(No Model.)

3 Sheets—Sheet 1.

A. W. ROBINSON.

HYDRAULIC DREDGE.

No. 504,750. Patented Sept. 12, 1893.

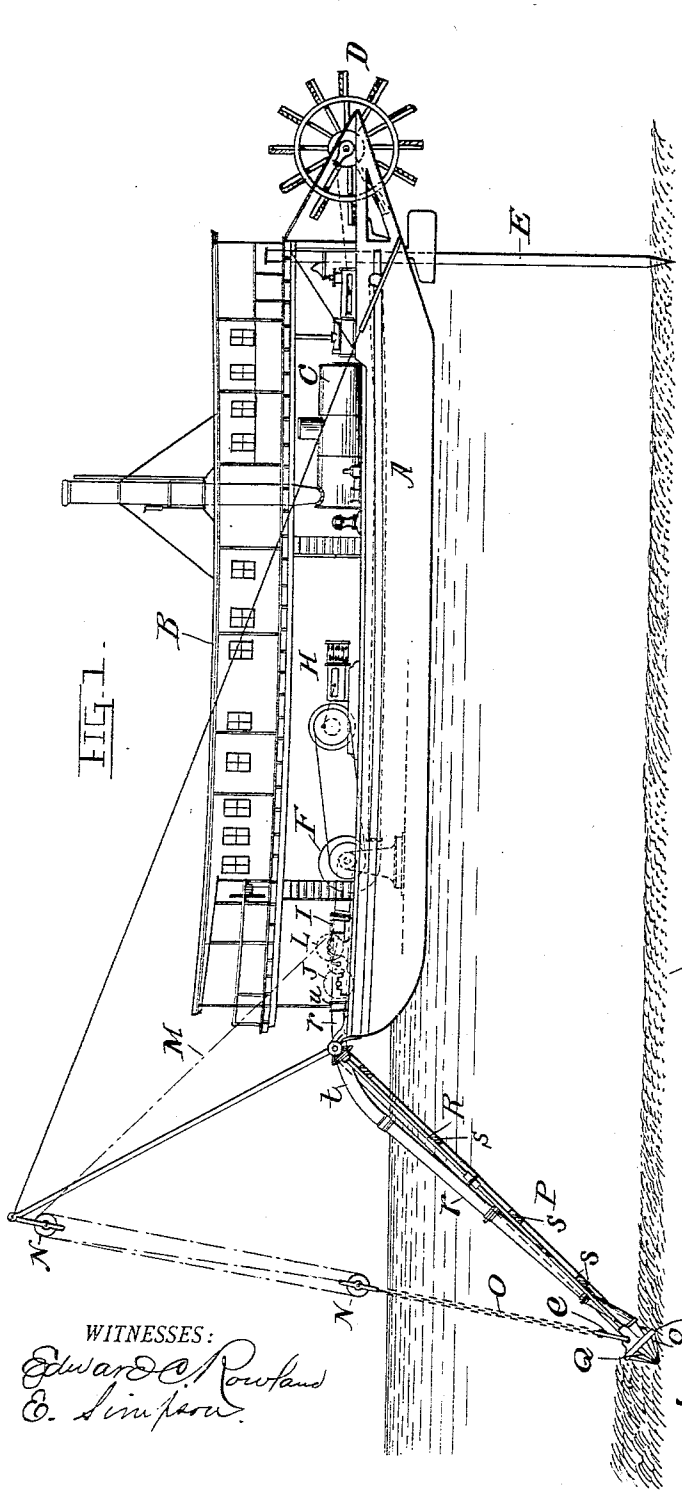

FIG. 1.

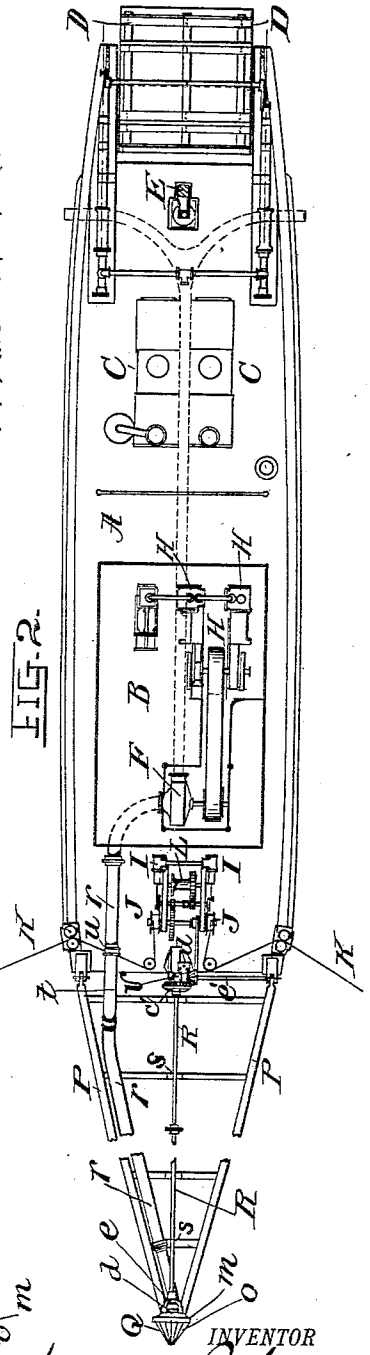

FIG. 2.

WITNESSES:
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(No Model.)

3 Sheets—Sheet 2.

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FIG. 4.

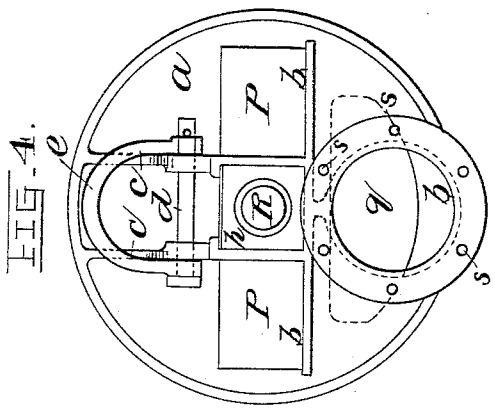


FIG. 6.

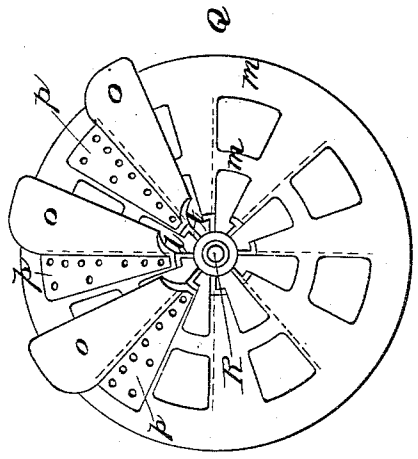


FIG. 3.

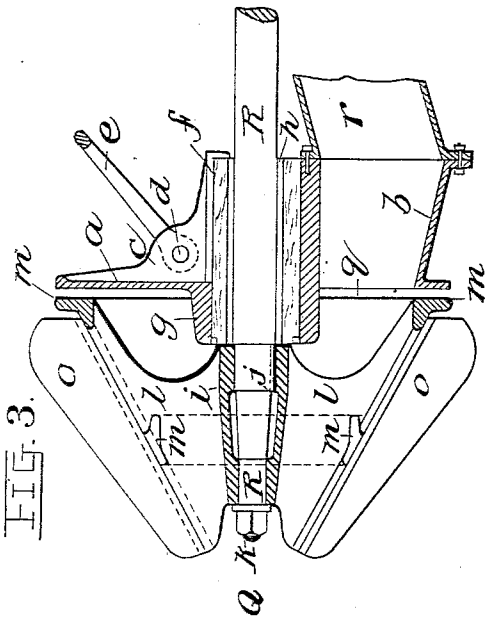
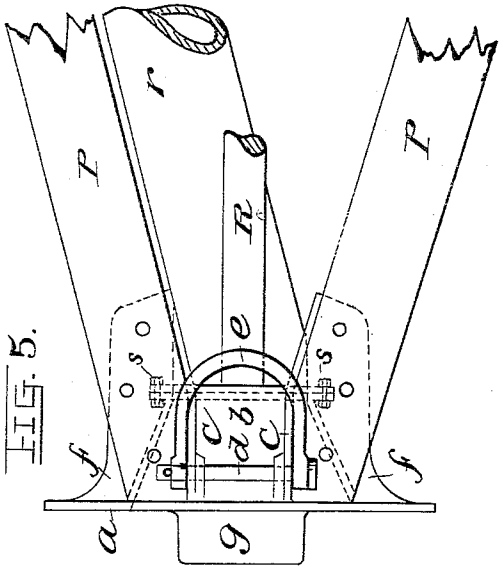


FIG. 5.



WITNESSES:

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(No Model.) 3 Sheets—Sheet 3.

A. W. ROBINSON.

HYDRAULIC DREDGE.

No. 504,750. Patented Sept. 12, 1893.

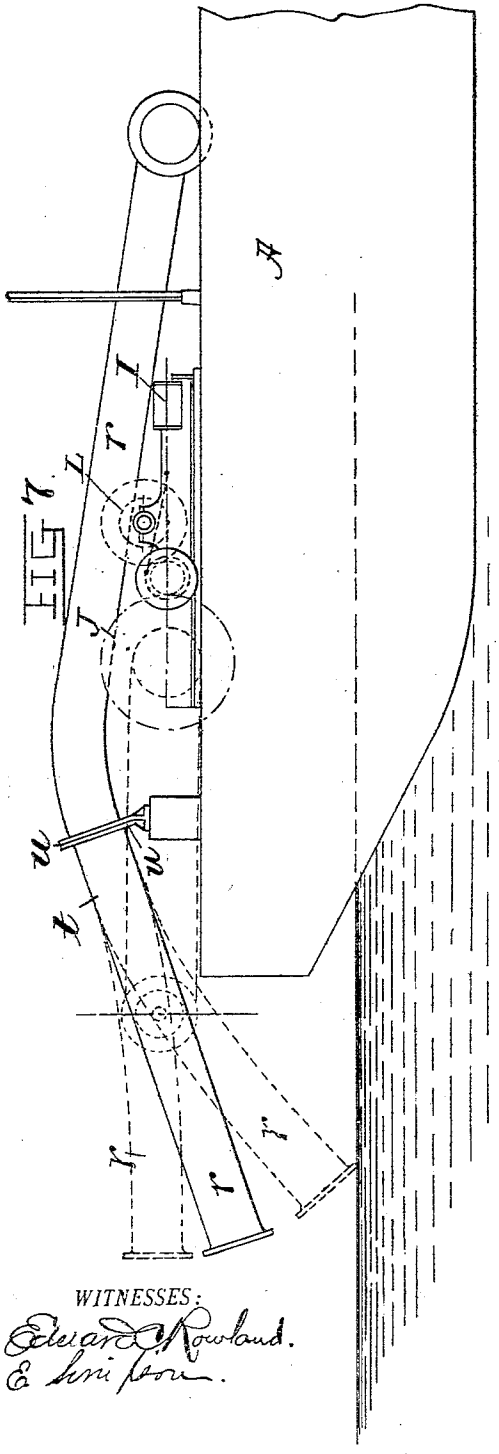

FIG 7.

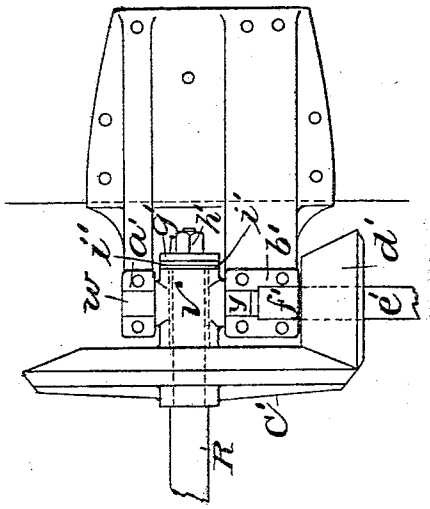

FIG 8.

WITNESSES:
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UNITED STATES PATENT OFFICE.

ARTHUR W. ROBINSON, OF BUCYRUS, OHIO.

HYDRAULIC DREDGE.

SPECIFICATION forming part of Letters Patent No. 504,750, dated September 12, 1893.

Application filed February 28, 1893. Serial No. 464,120. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR W. ROBINSON, a citizen of the United States, and a resident of Bucyrus, in the county of Crawford and State of Ohio, have invented certain new and useful Improvements in Hydraulic Dredging-Machines, of which the following is a specification.

My invention relates to improvements in hydraulic dredging apparatus of the class in which the scow is centered upon a spud, ordinarily placed at or near the stern of the scow, and the bows of the scow are caused to oscillate from side to side during the making of the excavation. The excavating mechanism comprises a rotary cutter or excavator provided with a suction pipe through which the spoil is drawn by a suitable suction pump located on the scow and forced thence through a suitable conduit or conduits to the place of discharge. This class of dredging apparatus is well-known and does not require more particular description.

Generally stated, my improvements consist, first, in a special form of rotary cutter; second, in a special form of back plate for the rotary cutter, whereby the delivery of the spoil from the cutters is rendered more free and by it also the driving shaft and frame timbers are supported in a stronger and more permanent and desirable manner than heretofore; third, in a special method of constructing the "A" frame and of attaching the same to the scow, securing simplicity and strength of construction and preferred position for the suction pipe; fourth, an improved method of supporting the cutter driving shaft; fifth, an improved method of construction and location of the suction pipe.

Referring to the drawings, Figure 1, is an elevation of the scow and dredge in their position when doing work. Fig. 2, is a plan view of the same. Fig. 3, is a longitudinal section of the rotary cutter head. Fig. 4, is an elevation of the stationary back plate for the cutter head. Fig. 5, is a plan of that which is shown in Fig. 4, showing also the forward ends of the A frame timbers. Fig. 6, is a front view of the rotary cutter head. Fig. 7, is an elevation showing the construction and location of the suction pipe where it passes over the bows of the scow. Fig. 8, is a detail, shown in plan, of the upper end of the cutter shaft showing its method of gearing and its oscillating support, &c.

A, is the scow. B, is the house erected thereon, in which are the usual compartments, rooms, &c.

C, are the boilers.

D, is any suitable wheel for propelling the scow.

E, is the movable spud on which the scow oscillates.

F, is the suction pump, driven by an engine, H. The pulleys and belt are shown in the ordinary manner.

I, I, are two auxiliary engines, which drive the two drums, J, J, about which are coiled the strong chains or ropes, K, K, whereby the bows of the scow are oscillated from side to side. The auxiliary engines, I, I, also drive the drum, L, about which is coiled the chain, M, which lifts the A frame and cutter by means of the pulleys, N, N, and supporting chain, O. The A frame comprises two lateral timbers or iron trusses, P, P, which are suitably braced by cross rods and studs as shown.

Q, is the rotary cutter.

R, is the cutter shaft which is supported upon bearings, S, S, &c., bolted to the studs of the A frame.

Referring now more particularly to Figs. 3, 4, 5 and 6, which illustrate the rotary cutter and its immediately co-acting parts, *a*, is the back plate. It is stationary and circular in form and upon its lower side there is a flanged hopper, *b*, which connects at its forward end with a large opening, *q*, made through the back plate. Upon the flange the suction pipe is arranged. This hopper, as will be noticed is in the lower half of the back plate. *c*, are braces or ribs upon the back side of the stationary plate, *a*, through which at the upper part, extends a bolt, *d*, whereby a link *e* is supported, to which link the lifting chain, O, is attached. There are also strong flat ledges, *f*, *f*, upon the back side of the back plate to which the side timbers, P, of the A frame are bolted as shown best in Fig. 5. At the central portion of the back plate, there is a hub, *g*, which is bored centrally and contains a bushing, *h*, in which turns the cutter shaft, R.

Referring to Figs. 3 and 6, the rotary cut-

ter is composed of a hub, *i*, which is keyed by keys J to the shaft R, and is held in place by a heavy nut, *k*, on the end of the shaft R. From the hub, *i*, project in radial form wings, *l*, *l*, stiffened by annular rings, *m*, *m*. These wings are made in such shape that their total outline is conical, the small end being forward, and upon the outer inclined surfaces of these wings are bolted the cutters or knives, *o*, *o*. The knives are provided with flanges, *p*, through which the bolts pass which also pass through the outer flat surfaces of the wings, *l*, as shown in Fig. 6. The shape of the knives or cutters, *o*, is peculiar, that is to say, they are concave, so as to present a sharp cutting edge in the direction of rotation of the head and they are narrow at the forward end or apex of the cone but flare out much wider at the rear. In other words they grow wider as the diameter of the cone increases.

Referring now more particularly to Figs. 1, 2, 3, and 7, in which the construction of the suction pipe is more particularly illustrated, *r*, is the suction pipe. It is bolted at its lower end by bolts, *s*, to the open mouth of the hopper, *b*, and extends thence, upwardly, being supported by the A frame and preferably at one side of the A frame, so as not to interfere with the engines, I, I, on the deck of the scow. It may be a rigid pipe made of any suitable material, all but the single section which curves over the bows of the boat. That section is made of flexible material, as shown at *t*, (see Figs. 1, 2 and 7;) and the rear end of this flexible section is or may be rigidly supported as at *u*, (see Fig. 7) upon a suitable casting rigidly bolted to the deck or other suitable support on the scow, and this flexible section is so placed that it will be straight when in mid-position as illustrated in full and dotted lines in Fig. 7, and so that when the A frame is depressed for work or elevated for transportation, the flexure of this section will be as little as may be. In this way the length of the suction pipe is not increased, and I secure large curves which facilitate the delivery of the spoil.

Referring now to Figs. 1, 2 and 5, in which the construction of the A frame is more particularly illustrated; it will be seen that its construction is exceedingly simple. The two lateral beams or trusses, P, P, are firmly bolted at their forward ends, to the flanges of the strong back plate, *a* of the rotary head and at their rear ends they are hinged by strong hinges to the front upper portions of the scow.

Referring now to Figs. 1, 2 and 8, in which the cutter shaft and its co-acting parts are more particularly shown; it will be seen that the rear end of the center shaft is mounted in a trunnion bearing, *v*. The trunnion oscillates upon axes, *w*, *y*, which are supported in the bearings, *a'*, *b'*.

c', is a beveled driving gear, keyed to the cutter shaft R, and it is driven by a beveled gear *d'*, keyed to a shaft, *e'*, which is journaled at its forward end, *f'*, in the same bearing, *b'*, that supports one side of the trunnion, *v*, and the axis of the shaft, *e'* is on the same line as the axes of the trunnion. Upon the rearmost end of the cutter shaft, R, there is a plate, *g'* which is held in place by a nut, *h'*, and there is a thrust bearing shown by two plates, *i'*, *i'* placed between the plate, *g'* and the trunnion, whereby the weight of the cutter shaft is supported and its easy rotation secured; and it will be especially noticed that the axes of the trunnion and of the shaft, *e'* and of the hinges of the A frame are all upon the same or substantially the same line. Consequently the elevation or depression of the A frame does not throw anything out of line, and does not interfere with the proper intermeshing of the beveled gears which drive the cutter shaft.

The construction and arrangement of the parts, as above shown are, in many respects material improvements upon the old methods of construction. Among the advantages secured by me are the following: First, the cutter blades of my improved rotary head are easily replaced when broken, without disorganizing any part of the apparatus; also their area is least at the point of greatest strain, that is at the apex of the cone. Consequently their strength is greatest there and their capacity increased to catch and direct inwardly the spoil, as the spoil increases in bulk, as it becomes broken up, by the increased width of the cutters, as the diameter of the cone increases, and also produces an increased inward movement, so that practically all of the spoil is caught by the cutters and thrown into the interior of the cutter head, where it is drawn by the suction into the suction pipe. I thus also generate a more uniform flow through the interior of the cutter head, so that material is not apt to lodge therein; also the weight of the cutter is materially reduced, also torsional and bending strains of the shaft are reduced because the diameter of the cutters is less at the point of greatest resistance; also the conical form of the head cuts a level bottom instead of a grooved one, which is the objection with all cylindrical cutting heads; second, my form of back plate is superior to anything known to me, because the hub thereof extends forwardly into the cutter chamber, so as to lengthen the bearing for the cutter shaft, without increasing the weight of the parts; also my peculiar construction of the back plate affords better means for attaching the timbers or trusses and for connecting the suction pipe than heretofore, third; the construction and method of attachment of the A frame both to the the back plate of the cutter head and to the scow are superior to anything known to me; fourth, the arrangement of the trunnion which supports the upper end of the cutter shaft in a line with the counter shaft which drives the cutter shaft and also with the hinges of the cutter frame and the arrange-

ment of the thrust bearing for the cutter shaft, enable the cutter frame to be moved as desired without interfering with the proper intermeshing of the bevel gears before referred to, and also is a very simple and effective way for supporting the cutter shaft against end movement; fifth, the construction and method of supporting and the position of the suction pipe as shown, enable me to employ a single flexible section, which is the part especially liable to derangement and especially expensive and by so erecting it that the flexible section is straight when in mid-position or substantially that position, the length of the pipe is not effected by movement of the A frame and also its degree of flexure for any desired position is less than in any other construction known to me and the flexible section is consequently less apt to leak and it presents a smooth continuous interior surface, and its curves are of large radius, all conducing to ready flow of the water and spoil and the avoidance of deposits.

It will be understood by those who are familiar with this art, that modifications or alterations may be made in the details of construction without departing from the essential features of my improvements. I therefore do not limit myself to the precise details shown and described.

I claim—

1. The combination with a dredge of a conically shaped cutter head having detachable cutting blades, which are themselves conical longitudinally, also a back plate which closes the rear end of the cone, and a suction pipe, connecting through the back plate with the interior of the cutter head, substantially as set forth.

2. The combination with a dredge of a conical cutter head, having detachable cutters or blades concave in transverse outline and conical in longitudinal outline, also having a back plate, which closes the rear end of the cone, and a suction pipe which connects through the back plate with the interior of the cutter head, substantially as set forth.

3. The combination with a dredge of a cutter head comprising a flat stationary back plate provided with flanges upon and to which the beams or trusses of the A frame may be bolted, and having a centrally located hub for the driving shaft, on which the cutter is mounted, and which braces the said flanges, and against which the beams or trusses are supported, and a conical rotary cutter head, the greatest diameter of which is adjacent to the said back plate, substantially as set forth.

4. The combination with a dredge of a cutter head comprising a stationary back plate having a hub at or near its central part, which projects forwardly beyond the plane of the back plate, the sides of the hub on the exterior of the back plate, being squared, flanges or ledges on the back side of the back plate, adjacent to the squared sides of the hub, upon which the beams of the A frame may be bolted, being supported by the sides of the hub, and a rotary conical cutter, the shaft of which passes through said hub, said cutter having a single set of detachable cutting blades, substantially as set forth.

5. The combination in a dredge of an A frame hinged to the scow, a rotary cutter on the forward end of the A frame, having a conical frame and detachable conical blades bolted thereto, a cutter shaft supported on the A frame, the rear end of which is supported on a trunnion, the axis of which is on the same line as the axes of the hinges, which connect the A frame to the scow, and the front end of which is supported in a hub, on the back plate of the conical cutter head, and a suction pipe which opens into the cutter head through the said back plate, and at its inner side, substantially as set forth.

Signed at Bucyrus, in the county of Crawford and State of Ohio, this 17th day of February, A. D. 1893.

ARTHUR W. ROBINSON.

Witnesses:
E. B. FINLEY,
SMITH W. BENNETT.