No. 760,324. PATENTED MAY 17, 1904.

A. D. ELLIOTT.

PUMP.

APPLICATION FILED SEPT. 14, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

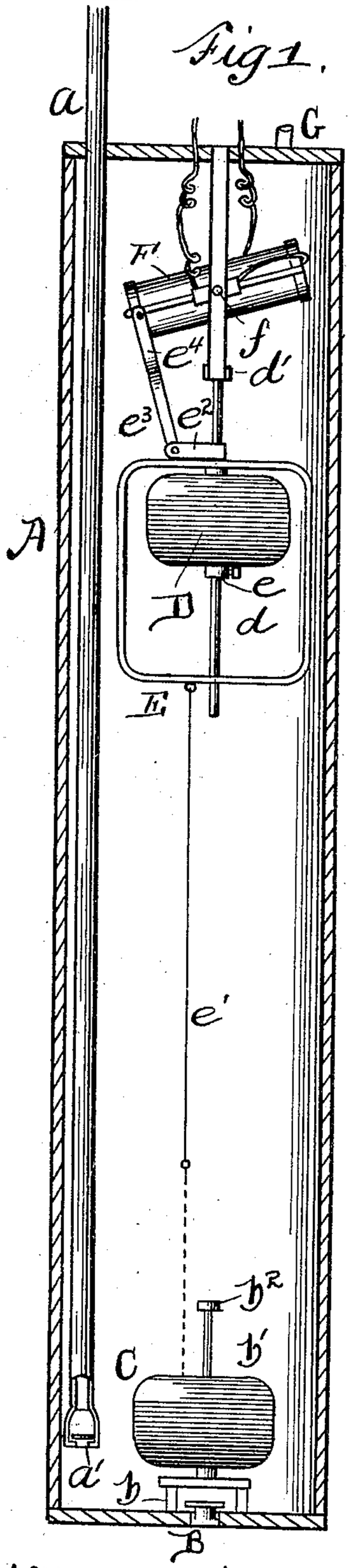

Fig. 2.

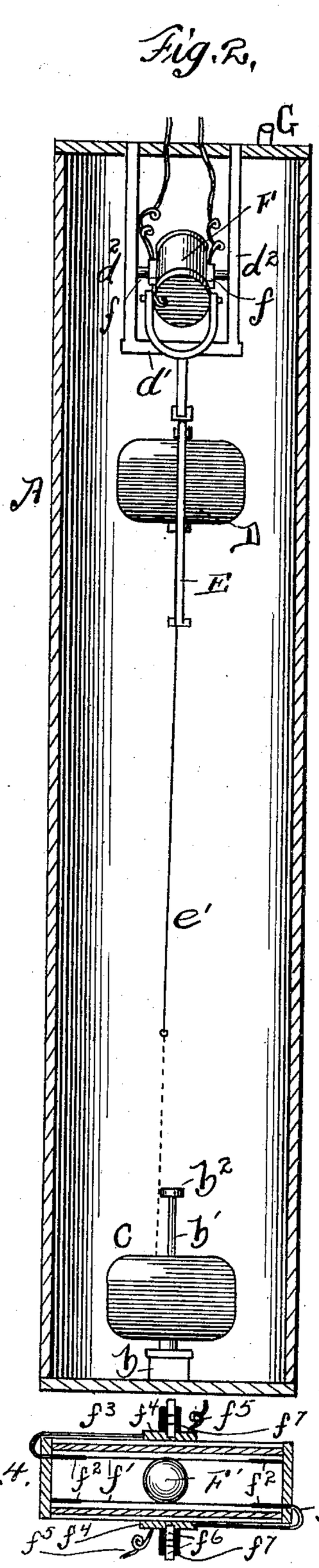

Fig. 3.

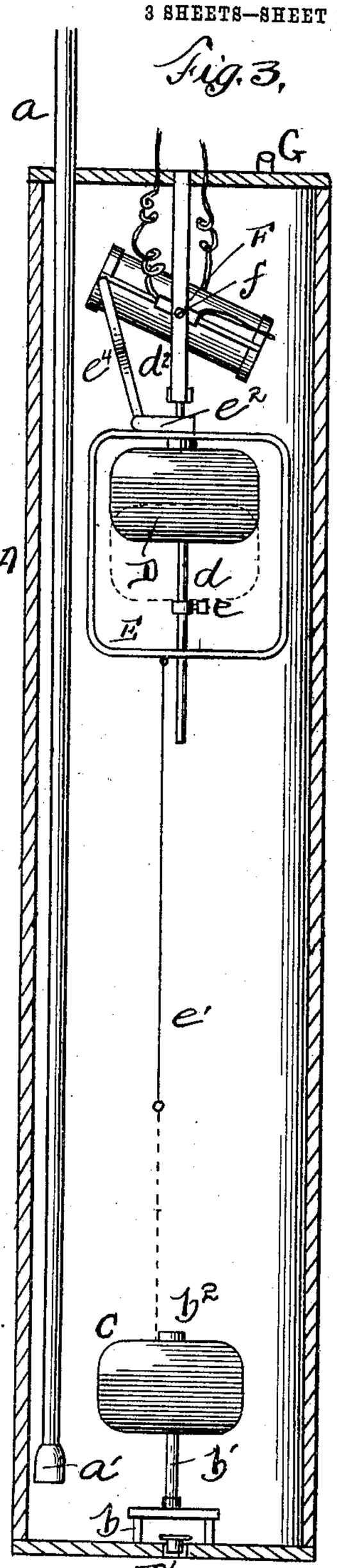

Fig. 4.

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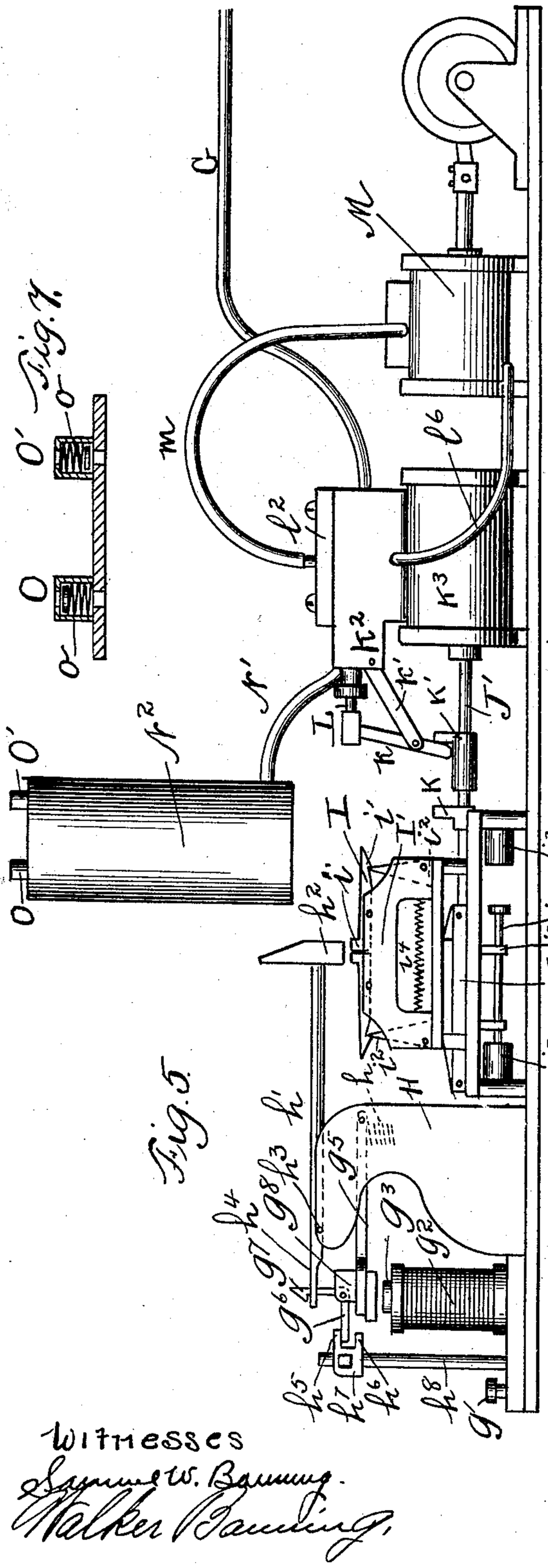
NO MODEL. 3 SHEETS—SHEET 2.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 8.

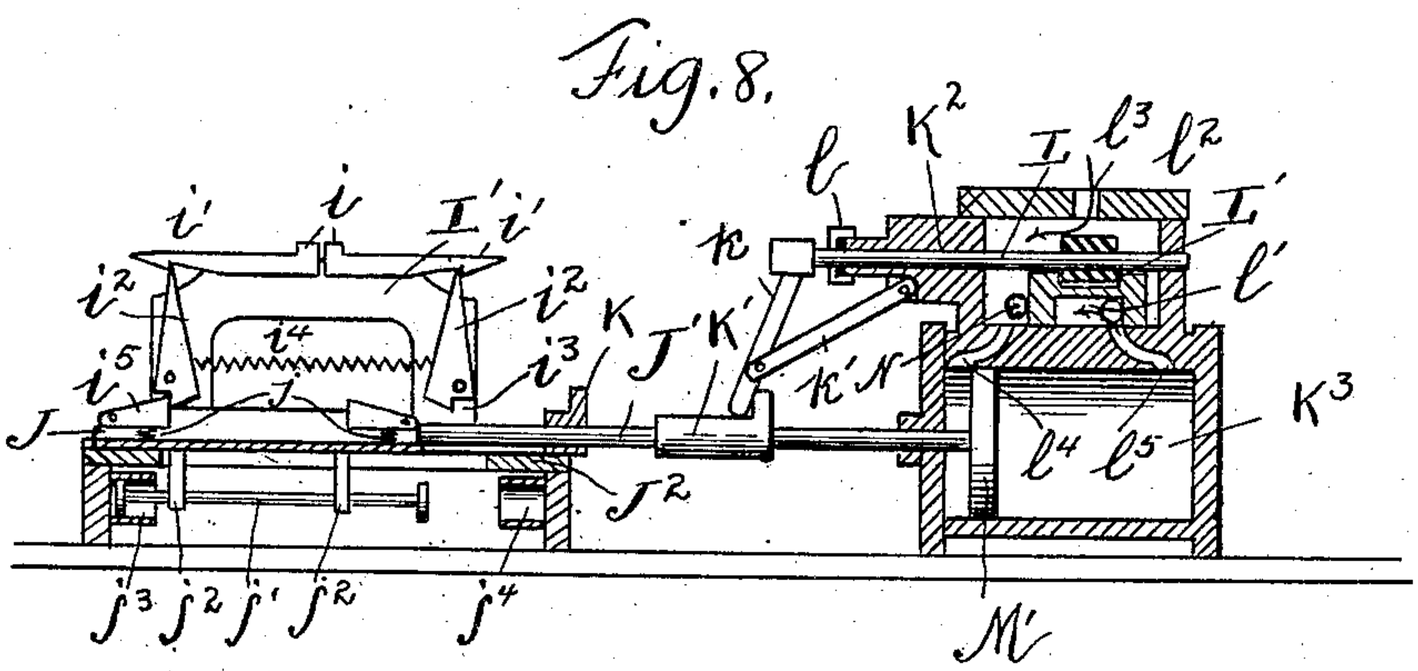
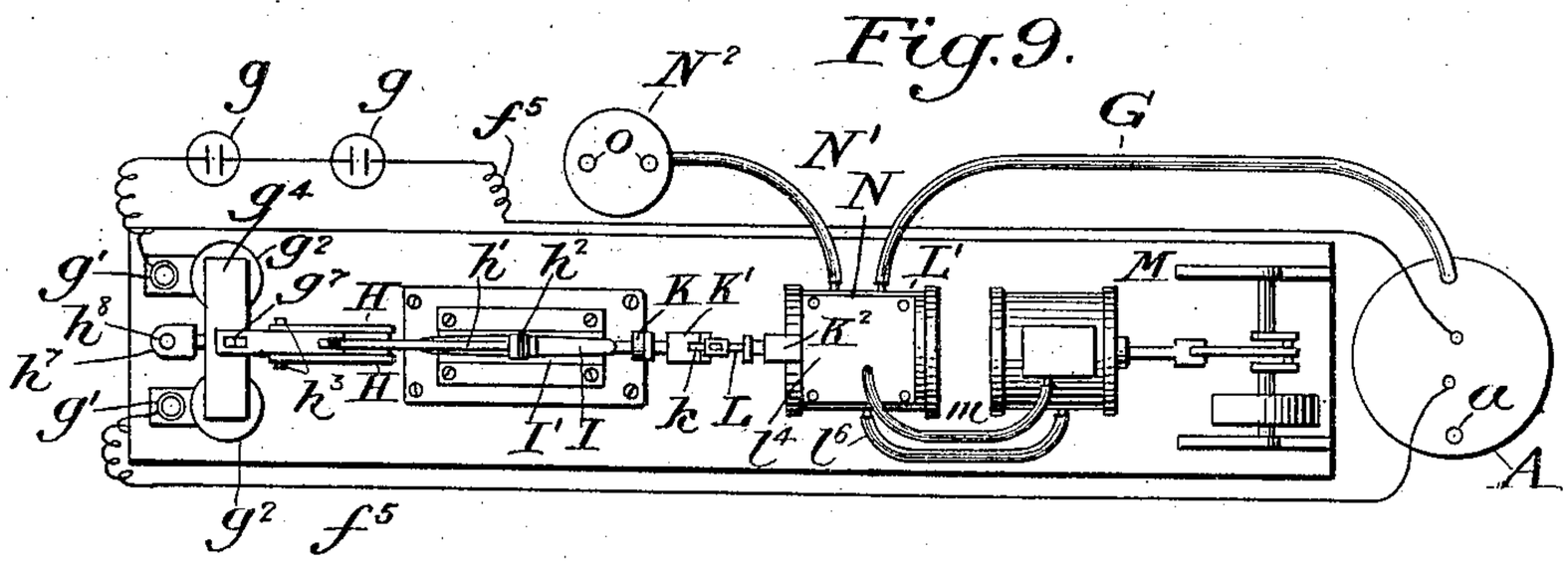


Fig. 9.



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UNITED STATES PATENT OFFICE.

ALEXANDER D. ELLIOTT, OF VIOLA, ILLINOIS.

PUMP.

SPECIFICATION forming part of Letters Patent No. 760,324, dated May 17, 1904.

Application filed September 14, 1903. Serial No. 173,125. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER D. ELLIOTT, a citizen of the United States, residing at Viola, in the county of Mercer and State of Illinois, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

This invention relates more especially to pumps adapted for use in oil-fields, although the principles here involved are applicable to pumps for use in other connections.

The invention consists in the arrangement of parts by which an alternate suction and pressure produced by suitable pressure mechanism alternately fills and discharges the pump-cylinder, to the mechanism by which the pressure and suction are regulated, to the electrical contact mechanism for actuating the pressure-regulating mechanism, and to the features of construction and combination of parts hereinafter described and claimed.

In the drawings illustrating the invention, Figures 1, 2, and 3 are sectional views of the pump-cylinder in various positions; Fig. 4, an enlarged view of the electrical contact mechanism within the pump-cylinder; Fig. 5, a side elevation of the mechanism exclusive of the pump-cylinder; Fig. 6, a top or plan view of the parts of Fig. 5, showing the pressure-valve with its top removed; Fig. 7, a sectional view of the top of the pressure-storage tank or reservoir, showing the valve arrangement therein; Fig. 8, a longitudinal sectional view of the valve controlling the flow of pressure; Fig. 9, a diagrammatic plan view.

As shown, the pump mechanism of this invention consists in an elongated lifting-cylinder A of any suitable length, preferably about thirty feet, which cylinder is adapted to be inserted bodily into the oil to be pumped out, and within the cylinder, which is closed at both ends, is arranged a discharge-pipe *a*, having at its lower end a valve *a'*, adapted to allow the inflow of liquid into the discharge-pipe when pressure is exerted within the cylinder. The liquid is admitted to the cylinder through a valve B, located in the bottom of the cylinder, and above said valve is arranged a support *b*, sufficiently raised to allow of the action of the valve under the support, and upwardly extending from said support is a rod *b'*, having on its end a cap or head b^2. Upon said rod is arranged a float C, adapted to easily travel up and down the rod and have its rise limited by the cap or head on the end of the rod. At a suitable distance above the float C is a float D, adapted to travel upon a rod *d*, which rod is supported from a bracket *d'*, having vertical side arms d^2 attached to the top of the cylinder, and around the float and of a size to allow the movement of the float therein is a frame E of substantially square formation, likewise adapted to travel up and down the rod *d*. The downward movement of the float D is limited by an adjustable collar *e* upon the rod *d*, and when in the position shown in Fig. 1, in which the cylinder is empty and adapted to be filled with liquid, both floats are in lowered position, the float C resting upon the support *b* and the float D resting upon the collar *e* and the frame E resting upon the top of the upper float. Between the two floats is a suitable chain connection *e'*, which enables the two floats to cooperate with one another. As the liquid rises in the cylinder the lower float will rise until its movement is limited by the head on the lower rod, and the chain connection between the two floats will be slack until the liquid has risen sufficiently to raise the upper float and with it the surrounding frame, both float and frame sliding upwardly upon the rod *d* until they assume the position shown in Fig. 3.

Connected to the upper side of the frame E is an arm e^2, to which is pivoted a yoke e^3, having arms e^4, between which is pivoted the end of a swinging tube F, which is journaled upon trunnions *f* between the arms d^2 of the bracket *d'*. When the float and frame are in the position shown in Fig. 1, the yoke will be lowered, and the end of the tube attached thereto will likewise be lowered; but when the upper float has been raised the end of the tube connected therewith will be raised and the pivoted tube swung on its trunnions, as shown in Fig. 3. Within the tube are arranged two contact-wires *f'*, having their ends f^2 insulated and having the opposite ends f^3 of the respective wires carried out through the ends of the swinging tube and connected with contact-blocks f^4, to which the trunnions

are attached, whence lead wires f^5 up through the end of the lifting-cylinder and enable a contact to be made and broken by the action of the swinging tube, as will hereinafter appear. Within the swinging tube is a metal ball F', adapted to roll back and forth and contact with the uninsulated portions of the contact-wires within the swinging tube at all points, except when the ball has rolled to one end or the other and comes in contact with the insulated portions of wire at the ends of the tube, at which point the contact will be broken. When the swinging tube is in the position shown in Fig. 1, the ball will lie at one end and no contact will be had between the wires, such contact being established as the swinging tube is moved to assume the position shown in Fig. 3, at which point the contact will again be broken when the ball comes into contact with the insulated portions of the wire at the opposite end of the swinging tube. The object of making and breaking the electrical connection is to actuate a suitable mechanism, hereinafter described, for alternately producing a suction and pressure through the pipe G for alternately filling and discharging the lifting-cylinder. When a suction is induced in the lifting-cylinder by the suction through the pipe G, the liquid will rise and the induction of air through the discharge-pipe a will be prevented by the action of the valve a', causing the liquid to rise in the lifting-cylinder until both floats are raised and the swinging tube tilted, causing an electrical contact to be established as the ball rolls along the uninsulated portions of the wires within the swinging tube, which electrical contact actuates the mechanism for substituting a pressure for the suction heretofore employed, which pressure serves to discharge the liquid heretofore sucked up into the lifting-cylinder through the valve a' and the discharge-pipe a. As the liquid begins to fall the upper float will assume the position shown in dotted lines in Fig. 3; but the frame E will continue to remain in raised position until the liquid has fallen sufficiently to carry down the lower float, at which point the weight of the lower float will serve to pull down the frame and cause the swinging tube to be drawn back into the position shown in Fig. 1 and establish an electrical connection for once more inducing a suction within the lifting-cylinder, which alternate pressure and suction will continue during the pumping operation.

As shown in Fig. 6, wires f^5 are carried from the lifting-cylinder through suitable batteries g and connect with suitable binding-posts g', which form part of an electromagnet consisting of coils g^2 and cores g^3 of the usual formation. Above the cores is arranged a metallic bar g^4, adapted to be drawn down by the passage of a current of electricity through the coils of the electromagnet, and said cross-bar is carried by a pivoted arm g^5, extending forwardly from the bar, upon which arm is arranged a bent lever g^6, the upper end of which terminates in a catch g^7, (best shown in Fig. 5,) said bent arm being pivoted between ears g^8 on the pivoted arm g^5, which latter is normally held in raised position within a support H by the action of a spring h (shown in dotted lines) or in any other suitable manner. Above the arm g^5 is pivoted a hammer h', having a head h^2, which hammer is pivoted by means of pins h^3 passing through the shank, which latter terminates in a slotted end h^4, through which slot projects the catch end g^7 of the bent lever, so that a downward pull upon the slotted end of the hammer will tend to raise the head thereof preparatory to the striking of a blow. The rearwardly-extending member g^6 of the bent arm is adapted to be contacted between an upper ear h^5 and a lower ear h^6 of contact member h^7, adjustably mounted upon an upright rod or post h^8 in proximity to the electromagnet. As the cross contact-bar is drawn down against the electromagnet the hammer will be raised by the contact of the catch end of the bent lever within the slotted shank of the hammer until the cross-bar has been drawn down sufficiently to cause the straight member g^6 of the bent arm to contact the lower ear h^6, which serves to throw back the catch end of the bent arm within the slot in the shank of the hammer, releasing the latter and allowing the head of the hammer to fall and strike a blow, after which the cross-bar will rise, carrying up the bent arm until the member g^6 strikes the upper ear h^5, which serves to throw back the catch end within the slot preparatory to the striking of succeeding blows by the hammer.

The hammer is adapted to strike simultaneously the inner ends i of two catch members I, each of the catch members terminated in a notched outer end i', adapted to hold the upper ends of suitable triggers i^2, pivoted between supporting side bars I', between which are also pivoted the two catch members heretofore described. The triggers i^2 are each provided on their lower faces with notches i^3 and are held in substantially upright position by the action of a spring i^4, which extends between the two triggers, as shown in Fig. 8. The triggers are adapted to hold and release the piston of a pressure-inducing apparatus, which will be hereinafter described, and are intended to contact lugs i^5, pivoted within a sliding member J, carried by the piston-rod J', and each of the lugs is normally held in raised position by the action of a spring j beneath the lug, causing the same to be upwardly sprung to engage the notch in the trigger, which coöperates therewith. The sliding member of the piston-rod is supported upon a base J^2 of suitable formation, and said sliding member carries a double-headed cushioning-piston j', supported by means of depending arms j^2 and adapted to alternately enter cylinders j^3

and j^4, which arrangement serves to produce a cushioning action and prevent the action of the sliding member from being violent, which would tend to disarrange the parts and impair the apparatus.

Upon the piston-rod are located two tappets K and K′ at a suitable distance from one another, and said tappets are intended to operate a swinging arm k, supported by means of a pivoted link k', which latter is attached to the valve-casing K^2 of a cylinder K^3, as shown in Fig. 8. To the upper end of the arm k is attached a valve-operating rod L, which passes through a suitable stuffing-box l and has attached thereto a sliding valve member L′, having a passage-way l' transversely extending beneath the valve member. The sliding member is so attached to the rod that it may be slightly raised when sufficient pressure is exerted beneath it, but which is normally held seated by the action of the pressure entering the port l^3 in the top of the valve-casing l^2 for allowing of the admission of pressure through the valve and into the cylinder. Between the valve-chamber and the cylinder are two passages l^4 and l^5, the former of which, as shown in Fig. 8, is in communication with the pressure-induction passage l^3 and the latter of which, as shown, is in communication with the space l' beneath the sliding valve member, from which space, as shown in Fig. 6, leads a pipe l^6, which communicates with the pressure-pump M, which latter may be of any suitable formation. The pressure-induction passage l^3 is likewise connected with the pressure-induction pipe m of the pressure-pump, so that a pressure will be constantly exerted through the port or passage l^3 and a suction produced from the back face of the piston-head M′ within the cylinder K^3.

As shown in Fig. 8, the parts are in position for a back stroke of the piston, which back stroke will continue until the tappet K strikes the arm k and reverses the valve mechanism, establishing communication between the pressure-induction passage and the valve-passage l^5 and simultaneously establishing communication between the passage l^4 and the vent-passage l' back to the pressure-pump.

If the action of the pressure-regulating valve and cylinder K^3 were unimpeded, there would be an alternate backward and forward thrust of the piston-rod j' and a pressure would be alternately exerted upon one side or the other of the piston-head. It is necessary, however, that the pressure and suction should be exerted upon the lifting-cylinder for the purpose of alternately filling and discharging the same, and for this reason the hammer-releasing apparatus hitherto described has been employed. As shown in Fig. 8, the backward thrust of the piston-head is prevented by the contact of the outer lug i^5 against the notched end of the trigger i^2, the end of which is caught by the catch end of one of the releasing members i. As long as the contact between the releasing member and the trigger continues the backward thrust of the piston-head will be prevented, and pressure entering the valve-chamber instead of acting upon the piston-head will pass out through a port N and pipe N′ to a storage tank or reservoir N^2, which arrangement will fill the storage-tank with pressure, and meanwhile, since the piston-head cannot be drawn back by the sucking action of the pressure-pump, a suction will be induced through the pipe l^6, which is in communication with the chamber l' beneath the movable valve member and through the pipe G, leading to the pump-cylinder. It will thus be seen that with the parts in the position shown in Fig. 8 a pressure will be stored up within the pressure-reservoir, and at the same time a suction will be produced within the pump-cylinder, which action will continue until the liquid has risen sufficiently to tilt the pivoted tube and produce an electric current through the electromagnet, drawing down the cross contact-bar thereon and striking a blow of the hammer against the inner ends of both releasing mechanisms, which action releases the triggers and allows the piston-rod to be drawn back by the action of the pressure against the piston until the valve member has been thrown and the pressure and suction have been reversed.

By the action of the compression-pump a constant pressure will enter the port l^3 in the top of the valve-casing and a constant suction will be maintained through the pipe l^6, leading from the side of the valve-casing beneath the slidable member therein. With the valve as shown in Fig. 8 the pressure entering the top of the casing will pass out through the port N and into the storage-reservoir and the suction through the pipe l^6 will withdraw the air through the port l' and the pipe G, thereby exhausting the air from the lifting-cylinder, which causes the liquid to rise therein. After the valve has been reversed the port N will enter beneath the movable valve member, thereby establishing communication with the storage-reservoir, and the stored-up pressure therein will raise the movable member sufficiently, by reason of its great pressure, to escape from beneath the movable member and enter the port l' and through the pipe G into the lifting-cylinder, thereby initially forcing out the liquid therein. While the valve is in the last-mentioned position, a suction will be maintained through the port N and the return-pipe l^6, leading to the air-compressor, which suction will withdraw the air from the storage tank or reservoir and create a partial vacuum therein, and at the same time the pressure from the air-compressor entering the port l^3 will be exerted within the lifting-cylinder and complete the work of forcing out the liquid therein contained after the pressure from the storage-reservoir has been spent.

When the slidable member has again been returned to the position shown in Fig. 8, there will be a partial vacuum within the storage-reservoir and a heavy pressure within the lifting-cylinder, and said pressure will rush back through the pipe G and the port l' and beneath the movable member of the valve and lift the same sufficiently to escape thereunder and back through the port N and pipe N′ into the storage tank or reservoir, creating an initial suction within the lifting-cylinder, which suction will be maintained thereafter by the action of the force-pump, as heretofore described. It is advisable to have the movable member of the valve attached in this manner, which allows direct communication between the ports l' and N to be established without the necessity for the pressure to travel through the air-compressor, although the latter arrangement is operative under ordinary circumstances.

Within the top of the pressure-reservoir are located valves O and O′, each of the valves being provided with spring members o. The valve O is adapted to allow the inflow of air against the pressure of the spring o, while the valve O′ is adapted to allow the escape of pressure against the action of the spring. These valves are arranged so that if an undue amount of suction is created within the storage-tank a slight amount of air will be admitted to permit the continued operation of the pump, and the valve O′ likewise operates to allow the escape of air in case an undue pressure has been created which would tend to impair the operation of the other parts of the apparatus.

As shown in Fig. 4, the trunnions mounting the swinging tube F are composed of two members f^6, separated from one another and surrounded by an insulated jacket f^7, which arrangement thoroughly insulates the parts and prevents the escape of current therefrom.

From the foregoing description the operation of the device will be partially understood, but may be briefly stated as follows: With the pump in normal condition and ready for the pumping operation the parts will stand in the position shown in Figs. 1 and 8, in which a pressure from the pressure-pump will be stored up within the reservoir and a suction simultaneously produced in the lifting-cylinder. As the liquid rises the respective floats will be raised until the swinging tube is tilted and an electric current established, which operates the electromagnet and strikes the hammer, releasing the catch mechanism and allowing the piston-head to be moved back until the tappet throws the valve mechanism and reverses the flow of pressure and suction, thereby releasing the pressure stored up within the pressure-reservoir into the lifting-cylinder to force out the liquid therefrom, which pressure will initially come from the pressure-reservoir and afterward from the pump and which action will continue until the liquid has been forced from the lifting-cylinder sufficiently to allow the weight of the lower float to tilt back the pivoted tube and again create a current and a movement of the valve back to its initial position.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a pump, the combination of a lifting-cylinder, a closed tube within the lifting-cylinder having therein a movable contact member, an electrical communication leading from the lifting-cylinder and connected with the closed tube therein and adapted to be closed and broken by the movement of the movable member within the tube, and means actuated by the rise and fall of liquid within the lifting-cylinder for moving the closed tube to actuate the movable member therein for closing and breaking the electrical connection leading from the lifting-cylinder, substantially as described.

2. In a pump, the combination of a lifting-cylinder, a discharge-pipe leading therefrom, a storage tank or reservoir in communication with the lifting-cylinder, a pressure and suction pipe leading to the lifting-cylinder, means for alternately producing suction within the lifting-cylinder and simultaneously storing pressure within the storage tank or reservoir, means for reversing the flow of pressure and producing a partial vacuum in the storage tank or reservoir and pressure in the lifting-cylinder, a contact mechanism within the lifting-cylinder, an electrical connection leading from the contact mechanism and a float mechanism adapted to actuate the contact mechanism and establish an electrical connection for reversing the action of the pressure apparatus for alternately establishing pressure and suction in the lifting-cylinder, substantially as described.

3. In a pump, the combination of a lifting-cylinder, a discharge-pipe leading therefrom, a closed tube within the cylinder, an electrical contact mechanism within the closed tube, a float apparatus within the lifting-cylinder and adapted to move the closed tube to intermittently establish an electrical connection upon the rise and fall of liquid within the lifting-cylinder, a pressure-cylinder and valve for alternately establishing a flow of pressure to and from the lifting-cylinder, and means actuated by the electrical contact mechanism within the closed tube for intermittently actuating the valve to change the flow of pressure to and from the lifting-cylinder, substantially as described.

4. In a pump, the combination of a lifting-cylinder, a valve-controlled discharge-pipe leading therefrom, a float mechanism within the lifting-cylinder consisting of a lower float and an upper float, the upper float being adapted to operate a pivoted tube within which is located a movable member for making and breaking electrical connection upon the rise and fall of the upper float, a connection be-

tween the two floats for drawing down the pivoted tube upon the fall of the lower float, current-wires leading from the pivoted tube to an electromagnet, a pressure-cylinder, a valve connected therewith and adapted to alternately establish a flow of pressure to and from the lifting-cylinder, and a releasing mechanism actuated by the electromagnet for allowing the movement of the pressure-piston upon the rise and fall of liquid within the lifting-cylinder, substantially as described.

5. In a pump, the combination of a lifting-cylinder, a float mechanism within the lifting-cylinder for establishing an electrical connection upon the rise and fall of liquid within the lifting-cylinder, an electromagnet actuated by the electrical connection, a releasing mechanism actuated by the electromagnet, a pressure-cylinder having therein a piston-head, a valve for alternately admitting pressure to the opposite sides of the piston-head, a piston-rod connected with the piston-head and adapted to be moved upon the action of the releasing mechanism, a tappet upon the piston-rod for actutating the valve mechanism for alternately establishing a flow of pressure to and from the lifting-cylinder, and a storage-tank having communication with the valve-controlled cylinder and adapted to have a reverse flow of pressure as compared with the lifting-cylinder, substantially as described.

6. In a pump, the combination of a lifting-cylinder, a discharge-pipe leading therefrom, a lower float slidably mounted upon a rod, an upper float slidably mounted upon a rod, a frame surrounding the upper float and mounted upon the same rod, a connection between the lower float and the frame, a tube pivotally mounted and adapted to be tilted by the rise and fall of the frame, a movable member within the tube adapted to make and break an electrical connection as the tube is tilted, and means actuated by the electric current for alternately producing a suction and pressure within the lifting-cylinder, substantially as described.

7. In a pump, the combination of a lifting-cylinder, a discharge-pipe leading therefrom, a lower float slidably mounted, an upper float carried by a depending rod, a frame surrounding the upper float and carried by the depending rod, a collar upon the depending rod for limiting the downward movement of the float, a tube pivotally mounted and connected by a lever with the frame, a movable member within the tube for making and breaking an electrical connection allowing one end of the tube to be raised by the rise of the frame, and a connection between the frame and the lower float for allowing the fall of the lower float to pull down the frame and tilt the pivoted tube back to initial position, substantially as described.

8. In a pump, the combination of a lifting-cylinder, a storage tank or reservoir connected with the lifting-cylinder, a discharge-pipe leading from the lifting-cylinder, means for supplying pressure to the storage tank or reservoir and withdrawing it therefrom and creating a partial vacuum therein, and means actuated by the rise and fall of liquid within the lifting-cylinder for intermittently reversing the flow of pressure between the lifting-cylinder and the storage-tank for alternately creating a suction and pressure within the lifting-cylinder for filling and discharging the liquid in the lifting-cylinder, substantially as described.

9. In a pump, the combination of a lifting-cylinder, a discharge-pipe leading therefrom, a valve opening thereinto, a storage-reservoir, means for alternately storing up pressure within the storage-reservoir and creating a partial vacuum therein, a valve mechanism alternately controlled by the rise and fall of liquid within the lifting-cylinder for intermittently reversing the flow of pressure between the storage-reservoir and the lifting-cylinder for alternately creating a suction and pressure within the lifting-cylinder, and an electrical contact mechanism actuated by the rise and fall of liquid within the lifting-cylinder for intermittently actuating the valve mechanism, substantially as described.

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