(No Model.) 3 Sheets—Sheet 1.

S. A. HILL.
DREDGING MACHINE.

No. 554,510. Patented Feb. 11, 1896.

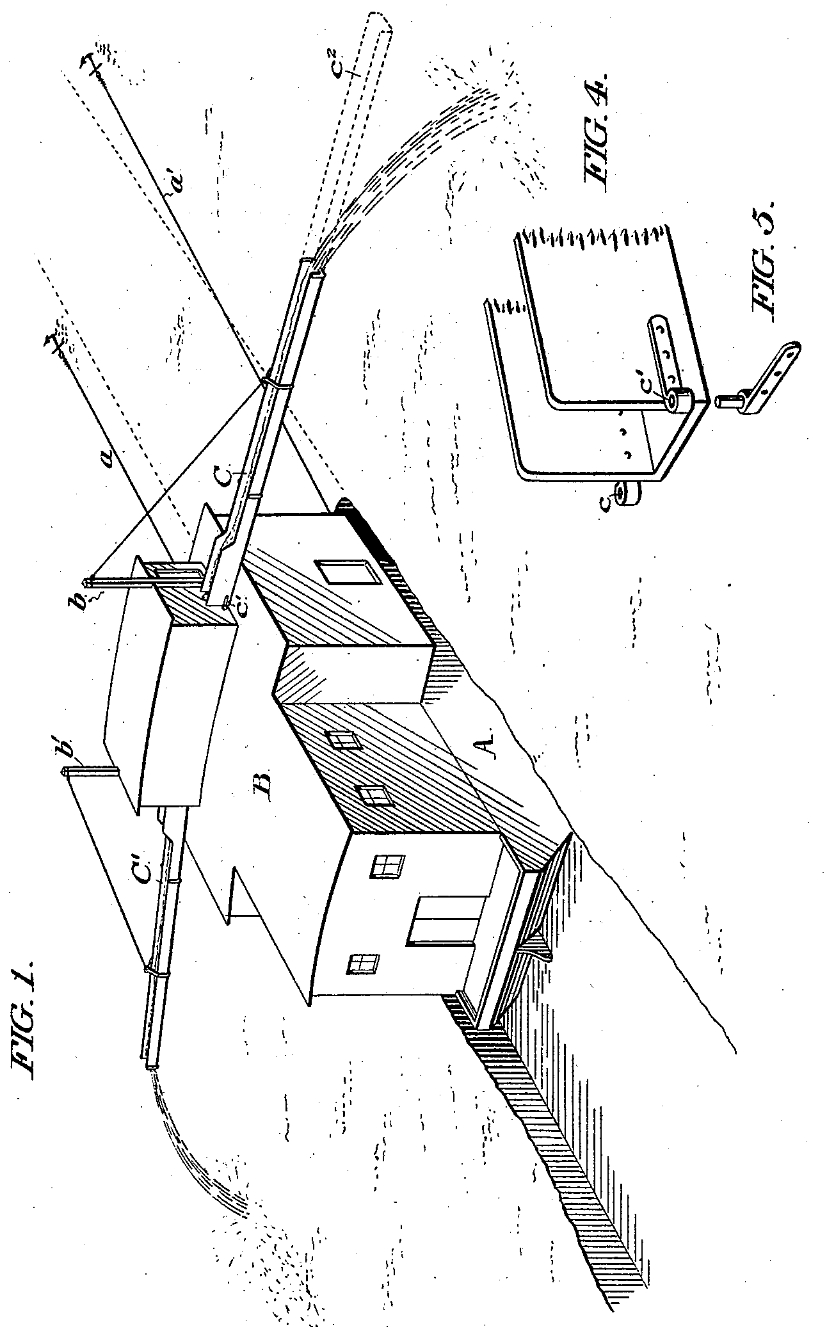

FIG. 1.

FIG. 4.

FIG. 5.

WITNESSES:
James H. Bell.
Henry M. Paul Jr.

INVENTOR
Samuel A. Hill
by his Attys
Hollingsworth & Fraley

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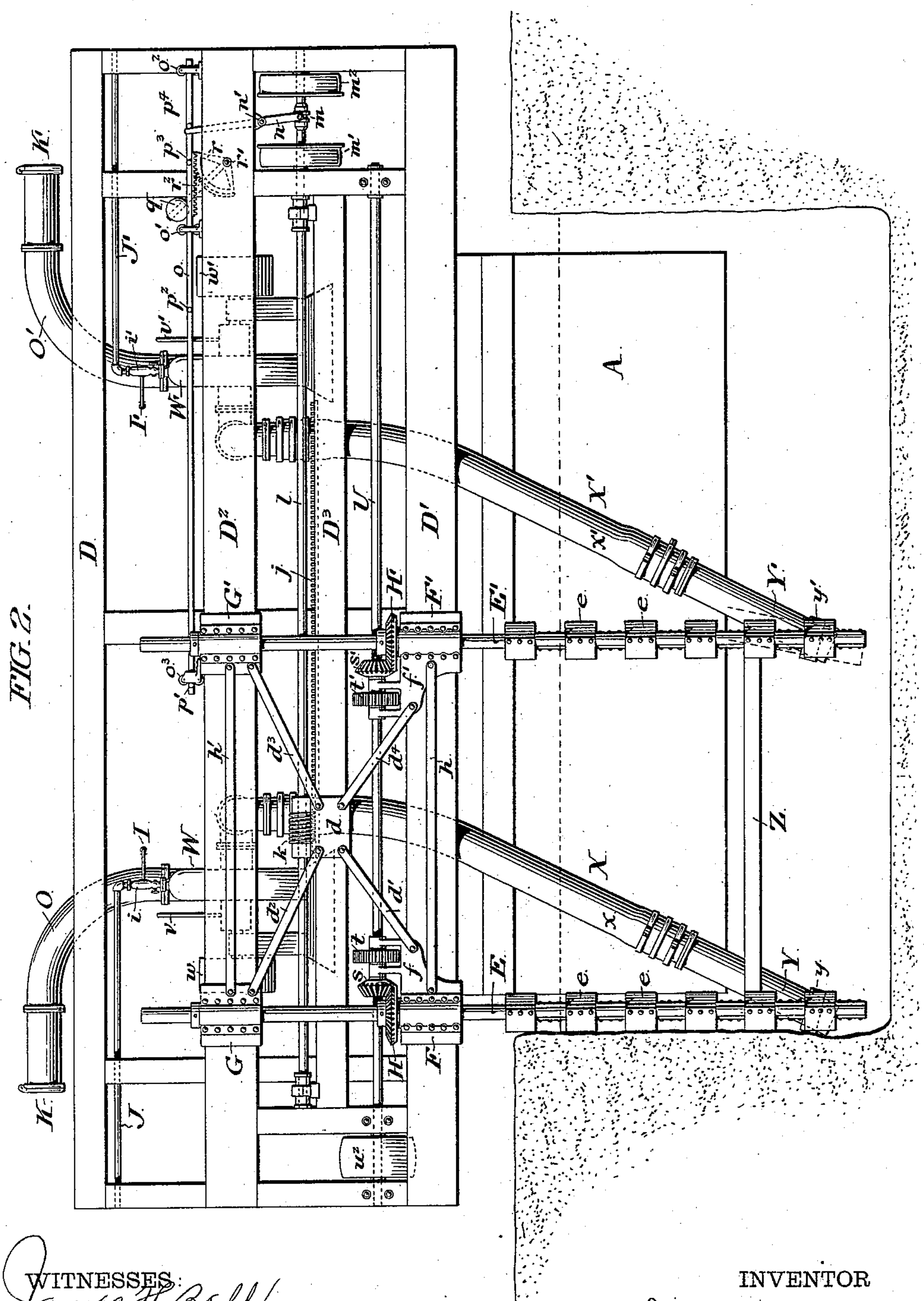
FIG. 2.



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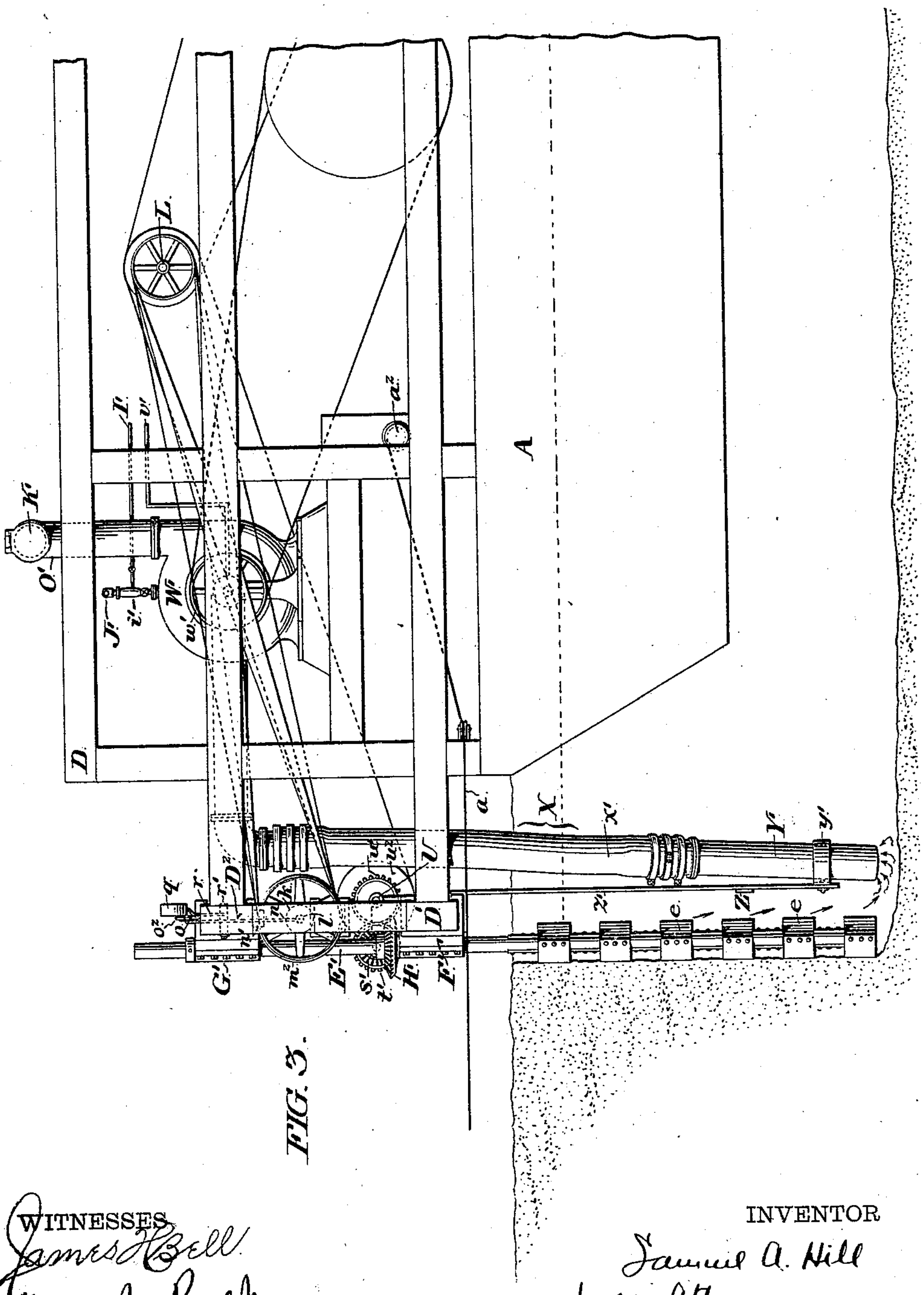

FIG. 3.

WITNESSES:

James H. Bell

Henry U. Paul Jr.

INVENTOR

Samuel A. Hill

by his Attys

Hollingsworth & Kinley

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

SAMUEL A. HILL, OF PHILADELPHIA, PENNSYLVANIA.

DREDGING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 554,510, dated February 11, 1896.

Application filed September 7, 1894. Serial No. 522,313. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL A. HILL, a citizen of the United States, residing in the city of Philadelphia, State of Pennsylvania, have invented a certain new and Improved Dredging-Machine, whereof the following is a specification.

My invention relates to that class of dredging-machines which are used for cutting and dredging canals, and, although capable of doing other work, is peculiarly adapted to cut a canal immediately in front of itself of sufficient depth to float its own body, the constant advance of the dredge over ground which it has thus cut to the full necessary depth being in this way continuously permitted.

More especially my invention relates to a new and improved form of revolving cutter employed by me, to the mechanism whereby the constant and steady revolution and also the reciprocation of these cutters in a vertical plane across the front of the dredge are secured, to the form and arrangement of flexible suction-pipes working in attendance upon these cutters and constantly adjusted to coöperate with them, to the form of pumping and discharge mechanism employed by me in connection with the suction-pipes, and also to the anchoring mechanism whereby the propulsion of the dredge is effected without reference to its screw-propeller.

In the accompanying drawings, Figure 1 is a perspective view of the exterior of the dredge in the performance of its work, as seen from the rear. Fig. 2 is a front elevation of the cutting and pumping machinery and the framework supporting the same. Fig. 3 is a side elevation of the same, and Figs. 4 and 5 are detail views of the double-hinged discharge-trough.

Referring to Fig. 1, A represents the body of the dredge. It is driven by an ordinary screw-propeller, which is not seen. B is a large deck-house which protects the cutting and pumping machinery and also the boiler and engines which operate both this machinery and the propeller. As the cutting and propelling machinery is necessarily at the extreme forward end of the dredge, it is desirable to mount the boiler and engines as far to the rear as possible, so that the dredge may float with an even keel. As it is necessary for the dredge to cut a channel wider than itself, the cutters must have a play greater than the width of the body of the dredge. Consequently the forward portion of the deck-house projects over the edge of the body of the dredge, both forward and at the sides.

In Figs. 2 and 3, D D′ D^2 represent a framework of heavy squared timber mounted on the deck of the dredge and projecting well over the sides and forward end of its body. Running across the entire front of this framework are two parallel horizontal beams D′ D^2 of great size and strength, which form the support for the cutters E E′. These cutters consist of two parallel vertical shafts of iron or steel revolving each in two heavy bearing-blocks F F′ G G′, which slide horizontally along the beams D′ D^2, the lower bearings, F F′, sliding along the beam D′, and the upper bearings, G G′, sliding along the beam D^2. The lower and operative parts of these cutters are armed with cutting-blades *e e*, consisting of square steel plates bolted tangentially upon the shafts of the cutters. These plates are mounted in pairs along the length of the cutting portions of the shafts, two diametrically opposed to each other alternating with two others similarly opposed, but at right angles to the former.

The cutters have two regular motions: first, a motion of revolution, and, secondly, a motion of reciprocation across the front of the dredge. In addition to this they are capable of being, when necessary, vertically adjusted. These motions and the mechanism whereby they are controlled will be described in order.

First. The motion of reciprocation. The lower bearing-blocks, F F′, partially encircle at their back and slide freely upon the transverse beam D′. They are held in constant relation to each other by a connecting-rod *h*. Similarly the upper bearing-blocks, G G′, are connected by the rod *h′*, and slide upon the transverse beam D^2. All four of these bearing-blocks are connected to a fifth block *d*, situated centrally in relation to them and approximately in the same plane, by diagonal connecting-rods d' d^2 d^3 d^4. This fifth block *d* slides horizontally upon a transverse beam D^3, supported in the same plane with and about midway between the beams D′ D^2. To the upper surface of the beam D^3 is fitted a rack j, which gears with a worm k, supported by bearings fixed to and above the block d. A transverse shaft l, supported by bearings at each end of the beam D^3, passes through the worm k, which slides along its length but revolves with it in consequence of a key playing in a keyway cut along the shaft. In consequence of this arrangement the revolution of the shaft l effects a lateral movement of the bearing-blocks F F′ G G′, all maintained in constant relation to each other, and with them a transverse movement of the two revolving cutters, the direction of this movement being determined by the direction of the revolution of the shaft l. The revolution of this shaft is effected by two pulleys m' m^2, revolving upon its end and driven in opposite directions from a counter-shaft L, Fig. 3. Between these pulleys is a differential clutch m, controlled by a lever n, pivoted at n', by the oscillation of which the shaft l is caused to revolve in either one or the other direction. The movement of the lever n is determined by a slide-rod o, carried by two sets of roller-bearings o' o^2, mounted immediately above the beam D^2. The slide-rod o carries four stop-pins p' p^2 p^3 p^4. The end of the lever n is between the pins p^3 and p^4, and its movement is controlled by them. A third roller-bearing o^3 is carried by and oscillates with the block G′, and plays along the slide-rod o between the stop-pins p' and p^2, striking one or the other shortly before it reaches the end of its course. This effects a lateral movement of the slide-rod, which immediately brings one of the pins p^3 p^4 in engagement with the lever n, effecting a reversal of the shaft l. In order to render this reversal quick and positive, I employ a weight q carried by an arm extending from a sector r, which is pivoted at r' upon the beam D^2, and the periphery of which gears with a short rack r^2 upon the under surface of the slide-rod. Shortly before the oscillating blocks have completed their course in one or the other direction, the bearing o^3 comes in contact with one of the stop-pins p' p^2, and sets the slide-rod in motion. As this motion progresses the arm carrying the weight q begins to assume a vertical position, and by the time it reaches this position, one of the pins p^3 p^4 is in contact with the lever-arm n. The moment the weight q passes its vertical position it falls to the end of its limit, effecting instantly the movement of the lever n, and consequently of the clutch m, thereby effecting the reversal of the direction of the revolution of the shaft l. In this way I effect the constant and automatic reciprocation of the bearing-blocks carrying the vertical cutters, the extent of this reciprocation depending upon the situation of the stop-pins p' p^2, the position of which upon the slide-rod o may be varied in accordance with the width of the canal which it is desired to cut, it being only necessary that they should at all times be far enough apart to cut a canal of greater width than the body of the dredge upon which they are mounted. This movement of the cutters is automatic and positive, but as at times the cutters meet with circumstances of unusual resistance, the connecting-rods between the bearing-blocks are bolted pivotally upon them, and so admit of a very slight yielding when unusual resistance is presented.

Second. The motion of revolution. The shaft of each of the cutters E E′ carries just above its lower bearing a bevel-wheel H H′. Each of the lower bearing-blocks F F′ carries an angle-arm f f' with bearings for a short shaft, one end of each of which carries a bevel-wheel s s', gearing respectively with the bevel-wheels H H′, and the other end of which carries a spur-wheel t t', gearing with a corresponding spur-wheel u u' on a long shaft U, mounted parallel to and a short distance above the transverse beam D′, and driven from the pulley u^2 by a band running to a pulley on the counter-shaft L. In order that the revolution of the cutters shall proceed notwithstanding their reciprocation, the spur-wheels u u' are made to slide along the shaft U, being caused to revolve with it by means of keys sliding in a keyway along the shaft, and held constantly in position opposite to the spur-wheels t t' with which they gear by arms projecting rearwardly from the angle-arms f f'.

The bevel-wheels H H′ are affixed to the cutting-shaft by set-screws, as are also the collars g g' situated immediately above the upper bearings, G G′. By adjusting these bevel-wheels and collars upon the cutting-shafts, the cutters may be raised or lowered according to the depth to which it is desired that the machine shall be capable of excavating.

The pumping machinery consists of two large circular pumps W W′ driven from the pulleys w w', and preferably operated by engines and shafting distinct from that which effects the revolution and reciprocation of the cutters. On account of the nature of the material to be pumped, water-bearings are provided for the pumps fed by the pipes v v'. From the pumps the main suction-pipes X X′ pass forward and down to the lower ends of the cutters. In order that they may be able to accommodate themselves to the motion of reciprocation the descending portions x x' of the pipes are made of rubber or other flexible material. The nozzles Y Y′ are of metal and pass loosely through large iron rings y y' carried at the lower ends of rods z z', which depend from the lower bearing-blocks F F′ and reciprocate with them. These depending rods are braced toward their lower ends by a cross-piece Z, and by means of them the nozzles of the suction-pipes are held constantly in position a short distance to the rear of the lower ends of the revolving cutters. The discharge-pipes O O′ pass up from the pumps and through the roof of the deck-house, where they pour their contents into two large hinged troughs C C′, which project transversely from the sides of the dredge and which are long enough to extend some distance inland from the edges of the canal which is being cut. These troughs are supported by stays from the posts b b' erected on top of the deck-house. To their inner ends are affixed double hinges c c' (shown in Figs. 4 and 5) by means of which they may be hung alternately from either side and may be accordingly given a forward or backward trend as is desired. Should it be necessary to carry the spoil farther from the dredge than the length of these troughs will permit, an extension c^2 may be provided, as shown in the dotted lines, Fig. 1.

At the commencement of the pumping operation much power is wasted before a sufficient vacuum can be created by the pumps. I therefore provide the pumps with steam-ejectors i i', which are fed by pipes I I′ from the steam-boiler and discharge through the pipes J J′. By means of these ejectors a preliminary vacuum can be quickly created within the pumps before they are set in operation. In order to prevent the inrush of air from the discharge-pipes when this vacuum is created the ends of these pipes are protected by flat valves K K′.

If it is found that the forward motion of the dredge cannot be sufficiently controlled by the ordinary propelling machinery, anchors may be thrown forward, the cables a a' of which pass back into the dredge and are separately wound up upon the winch a^2.

In operation the revolution of the cutters, their reciprocation and the action of the pumps proceed simultaneously with the steady but slow advance of the dredge. As this advance continues the cutters are brought into contact with the forward end of the bank which is being cut away. The revolution of the cutters excavates the earth or sand from the bank, and the spoil formed by the mixture of this earth or sand with the water is pumped up through the suction-pipe and discharged from the sides of the dredge from the troughs far enough away to prevent its running back into the canal. If it is found that the cutting does not proceed quite evenly, a more delicate adjustment may be attained by winding in upon the anchored cables by the winch.

Having thus described my invention, I claim—

1. In a dredge, the combination of two vertically-revolving cutters; means for automatically reciprocating the same in constant relation to each other; and pumping and discharge mechanism for removing the spoil which is produced by the action of the cutter, substantially as described.

2. In a dredge, the combination of one or more revolving vertical cutters; one or more transverse beams along which the bearings of these cutters slide; mechanism for effecting the continuous revolution of the cutters; and mechanism for effecting the continuous reciprocation of the same along the transverse beams, substantially as described.

3. In a dredge, the combination of one or more revolving vertical cutters; one or more transverse beams along which the bearings of these cutters slide; and mechanism whereby the direction of the movement of these bearings is automatically reversed at each end of its course, substantially as described.

4. In a dredge, the combination of a revolving vertical cutter, reciprocating laterally across its front; a suction-pipe, the lower end of which is held in attendance upon the lower end of the cutter; a stationary pump operating said suction-pipe; and a flexible connection introduced in the downwardly-projecting portion of the suction-pipe, substantially as described.

SAMUEL A. HILL.

Witnesses:
A. E. PAIGE,
JAMES H. BELL.