(No Model.) 7 Sheets—Sheet 1.

E. CHAQUETTE.

DREDGING AND EXCAVATING MACHINE.

No. 306,580. Patented Oct. 14, 1884.

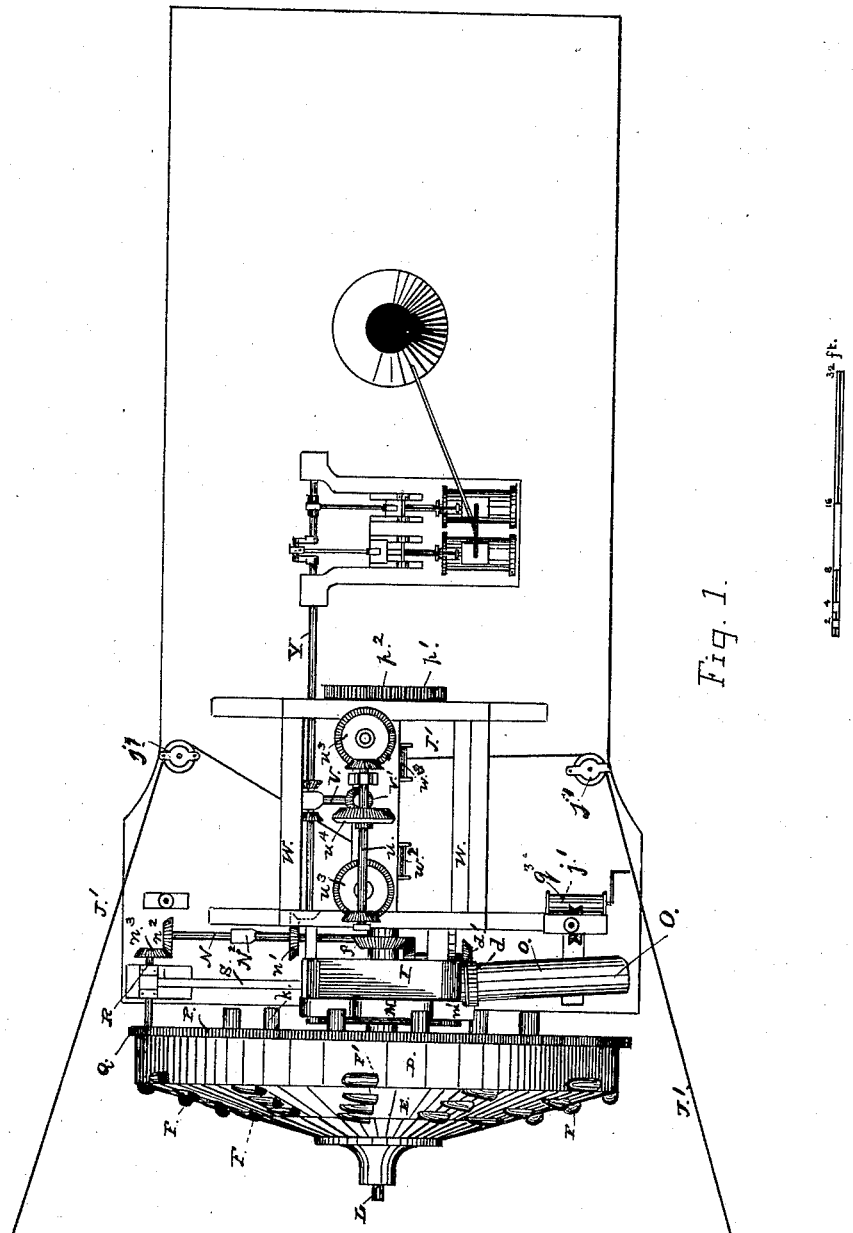

Fig. 1.

Witnesses:

Geo. A. Dickson

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Inventor:

Ephraim Chaquette

by E. G. Dewey Atty.

(No Model.) 7 Sheets—Sheet 2.

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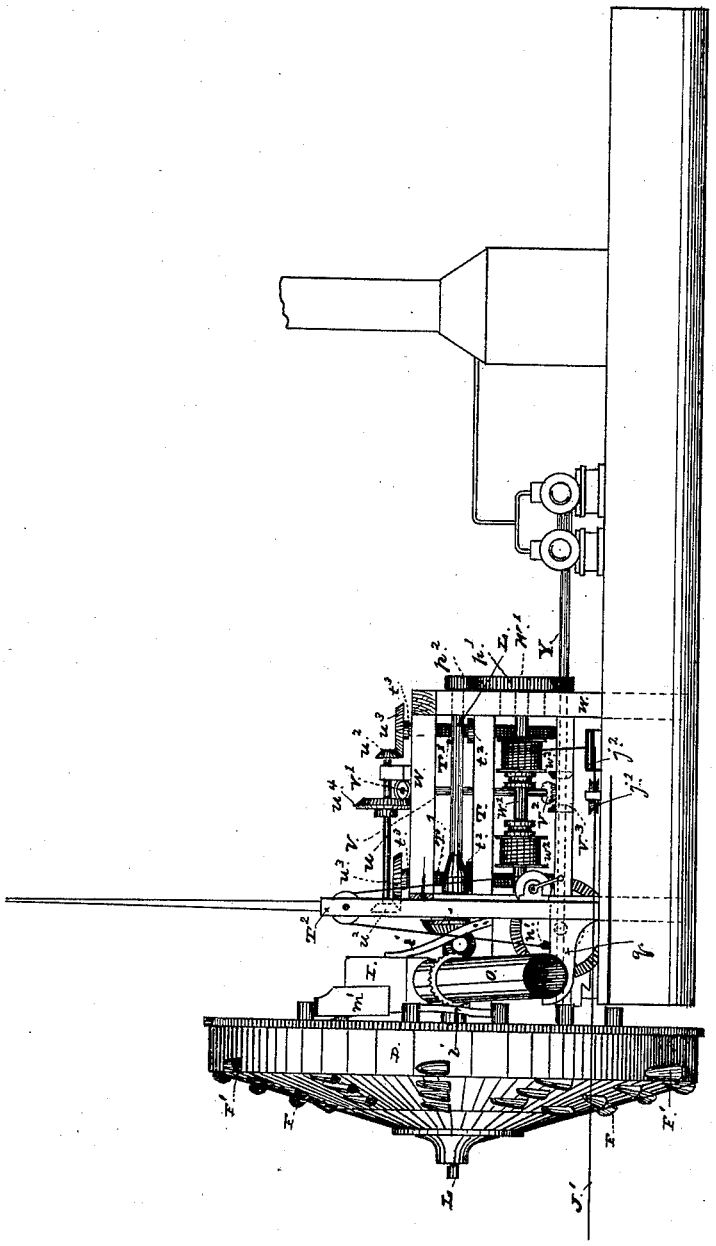

Fig. 2.

Witnesses:

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(No Model.)

7 Sheets—Sheet 3.

E. CHAQUETTE.

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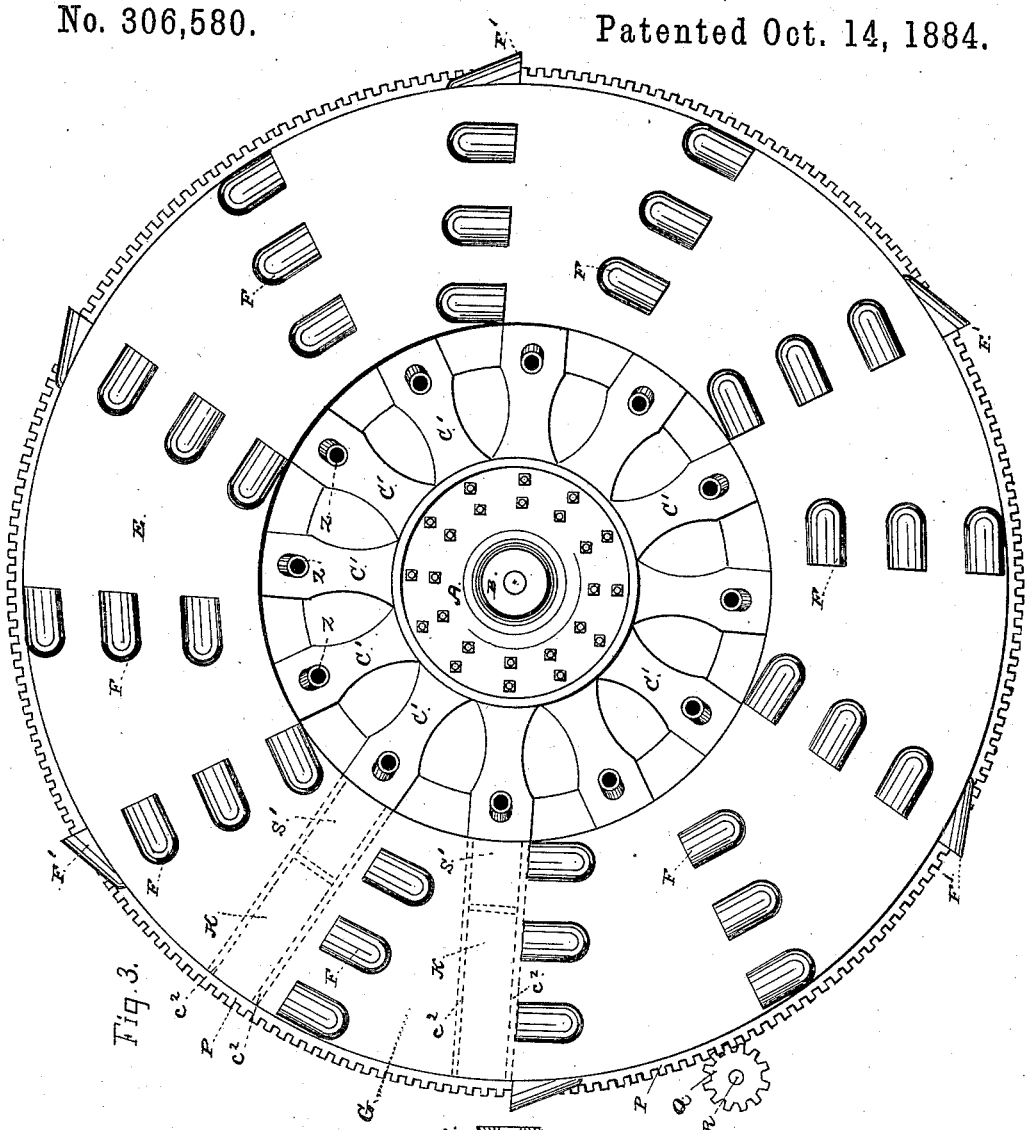

Fig. 3.

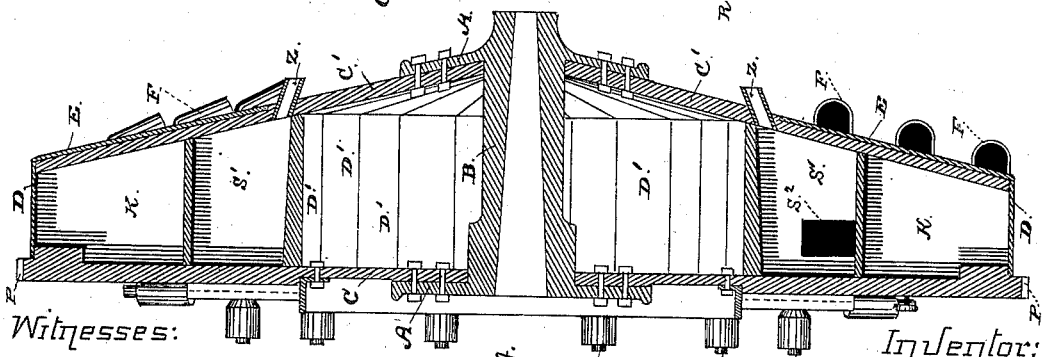

Fig. 4.

Witnesses:

Geo. A. Dickson

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(No Model.) 7 Sheets—Sheet 4.

E. CHAQUETTE.

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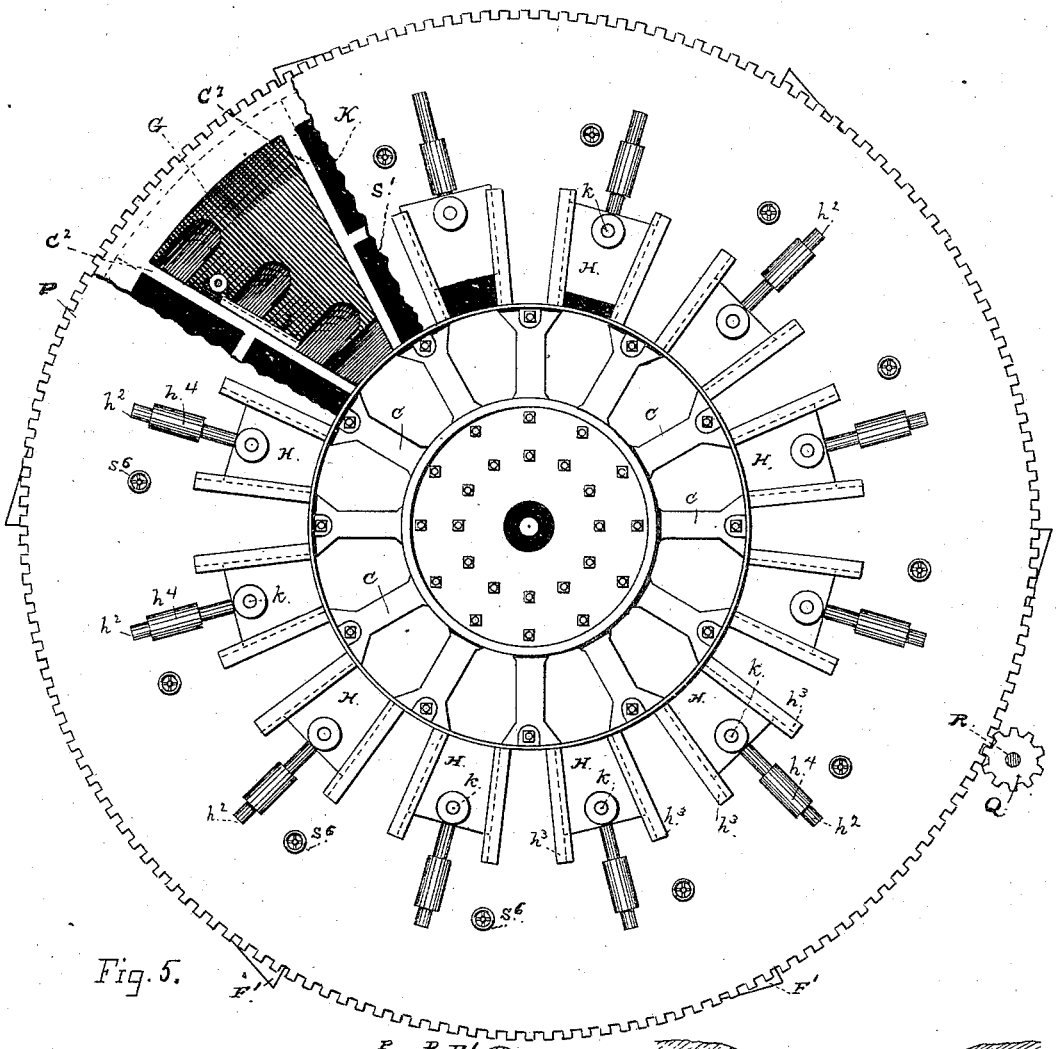

Fig. 5.

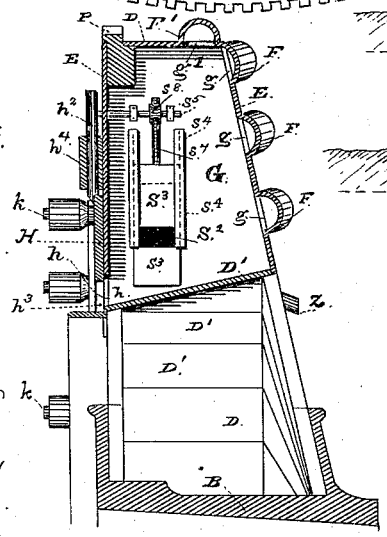

Fig. 6.

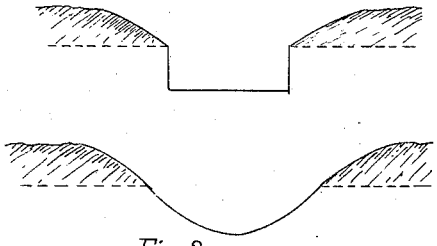

Fig. 8.

Witnesses:

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(No Model.) 7 Sheets—Sheet 5.

E. CHAQUETTE.

DREDGING AND EXCAVATING MACHINE.

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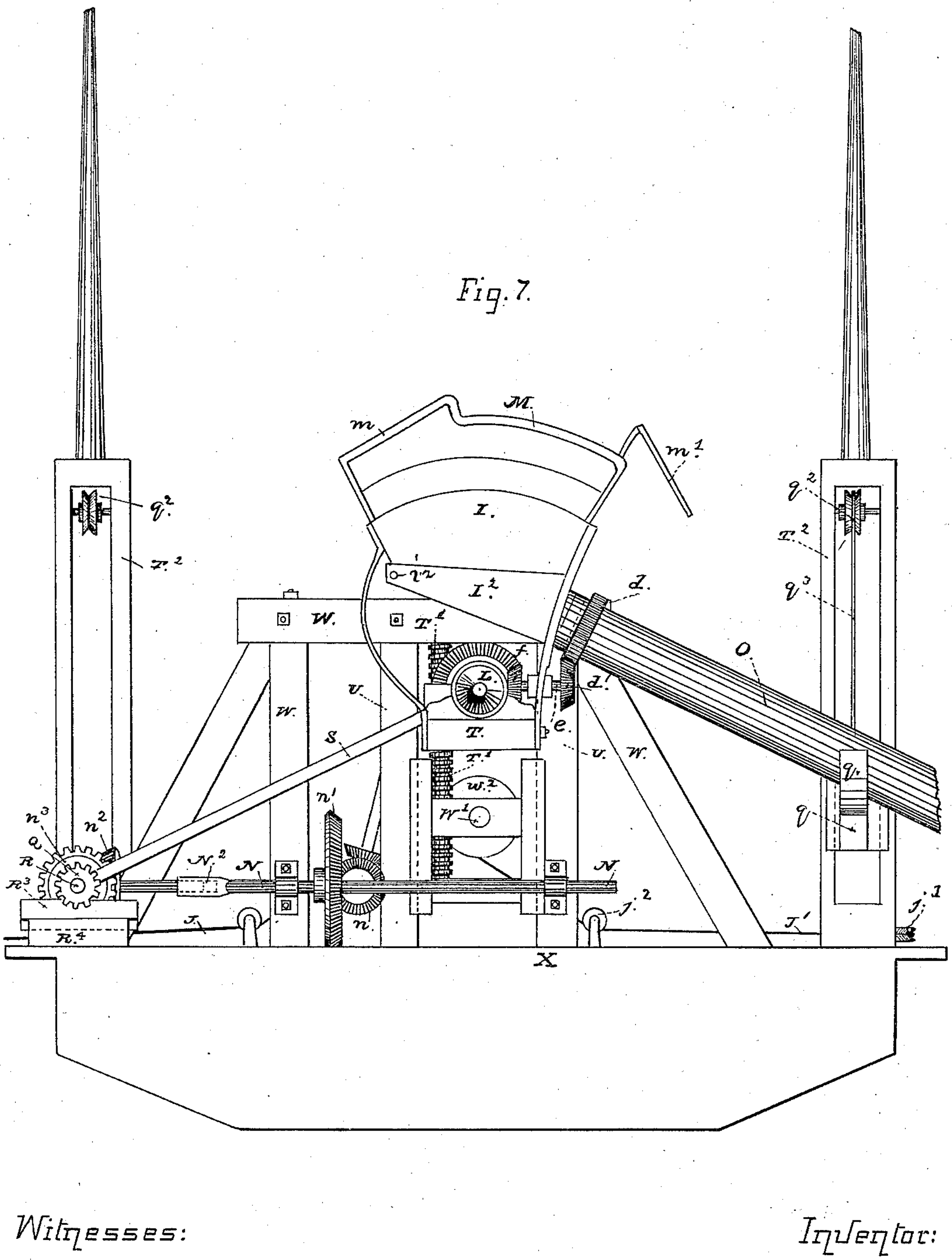
Fig. 7.



Witnesses:

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(No Model.) 7 Sheets—Sheet 6.

E. CHAQUETTE.

DREDGING AND EXCAVATING MACHINE.

No. 306,580. Patented Oct. 14, 1884.

Fig. 8a

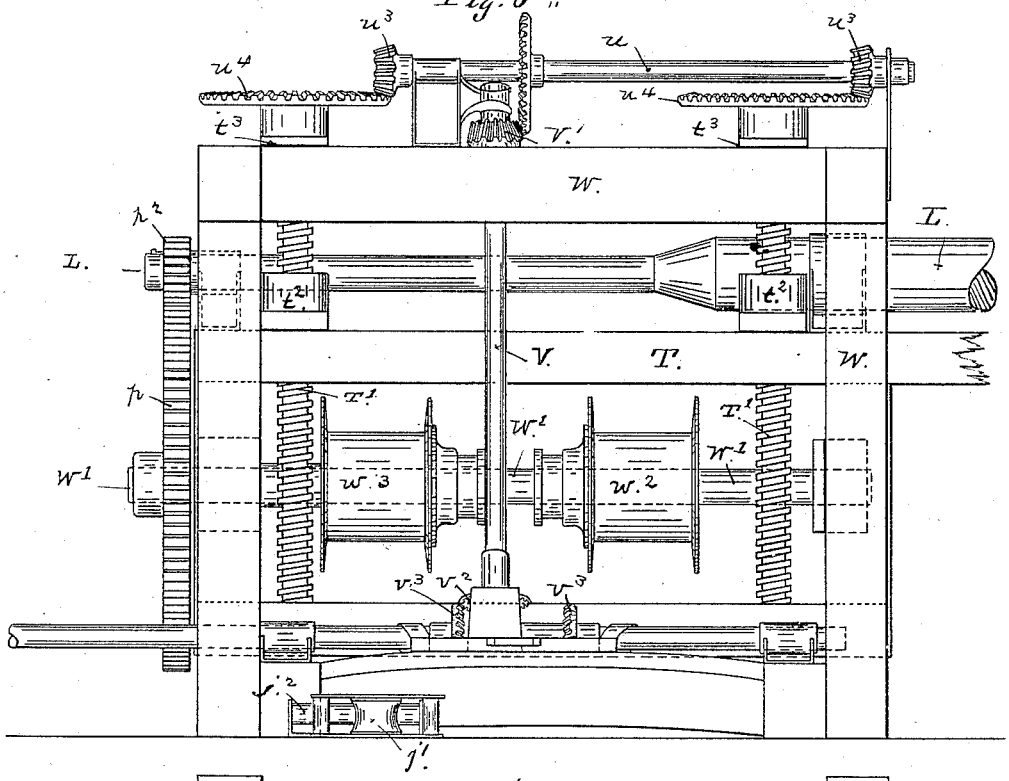
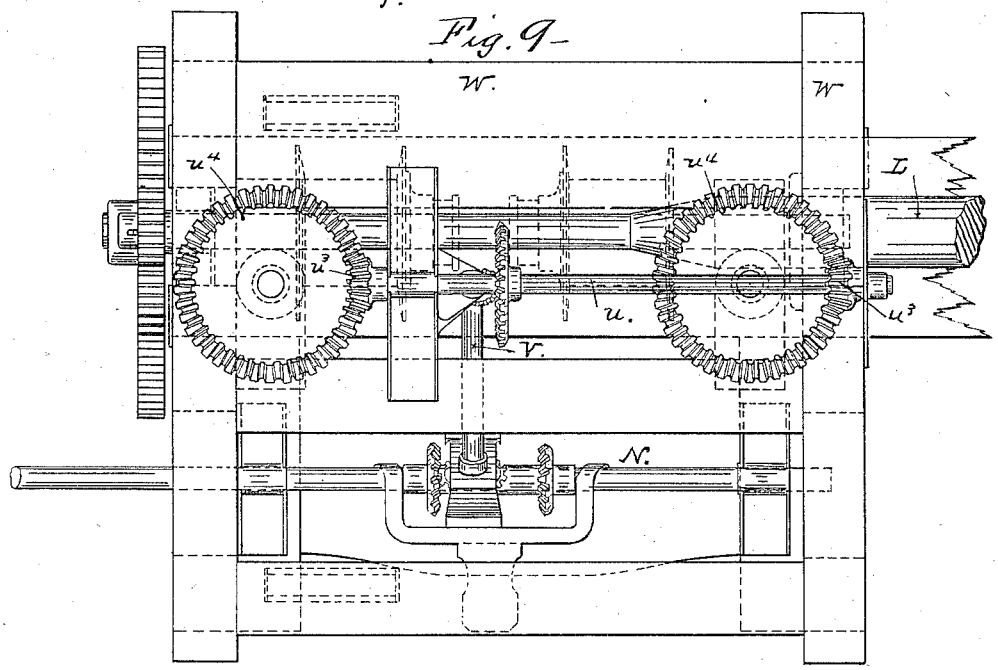


Fig. 9.



Witnesses:
Jno. L. Taggard
Alphonso C. Smith

Inventor:
Ephraim Chaquette.
By his Atty. E. G. Dobson

(No Model.) 7 Sheets—Sheet 7.

E. CHAQUETTE.

DREDGING AND EXCAVATING MACHINE.

No. 306,580. Patented Oct. 14, 1884.

Fig. 10.

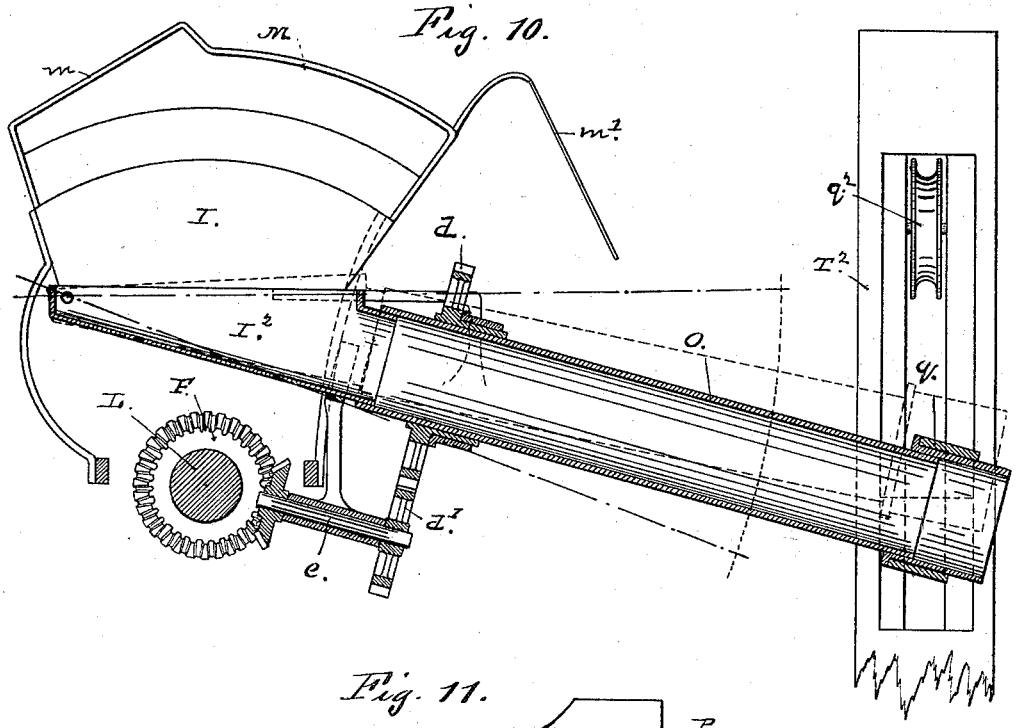
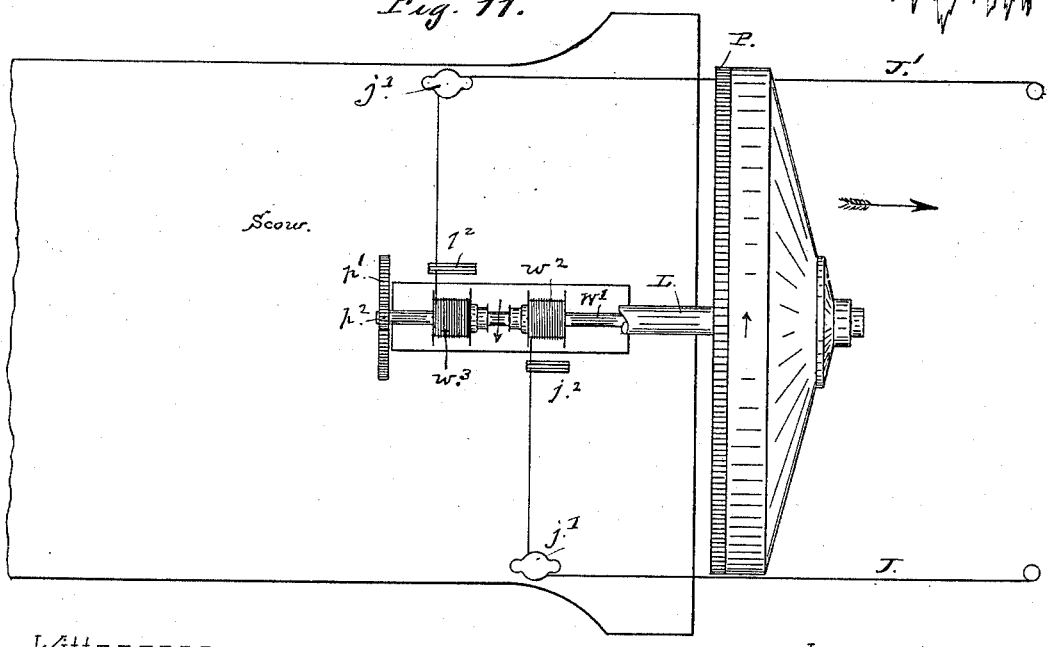


Fig. 11.



Witnesses:
Jno. T. Taggard
Alphonso Smith

Inventor:
Ephraim Chaquette
By his Atty. W. Edson

UNITED STATES PATENT OFFICE.

EPHRAIM CHAQUETTE, OF SAN FRANCISCO, CALIFORNIA.

DREDGING AND EXCAVATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 306,580, dated October 14, 1884.

Application filed December 26, 1883. (No model.)

To all whom it may concern:

Be it known that I, EPHRAIM CHAQUETTE, of the city and county of San Francisco, State of California, have invented certain Improvements in Dredging and Excavating Machines; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to machinery and apparatus for excavating and raising earth and like matter in the construction of levees and ditches, and in other engineering operations.

The machine and apparatus constructed in accordance with my invention is adapted either for submerged work, in which case it has the characteristics of a dredger and is mounted upon a boat or a scow, or for operations upon land or out of water, in which application it is more properly termed an "excavator," and for required portability it is placed upon a truck or wheeled platform.

The general object of my invention is to produce a dredging and excavating device, machine, or apparatus that shall be qualified to make a ditch, trench, or line of cut with sloping sides, whereby a ditch or channel with slanting sides can be constructed, and a bank or levee produced by the machine shall have a shelving face.

The following description fully explains and sets forth the nature of the improvements constituting my said invention, and the manner of constructing, combining, applying, and making use of the same.

In the drawings referred to by letters and figures, Figure 1 is a plan or top view of the apparatus mounted and arranged as a dredger, representing it in position for work. Fig. 2 is a side elevation. Fig. 3 is a view of the excavating and elevating wheel taken from the front. Fig. 4 is a transverse section taken at the center. Fig. 5 is a view of the rear or inner side of such wheel. Fig. 6 is a transverse section of a part of the wheel through one of its chambers or receptacles, and showing the water-discharge and the adjustable gate by which water and the solid matter taken into the chamber together are separated and caused to discharge through different outlets. Fig. 7 is a view taken from the front of the scow and supporting-frame with the wheel removed. Fig. 8 is a diagram illustrating the difference between the ordinary vertical side cut and the improved form of cut or excavation made by my machine. Fig. 8ª is a side elevation of the carriage and means for adjusting it. Fig. 9 is a plan view of the same. Fig. 10 is a section of movable hopper and pipe with connected parts. Fig. 11 is a plan view of the device, showing only the drums, cords, and pulleys.

My invention consists, essentially, in arranging and mounting dredging or excavating buckets or receptacles with cutting lips or edges in a suitable carrying frame-work to move about a shaft or axis in a vertical direction and a circular path or with a rotary movement, so that their cutting-edges describe a circle having the shaft as the center. This shaft or axis is set in line with the direction of the trench, ditch, or line of cut to be made, and the path described by the buckets in traveling about this center is substantially at right angles or perpendicular to the line of the ditch or excavation. The face of the wall or bank produced by a revolving line of buckets arranged and operated in this manner has a slope or inclination proportionate to the radius of the circle in which the cutters travel. Each bucket or receptacle cuts into and takes up a charge or body of the material against which its cutting-edge is carried, and by the revolution of the frame about the axis it is raised up into position of discharge at or above the axis, where it is brought into line and caused to deposit its material into a spout or conductor.

In connection with a set of dredging and excavating buckets or receptacles arranged to work in a circle around an axis I employ a number of air-tight compartments alternating with the buckets or receptacles in such manner as to give increased buoyancy of the structure when submerged or partly submerged in the water. The application and use of these air-tight compartments, however, is not essential in operating upon land or dry excavation where the chambers are not submerged.

Another part or feature of my improvements consists in providing separation and discharge of the water from each bucket or receptacle apart from and independent of the solid matter, so that while more or less water may be taken up in the course of work, there discharges into the spout or conducting-pipe only

the earthy matter, which is thereby delivered as nearly as practicable in a solid condition. For this purpose each chamber communicates through a side aperture with a water-passage having a discharge nozzle or tube leading from it to the outside of the excavator, and an opening between the excavator chamber or receptacle and this water-passage is controlled by a valve in such manner that the position and area of the opening is capable of being regulated to allow only the water to pass off through the discharge and to retain the solid matter. Where no water is obtained as a product of the operation this opening is closed up; but in an excavator of this character, intended altogether for excavating purposes, as in grading, ditch-making, and in dry material generally, the water passages and apertures need not be provided.

My improvement includes a novel construction of buckets or excavating and elevating receptacles in the form of a wheel; also certain application and combination of mechanism therewith to produce a regular rotary movement of the wheel upon its axis, and also to cause it to advance mechanically forward against a bank or body of matter, and with a speed proportionate to the character and quality of the work; also certain mechanism whereby the wheel can be raised or lowered in a vertical direction and caused to feed downward or into a body of matter directly beneath it with a regular movement, the extent of which is under control; also in the application of mechanism to open and close automatically the outlet-gates of the chambers, and, finally, in a means of insuring uniform discharge of the matter from the spout or conductor into which the contents of the excavator-chambers are discharged.

I proceed to produce a number of buckets or receptacles in the form of a wheel by forming around a central hub in radial manner a number of receptacles having mouths or inlets provided with cutting lips or edges like a scoop, a chamber which gives a receptacle for the matter taken up by the cutter, and an outlet controlled by a gate, through which the charge taken into the chamber is emptied into a conducting-spout at a point near the center or axis. A hub, A A′ B, and a number of radial arms or ribs, C C′, at regular distances apart constitute a skeleton frame in the form of a wheel. Sheet-metal ends D D′ and sides E inclosing the principal portion of the wedge-shaped spaces between the arms C produce a number of chambers or close receptacles, G G, of uniform size. The space between the hubs and the bottom or inner ends, D′, of these chambers is not inclosed. One face of the wheel is plane or at right angles to the axis; but the other face is dished or with a taper from hub to rim, the arms C′ being set out at the hub for this purpose. This gives the chambers greater breadth at the bottom than at the top. The floor in each chamber is inclined from the outer to the inner side, at which point an outlet, *h*, is provided through the face E′ on a level with the floor or that end next the hub. The mouth or inlet-opening of each receptacle is on the outer face and consists either of one aperture through the side E or of several apertures, *g g*, in line at intervals apart, the edges of which are surrounded by a scoop-shaped lip, F, that at the front or forward edge stands out from the face of the chamber, but at the back edge of the opening sets down closely against the face. These lips are, then, practically extensions of the edges of the openings *g*, and by setting out from the face of the wheel they constitute cutters to take up a charge or portion of material and direct it into the receptacles or chamber behind the openings. Several cutters of smaller size would offer less resistance to the forward rotation of the wheel than a single large cutter, and for such reason I prefer to provide two or more separate cutters and inlets to the face of each receptacle. In the construction specially shown in Figs. 3 and 5 of the drawings I have arranged three cutters in line with as many inlets into the chambers.

Upon the outer edge of the wheel, and projecting from the rim, I fix auxiliary cutters F′, with openings *g′*, leading into the end of the chambers. These additional cutters act directly against the material under the rim of the wheel, and are chiefly of use to cut away the solid matter beneath and give clearance for the wheel. The discharge of material from each chamber is provided for through an opening, *h*, in the back or inner face. A sliding gate, H, fixed to a guide-rod, h^2, is held in guides h^3 h^3, on the vertical face E at each side of the opening, and the rod h^2 slides through a fixed socket, h^4. These parts confine the gate in whatever position it takes, whether open or closed, so that there shall be no tendency of the gates to drop and uncover their openings at any time in the movement of the wheel. Each gate is raised up, however, to uncover the outlet as the chamber is brought into upright position or over the axis and in line with a spout to afford discharge of the matter brought up by the chamber; also, after the discharge takes place, the gate is shut down and remains closed until the elevated position of the chamber occurs again in its turn. These movements are produced automatically by fixing a stud, *k*, with a friction-roller on the face of the gate, and placing a stationary track, M, over the axis in the vicinity of the receiving-hopper of such shape or figure that at the extreme ends or points where the rollers take upon it the track meets the circular path described by the rollers; but from this point it takes the form of a straight incline, *m*, of such length that the rollers are lifted to the required height in traveling from the lowest to the highest point. The track from this point curves downwardly, and carries the gate down again. The final closing is insured by fixing a guide-plate, *m′*, just over this end of the track in such position that the

roller of each gate is brought against the face of the plate in leaving the curved track. The hub has a long box or socket, B, with a tapering bore to take the tapering shaft L, to which the wheel is fixed. Power to move the wheel is applied at or near the periphery through the medium of gear-teeth P, formed or provided on the rim, and a pinion, Q, upon a shaft, R, projecting from the platform X at one side, and having motion imparted to it through an engine-shaft on the platform. The wheel and shaft therefore turn together.

To obtain regular rotation of the wheel, the counter-shaft and gearing seen in Figs. 1 and 7 are not necessary, as the shaft R could be connected more directly with the power; but this additional gearing is employed for raising and lowering the wheel to throw it into and out of action, and for feeding it down to produce regular increase in the depth of the cut.

The driving-pinion Q is kept in gear with the toothed rim of the wheel by a radius-bar, S. The shaft R is mounted in a shifting box that is connected by the radius-bar S with the shaft L. The shaft-boxes R^2 are fixed on a slide, R^3, held in guides R^4 on the edge of the platform, and the radius-bar is attached to the slide at one end, while the upper end has a collar that takes loosely around the thick part of the shaft L. This construction keeps the two centers L R at a fixed distance apart, and the toothed rim and its driving-pinion are always in gear under all changes in the position of the wheel. Such changes result from the adjustment and movement of the wheel up and down, the shaft L being mounted on a block or carrier, T, set in guides U in a frame, W, on the platform to which elevating-screws T' T', working through nuts or threaded boxes t^2 t^2 in the carrier, are applied to raise and lower it. These screws have bearings t^3 t^3 in the top of the frame, and a counter-shaft, u, and bevel-gears u^2 u^3 u^4 give rotation to both with the same movement. An intermediate shaft, v, with gears v' v^2 and a shifting clutch-gear, v^3 v^3, connects the screw-actuating shaft u and the power-shaft together. The clutch-gears afford a means for reversing the movement to run the carrier up and down in the frame, as well as for throwing the mechanism out of gear. From the power-shaft a counter-shaft, N, connects with the pinion-shaft R through bevel-gears n n' n^2 n^3; but, as the shaft R has a shifting movement in the guides R^2, the counter-shaft is made extensible to keep the gears n^2 n^3 always engaged. The shaft N is therefore made in two parts with an extension-joint, N^2. This mechanism and connection of parts are seen in Figs. 1, 2, and 7. The elevation and depression of the wheel is thus produced mechanically without interfering with its general rotation.

W' is an axle mounted on the same carriage with the wheel and carrying two winding-drums, w^2 w^3, from which cables J' J' are carried out ahead and made fast to fixed points in advance of the machine. Rotation of these drums produces a forward movement of the platform and holds the face of the wheel against the wall or bank with a certain amount of pressure or feeding movement, the degree of which is governed by the speed of the drums. This mechanism produces regular progression of the wheel against the bank. The drums are driven directly from the shaft L by a spur-wheel, p^2, on said shaft, and a pinion, p', on the axle W', and as the progress of the machine when in operation will be governed by the character of the material it is working upon, they will be changed to feed at different rates of speed as the matter being cut into offers greater or less resistance to the cutting-edges of the buckets. The pinions p' p^2, being located on the end of the shafts L W', can readily be removed and replaced by others of a different relative size, and thus the speed is controlled as desired. Each cable J' is secured at one end to its drum and is carried out and turned over sheaves and guide-rollers, j' j^2, to bring it to the head of the platform. An anchorage is provided ahead of the platform, and the outer end of the cable is made fast to it. In passing around the drums one cable is laid over and the other one under. The revolution of the drums will be regulated with reference to the rate of movement of the wheel of buckets to draw the machine forward as rapidly as the buckets will take the material. This change is obtained by altering the proportions of the wheel and pinion p' p^2 to give the desired rate of feeding movement. The proportions of the gears shown in Figs. 1 and 2 will give three feet advance of the wheel to each complete revolution, and is calculated to produce a cut or chip of three inches in depth or thickness. The machine thus constructed will operate to cut and excavate in an arc having the shaft L as the center, and as it advances in a direction at right angles to the plane of rotation of the buckets the shape of the wall or face of the bank will always be left on a slope or incline. This feature in the operation of the machine renders it especially valuable in the formation of levees and embankments under and along water-lines. The shelving face left by the machine avoids all danger of the upper structure being undermined by washing away of the face below the water, which in all dredging operations that leave a straight or perpendicularly-cut face is more or less liable to take place. The diagram Fig. 8 illustrates the difference between these two forms of cut. Air-chambers K K between the chambers G are employed to give buoyancy and overcome the weight of the wheel and the machine when working in water. These chambers are formed in the wall-partition c^2, or between the chambers G, as shown in Figs. 3, 4, and 5, and are made air-tight. A portion of the same space within the partiton is taken for a water-passage, S', that affords an independent outlet for excess of water taken into the chambers G. Each chamber G has a passage and outlet of such char-

acter, and is thus enabled to discharge its contents in comparatively a solid condition, as the water is carried off from the top of the charge of the material as the chamber approaches the upright position and before the gate H rises. The water-outlet S^2 from the chamber G is controlled by a movable gate, S^3, sliding in guides S^4, and adjusted from the outside of the wheel by means of a shaft, S^5, having a hand-wheel, S^6, in the outer end, and connected with the gate by a rack-bar, S^7, and a pinion, S^8. This gate is so arranged that being moved up and down changes the distance of the lower edge of the outlet from the bottom of the chamber, and thereby enables the height of the inlet to be regulated accordingly and caused to draw off the water at any point. The discharge for the water-passage S′ is through a spout, *z*, extending out through the front of the wheel, which allows the water to pass off without being thrown back into chamber G.

It is obvious that the air-chambers and the separate passages and outlets for water will be unnecessary to the successful operation of the machine out of water and in dry material, and therefore they need not be provided in a wheel to be used entirely upon land, and in place of making the compartment between the chambers G in the form of air and water tight chambers they can be simply spaces either open or closed to afford the greatest possible lightness to the structure. The hopper I is provided with a hinged trough, I^2, on the bottom from which a swinging spout, O, is carried laterally to carry and discharge the material to the required distance. The hopper I is held on supports *i i*, (see Fig. 2,) secured to a part of the fixed framing. The trough I^2 is hinged or pivoted to the hopper I, as shown at i^2, and its free end is elevated or lowered in any convenient manner to agree with the adjustable spout O. A sliding carrier-block, *q*, in vertical guides T^2, supports the spout at a point beyond the hopper, and affords means of regulating its degree of inclination. A simple device for this purpose is illustrated in Figs. 2 and 7, and consists of a sheave, q^2, in the guide-frame, and a winding-shaft, q^3, for working a rope that is attached at the lower end to the spout-carrier. One of these guide-frames and block-operating device is provided at each side for shifting the spout to deliver from one side or the other of the platform.

To insure regular discharge of the material through the spout, I impart to it a rotary motion through the agency of a bevel-gear, *d*, surrounding the spout at the upper end, a pinion, *d′*, on a short shaft, *e*, and a gear, *f*, on the shaft L. The pinion *d′* may have plane unbeveled gear, as shown in Fig. 10, and the shaft *e* be set at an inclination in order to compensate for the change. The shaft *e* is horizontal, and the gears on *d′* are beveled, as shown in Figs. 1, 2, and 7. A slow rotary movement of this conductor is sufficient to overcome any tendency to choke and clog and induce continuous discharge of the material.

As an excavator for operating upon land the platform is mounted upon trucks. Progression of the platform to advance the cutting and excavating wheel takes place in proportion to the speed of the wheel through the operation of the winding-drums and their cables, and the feed of the machine in both forms of a dredger and an excavator is thus produced and controlled directly from the excavating-wheel.

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

1. The combination of a suitable supporting and carrying frame, a horizontal shaft mounted thereon, a set of buckets or excavating and elevating receptacles having mouths or inlets surrounded by cutting-lips or projecting edges on the face of the wheel, and outlets controlled by gates, and so mounted upon said shaft that they travel in a circle about it and their cutting-edges move in a plane and cut in a circular path substantially at right angles to the shaft, a means for imparting to said set of excavators and elevators a rotary motion about such shaft, and a receiver and conducting-spout arranged with relation to the outlets of said receptacles, substantially as hereinbefore described.

2. A set of excavating and elevating receptacles around a central hub or axis having inlets *g*, surrounded by projecting cutting-lips F and outlets *h*, controlled by gates, in combination with mechanism for imparting to said receptacles rotation in substantially a vertical plane about the axis in such manner that the cutters F move in a circular path and cut in a plane across the axis of rotation, substantially as hereinbefore described.

3. The combination, in a suitable supporting-frame about a central hub or axis, of a set of excavating and elevating receptacles, G, having mouths or inlets *g*, provided with projecting cutting lips or edges F, and sloping bottoms D′, with outlets at the lower end thereof controlled by gates.

4. The combination, with the set of excavating and elevating receptacles G, arranged about a central hub or axis, and adapted to rotate in substantially a vertical plane about said axis, of the peripheral cutters F′ and inlets *g′*, substantially as hereinbefore described, for the purpose set forth.

5. The combination, with the excavating and elevating receptacles G, arranged about a central hub or axis, of the air-chambers K, substantially as hereinbefore described.

6. The combination, with the excavating and elevating receptacles arranged about a central hub or axis, of the air-chambers K and the water-passages S′ S^2 Z as a means of carrying off and discharging the water separately from the solid matter, substantially as hereinbefore described.

7. The combination with an excavating and elevating receptacle, as G, of an independent water-receptacle and discharging-passage hav-

ing communication with the receptacle G through an aperture controlled by a gate or valve, substantially as hereinbefore described.

8. The combination, with the excavating and elevating receptacle G, mounted on and adapted to rotate around a horizontal axis, and having an outlet, *h*, controlled by a sliding gate, of the stud *k* on the gate, and the fixed track M *m m'*, applied to operate substantially as hereinbefore described.

9. The combination of the excavating and elevating wheel A, the winding-drums w^2 w^3, the shafts L and W', upon which these parts A and w^2 w^3 are respectively placed, having the removable gear-wheels p^2 p' on their ends, and the cables J' J', applied to operate substantially as hereinbefore described, for the purpose set forth.

Witness my hand and seal.

EPHRAIM CHAQUETTE. [L. S.]

Witnesses:
EDWARD E. OSBORN,
G. W. EMERSON.