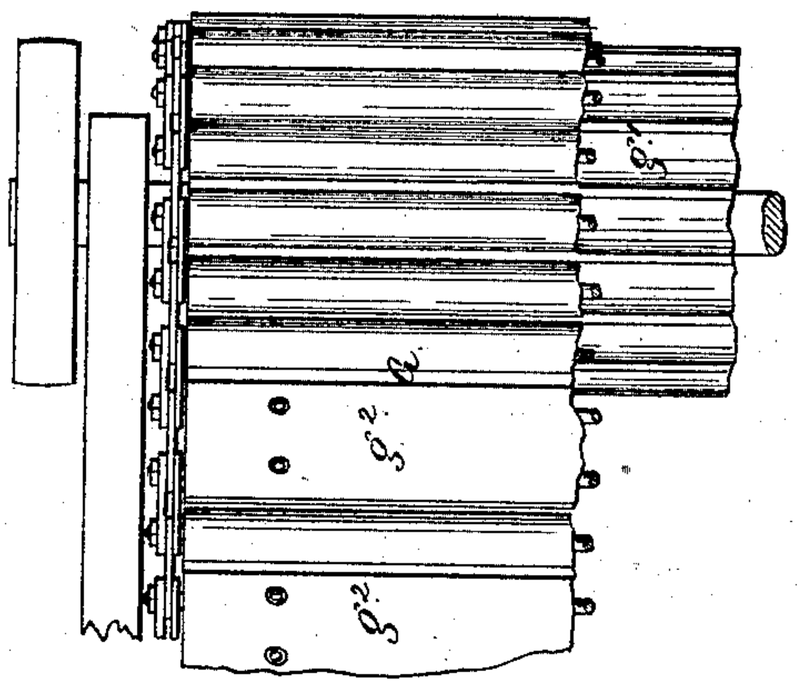


Fig. 11.

Fig. 12.

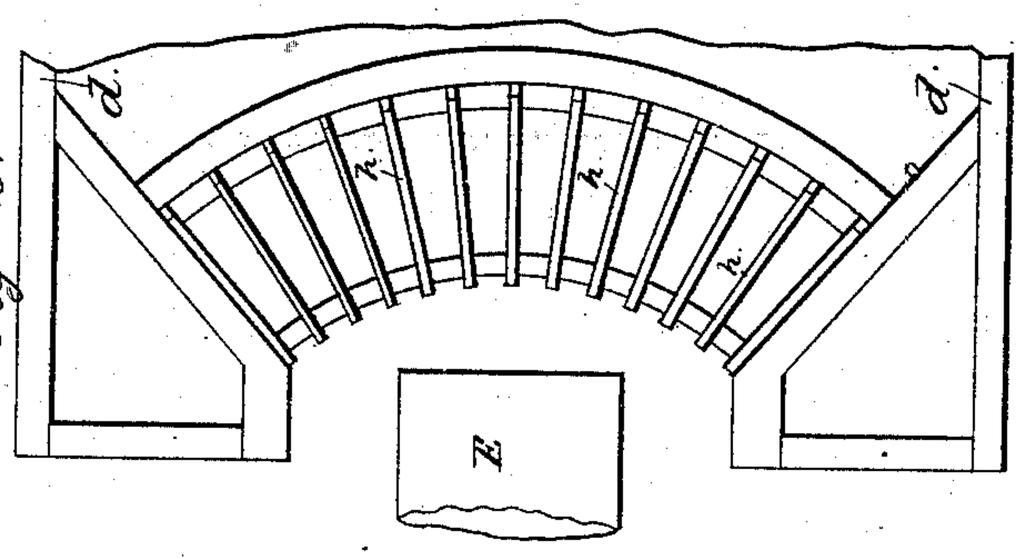


Fig. 8.

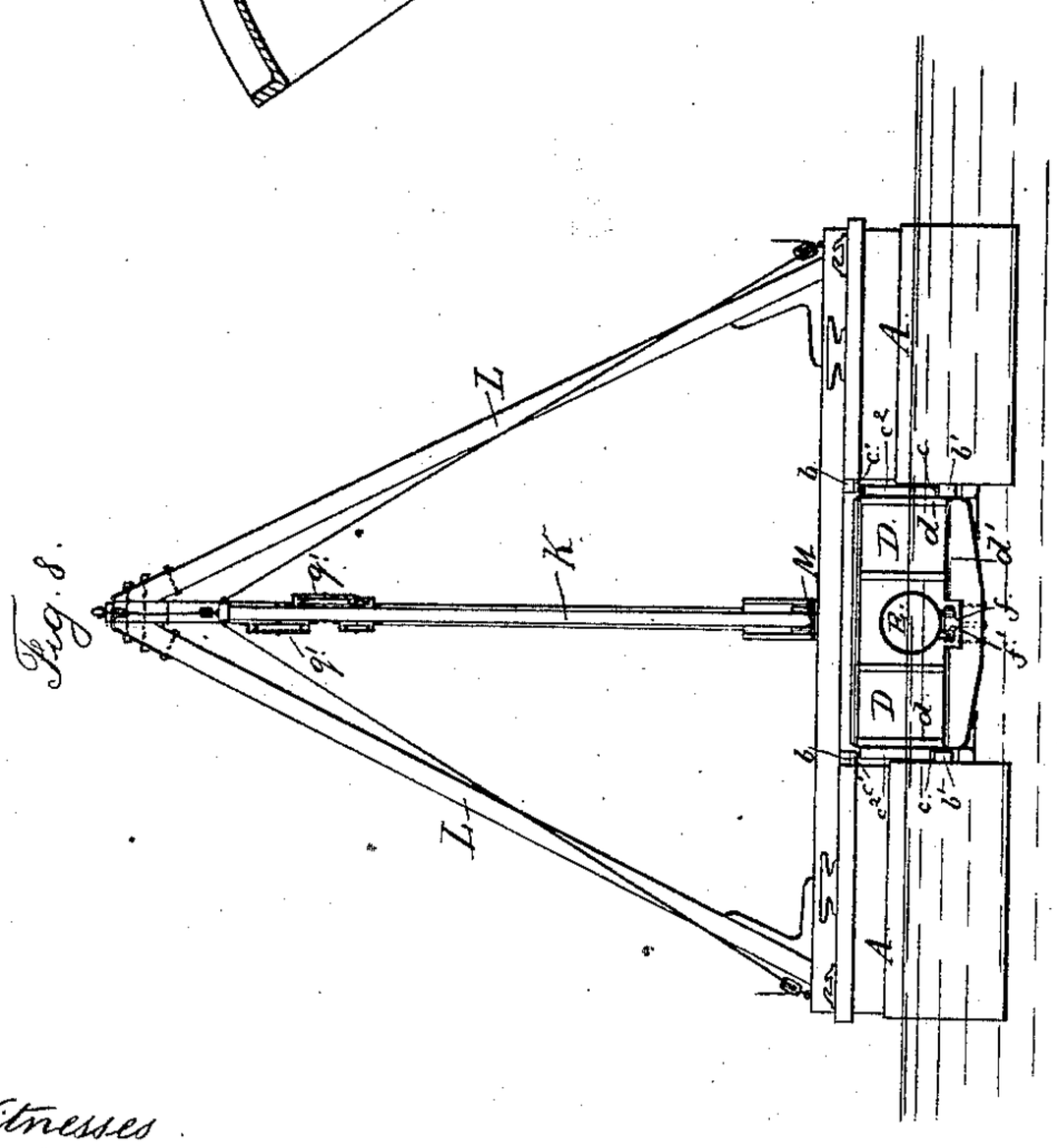


Fig. 13.

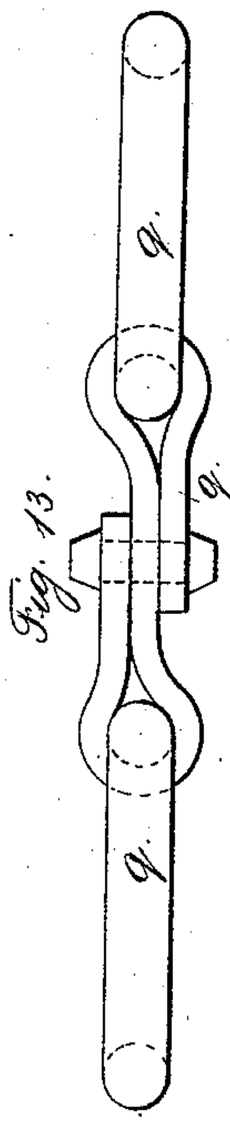
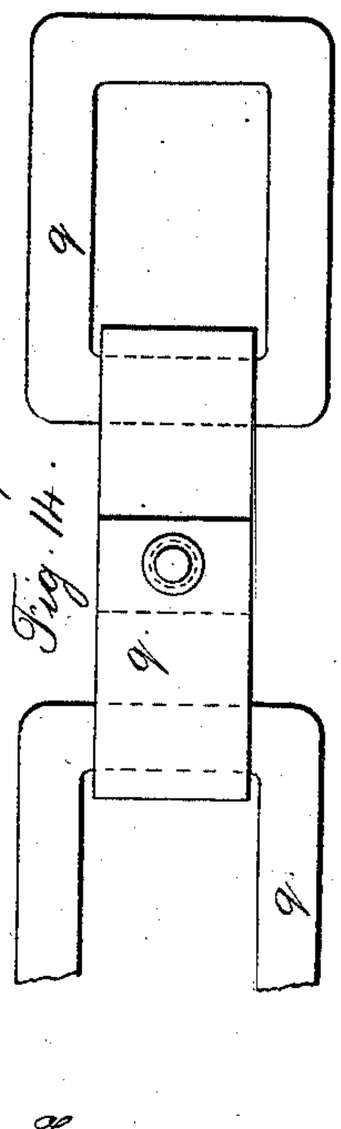


Fig. 14.



Witnesses.
J. Stahl
William G. Mott

Inventor
Roy Stone
per Samuel W. Serrell Atty

UNITED STATES PATENT OFFICE.

ROY STONE, NEW YORK, N. Y.

HYDRAULIC EXCAVATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 316,497, dated April 28, 1885.

[Application filed April 3, 1882. (No model.)

To all whom it may concern:

Be it known that I, ROY STONE, of the city and State of New York, have invented an Improvement in Hydraulic Excavating Machinery, of which the following is a specification.

This invention is an improvement upon the devices for which Letters Patent No. 224,309 were granted to me February 10, 1880.

In the excavation of phosphate rock, such as is found in Charleston harbor, the surface is quite hard, and forms a layer of about one foot in thickness. My present apparatus is made with special reference to the breaking up of this surface-layer and conveying the same up the induction-tube, as well as for excavating the loose and easily-disintegrated materials below such layer. My improvements are also available in the excavation of other materials, and the machine may be used as a whole in the form herein described, or it may be constructed with some of the present features of improvement and without others, or some appliances may be removed and others substituted, according to the character of the materials operated upon.

In the drawings, Figure 1 is a general plan of the machine. Fig. 2 is a vertical section of the floats and upper part of the induction-tube. Fig. 3 is a cross-section of the floats and sluice. Fig. 4 is a plan of the sluice, and Fig. 5 is a vertical section, the parts being of larger size than those shown in Figs. 1 and 2. Fig. 6 is an elevation in larger size of the lower end of the induction-tube, and Fig. 7 is a plan of the same. Fig. 8 is an end view of the floats. The other figures are separately referred to.

The floats A A are of suitable size to support the other parts of the apparatus. These floats are connected together by timbers *a a* and by flooring *a'* at the deck, and by flooring a^2 below the water-line at the central space between the floats, forming a sluiceway. Upon these floats are to be suitable boilers and engines or other sources of power for actuating the various portions of the machinery. These engines and boilers are not shown in the drawings; but I have represented the gearing and pulleys receiving motion and actuating the various parts.

Upon the opposite faces of the floats in the sluiceway there are sills *b b'*, firmly bolted and provided with rails forming upper and lower tracks, *c c'*, for the wheels c^2, that are upon axles c^3 that cross from one side to the other of the sluiceway and have their journal-boxes or bearings in the sides *d* of the movable sluice D. The bottom *d'* of this sluice is planked and provided with the required timbers to make a strong sluice-box open at the top and at the back end, and the front end is open, or partially so, for receiving the upper end of the induction-tube E.

This sluice is provided with racks d^2 upon its upper edges, into which gear the toothed wheels *e*, upon a cross-shaft, *e'*, the bearings of which are upon the floats, and such shaft *e'* and gear-wheels can be revolved by suitable power, so as to roll the sluice D in either direction upon its tracks *c*, and the upper tracks, *c'*, prevent the back end of the sluice tipping up if the sluice is projected at the forward end as far as to overbalance the back end. A convenient device for moving the gear-wheels is a bevel-pin, e^3, constantly rotated by the driving-power, and the shaft of this pinion is supported in a bearing upon a lever, e^4, so that by moving the pinion it may be brought into gear with either bevel-gear e^5 or e^6, and through their shaft and pinion e^7 revolve the gear-wheels *e* in either one way or the other, and either project the sluice and induction-tube forward against the material to be excavated or withdraw the same, as required from time to time.

At the forward end of the sluice there is a cross bearing-beam with a socket, *f*, receiving a vertical pin, upon which the induction-tube E can be swung horizontally, and between the top of this pivot-pin and the tube E there is a hinged joint, *f'*, that allows the lower end of the tube to be raised or lowered. The excavated material is carried up this induction-tube E, as in my aforesaid patent, and it is delivered into the sluice D.

According to the character of the materials being excavated, so the details of this sluice are made in one form or another.

Where all the coarser materials coming up the induction-tube are to be saved, they are delivered upon the sluice and carried back by the rush of water to the elevator G, that raises

them up and delivers them into a scow or other receptacle. This elevator G is preferably an endless apron over the rollers or heads g g', to the upper one of which the propelling-power is communicated. The elevator-apron is preferably made of tubes, with chains at the edges, as shown in the drawings, Figs. 9 and 10, the pivot-rods of the flat links of the chains passing through the tubes. This will allow sand, mud, and fine materials to wash through the elevator, and the pieces of phosphate rock or other material will be carried up on the elevator. Buckets will usually be employed upon such elevator, the same being formed of wooden or metal slats, g^2, bolted to the tubes by strap-bolts.

The stationary flooring between the floats extends to the elevator, and the bottom roller of the elevator is below the same, so that the material passes from the floor a^2 directly upon this elevator, and there will be usually a shoe piece or flap, a^3, hinged to the floor a^2 at its end, and resting upon the inclined elevator to prevent any pieces rolling back under the floor and dropping from the elevator. This flap at its outer end simply rests upon the surface of the elevator, and such elevator is moved along beneath the same.

The rush of water through the sluiceway might wash the materials toward the edges of the elevator-apron and portions be lost. To avoid this I employ the stationary deflectors g^4, placed diagonally near the ends of the floor a^2 to concentrate the material near the middle of the elevator. These deflectors g^4 are not as high as the water is deep, so that the water may pass freely over such deflectors and escape down through the grated openings g^5. It is to be understood that the heavy materials will subside in the current of water, so that little or no loss will occur over the deflectors.

If auriferous sands are being operated upon, the floor a^2 will be extended to the rear any suitable distance, and be provided with pockets or riffles, into which the gold will be washed as the sand and refuse is carried off by the current of water.

In some instances large stones and bowlders are brought up by my submarine excavator, and these and other useless substances may be discharged directly into the water again by placing a semicircular range of inclined bars, h, Figs. 11 and 12, around the end of the chute adjacent to the upper end of the induction-tube, so as to arrest such useless substances and allow them to slide down the grating and fall to the bottom instead of going upon the sluice. These bars, however, do not interfere with the materials that are smaller being delivered by the current into the sluice. The same effect may be accomplished by allowing the stones and large substances that are not to be saved to fall upon a grating, from which they are raked by hand to the ends of the bars and allowed to drop through an opening in the floor of the sluice, the same having a curb or steining that rises sufficiently high to prevent useful material being washed through such opening.

The tube itself is of a suitable length, and it may be made telescopic, so as to be extended as necessary; but usually it will be rigid. At the lower end there is a flaring mouth having a cast-iron rim of sufficient strength to prevent the tube being injured.

One feature of the improvement in the tube portion relates to the employment of one, two, or more jet-nozzles at one or opposite sides of the tube, as seen at k, Fig. 18. These are at an inclination, and the sides of the tube are enlarged or formed with tapering hoods where the nozzles are connected, so that the upward current is induced by these jets; but the entire area of the tube is unobstructed, so that anything that will enter the mouth will be carried up and discharged. In my former apparatus the jet-pipe entering into the induction-tube lessened its capacity and sometimes caused the lodgment of an obstruction against such jet-pipe. One such jet-pipe may be used, but two are preferable.

It is important that the boring-jet be directed down as low as the bottom of the tube, and that the nozzle be capable of being turned so as to bore or excavate the material in advance of the tube, as said tube may be swung around horizontally. To effect this object the excavating jet-tube l is passed through the flaring lower end of the induction-tube E, (see Fig. 6,) and provided with a curved nozzle, l^2. In the tube l there is a union-joint that allows the lower part, l', of the tube l to be partially turned, and there is a chain-wheel, l^3, on this tube, and chains n n' pass up from this around the pulleys l^4 l^5, the ends of the chains n n' being fastened to the wheel l^3, so that when the chain n is drawn upon to swing the boom K and the tube E around to the right the nozzle l^2 will be turned so that the excavating-water will act to loosen the materials that are to be drawn up by the current of water in the tube, and such materials will be loosened in front of the lower end of the induction-tube and in the direction in which such tube is being swung. If the chain n' is drawn upon to move the boom and induction-tube around the other way, the nozzle l^2 is first given a partial rotation, so that the water will be discharged to the left and will stir up the material to be excavated in advance of the moving end of the said tube E. In some cases the nozzle l^2 will be made in the shape of a ram's horn, as seen in section, Fig. 19, and end view, Fig. 20, and the same can revolve by the reaction of the water, and it will spread the water and cause it to act over a larger area than a stationary nozzle in loosening the material that is to be excavated.

Where a thin layer of hard material exists, as illustrated in Fig. 6, the lower end of the tube E should be supported thereby. To effect this object, I place out at the front of the said tube E a frame, o, that carries a wheel, o', which,

resting upon such hard crust or stratum, supports the tube E with its end against the edge of such layer. In order to break up such layer or crust, I make use of one or two vertically-reciprocating cutters, *s*, each of which is preferably made of a steel point or chisel secured into the end of the cutter-bar *s'* by being screwed thereinto and kept from turning by soft metal cast into recesses in the ends of the cutter and cutter-bar where they come together, as seen at 3. The frame *t* for these reciprocating cutters is upon the top of the tube E at the lower end. There are guides at *t'* for the cutter-bars, and around each cutter-bar is a collar, against which a helical spring, t^2, acts, the same being within the tubular case t^4 on the frame *t*.

There is to be a yielding bushing at *u* for the cutter-bar to pass through, the same being formed of a metal tube for the cutter-bar to run through, and a rubble-tube between it and the frame *t'*. This will lessen risk of injury in case the cutter strikes with a glancing blow upon a hard substance. The rubber cushion *u'*, with a metal plate upon the top, is adapted to prevent injury in case the cutter strikes down where there is nothing for it to come in contact with. There are projections at u^3 on the cutter-bar to rest upon the cushion at the extreme of the stroke.

In order to actuate the cutters, I make use of a wheel, *p*, revolved by an endless chain, *q*, and this wheel *p* is upon a shaft in bearings in the frame *t*, and said wheel has at its sides tappet-wheels with tappets or lifters, *i i*, that act within slots in the cutter-bars to lift them. (See section, Fig. 21.) These tappets are placed alternately, so that one cutter is raised as the other is being thrown down by its spring. Each tappet *i* is in the form of a pivoted arm in a slot in the wheel, and there is a helical spring beneath each tappet occupying a recess provided for it, so that the concussion of the tappet with the cutter-bar will be lessened in consequence of such spring yielding as the pressure comes upon the cutter-bar to lift the same.

The endless chain to the chain-wheel P may be moved by any suitable means. I prefer and use pulleys *q'* in the boom K, over which such endless chain passes to the driving-wheel q^2 at the base of the boom. This boom is supported by the tripod-frame L and guy-ropes, and it turns at its base with the pivoted plate M, upon which the frame carrying the chain-wheel q^2 is supported.

The pulleys and belts represented form a convenient means for connecting the chain-wheel to the driving-power. These parts, however, may be varied to suit the floats and the location of the engine.

The induction-tube E may be suspended from the top part of its upper end, as shown in Fig. 11.

The chains *q* are preferably made of links and intermediate straps, as seen in Figs. 13 and 14.

The induction-tube sections E may be joined up by notched flanges and bolts, as seen in Figs. 16 and 17.

The induction-tube may be moved by chains applied at its lower end, and led to the corners of the floats at the front end; or said tube may be moved by the swinging of the boom; but I prefer to pass the chains from the lower end of the induction-tube up through pulleys on the boom, and diverging in opposite directions, so that the induction-tube can be raised or lowered by the chains or swung in either direction with the boom. Suitable winch or windlass barrels actuated by hand or steam power are to be employed in operating these chains *n n'*, as illustrated at n^8.

I claim as my invention—

1. The combination, in a hydraulic excavating apparatus, of two floats, an open sluice between said floats, an induction-tube extending out from one end of the sluice, a pivot for supporting and connecting the induction-tube and jet-tubes for excavating, and induction-jets of water, substantially as set forth.

2. The combination, with the induction-tube, of an open sluice through which the water passes freely, means for supporting and moving the tube at the lower end, and a pivot at the upper end between the sluice and the induction-tube, substantially as set forth.

3. The combination, with the sluice-box and induction-tube, of floats at each side of the sluice-box, guide rails and wheels, and mechanism, substantially as set forth, for moving the sluice-box longitudinally between the floats, substantially as set forth.

4. The two floats with a flooring between them forming a sluice that is open for the free discharge of water, in combination with an induction-tube at one end of the sluice, the said flooring being below the water-level, and upon which the solid materials brought up by the current of water through the induction-tube pass, substantially as set forth.

5. The combination, with the induction-tube, floats, and sluice, of an elevating-apron receiving the materials from the bottom of the sluice, substantially as set forth.

6. The combination, with the induction-tube, of a movable sluice-box to which the induction-tube is attached, a stationary floor, the floats, and the elevator, substantially as set forth.

7. The combination, with the induction-tube and sluice, of the floats, an elevating-apron, the concentrators g^4, and the grated openings g^5 for the escape downwardly of water, substantially as set forth.

8. The combination, with the floats, sluice-box, and elevator-tube, of racks and gear-wheels to move the sluice-box endwise, and the bevel gear-wheels and movable bevel-pinion, whereby either a forward or backward

movement is imparted to the sluice-box, substantially as set forth.

9. The combination, with the induction-tube, floats, and sluice, of an elevating-apron and a flap between the flooring of the sluice and the elevator, substantially as set forth.

10. The combination, with the floats and an open sluiceway between said floats, of an induction-tube, means for connecting the same at one end of the sluice, a range of bars upon which the materials from the induction-tube pass, and a downward-discharge opening for the larger pieces that lodge upon the bars, substantially as set forth.

11. The combination, with the floats and induction-tube, of a hinge at the upper end of the induction-tube, a sluice-box upon which the water from the induction-tube passes, and a range of inclined bars between the induction-tube and the sluice-box, there being a space for the free discharge downwardly of large substances arrested by the bars, substantially as set forth.

12. The combination, in a hydraulic induction-tube, of a flaring metal rim, a boring jet-tube passing through such rim, and one or more water-nozzles introduced at the sides of the tube, and a hood at the junction of the nozzle and the tube, substantially as and for the purposes set forth.

13. The combination, with the induction-tube, of a boring jet-tube that is parallel with the induction-tube and provided with a curved end, and means for giving such tube a partial rotation, substantially as set forth.

14. The combination, with the induction-tube, of a boring jet-tube capable of being partially rotated, and ropes or chains passing from the same, substantially as set forth, whereby the jet-tube is automatically turned into the proper direction for loosening the material to be excavated in advance of the moving end of the induction-tube, substantially as set forth.

15. The combination, with a submarine induction-tube for excavating having its lower end open, of mechanism for supporting and moving such tube, and two or more jet-nozzles at opposite sides of the induction-tube to induce an upward current and to allow the induction-tube to be open from end to end and unobstructed, substantially as specified.

16. The combination, with the induction-tube, of two or more jet-nozzles at opposite sides of the induction-tube to induce an upward current, and a jet-tube at the lower end of the induction-tube to loosen the material to be excavated, substantially as set forth.

17. The combination, with the induction-tube, of a frame at the lower end connected to and supported by such tube, a cutter within said frame, and mechanism for reciprocating such cutter, substantially as specified.

18. The combination, with the induction-tube, of a frame at the lower end of such tube, a reciprocating cutter-bar and cutters, a chain, chain-wheel, and tappets, by means of which such cutters are moved, substantially as set forth.

19. The combination, with the induction-tube and its water-nozzles and supporting-boom, of two chains passing from the lower end of the tube over pulleys on the boom, and then diverging in opposite directions, and means for acting upon such chains to raise or lower such tube or swing it in either direction, substantially as set forth.

20. In combination with the induction-tube and the water-jets thereof, an elevator for receiving the material discharged by the tube and raising such material out of the water, substantially as set forth.

Signed by me this 27th day of March, A. D. 1882.

ROY STONE.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.