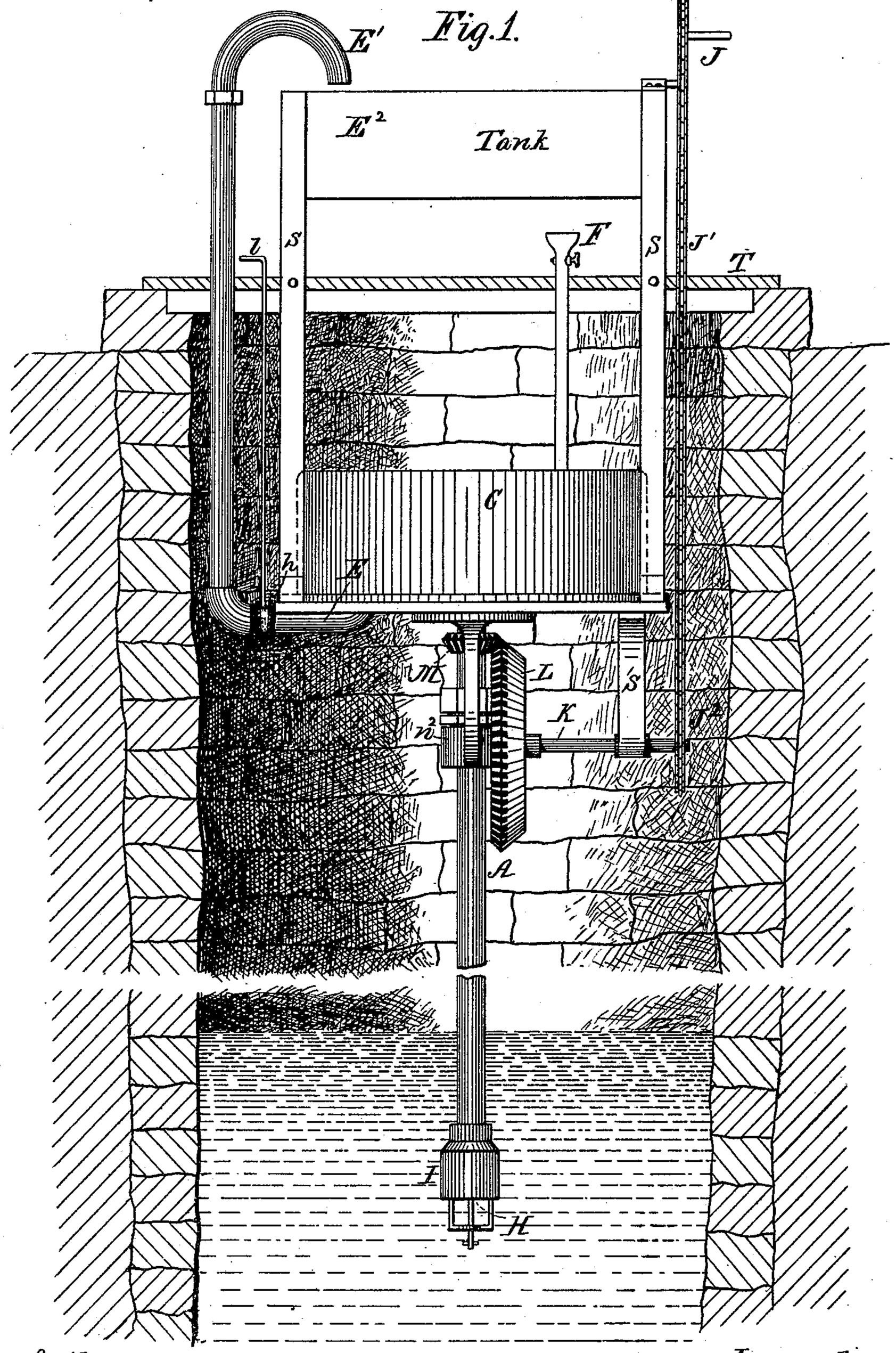
(No Model.) 3 Sheets—Sheet 1.

J. BAKER.

CENTRIFUGAL FORCE PUMP.

No. 405,294. Patented June 18, 1889.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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CENTRIFUGAL FORCE PUMP.

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Fig. 2.

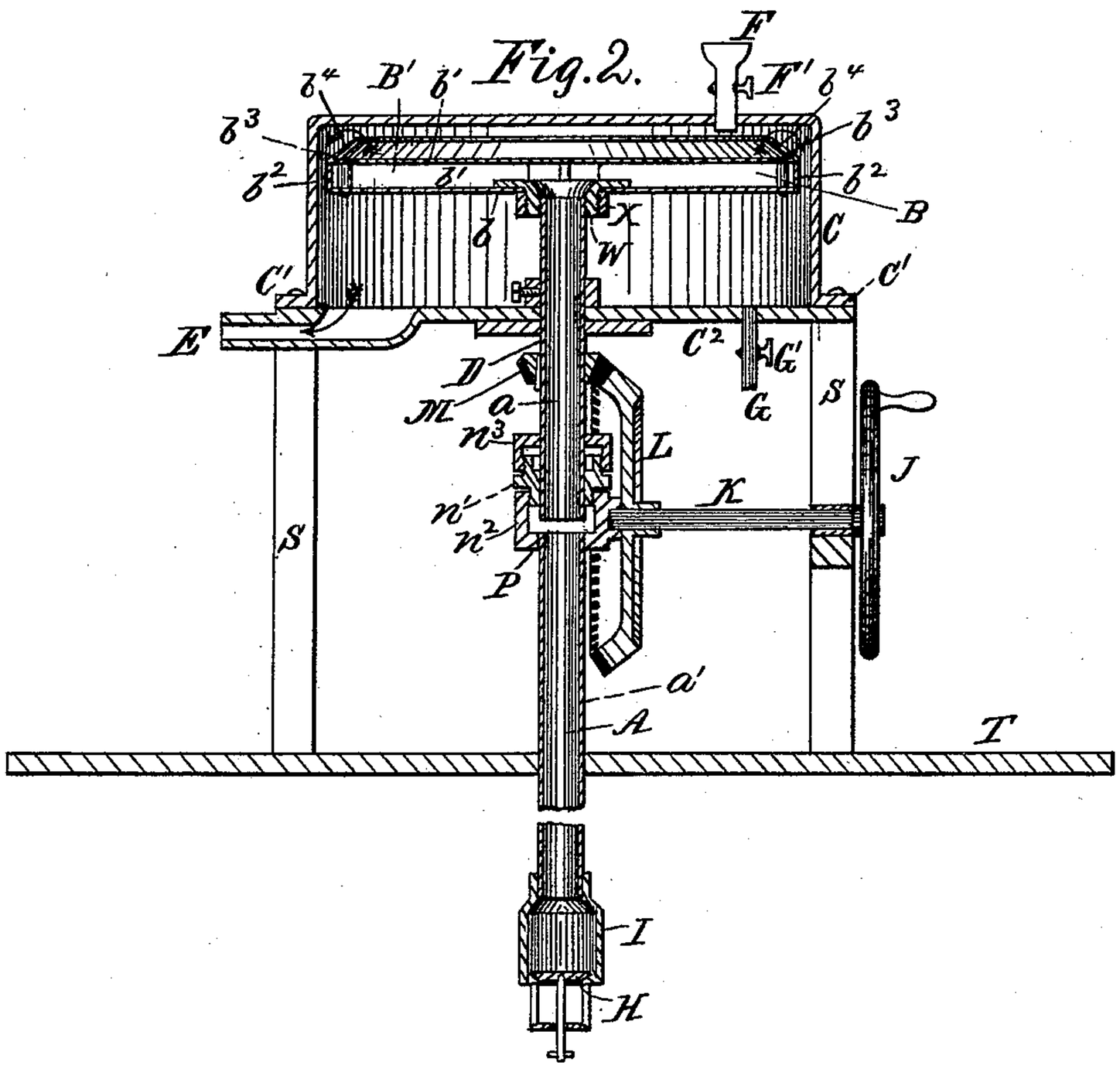
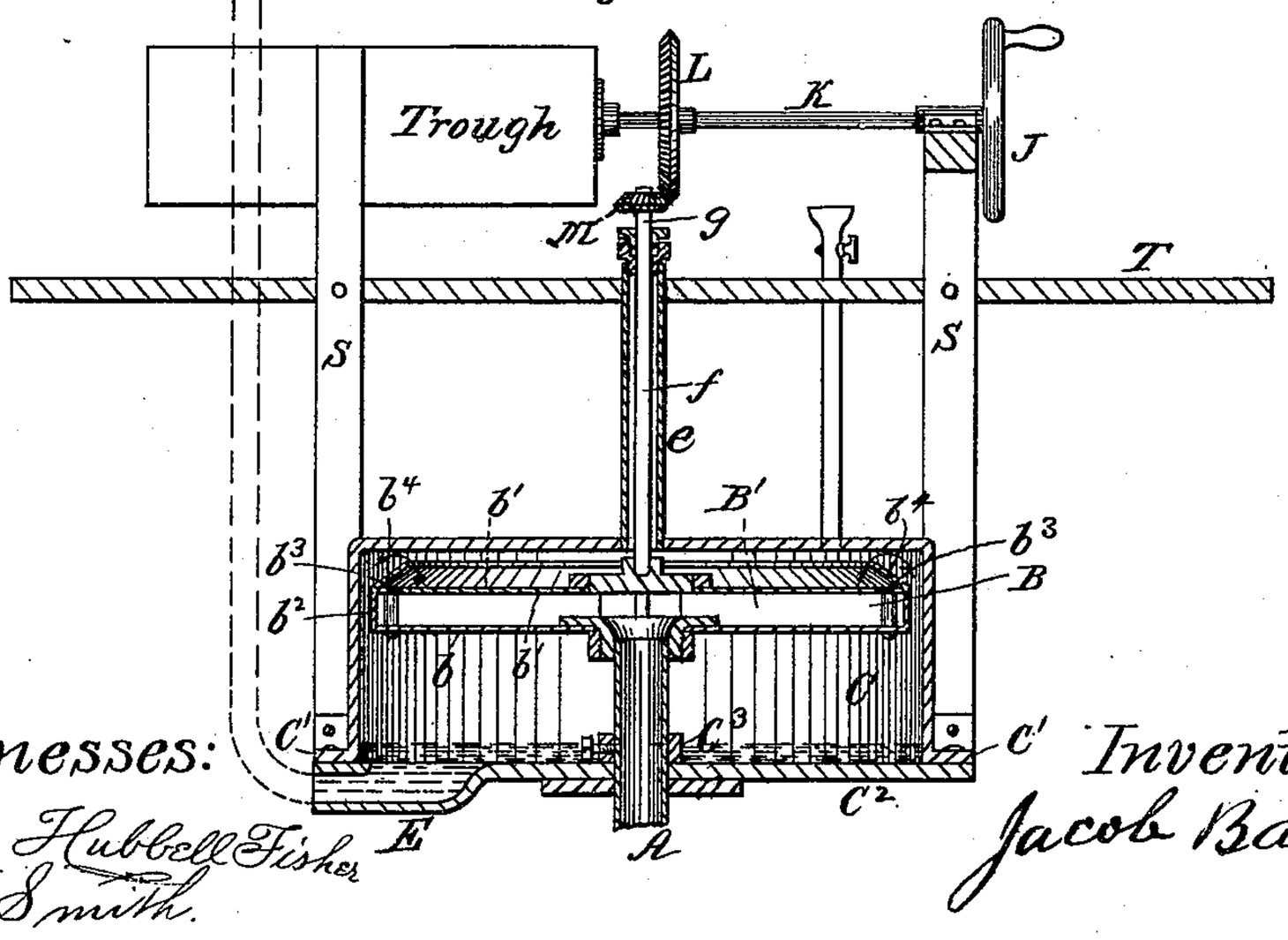


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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CENTRIFUGAL FORCE PUMP.

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Fig. 6.

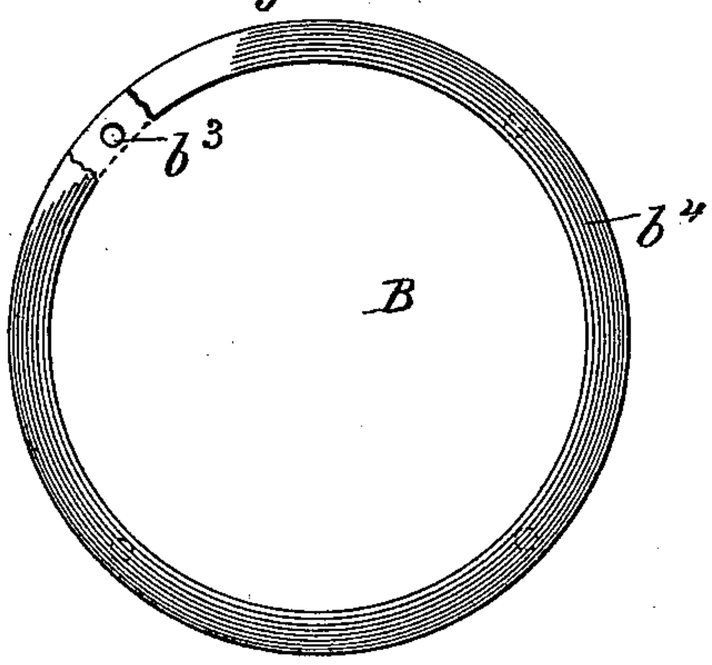


Fig. 5.

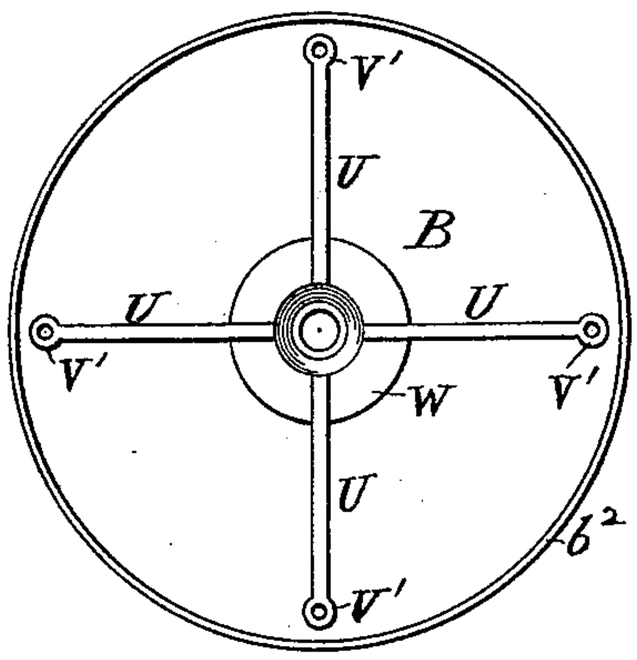


Fig. 8.

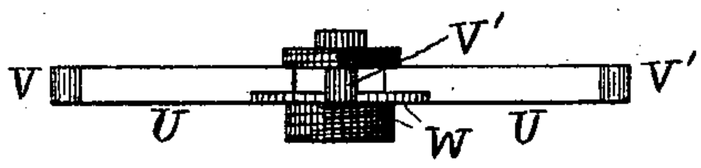
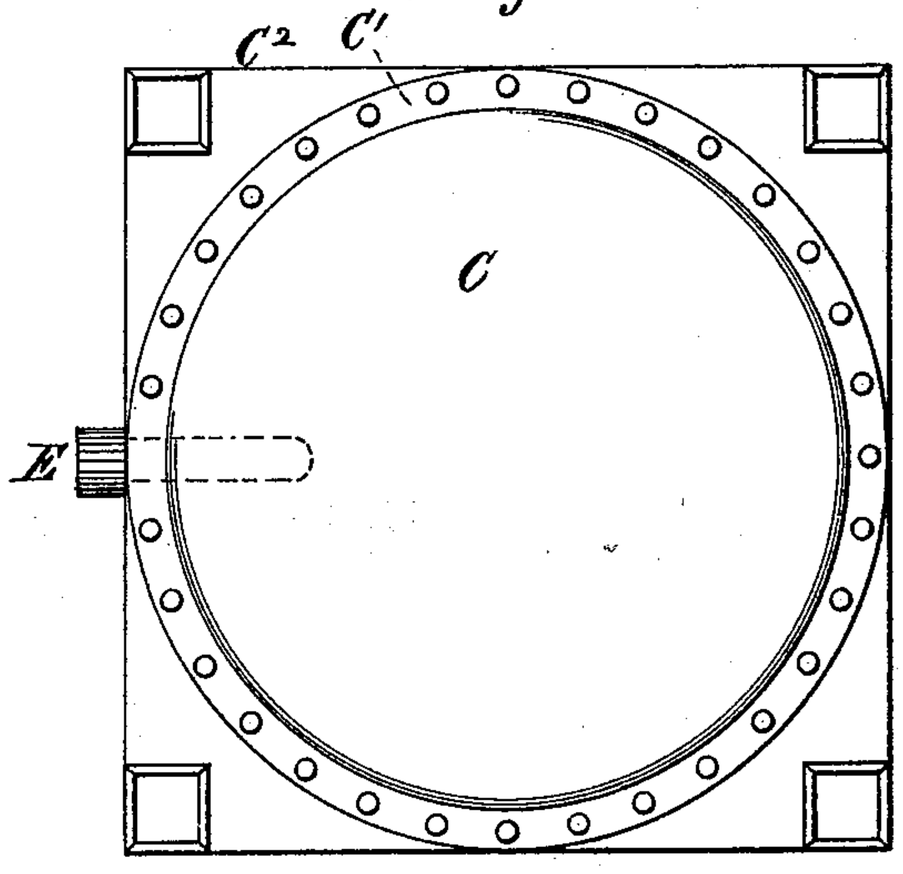


Fig. 7.

Fig. 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL FORCE-PUMP.

SPECIFICATION forming part of Letters Patent No. 405,294, dated June 18, 1889.

Application filed July 24, 1888. Serial No. 280,938. (No model.)

To all whom it may concern:

Be it known that I, JACOB BAKER, a citizen of the United States, residing at Greenville, in the county of Darke and State of Ohio, have invented a certain new and useful Improvement in Centrifugal Force-Pumps, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

The various features of my invention and the advantages resulting from their use conjointly or otherwise will be apparent from the following description.

In the accompanying drawings, forming part of this specification, Figure 1 is a side elevation showing the pump placed within the well. Fig. 2 is a vertical section of the pump standing above the well. Fig. 3 is a view in section showing a modification of the driving mechanism. Fig. 4 is a plan view of the air and water compressing chamber. Figs. 5, 6, 7, and 8 are details of the hollow wheel.

The same letters are used to indicate identical parts in all the figures.

One of the principal features of my invention consists substantially of a hollow tube or suction-pipe A and a hollow wheel or disk B, which latter is firmly connected to said hollow tube and communicates therewith. This hollow wheel or disk B is made to turn with great rapidity, so as to properly develop centrifugal force near the top of and within the combined water-receiver and air-compressing chamber C. This combined air-receiver and air-compressing chamber C is suitably supported by any desirable means. In the present instance it is supported on four uprights S S S S, said chamber C being provided with projections or flanges C′, respectively resting upon or secured to respective supports S.

In the event of its being desired to suspend the pump in the well, as in a case where it is desirable to place the pump where it will not freeze in the winter, a convenient mode of supporting the same consists of the uprights S S S S, (see Fig. 3,) fixed to the curb of the well T by means of bolts or screws or angle-iron bolted to the side of the support and also to the curb. The flanges C′ on the base of the chamber C are bolted or otherwise fastened to the uprights S. The base of the chamber preferably consists of a plate, as C^2, bolted or otherwise secured to an annular rim or flange C′ of the chamber C, the union between the said base and the portion of the chamber being water and air tight. The chamber is provided at or in its lower portion with an exit-conduit E, and this conduit is preferably cast in or formed with the piece C^2, as shown in Figs. 2 and 3.

The hollow pumping-wheel B consists, essentially, of the bottom *b* and a top *b′*, suitably connected together at their outer edges. Preferably the floor *b* and the roof *b′* of the chamber B are parallel to one another. At their outer edges there is present an upright perpendicular wall b^2, which extends from the floor to the roof *b′*. The preferred mode of forming and uniting the floor *b* and the roof *b′* of wheel is as follows, viz: The floor *b* is made of sheet metal and the upright perpendicular wall b^2 is made by turning up the outer edge of the floor *b* to the point where it will meet the roof *b′*, which latter is located at a suitable distance above the floor *b*. The roof *b′* is then united to the wall b^2 by soldering or other suitable means. This hollow pumping-wheel B is necessarily subjected while in operation to a very great degree of external pressure. This pressure is caused by a partial vacuum of the water within this wheel rushing toward the periphery of the wheel as the latter is revolving; secondly, from the pressure of air in the air-chamber C exterior to and upon the top and bottom as well as the edges of this revolving wheel. In order to prevent a collapse of the pumping-wheel from such pressure, I provide the wheel interiorly with the braces, which duly prevent the roof *b* and the floor *b′* from approaching each other. The preferred description of brace for this purpose is shown in Fig. 5 and 7. It consists of four radial arms or partitions U U U U, cast or otherwise fixed to the hub W. (Shown in Figs. 5 and 7.) Each of these radial arms is preferably provided at its outer end with an eye, V′, through which eyes pass the bolts that secure together the top and bottom pieces of the wheel B, and also hold these radial arms in fixed positions within the chamber of the wheel B. These radial arms preferably do not extend quite to the outer edge of the

chamber of the wheel, thereby leaving spaces between the outer edge of the chamber and the ends of the radial arms U, through which the water can pass around from one compartment or division of the chamber formed by the radial arms to another compartment thereof in the event of any one of the exit-orifices (hereinbefore described) of said chamber becoming clogged up by any foreign substances. These radial arms serve to compel the water within the revolving wheel to revolve with the same velocity as the wheel itself, and also by centrifugal force eject the water within said wheel out of the discharging-orifices b^3, located in the roof or top b' of said wheel, and thus tend to create a vacuum within the pumping-wheel when the upper end of the suction-pipe A is screwed into it or otherwise secured. The hub W of the radial arms projects through a close-fitting opening in the bottom of the floor b of the wheel. A nut X, screwed onto the exterior of the hub W, provided with a suitable packing of white lead, leather, rubber, or the like, is present between the upper edge of the nut and the floor or bottom of the pumping-wheel. The nut X, being screwed up tightly against said bottom, centrally secures these radial arms fixedly to the hollow pumping-wheel and secures the radial arms fast to the bottom piece of the hollow wheel. The outer wall b^2 of the pumping-wheel is at its upper edge extended to form or provided with an inwardly-inclined flange b^4, so shaped that its inner and upper portion is above the openings b^3 in the top of the wheel through which the water is discharged. This arrangement insures that when the pump is in motion a quantity of water shall be held by the said flange, propelled against its under surface by centrifugal force, covering the exit-holes b^3, and thus preventing the possibility of an ingress of any air to destroy the vacuum within the wheel.

The air-chamber and the combined water-receiver C is preferably provided in its lower portion with an exit-tube G, provided with a stop G′. The purpose of this tube is to enable the water in said chamber to be withdrawn when desired to rearrange or change any of the stand-pipes connected to the chamber or to otherwise repair the latter. There is also present in the air-chamber C a tube F, provided with stop-cock F′, and this tube forms the communication between the outer air and the air-space of the chamber C, and serves also as a convenient opening through which to prime the pump. This priming-tube F is preferably located at a point perpendicularly within one edge of the inclined rim b^4, so that when the chamber is first put in the well it can be conveniently primed through this tube, and then the stop-cock turned to prevent an escape of the air from the chamber C when used as a force-pump. This tube F can also be used to relieve the air-chamber C of the compressed air when the stand-pipes are used and which might demand repair or readjustment, thus allowing the water to sink down out of them. When the pump is suspended below the platform, as in Figs. 1 and 3, this tube F is preferably lengthened, as shown, and used in the same manner as heretofore described.

The water is retained in the hollow pumping-wheel and the suction-pipe by means of the valve H, which I have shown as situated at the lower end of the suction-tube A, although its location may be varied.

The upper end of the suction-pipe A is secured to the bottom of the wheel B, preferably as shown—viz., the end of the suction-pipe is screwed into the hub W, the latter having an orifice through it, as shown, the upper end of this orifice being preferably flared, so as to allow of the more free and rapid passage of the water laterally from the exit end of the suction-pipe toward the periphery of the wheel B. The lower end of the suction-pipe is located in the well, cistern, or reservoir or other supply of water or other liquid to be pumped, and is provided with a suitable valve, as H I, which latter allows the water to enter the suction-pipe and prevents the liquid from flowing back out of said pipe into the cistern, &c., when the pump is stopped.

The suction-pipe is preferably divided, so as to allow the lower portion a' to remain stationary while the upper part a rotates with the hollow pumping-wheel. The lower portion of the pipe A is usually quite long and heavy, and rotation of it would be difficult and add unnecessarily to the labor of operating the pump. Furthermore, the rotation of the valve H I would often damage the latter, as in rotating the pipe A the valve would impinge or be liable to strike against the sides or bottom of the well or reservoir on which it is located. This division of the suction-pipe A enables the pump to be used at a distance from the well, for the reason that a hose or bent tube may at one end be connected to the upper end of the stationary part a' of the pipe A and at the other end communicate with the lower end of the part a of said pipe A. This division and arrangement of pipe A become of special importance when this pump is used on steam fire-engines to enable it to be used in connecting the pump with a cistern from either side of the fire-engine. This division also becomes of importance when the pump is used in water-works at a distance to one side of the water-supply.

Any suitable packing-box for connecting the part a of the pipe A to the stationary part a', or to some intervening tube connecting said parts a and a' may be employed. A good form of packing device consists substantially as follows: The annular sleeve or ring n^2 is supported by a hanger connected to the base of the chamber C or to other supports. Into this hanger is screwed the flanged sleeve n', between whose upper end and the part a of

the suction-pipe A is a space for packing. An annular sleeve n^3 embraces and is screwed over the sleeve n' and compresses the packing against the suction-pipe a. The lower portion a' of the suction-pipe is screwed into the lower end of the annular ring n^2. This device allows the upper portion a of the suction-pipe to turn freely in the packing-box.

The hollow pumping-wheel B may be rotated by any suitable device and by any desired power. When the power is applied below the wheel B, it may be applied as shown in Figs. 1 and 2, the operating-shaft K rotating a gear-wheel L, engaging a pinion fixed by a set-screw or other fastening on the suction-pipe a. One end of the shaft K in the present instance is journaled in a support S and the other in the side of the sleeve n^2, or the hanger supporting the latter.

In Fig. 3 one mode of applying the power above the pumping-wheel B and allowing the pump to be in the well is shown, and consists as follows: The lower end of a tube or sleeve e is screwed into the top of the air-chamber C and extends up through the well-curbing and above the latter a short distance. Within this sleeve is a shaft f freely and loosely rotating, the lower end of this shaft being fixed in and to the wheel B, or a hub fixed thereon, as shown more fully in Fig. 8. This shaft passes up through a packing fixed to the tube e and located above the curbing for enabling the shaft and packing to be easily and conveniently readjusted without going into the well. The shaft carries at its upper end the pinion M, operated by the gear L, fixed on the power-shaft K. This power-shaft K, wherever located, may be operated by a pulley or crank driven by steam or a windmill or other power in lieu of the hand-wheel or crank J.

The mode of operation in general is as follows: The pumping-wheel B is rapidly rotated. The water passes out of the chamber B' up through orifices b^3, and thence over the flange b^4 of the wheel, and is thrown tangentially against the sides of the chamber C, and by gravitation is brought down to the bottom of the chamber and fills the discharge-pipe. After this no air can pass out. Where the discharge is not a perfectly free one, as where the delivery-nozzle is of a less diameter than the rest of the delivery-pipe, or where the water is elevated in the stand-pipe to a point above the pump, the water rises in the chamber C and compresses the air in said chamber. The water from the pump takes the direction shown by the arrows. As the water is thrown out of the outer side of the wheel B, its place is supplied by a fresh supply drawn upward through the suction-pipe A by the partial vacuum created in the wheel B near the upper end of the suction-pipe by the water being thrown out therefrom, and when the speed of rotation of the wheel B is slackened, so that it no longer discharges water to the delivery-pipe, the valve at the lower end of the suction-pipe closes and retains the water in the pipe and wheel B as priming for again starting the pump. In the event of possible leakage through the said valve from any cause the pump can be easily and quickly reprimed with water through tube F aforesaid. A cock or valve of suitable construction is located at h (see Fig. 1) in the lower part of the delivery-pipe E, and is operated by a rod l, for letting the water out of the vertical extension (or stand-pipe) of the delivery-pipe and out of the air-chamber C, to prevent the freezing of the water in said pipes and chamber. Chamber E^2 is a tank for receiving water from the pump. When desired, the upper end E' of the delivery-pipe may be unscrewed and a hose or other pipe may be connected by an elbow or collar, so as to utilize the pump in forcing water to the garden or lawn or any other desired point.

In Fig. 1 the pump is shown as operated by a hand-wheel J, having its shaft journaled in a suitable support, as upright S, and a sprocket-wheel J^2, fixed on shaft K, journaled in hanger S' and in the sleeve n^2, and an endless chain J', connecting and engaging said wheels J and J^2. When the well is deeper and a greater speed of rotation is required to raise the water, a smaller sprocket-wheel is to be substituted for wheel J^2. This will cause the pumping-wheel B to be more rapidly rotated and the water to be more forcibly raised. A convenient device for preventing the suction-pipe A from slipping down through the base of the chamber C consists of an annular rim or collar C^3, embracing said suction-pipe and fastened to said pipe by means of a set-screw. This collar C^3 rotates with the suction-pipe and rests upon the inner surface of the bottom of chamber C. It also performs the function of a packing, preventing the escape of water from the chamber C through the opening in the bottom of said chamber, through which pipe A passes. This collar is lubricated by water in the chamber, and as it wears it makes a more complete water-tight joint.

The advantages incident to a pump constructed as described are in greatly reduced friction, since the water in the pumping-wheel has practically the entire unobstructed interior chamber B' of the wheel through which to travel, instead of through more or less contracted passages in hollow arms, as has heretofore been common. Besides, my wheel is entirely above the water and rotates in the air, which, even though much compressed, offers little resistance to the movements of the wheel as compared with the resistance which would be offered by water.

While the various features of my invention are preferably employed together, one or more of said features may be used without the remainder, and in so far as applicable one or

more of said features may be used in connection with centrifugal force-pumps other than the one herein specifically described.

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

1. In a centrifugal force-pump, the pumping-wheel having the compartment or chamber B′ and the orifices b^3 and the inwardly-inclined flange b^4, substantially as and for the purposes specified.

2. In a centrifugal force-pump, the pumping-wheel having the compartment or chamber B′ and the radial partitions or arms, the chamber B′ having the orifices b^3 and the flange b^4, substantially as and for the purposes specified.

3. In a centrifugal force-pump, the pumping-wheel having the chamber B′ and the radial partitions or arms, the arms extending not quite to the outer wall of said chamber, substantially as and for the purposes specified.

4. In a centrifugal pump, the combination of the hollow pumping-wheel, a central hub projecting through one wall thereof, the radial arms or partitions located in the chamber of the wheel and fixed to the said hub, and the tightening-nut engaging with the projecting portion of the hub, whereby the said radial arms are secured in the wheel, substantially as described.

5. In combination with the pumping-wheel having an inwardly-inclined rim or flange, the chamber C, in which is mounted the pumping-wheel, provided with the priming-pipe F and its regulating-cock, the priming-pipe being located in the chamber C at a point within the circumference of the inner edge of said inclined rim, substantially as and for the purposes specified.

6. The combination of the hollow pumping-wheel, the radial arms mounted within the chamber of the wheel, the hub W, to which the arms are fixed, having the flared upper end opening into the pumping-wheel, and the tightening-nut X, engaging with the said hub, substantially as described.

7. The combination of the pumping-wheel and the radial arms and partitions having hub W and tightening-nut X, and the suction-pipe A, screwed into the hub W, substantially as and for the purposes specified.

8. The combination of chamber C, provided with the delivery-pipe E, and the hollow wheel B, having compartment B′, radial arms, orifices b^3, inclined rim b^4, and suction-pipe A, substantially as and for the purposes specified.

9. The combination of chamber C and hollow wheel B, having compartments B′, radial arms b^3, inclined rim b^4, suction-pipe a, packing, and suction-pipe a', having valve, substantially as and for the purposes specified.

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