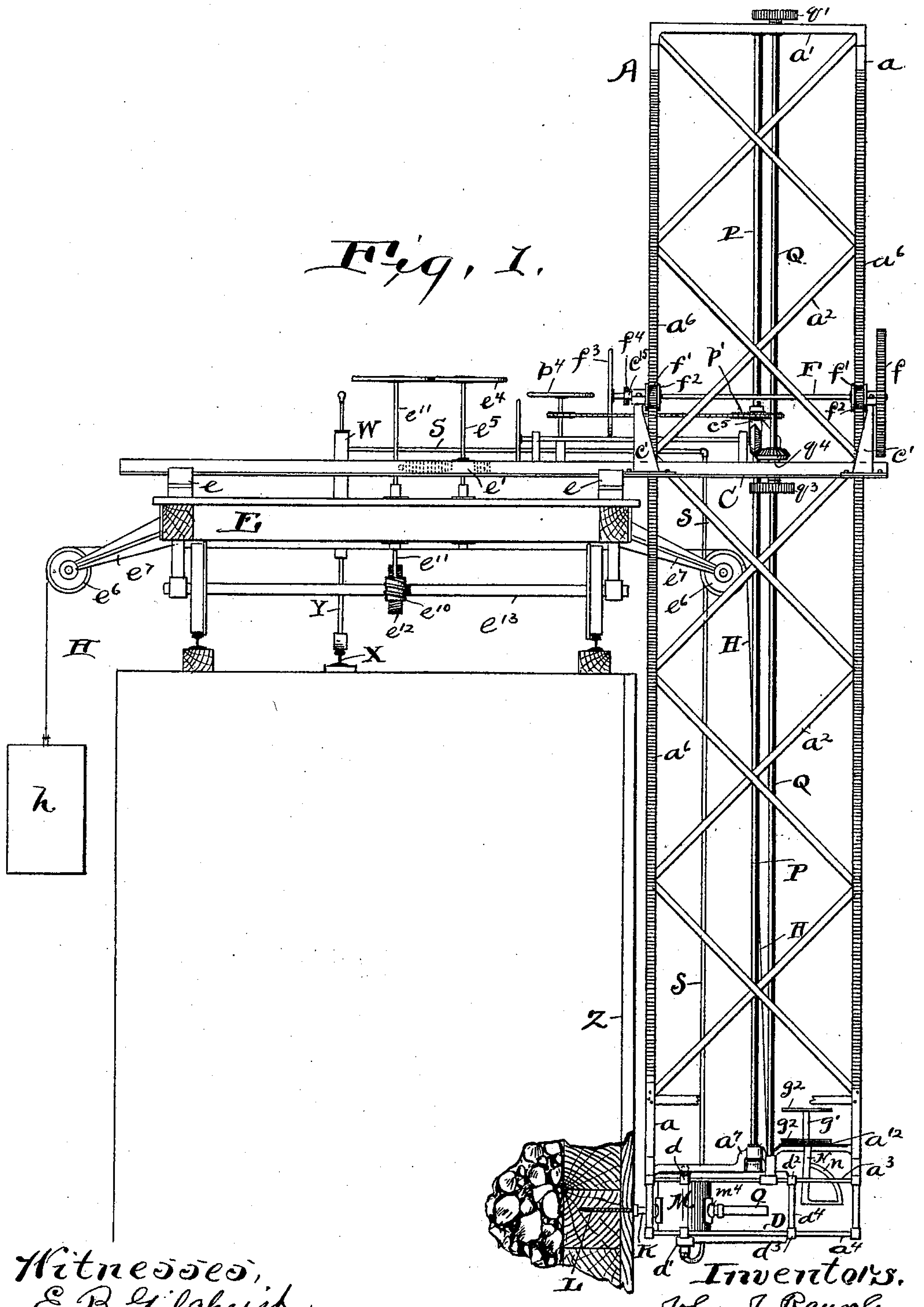
(No Model.) 5 Sheets—Sheet 1.

J. J. RAUSCHER & C. H. CLARK.

MACHINE FOR DRIVING SCREWS UNDER WATER.

No. 599,011. Patented Feb. 15, 1898.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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Fig. 2.

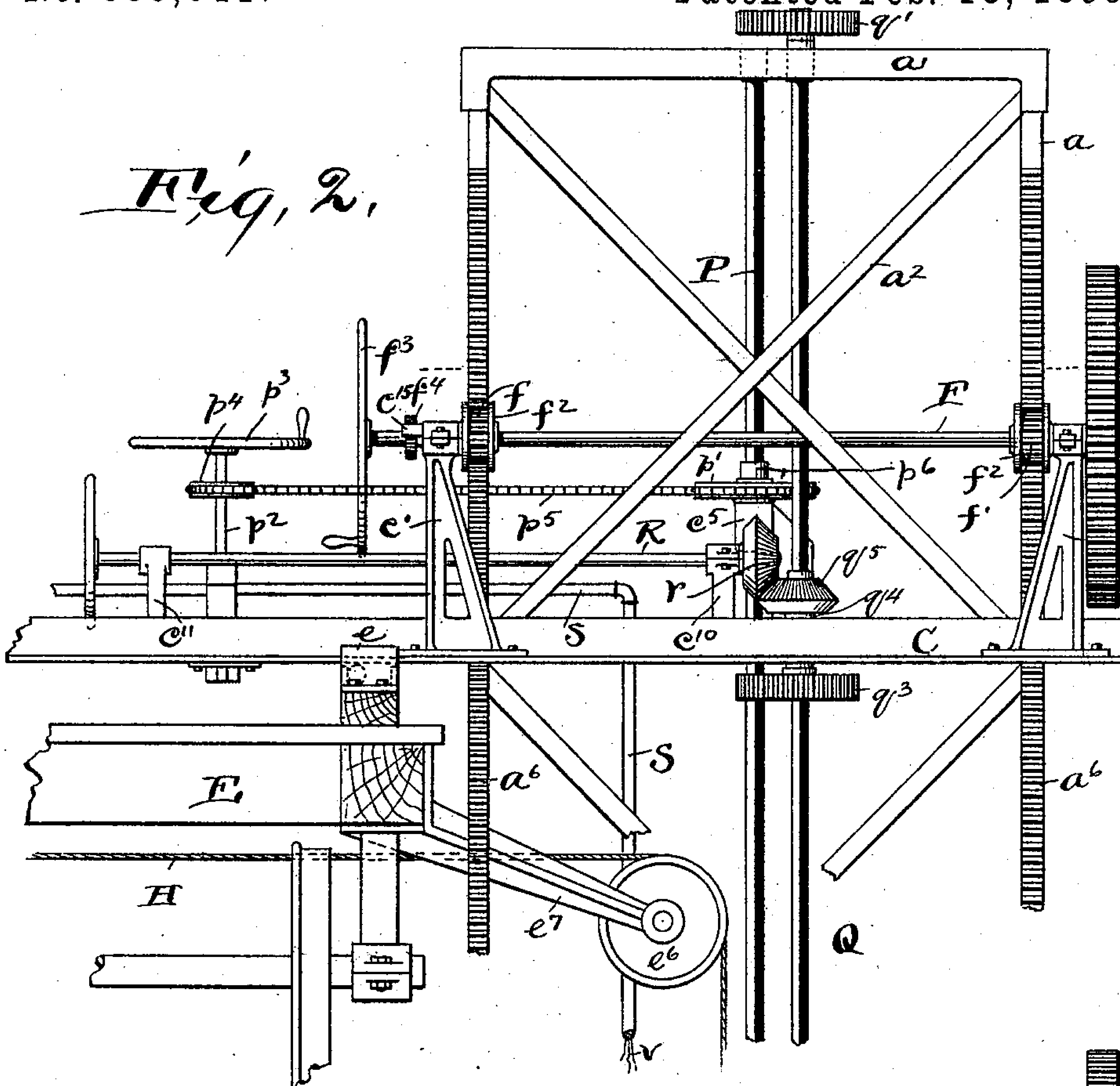
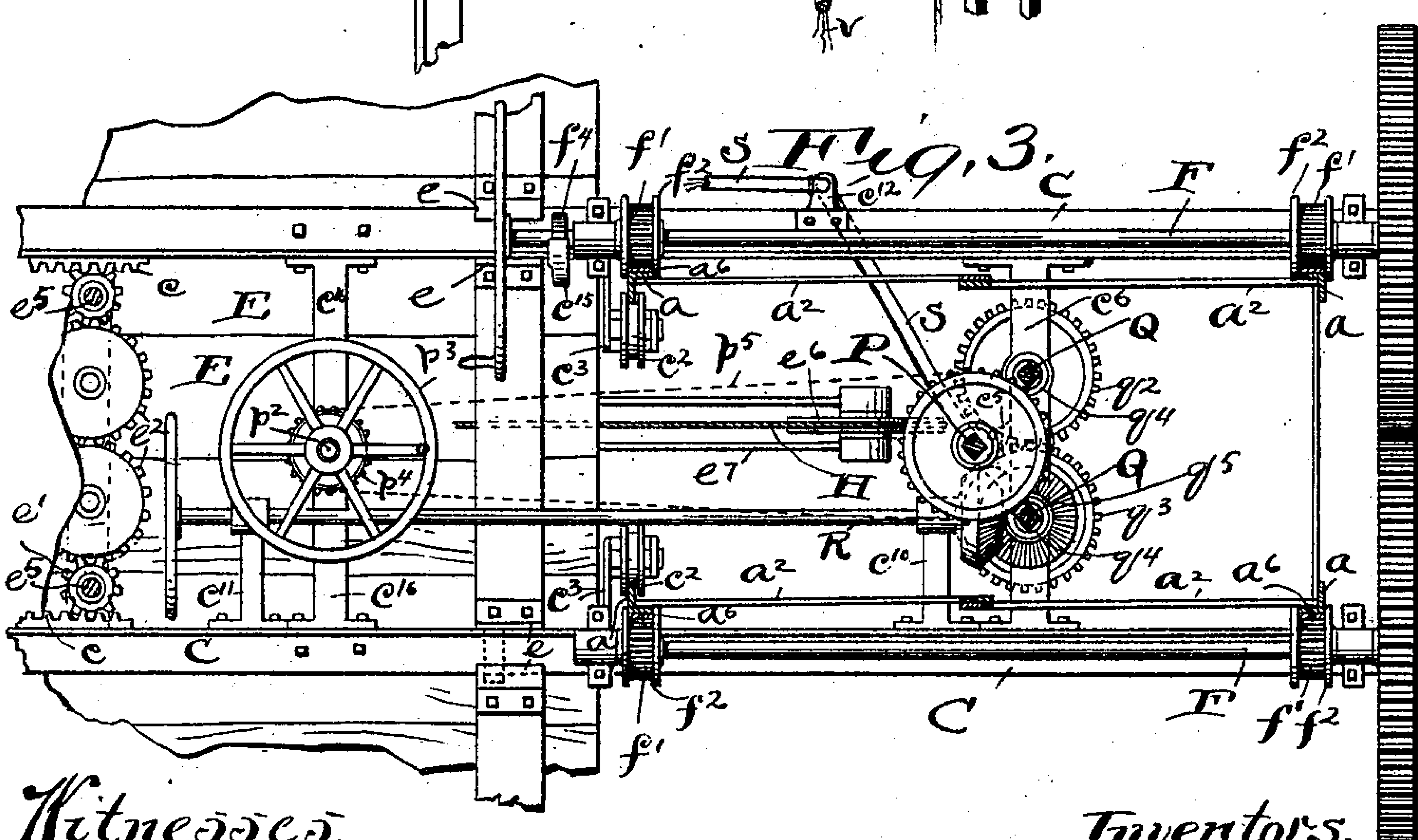


Fig. 3.



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(No Model.) 5 Sheets—Sheet 3.

J. J. RAUSCHER & C. H. CLARK.

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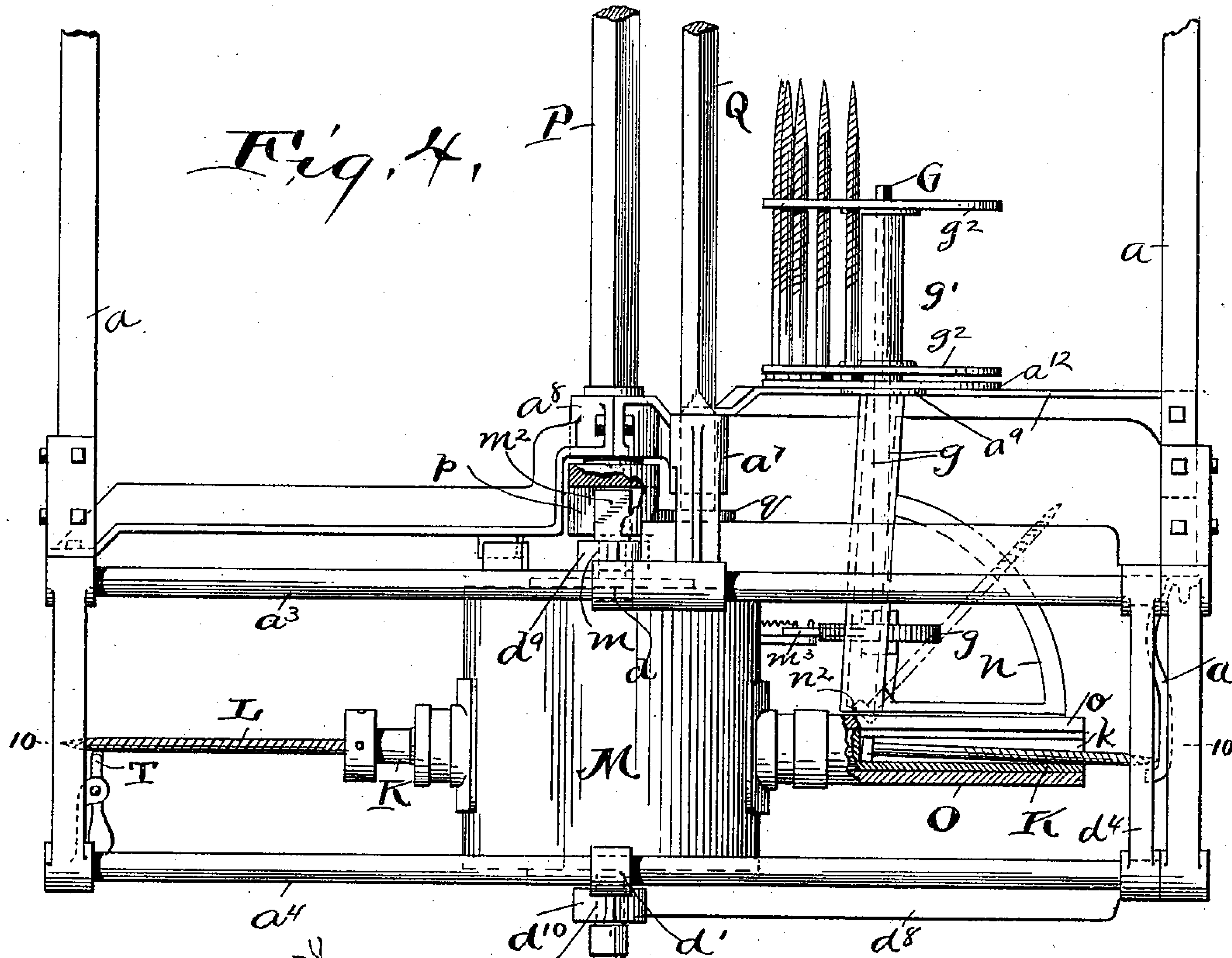

Fig. 4.

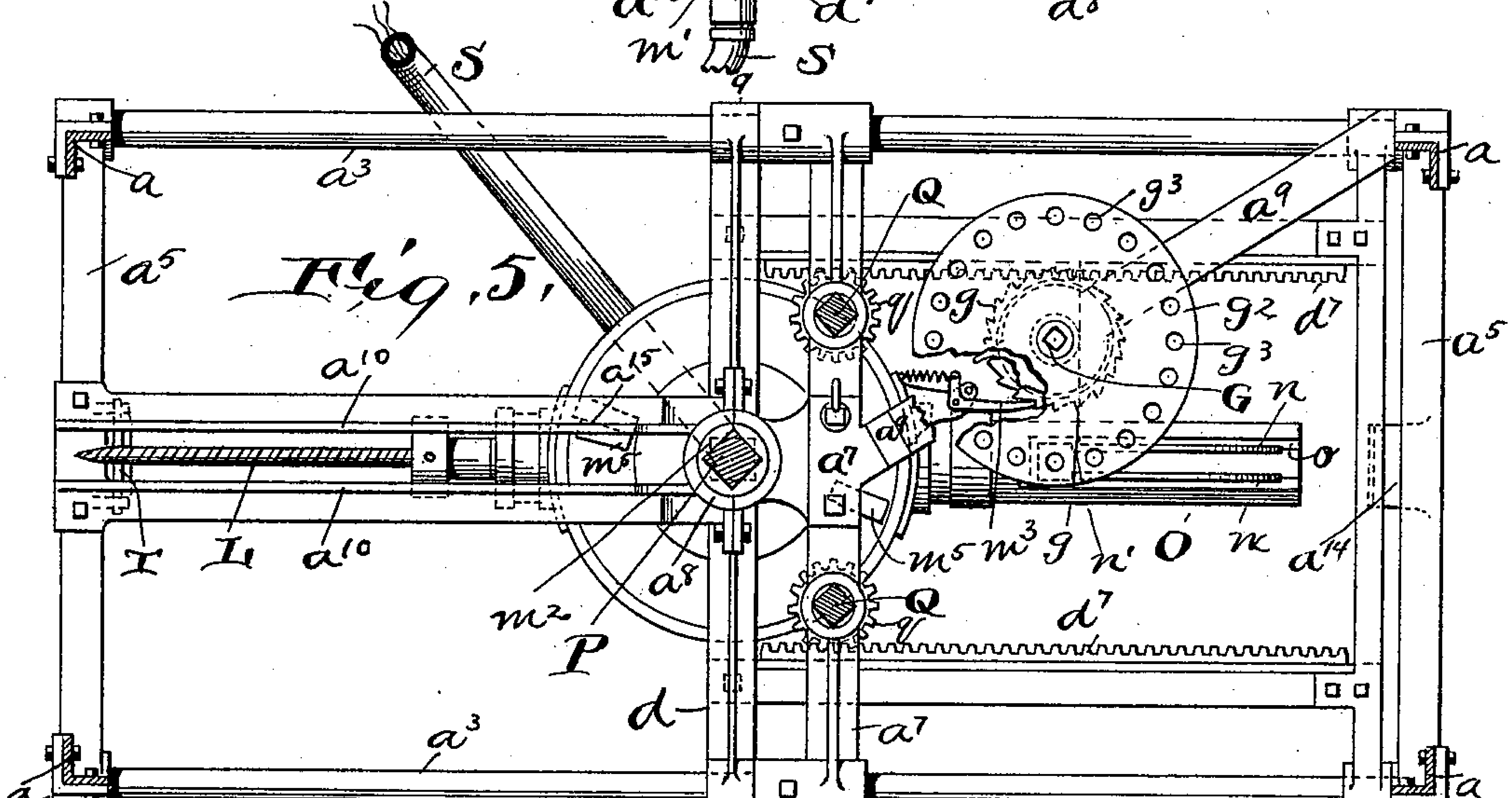

Fig. 5.

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(No Model.) 5 Sheets—Sheet 4.

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MACHINE FOR DRIVING SCREWS UNDER WATER.

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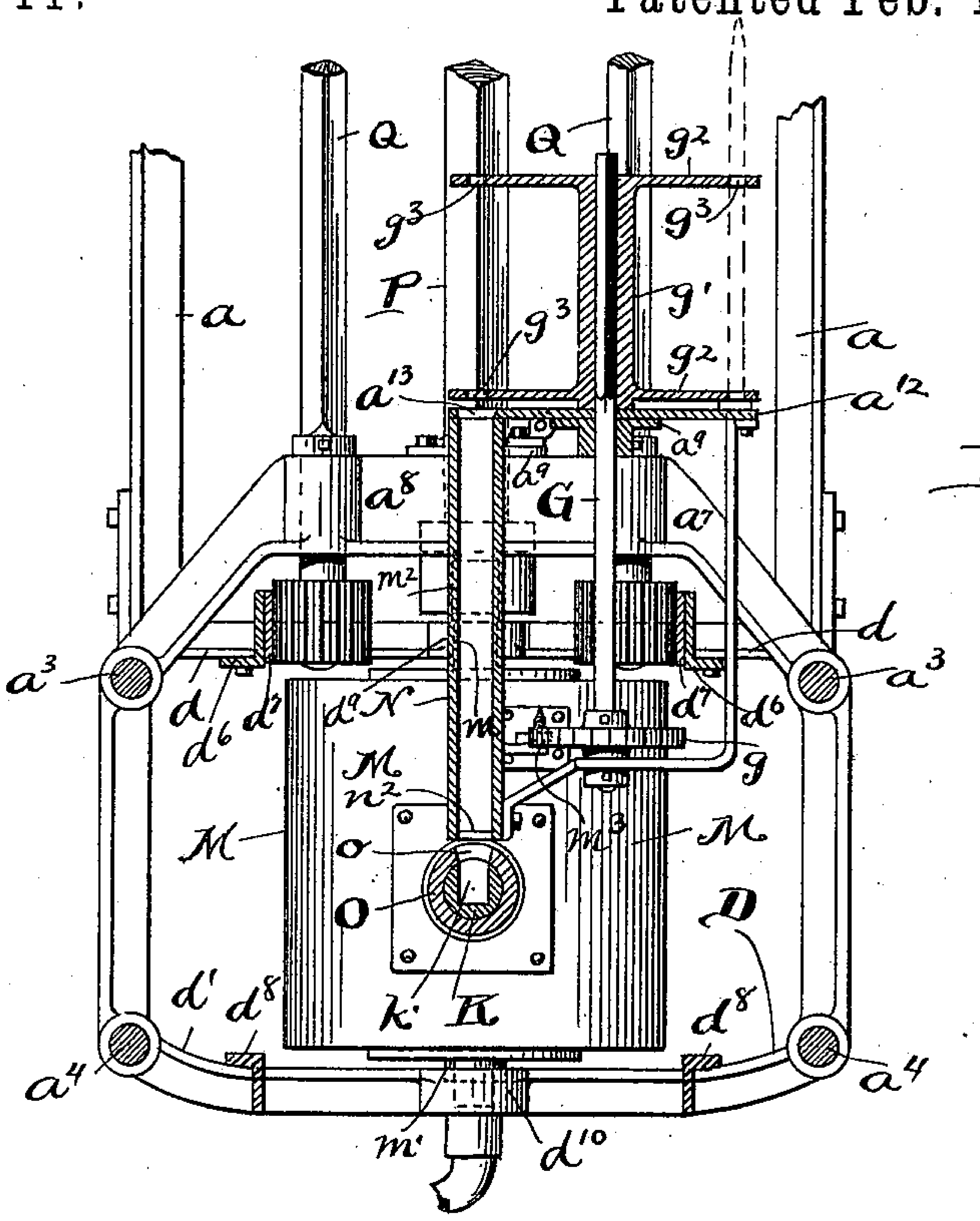

Fig. 6.

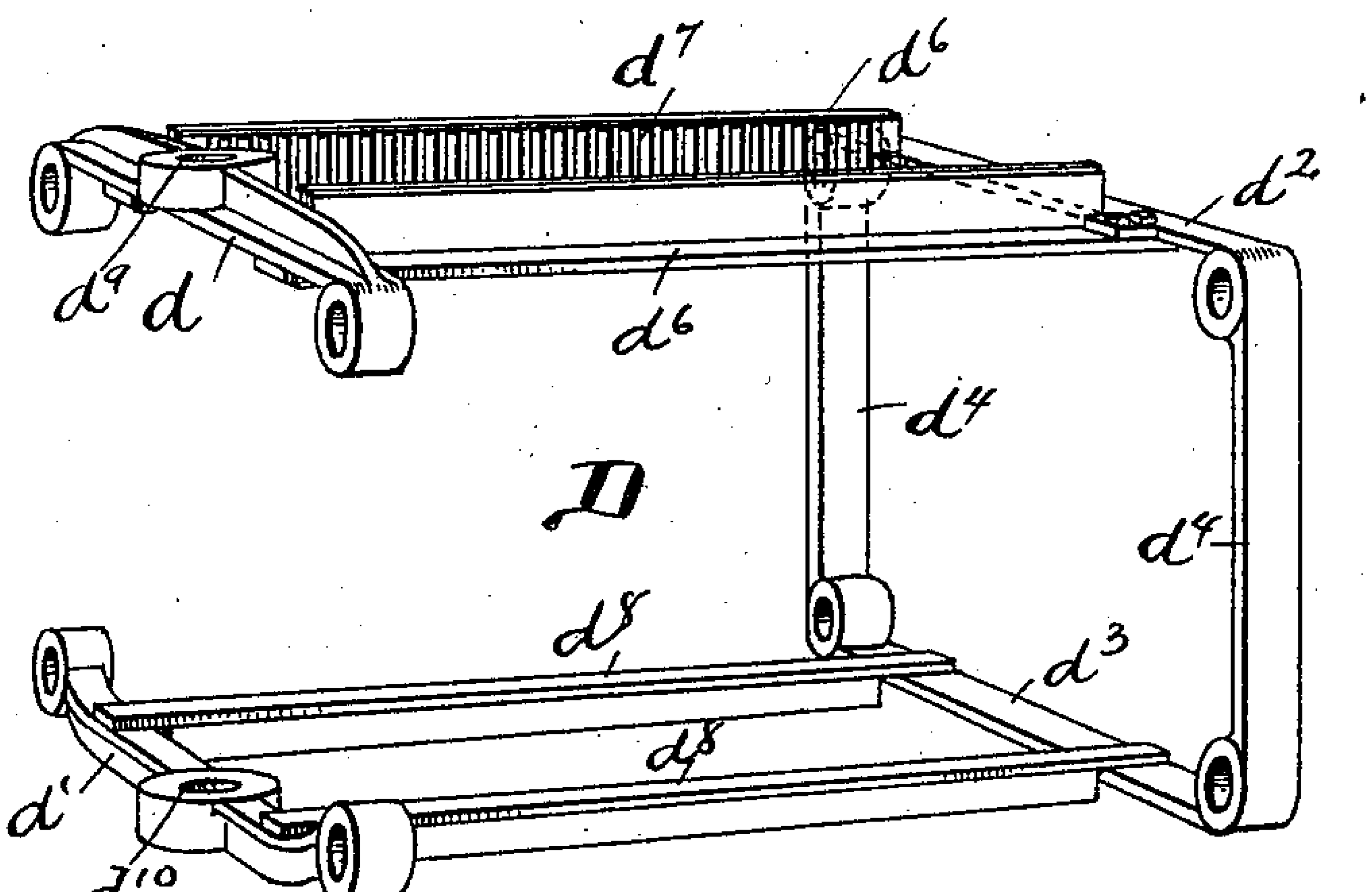

Fig. 7.

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J. J. RAUSCHER & C. H. CLARK.

MACHINE FOR DRIVING SCREWS UNDER WATER.

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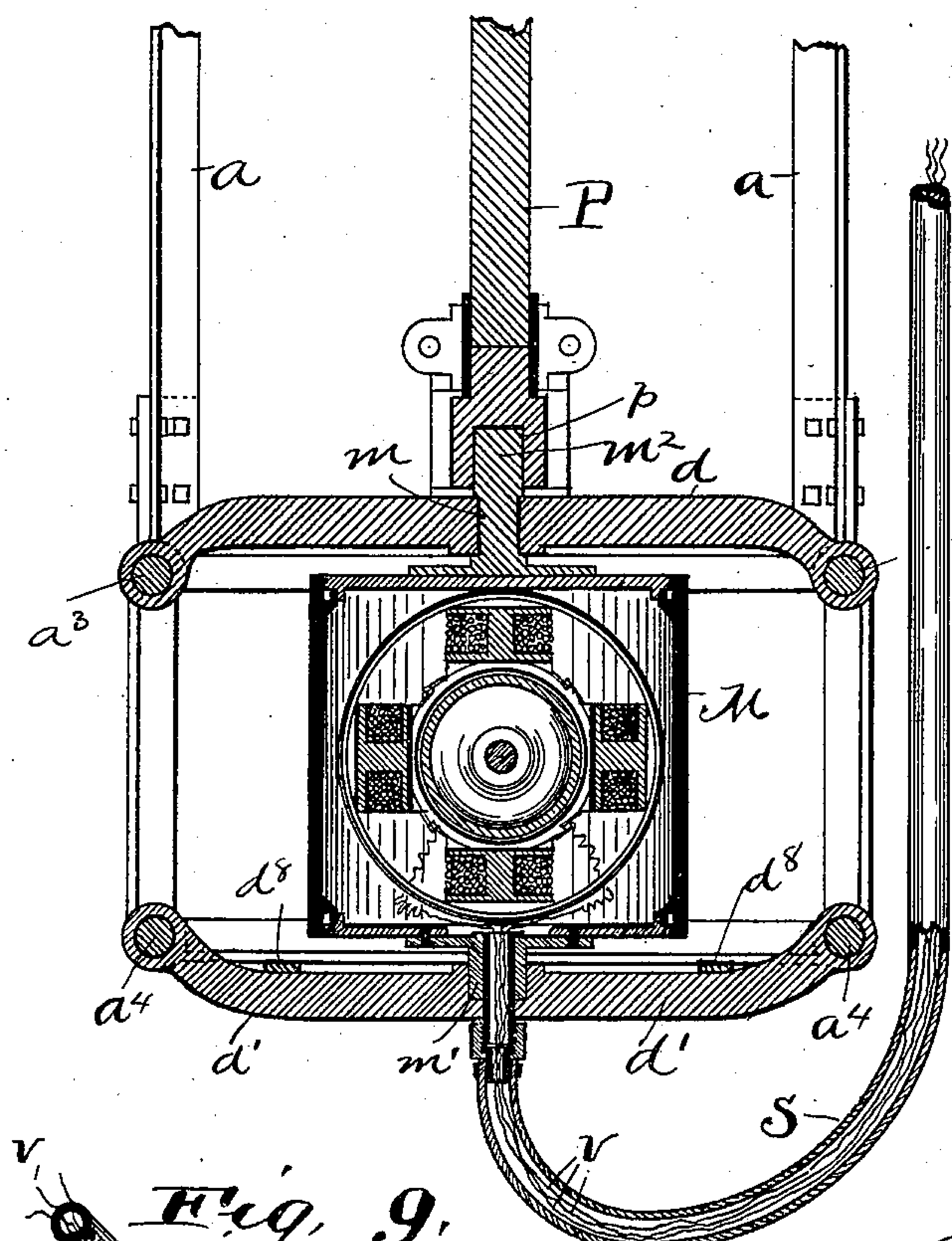

Fig. 8.

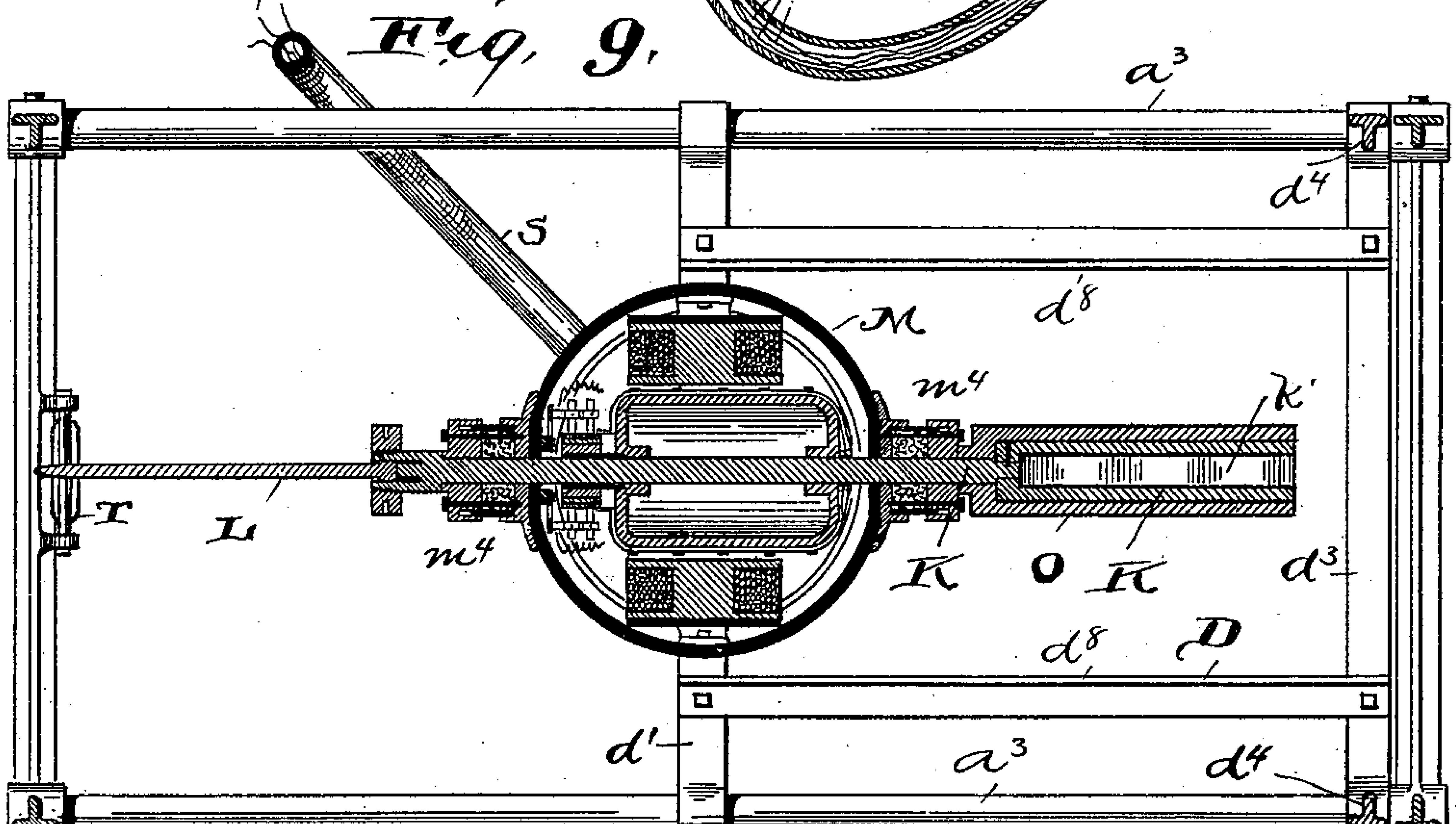

Fig. 9.

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UNITED STATES PATENT OFFICE.

JOHN J. RAUSCHER AND CHARLES H. CLARK, OF CLEVELAND, OHIO.

MACHINE FOR DRIVING SCREWS UNDER WATER.

SPECIFICATION forming part of Letters Patent No. 599,011, dated February 15, 1898.

Application filed May 17, 1897. Serial No. 636,850. (No model.)

To all whom it may concern:

Be it known that we, JOHN J. RAUSCHER and CHARLES H. CLARK, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Machines for Driving Screws Under Water; and we do hereby 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.

Our invention relates to a machine capable of drilling holes under water in the facing-planks of breakwaters and like structures and of introducing lag-screws into said holes and driving them in, to the end that said facing-planks shall be secured firmly to said breakwater.

The machine, as shown, includes a vertically-adjustable skeleton frame which hangs in the water from suitable supports on the breakwater, a sliding carriage supported upon that part of the frame which is normally under water, a horizontal shaft having a drill on one end and a screw-driver on the other, a shaft-supporting device which is mounted on said carriage on a vertical axis, whereby either end of the shaft may be turned toward the breakwater, and suitable mechanism adapted to be operated or controlled from above for imparting motion to said parts, together with means for presenting the screws to and holding them in operation relative to the screw-driving end of the shaft, and it also includes many subordinate parts intended to facilitate the operation of the machine, as hereinafter described.

The invention consists in the combination of parts above recited and in the other combinations and subcombinations which are hereinafter described, and pointed out definitely in the claims.

In the drawings, Figure 1 is an end elevation of our machine in operative position on a breakwater. Fig. 2 is an enlarged end elevation of the upper end of the machine. Fig. 3 is a plan view of the parts shown in Fig. 2. Fig. 4 is an enlarged end view of the lower or under-water part of the machine. Fig. 5 is a sectional plan view showing the parts which are shown in Fig. 4. Fig. 6 is a sectional end elevation of the parts shown in Figs. 4 and 5. Fig. 7 is a perspective view of the submerged carriage. Fig. 8 is a sectional view on line 9 9 of Fig. 5, and Fig. 9 is a sectional view on line 10 10 of Fig. 4.

The skeleton frame is indicated by A, and it includes four vertical corner-posts a, preferably made of angle-iron, and suitable bracing and connecting beams for holding said posts in fixed relation to one another. It is not material to the invention in what manner these four posts are connected. We have shown, however, beams a', connecting their upper ends, and diagonal braces a^2, which connect each post with its two neighbors. The lower ends of the end posts are connected by horizontal rods a^3 and a^4, arranged one above the other, and the side posts are connected by the side bars a^5. The rods a^3 and a^4 serve as guides for a horizontal sliding carriage D.

The skeleton frame hangs down into the water, being supported wholly or partly by two stiff horizontal beams C, which project laterally from a car E. These beams C are longitudinally movable in guides e, secured to the car, and they are so moved by means of pinions e', mounted on the car, which engage with racks c on the beams. Preferably both pinions are connected by means of two intermediate gears e^2, mounted on the car, whereby both pinions and both beams will be moved simultaneously and equally. The hand-wheel e^4, connected by a shaft e^5 with one of the said gears or pinions, is the means provided for operating both pinions. On each side of these beams C are secured the two standards c'. In each pair of standards a horizontal shaft F is mounted, the two shafts being connected by the two gears f, secured to them, whereby the rotation of one shaft is necessarily accompanied by a corresponding rotation of the other. To each shaft F are fixed two pinions f', which engage with the vertical racks a^6, secured to the corner-posts. By means of these racks and pinions the frame A is raised or lowered, and it is guided in a substantially vertical path by the annular flanges f^2 on the sides of said pinions, and by the flanged wheels c^2, mounted on bracket-arms c^3, which are secured to beams C.

Preferably the entire frame A is counterbalanced by a weight h, secured to one end of a cable H, which cable passes over the two sheaves e^6, which are mounted in arms e^7, projecting from opposite sides of the car. This cable is attached to the spider a^7 at the lower end of the frame A. This relieves the pinions and racks of unnecessary strain. Both shafts F may be rotated by means of a hand-wheel f^3 on one of them, and it is prevented from rotating in the other direction by a ratchet f^4 and pawl c^{15}.

D represents a skeleton carriage which slides upon the four rods a^3 a^4. This carriage consists of two front transverse bars d d', two rear transverse bars d^2 d^3, two vertical bars d^4, connecting bars d^2 d^3, two longitudinal bars d^6, connecting the bars d d^2 and carrying racks d^7, and two longitudinal bars d^8, connecting the bars d' d^3. This construction is adopted because it makes a light but rigid carriage, which is easily operated and does not interfere with the operation of other parts; but any other suitable construction might be substituted.

A spider a^7 is rigidly fastened to the two rods a^3 a^3, and the spider consists of a transverse beam a^8, a horizontal diagonal beam a^9 is connected at its rear ends with said beam a^8 and one of the corner-posts, and two parallel longitudinal bars a^{10} are connected with said beam a^8 and with the front bar a^5. Several shafts to be described are journaled in this spider, which forms a rigid part of the frame A.

A shaft K is journaled in what we will generically term a "shaft-supporting device" M, which in the form shown is a cylindrical casing having vertical trunnions m m', which are respectively mounted and adapted to turn in bearings d^9 d^{10} in the two transverse carriage-bars d d'. To one end of this shaft a drill L is secured, while the other end is in the form of a wrench for driving a lag-screw. This wrench end is surrounded by a sleeve O, which is fixed to the shaft-supporting device. A longitudinal slot o is made through the upper wall of said sleeve. In that part of the shaft which the sleeve embraces a square groove k is made which is coextensive with the slot o.

The upper trunnion m of the shaft-supporting device above its bearing is made square, as at m^2, and this square end is adapted to enter a transverse wrench-slot p in the lower end of a vertical shaft P, which shaft is journaled in the spider a^7 and in the upper end of frame A. This shaft is preferably square, and a sprocket-wheel p', which embraces said shaft, is compelled to rotate with it, although the shaft may move endwise through the said sprocket. This sprocket is secured to a sleeve p^6, which is mounted in a bearing c^5 on a cross-bar c^6, which extends between and is secured to the beams C. The shaft P may be turned by a hand-wheel p^3 and sprocket-wheel p^4, both secured to shaft p^2, which is mounted in a cross-bar c^{16}, and a chain p^5 transmits motion from sprocket p^4 to sprocket p'. This enables the operator to turn the shaft-supporting device M upon its vertical axis, so as to present either the drill end or the screw-driving end of shaft K to the face of the breakwater.

Two vertical shafts Q, which are mounted in the spider a^7 and in the upper end of the frame A, have secured to them near their lower ends the pinions q, which engage with the racks d^7, wherefore by turning these shafts the carriage may be moved toward or from the face of the breakwater. The shafts are compelled to revolve simultaneously in reverse directions by the meshing gears q', secured to them, and by other meshing gears q^2 q^3, which are secured to the lower ends of sleeves q^4, which embrace the square shafts Q, and are mounted in the cross-bar c^6 in such manner that they cannot move longitudinally in their said bearings. The shafts may therefore slide up and down through the sleeves. On one sleeve q^4 is a bevel-gear q^5, which meshes with a bevel-gear r, fast on a shaft R, which shaft is mounted in brackets c^{10} c^{11} on one beam C. By revolving this shaft both shafts Q are revolved in one direction or the other, with the result that the carriage D is moved forward or backward.

The lag-screws are automatically fed into the grasp of the driving end of the shaft K by the following mechanism: A vertical shaft G is mounted in the spider a^7. On its lower end is a ratchet-wheel g, with which a pawl m^3, carried by the shaft-supporting device M, engages when the carriage is moved backward. On the upper end of this shaft is a spool g', in the flanges g^2 of which are holes g^3. Below the lower flange is a fixed plate a^{12}, on which the heads of the lag-screws rest and slide when the bodies extend up through said holes. In this plate is a hole a^{13}, and below this hole a tube N is fixed. In the rear side of this tube is a slot n', wide enough for the body of the lag-screws to slide through, but not wide enough for the heads to pass through. The lower end of this tube is arranged just over the slot o in sleeve O. Two curved parallel guide-bars n are secured to the tube for the purpose of guiding into slot o the body of any lag-screw which falls out of slot n'. When by the action of the pawl m^3 on the ratchet g, the shaft G is turned to bring the head of the lag-screw over said tube N, the screw drops head first down said tube. The head strikes the shoulder n^2 at the lower end of the tube, wherefore the screw is upset. The head drops into the slot o in the sleeve O and the shank swings over, guided between the parallel bars n, and also enters said slot. When the shaft K is turned to bring the groove k therein in line below said slot o, the screw falls into said groove, its end projecting beyond the end of the shaft. The end of the screw may engage with the inclined plate a^{14} on the frame A, thereby holding the screw back in the shaft.

While any suitable means may be employed to rotate the shaft K without departing from the invention, we prefer to rotate the same by an electric motor which is contained in a water-tight casing M. (In such event this casing is the shaft-supporting device.) The shaft extends outside of the case through packed boxes m^4. The conducting-wires may extend down to the casing through a flexible pipe S, which is secured to the casing, preferably to the lower end of trunnion m', which in that case is made tubular. This pipe also furnishes an air-passage for ventilating the motor-casing. The upper end of this pipe is secured to a bracket c^{12}, secured to one of the bars C.

Any variety of electric motor may be used; but there are practical objections to employing a reversing motor. When a motor which can revolve in one direction only is used, it is necessary to employ either a left-hand drill L or left-hand lag-screws.

The conductor-wires v, which pass up through the tube S, go to a switch-box W on the car. The current may be supplied from a rail X on the breakwater through a trolley Y on the car.

The operation of the described mechanism will be as follows: The reservoir—that is to say, the flanged spool g'—is filled with lag-screws and then the frame A is lowered to the proper point. The facing-planks Z are placed and held by any suitable means. The shaft K, with its drill end facing said plank, is rotated and the carriage D is moved forward, the result being that a horizontal hole is made in the plank and breakwater. The carriage is now moved backward to the end of its path. Just before it stops the pawl m^3 strikes the ratchet g and turns the shaft G, thereby causing the release of a lag-screw, which falls, as before described, into the screw-driving end of the shaft. The square end of the upper trunnion m has entered the slotted end of the shaft P, which shaft is then turned one-half of a revolution. This turns the cylinder M until a stop m^5 thereon strikes a stop a^{15} on the spider a^7. The lag-screw strikes the beveled upper end of a swinging lever T, which lifts the end of said screw into line with the hole which has been drilled. The carriage D is then moved forward a short distance, sufficient to start the screw, the shaft K being simultaneously turned. This of course turns the screw, which as it continues to turn after the carriage is stopped screws into the hole and withdraws itself from the shaft K. When the screw has been driven in, the carriage is moved backward to the end of its path, the square end of trunnion m entering the wrench end of shaft P. The shaft-supporting device is now turned backward one hundred and eighty degrees until the stop m^5 strikes stop a^{15}. Thereafter these motions are repeated, the car E or frame A, or both, being previously moved to bring the shaft K into line with the point where a screw should be driven. During the forward and backward movements of the carriage the square end of trunnion m moves between the parallel bars a^{10}, wherefore the turning of the shaft-supporting device upon its axis is prevented. The car may be moved by the worm e^{10} on vertical shaft e^{11}, mounted on the car, and the worm-wheel e^{12}, secured to one of the axles e^{13}.

Many modifications of the construction of various parts described may be made, and especially may the mechanism for imparting the described motion to the different moving parts be varied without departing from the invention.

Having described our invention, we claim—

1. In a machine for driving screws under water, in combination, a vertically-movable depending frame, a horizontally-sliding carriage supported on the lower end of said frame, a shaft-supporting device mounted on a vertical axis on said carriage, a rotatable shaft mounted in said shaft-supporting device having a drill at one end and a wrench at the other end, and mechanisms for raising and lowering the frame, for sliding the carriage, for turning the shaft-support, and for rotating the shaft, substantially as specified.

2. In a machine for driving screws under water, in combination, a depending frame, a horizontally-sliding carriage supported at the lower end of said frame, a shaft-support mounted on said carriage, a rotatable shaft mounted in said support and having a wrench at one end, mechanism for automatically feeding lag-screws to said wrench, and mechanism for raising and lowering said frame, for moving said carriage and for rotating said shaft, substantially as specified.

3. In a machine for driving screws under water, in combination, a depending frame, means for raising and lowering it, a horizontally-sliding carriage supported upon said frame at the lower end thereof, a water-tight electric-motor casing mounted on a vertical axis on said carriage, the inclosed motor, the motor-shaft projecting from both ends of said casing, a drill secured to one end of the shaft, a wrench on the other end of said shaft, mechanism for automatically feeding lag-screws to said wrench, and mechanisms adapted to be operated at the upper end of said frame for turning the motor-casing upon its axis, and for moving said carriage, substantially as specified.

4. In a machine for driving screws under water, in combination, a depending frame, a horizontally-sliding carriage mounted on the lower end thereof, a motor-casing mounted on a vertical axis on said carriage, a motor in said casing the shaft of which projects at both ends from said casing, a drill secured to one end of said shaft, a longitudinally-slotted sleeve fixed to the motor-casing, and surrounding the other end of the shaft, which end of the shaft has a longitudinally-extended

square groove, and mechanisms for imparting motion to said several movable parts, substantially as specified.

5. In a machine for driving screws under water, in combination, the depending frame, a horizontally-sliding carriage mounted thereon, a shaft having a longitudinally square groove, a non-rotating sleeve having a longitudinal slot through its upper wall, a lag-screw reservoir, a guideway therefrom to the slot in the sleeve, and means for discharging said screws singly into the said guideway, and mechanisms for imparting motion to the carriage and shaft, substantially as specified.

6. In a machine for driving screws under water, in combination, the sliding carriage, its supporting depending frame, a shaft-supporting device mounted on a vertical axis on said carriage, means for periodically turning said support upon its axis, a shaft having a longitudinal square groove, a sleeve fixed to the shaft-supporting device, embracing said shaft and having a longitudinal slot in its upper wall, a rotating spool for supporting lag-screws in a vertical position, a fixed plate on which the heads of said screws rest, said plate having a hole through which they may drop, a slotted guide-tube extending from said hole to the slot in the sleeve, substantially as specified.

7. In a machine for driving screws under water, in combination, a depending frame, a sliding carriage at the lower end thereof, a shaft-supporting device having vertical trunnions which are mounted on said carriage, the upper trunnion having a squared end, and a shaft having a slot in its lower end which is adapted to engage with said squared end of the trunnion, substantially as specified.

8. In a machine for driving screws under water, in combination, a depending frame, a sliding carriage at the lower end thereof, a horizontal rack on said carriage, a pinion mounted on the frame, mechanism for operating said pinion, a shaft-supporting device mounted on said carriage, and a wrench-shaft mounted thereon, substantially as specified.

9. In a machine for driving screws under water, in combination, a shaft having a square longitudinal groove, a longitudinally-slotted sleeve embracing the same, combined with the following mechanism for feeding lag-screws to said shaft, viz., a spool having vertically-perforated flanges, a horizontal plate, having a hole, below said spool, a slotted tube extending from said hole to the slot in the sleeve, and parallel guide-bars, substantially as specified.

10. In a machine for driving screws under water, in combination, a shaft having a longitudinal square groove, a longitudinally-slotted sleeve embracing it, a substantially vertical slotted guide-tube having the shoulder *g*, means for dropping lag-screws head first into said tube, and the parallel guide-bars, substantially as specified.

11. In a machine for driving screws under water, in combination, a depending frame, a horizontally-movable carriage mounted in the lower end thereof, a water-tight casing carried by said carriage, a motor inclosed therein, the motor-shaft projecting at both ends from the casing through water-tight bearings, a flexible ventilating and conductor-containing tube connected with said casing, substantially as specified.

12. In a machine for driving screws under water, in combination, a car, longitudinally-movable beams projecting from the side thereof, a depending frame having vertical racks, pinions mounted on said beams engaging with said racks, mechanism for operating said pinions, and mechanism carried by said frame, at its lower end, for drilling holes and driving screws, substantially as specified.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN J. RAUSCHER.
CHARLES H. CLARK.

Witnesses:
E. L. THURSTON,
ALBERT H. BATES.