(No Model.) 3 Sheets—Sheet 1.

A. E. HALL.

ELECTRICAL WATER ELEVATOR FOR BUILDINGS.

No. 393,828. Patented Dec. 4, 1888.

Fig. 1.

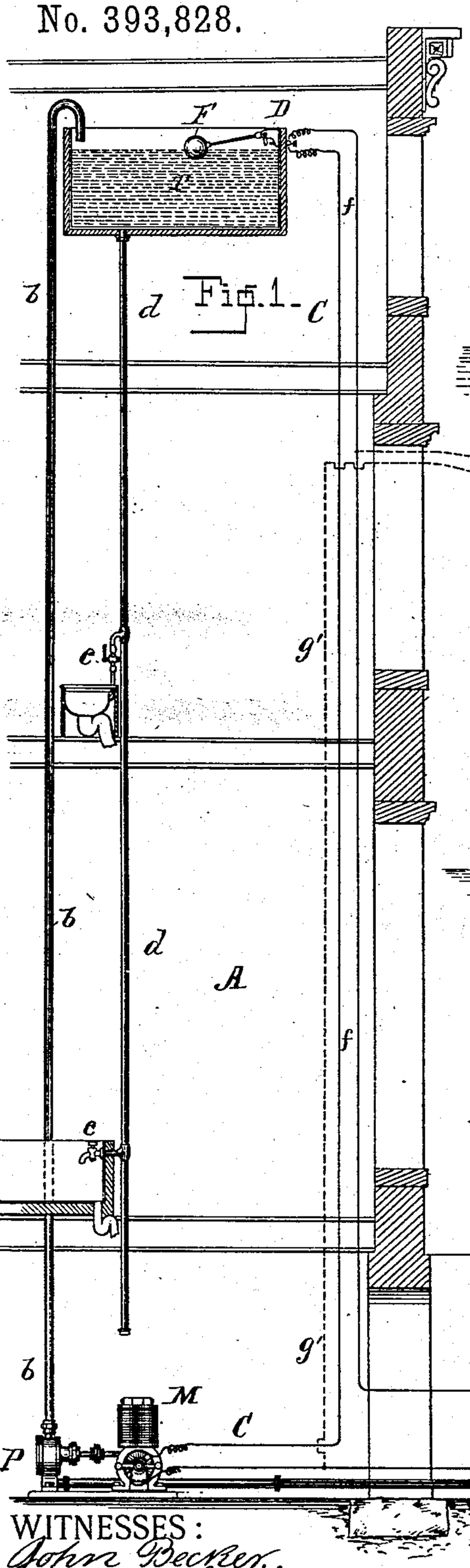


Fig. 5.

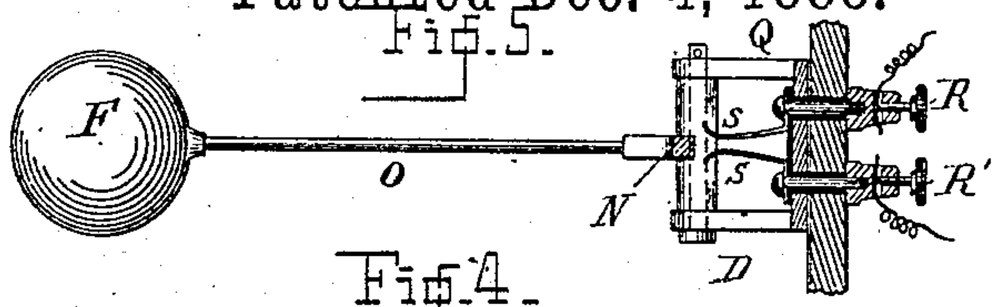


Fig. 4.

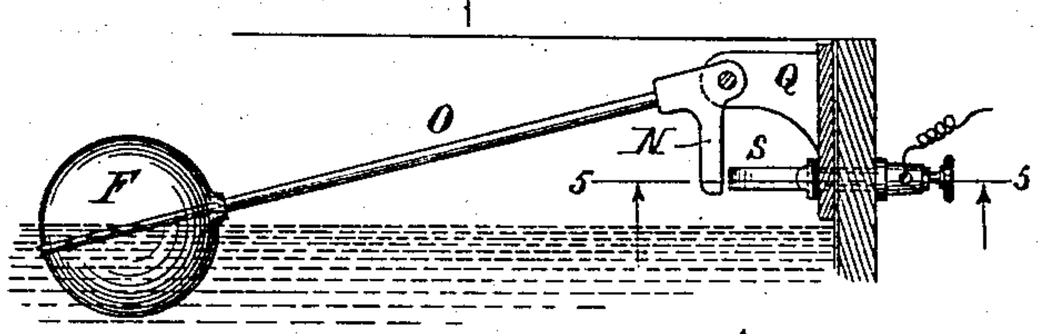
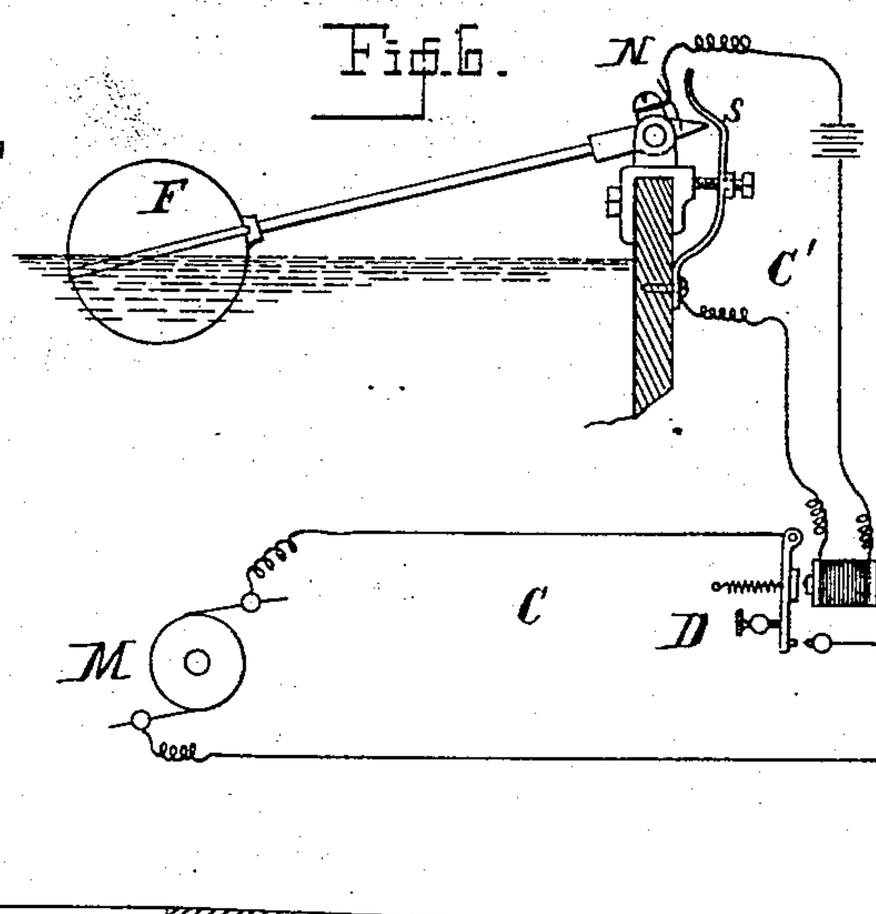


Fig. 6.



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Arthur G. Brown & Co

(No Model.) 3 Sheets—Sheet 2.

A. E. HALL.

ELECTRICAL WATER ELEVATOR FOR BUILDINGS.

No. 393,828. Patented Dec. 4, 1888.

Fig. 2.

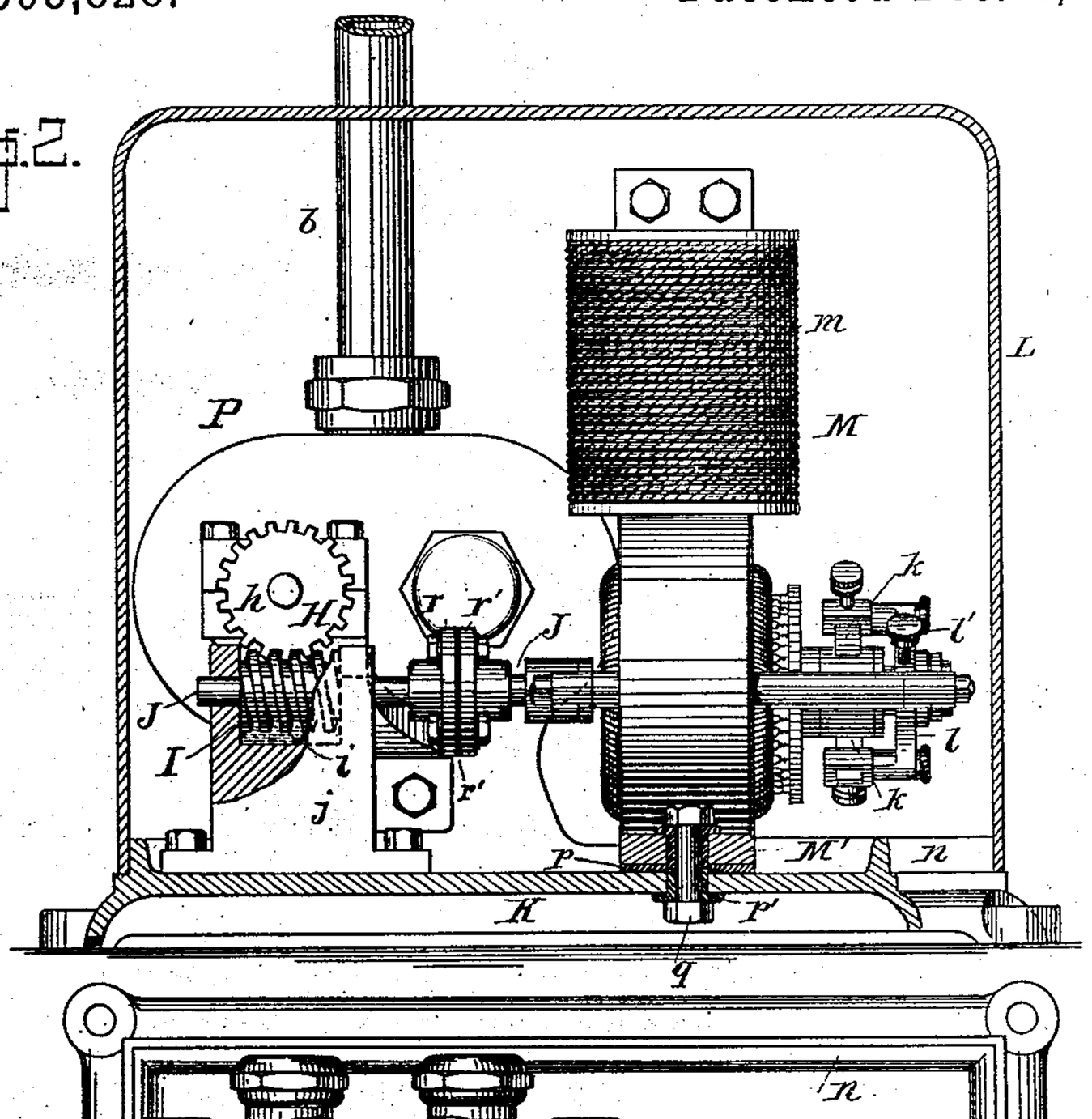

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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ELECTRICAL WATER ELEVATOR FOR BUILDINGS.

No. 393,828. Patented Dec. 4, 1888.

Fig. 7.

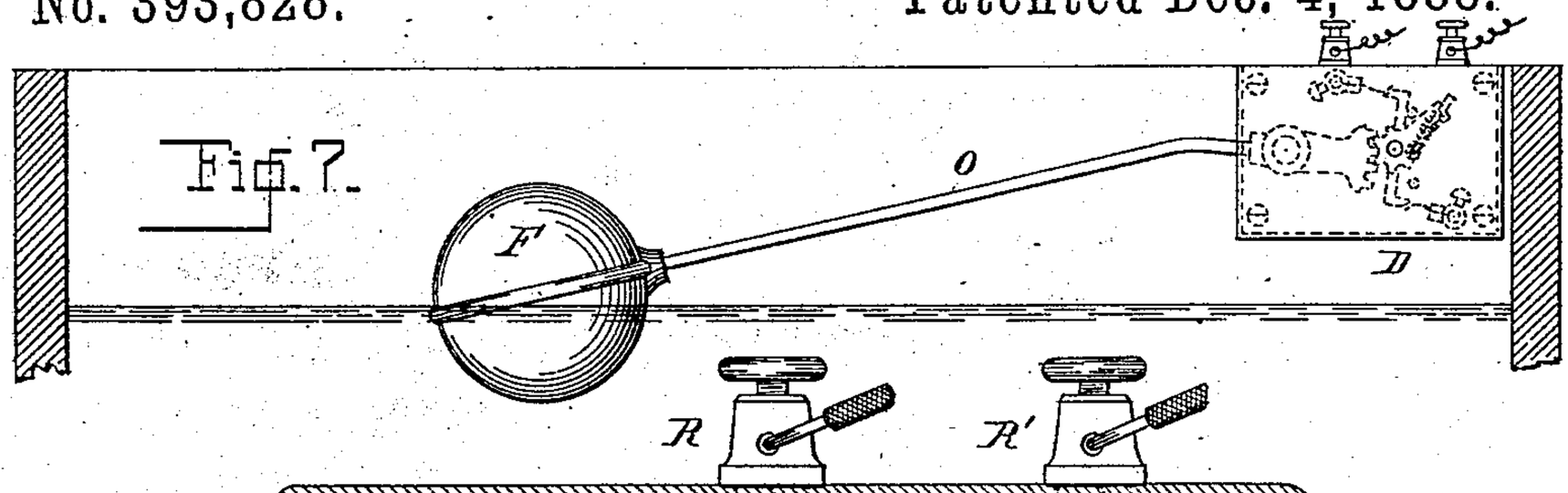


Fig. 8.

Fig. 9.

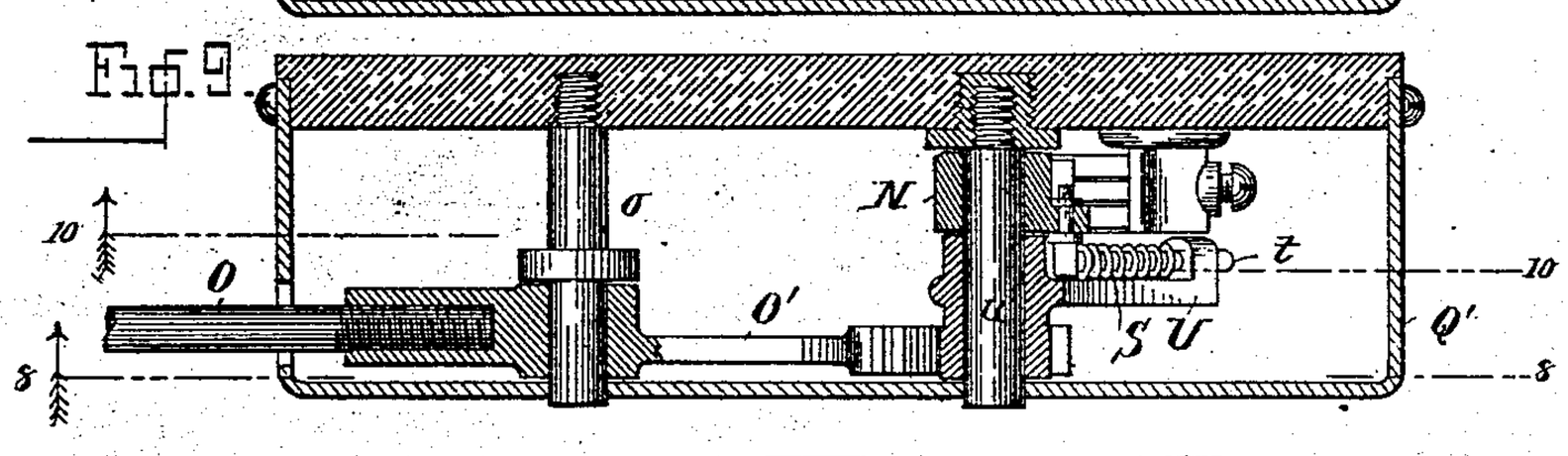
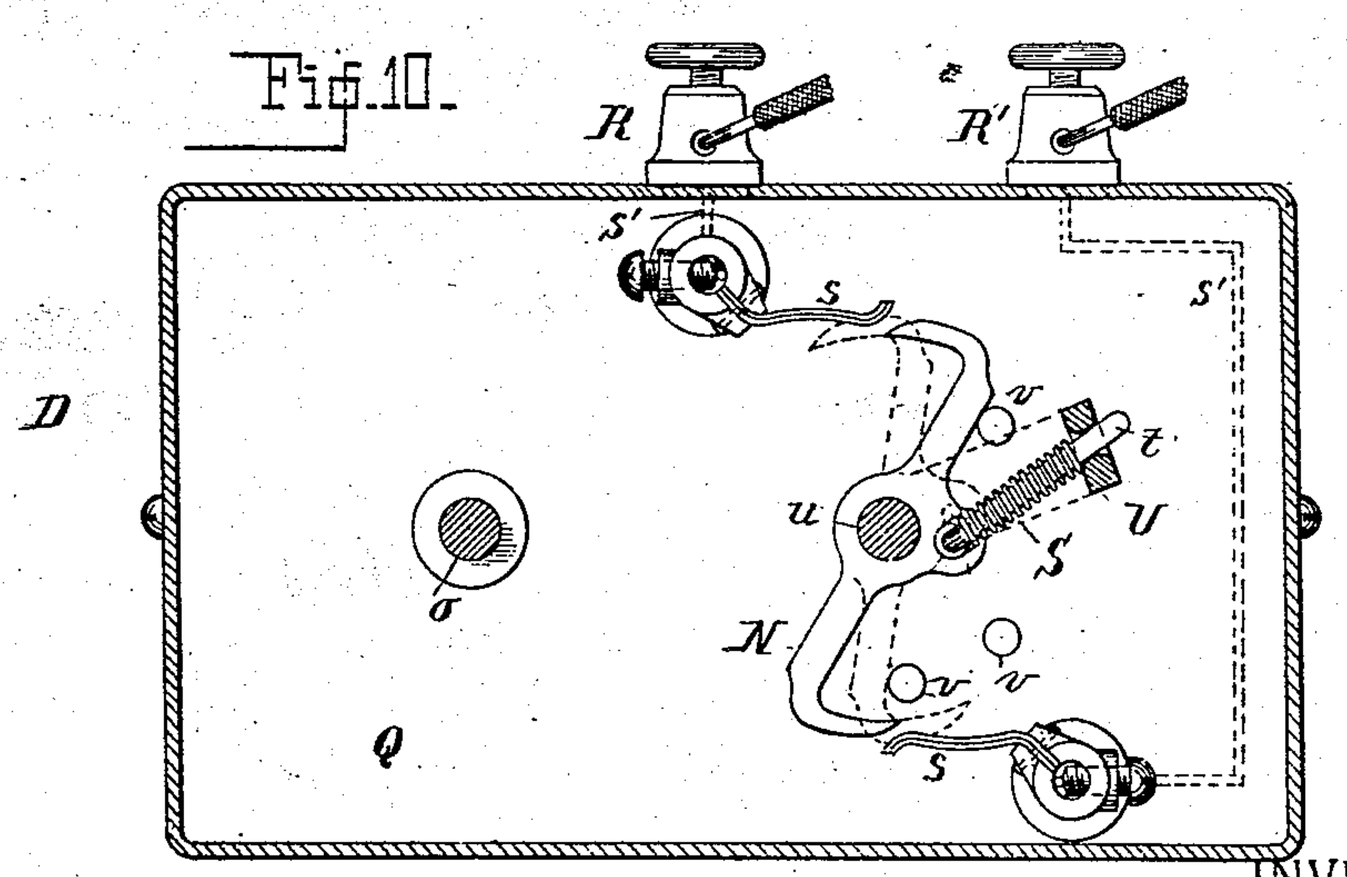


Fig. 10.



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UNITED STATES PATENT OFFICE.

ALBERT E. HALL, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO THE HALL ELECTRIC PUMP COMPANY, OF SAME PLACE.

ELECTRICAL WATER-ELEVATOR FOR BUILDINGS.

SPECIFICATION forming part of Letters Patent No. 393,828, dated December 4, 1888.

Application filed March 19, 1888. Serial No. 267,591. (No model.)

To all whom it may concern:

Be it known that I, ALBERT E. HALL, of Plainfield, Union county, New Jersey, have invented certain new and useful Improvements in Electrical Water-Elevators, of which the following is a specification.

This invention relates to means for automatically elevating water to tanks in buildings and elsewhere, from which tanks it is drawn for the usual purposes of water-supply. In those locations where the pressure at which the water is delivered from street-mains or other sources of supply is insufficient to force it to the upper stories of the building, so that it is necessary to provide an elevated tank and pump the water to such tank, it has been customary heretofore to elevate the water by a pump driven either by hand or by power and operated at intervals, so that the tank is alternately filled and drawn from and refilled.

My invention provides a water-elevating pump driven by means of an electromotor fed from any suitable source of electric energy, and so arranged and connected as to be put into operation automatically by the drawing down of the water-level in the tank.

My invention relates not only to the general system by means of which this result is attained, but also to the details of the apparatus employed in carrying that system into practice.

My invention involves a suitable force-pump connected with the source of water-supply, and having its delivery-pipe extending up to and emptying into the tank, which will ordinarily be placed at the top of the building, an electromotor geared to this pump, so that when its armature revolves the pump shall be driven, and having its terminal brushes connected to any suitable source of electrical current—such, for example, as the electric-lighting circuits commonly used in cities and towns, and a circuit-closer operated by the rise and fall of a float in the elevated tank for closing the circuit through which the electromotor is driven.

In the accompanying drawings, Figure 1 is a vertical section of a building, showing the general arrangement of the elevated tank, water-pipes, and electric-circuit wires. Fig. 2 is an elevation of the pump and electromotor and their connecting-gearing, the base-plate and inclosing-case thereof being in vertical section. Fig. 3 is a plan of this apparatus with the case removed. Fig. 4 is a fragmentary section of the elevated tank, showing the float and one construction of circuit-closer; and Fig. 5 is a transverse section on the line 5 5 in Fig. 4, looking upward. Fig. 6 shows another construction of the circuit-closer and a modified arrangement of the circuit-connections. Fig. 7 is a fragmentary longitudinal section of the tank, showing the preferred construction of circuit-closer in elevation. Fig. 8 is an enlarged elevation of the circuit-closer, with the inclosing-case thereof in section, on the line 8 8 in Fig. 9. Fig. 9 is a horizontal section of the circuit-closer cut on the line 9 9 in Fig. 8. Fig. 10 is a front view of the circuit-closer cut on the line 10 10 in Fig. 9.

Referring to the drawings, and especially to Fig. 1, let A designate a suitable building or structure to which my invention is applied; B, a source of water—as, for example, a street-main; T, an elevated water-tank; P, a pump for pumping water up to said tank; M, an electromotor for driving said pump; C, the electric circuit for conducting electric energy to said motor; D, a circuit-closer or breaker for controlling said circuit, and F a float in the tank T for operating by its rise and fall the circuit-breaker.

From the street-main B the usual service-pipe *a* leads into the building and communicates with the suction-inlet of the pump P, and from the pump a delivery or discharge pipe, *b*, leads up through the building to the tank T, into which it discharges water. From the bottom of the tank T the usual water-delivery pipe, *d*, extends down and communicates with the several faucets or cocks *c c*, by means of which water is drawn off.

The electromotor M is driven by means of an electric current taken from the usual electric-lighting circuit in the case of a city or town supplied therewith. If, as is preferred, it is operated from a low-tension circuit adapted for feeding incandescent lamps in multiple arc, the circuit-connections are made as shown by full lines in Fig. 1.

E designates the street-main carrying the positive and negative conductors of the main electric circuit, and *e e* designate the branch wires leading therefrom into the building and forming part of the circuit C, which terminates at the respective brushes of the motor. In the arrangement shown in Fig. 1 a loop of this circuit (lettered *f f*,) extends up to the top of the building and is connected to the respective contacts of the circuit-closer D. This circuit-closer, the construction of which will be presently described, is operated by the float F in the tank T in such manner that when the float is lifted it breaks the circuit, and thereby stops the motor M and the pump, and when water is drawn off, and the float consequently descends, the circuit is closed, and the motor automatically starts and operates the pump until the normal water-level in the tank is restored, whereupon the pumping action automatically ceases. Thus the tank is kept full, or very nearly so, without requiring any attention on the part of the occupants of the building, and a full and uniform pressure on the water-pipes of the building is maintained.

In case the motor is to be fed from circuit-wires carried overhead through the streets of the town or city, as arc-light wires are commonly carried, connection is made therewith in the manner shown in dotted lines in Fig. 1, where G designates a street-pole carrying the wires, and *g g* designate the wires connected to the respective main circuit-wires and leading into the building, wherein one of them is joined to one of the wires of the loop *f*, and the other wire, *g'*, extends down to the electromotor.

Figs. 2 and 3 show the preferred construction of the pump and motor. The pump P here shown is a rotary pump of the Holley type, and its operating-shaft (lettered *h*) has fixed to it a worm-wheel, H, with which meshes a worm, I, which is fixed on the armature-shaft J of the electromotor M. This shaft J has bearings in a pillow, *j*, in the top of which is formed a cup or well, *i*, inclosing the worm I, and serving as an oil-receptacle, so that the worm and worm-wheel shall run in oil, and hence be thoroughly lubricated. By employing a worm and worm-wheel the rapid rotation of the armature-shaft is geared down to a slow rotation of the pump-shaft with the minimum amount of gearing, and the electromotor is protected from the effects of any shocks or undue resistance that might be communicated to it from the pump-shaft.

The particular construction of electromotor shown is known as the Daft motor, having an electro-magnetic field-magnet and a Gramme armature. Any suitable construction of electromotor may, however, be used in lieu of the one shown.

k k are the brushes of the commutator on the motor, which are fixed on a cross-bar, *l*, which is adjustable by a set-screw, *l'*, in order to vary the lead of the brushes. The terminal wires of the electric circuit C in Fig. 1 are connected the one directly to one of the brushes *k* and the other through the field exciting-coil *m* and thence to the other brush, *k*, as is usual in electromotors, or any other suitable electrical arrangement may be substituted.

Both the electromotor M and the pump P are mounted on one base plate or frame, K, to which they are firmly screwed or bolted and which is itself provided with screw-holes, by means of which it may be fastened to some solid support in the cellar or other part of the building where the pump is to be located. An inclosing case or box, L, preferably of metal, is placed over the pump and motor, inclosing them and protecting them from injury and from the access of dust. The pump delivery-pipe *b* passes out through a hole in the top of this box. The bottom of the box fits over a flange, *n*, formed on the base-plate K, or is otherwise united to the base-plate, being either simply set thereon or fastened thereto in any suitable manner, as may be preferred. The pump and motor being connected compactly together through the medium of the worm-gearing and being themselves small and compactly made, the base-plate K and its case L take but little room, and the parts may be arranged in some corner of the cellar or other part of the building where they will be out of the way.

My invention admits of the use of a very small pump, owing to the automatic operation of the electromotor, which causes the pumping operation to commence instantly upon the lowering of the normal water-level in the tank, so that as long as the water is being used at all the pump will be kept in operation to replenish the supply, and hence its capacity need not be as great and it need not, consequently, be made as large as if its operation were intermittent, as heretofore, and it were required to rapidly refill the tank.

In order to prevent leakage of the electric current in the event of any grounding of the circuit C or other disarrangement, I provide for the thorough insulation of the motor from the pump and other parts. To this end I insulate the base M of the motor from the plate K by placing between them a strip, *p*, of insulating material, and I insulate the bolts *q*, Fig. 2, by which the motor is bolted to the plate K, from either the motor or the plate, and preferably from both, by means of an insulating-sheath, *p'*, as clearly shown. The armature-shaft J, I divide into two parts or sections, one of which carries the armature and the other of which carries the worm I, and I separate these sections by intervening insulation. The preferred construction is that shown, wherein each section of the shaft terminates in a disk or flange, *r*, between which is placed an insulating-disk, *r'*, and the two disks are fastened together by bolts *q'*, which have insulating-sheaths around them, as shown in Fig. 3. Hence the motor is effectually insulated, so that no electrical connec-

tion can be made with the water-pipes of the building, which, if it occurred, might result in the transmission of electric shocks to the occupants thereof.

Figs. 4 and 5 show the details of a very simple construction of circuit-closer suitable for currents of very low tension. The float F is mounted on a lever, O, which is pivoted to a standard or frame, Q, attached to the upper part of the tank, and the circuit-closing arm N, projecting from this lever, is moved by the vibration of the lever as the float descends between two leaf contact-springs, *s s*, which approach each other, as shown in Fig. 5, and which are insulated from each other and from the standard Q and connected by fastening-screws to binding-posts R R, to which the wires of the circuit C are connected. As the float descends and the arm N passes between the springs, it forms a conducting-bridge between them and closes the circuit, and as the float rises the arm N is drawn out from between the springs and breaks the circuit. This arrangement is not suitable for currents of considerable electro-motive force, as with such, an arc is liable to be formed between the arm N and the contact-springs which will burn or corrode the contacts.

Fig. 6 shows a modification wherein the float F does not directly cause the closing of the circuit C, but causes the closing of an intermediate circuit, C′, energized by a battery, X, which when closed acts by the excitation of an electro-magnet, *x*, to operate the circuit-closer D, which manipulates the circuit C. When the float F is lowered, the arm N touches a circuit-closing spring, *s*, thereby closing the circuit C′ and causing the magnet *x* to attract its armature, and thereby close the circuit C and start the motor and pump. Other means, either electrical or otherwise, may be provided as a connection between the float F and the circuit C, so that this latter circuit need not extend up to the tank T.

Figs. 7 to 10 show the preferred construction of the circuit-closer D for use with currents of considerable electro-motive force. This circuit-closer acts on the principle of storing up power during the first part of the movement of the float either in ascending or descending in order to effect at the end of a predetermined movement the sudden breaking or closing of the circuit. The breaking of the circuit is effected by so wide a movement apart of the contact-surfaces that no arc can form between them. Circuit-closers operating on this general principle are already known to electricians. The float-lever O is fulcrumed on a pin, *o*, and is formed with a toothed sector, O′, meshing with the teeth of a pinion or partial pinion, *u*, to which is fixed a radial arm, U, the end of which is turned back, as shown in Fig. 9, and receives loosely through it the end of a sliding pin, *t*. The pinion *u* and lever U, which are best formed in one piece, as shown, are pivoted on a pin or stud, *u′*, on which is also pivoted a circuit-closing arm or lever, N, (shown best in Fig. 10,) the outer ends of which are arranged to make and break contact with leaf-springs *s s*, which are connected in the manner shown by dotted lines *s′ s′* with the respective binding-posts R and R′. Stops *r r* are arranged to project from the base-plate or standard Q, on which the several parts are mounted, these stops serving to limit the play of both the contact-lever N and the vibrating arm U. This latter has much the wider range of vibration, as shown by dotted lines. The pin *t* is jointed to the hub of the lever N in the manner clearly shown, and is provided with a spring, S, coiled on it, which reacts in one direction against a shoulder on the pin and in the other direction against the turned-back end of the arm U. The pivot *w* of this pin *t* is so placed relatively to the two levers N and U that if both the latter were at midstroke it would stand in a direct line between the axial center on which the levers turn and the center of the hole or socket formed for the end of the pin *t* in the arm U. In either of the extreme positions of the levers N and U, as shown either by full or dotted lines, the pin *t* and the portion of the lever N extending from the pivot *w* to the fulcrum-axis constitute together a toggle-lever, so that the expansive action of the spring S serves to hold the two levers in either relative position. Starting with the lever U in one position, this lever can be swung around nearly to its extreme other position before the pin *t* will be brought into line with the fulcrum-axis; but upon this point being passed the expansive tension of the spring, acting through the toggle-levers, serves to throw the lever N suddenly from one position to the other. On the return movement of the lever U the same action takes place, power being gradually accumulated or stored up by the gradual compression of the spring S until, near the end of the movement, the center is passed, and the spring is enabled to react and suddenly throw the lever N over to its opposite or former position. The float is given a certain limited up-and-down movement, and the opening or closing of the circuit is effected only upon the completion of this movement, the greater portion of the movement being devoted to storing up the power necessary to throw the lever over from one position to the other. When the lever N is in the position for breaking the circuit, its ends are moved so far away from the contact-springs *s* that the formation of an arc between them is impossible. The peculiar advantage of this construction of circuit-closer is found in the fact that the breaking of the circuit is effected suddenly instead of gradually, so that a very slight change in the water-level will not affect the circuit-closer, so that the formation of an arc is avoided and the stopping and starting of the electromotor and pump are less frequent, the pump being started only when the water-level has been drawn down sufficiently to

make it worth while to pump up more water.

Q′ is a box or case inclosing the working parts of the circuit-closer.

My invention renders the supplying of water to elevated tanks automatic and economical, requiring no personal attention or supervision, keeping always a full supply of water and full pressure on the faucets and consuming power only when it is actually needed for the performance of work.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, viz:

1. The combination, with a source of water-supply, an elevated water-tank, and a water-service pipe leading from said tank and having the usual faucets or outlets, of a pump connected to the water-supply and having its discharge-pipe leading to said tank, an electromotor geared to said pump, an electric circuit supplying said motor, a float actuated by the rise and fall of water in said tank, a quick-action circuit-closer for manipulating said circuit, adapted to open it suddenly and widely to prevent the formation of an arc, and power-storing connections intervening between the float and said circuit-closer, whereby, on the rise of the float, power is stored up for finally breaking the circuit, and on the descent of the float the circuit is closed and the pump thereby started in order to refill the tank.

2. The combination, with a source of water-supply, an elevated water-tank, and a water-service pipe leading from said tank and having the usual faucets or outlets, of a pump connected to the water-supply and having its discharge-pipe leading to said tank, an electromotor geared to said pump, the main distributing-conductors of an electric lighting or power circuit, a branch circuit looped therefrom and connected to said motor for diverting a portion of current to drive the latter, a float actuated by the rise and fall of water in said tank, a quick-action circuit-closer for manipulating said circuit and adapted to open it suddenly and widely to prevent the formation of an arc, and power-storing connections intervening between the float and said circuit-closer, whereby on the rise of the float power is stored up for finally breaking the circuit, and on the descent of the float power is stored up for closing the circuit and thereby starting the pump in order to refill the tank.

3. The combination, with a source of water-supply, an elevated water-tank, and a water-service pipe leading from said tank and having the usual faucets or outlets, of a pump connected to the water-supply and having its discharge-pipe leading to said tank, an electromotor geared to said pump, the main distributing-conductors of an electric lighting or power circuit, a branch circuit looped therefrom and connected to said motor for diverting a portion of current to drive the latter and extended also up to said elevated tank, a quick-action circuit-closer at said tank in connection with said branch circuit, and a float actuated by the rise and fall of water in said tank and connected to and actuating said circuit-closer, whereby said branch circuit is closed by the descent of the float and the pump thereby started to refill the tank and is broken by the ascent of the float when the tank is refilled.

4. The combination of a pump, a worm-gear on the driving-shaft thereof, an electromotor, a worm on its armature-shaft gearing with said worm-gear, and an insulation dividing said armature-shaft between said worm and armature, whereby the electromotor is insulated from the pump.

5. The combination of an electromotor and a pump, a base to which both are fastened, gearing through which the pump is driven from the motor, and an insulation for the motor, whereby it is insulated from the pump.

6. The combination, with a water-tank, of a float therein and a circuit-closer operated by said float and constructed with a circuit-closing lever, and a spring intervening between said lever and the float-lever and adapted to be compressed during the first movement of the float and to act upon said circuit-closing lever before the end of the movement of the float to throw said lever suddenly from one extreme position to the other, and thereby to suddenly break or close the circuit.

7. The combination, with a tank and float, of a circuit-closer consisting of a vibrating lever, U, connected to and moved by said float, a circuit-closing lever, N, a rod, *t*, jointed between said levers, a spring, S, acting on said rod, and a contact-spring, *s*, arranged to be touched by said lever N in one position and out of contact therewith in its other position.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALBERT E. HALL.

Witnesses:
ARTHUR C. FRASER,
GEORGE H. FRASER.