(No Model.) 2 Sheets—Sheet 1.

W. HARTMANN.

MECHANISM FOR GOVERNING OPERATION OF DRIVING ECCENTRICS OR CRANK SHAFTS OF PUMPING ENGINES.

No. 582,642. Patented May 18, 1897.

Fig. 4.

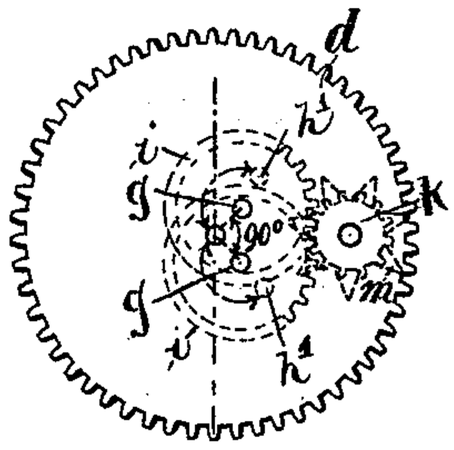


Fig. 1.

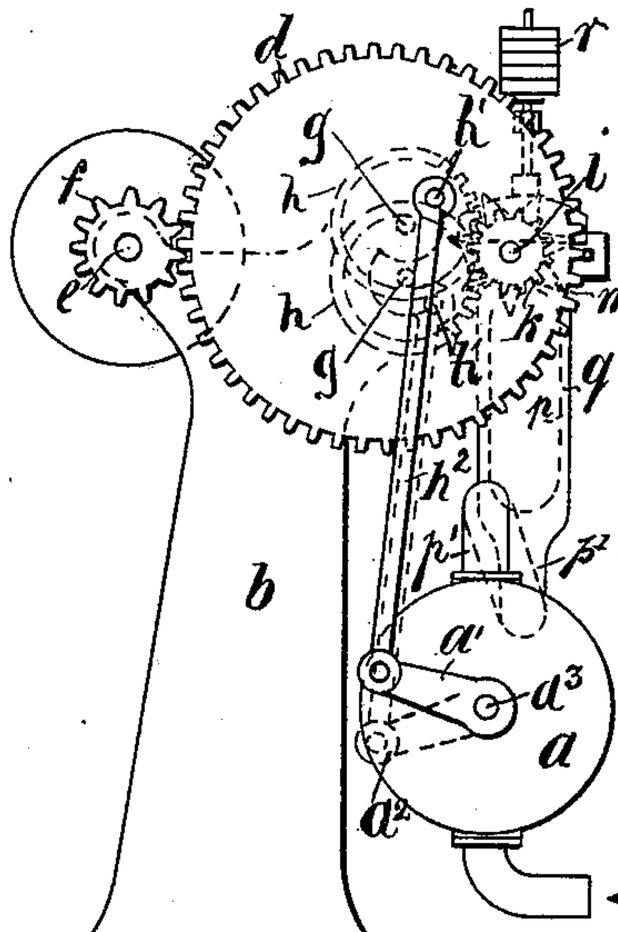


Fig. 2.

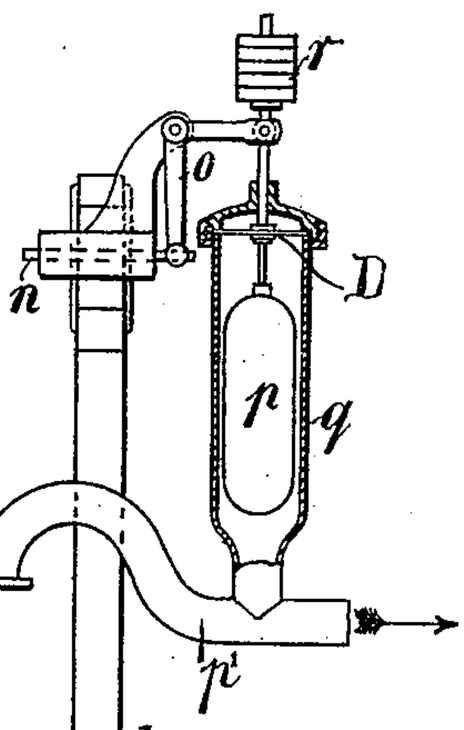


Fig. 3.

Fig. 5a.

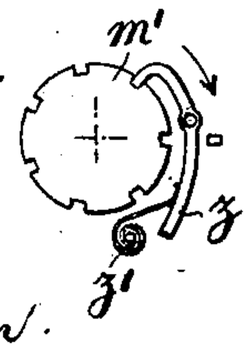
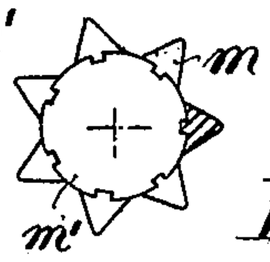


Fig. 5.



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(No Model.) 2 Sheets—Sheet 2.

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MECHANISM FOR GOVERNING OPERATION OF DRIVING ECCENTRICS OR CRANK SHAFTS OF PUMPING ENGINES.

No. 582,642. Patented May 18, 1897.

Fig. 5c

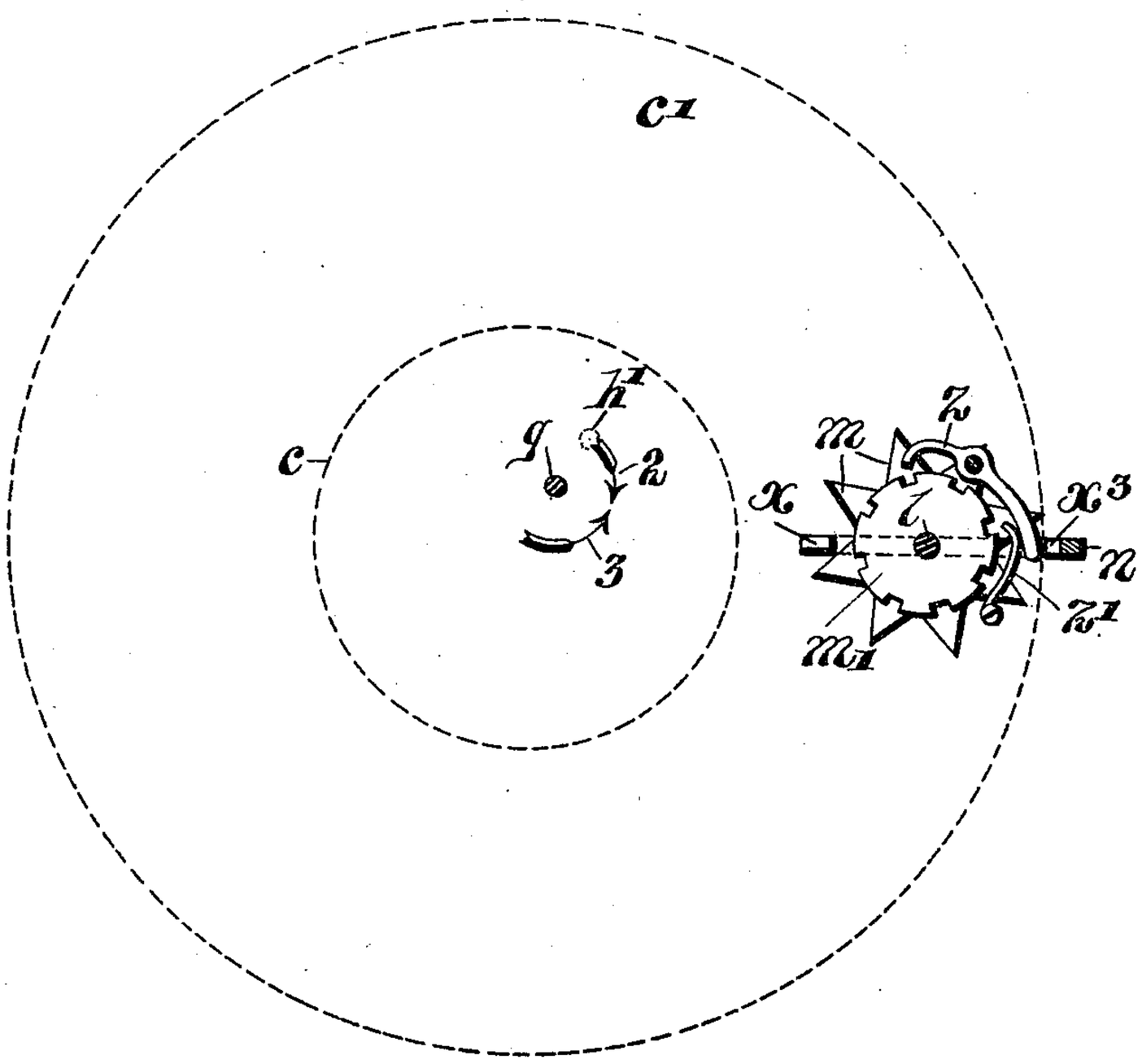
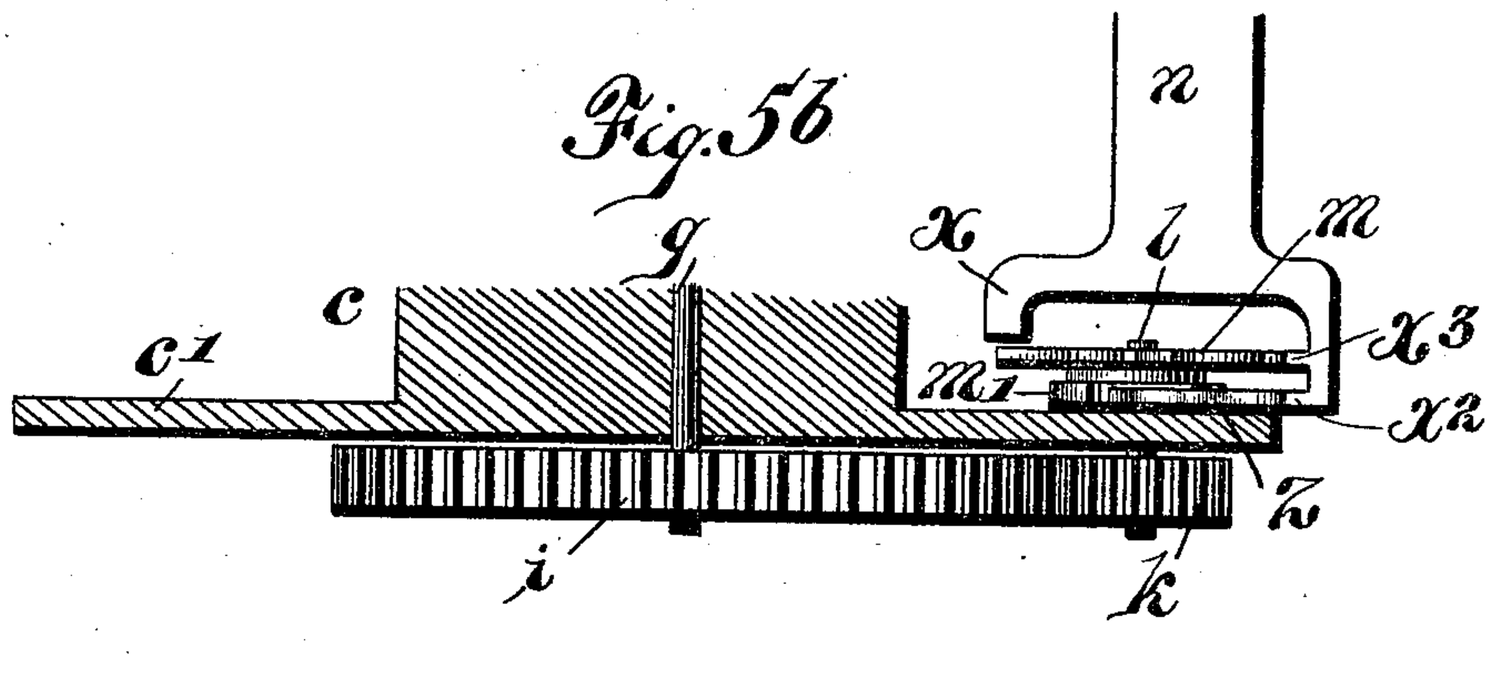


Fig. 5b



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UNITED STATES PATENT OFFICE.

WILHELM HARTMANN, OF OFFENBACH-ON-THE-MAIN, GERMANY.

MECHANISM FOR GOVERNING OPERATION OF DRIVING-ECCENTRICS OR CRANK-SHAFTS OF PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 582,642, dated May 18, 1897.

Application filed November 4, 1892. Serial No. 450,962. (No model.) Patented in Belgium July 30, 1892, No. 100,563; in England July 19, 1892, No. 13,230; in France October 28, 1892, No. 223,099; in Switzerland February 15, 1893, No. 5,641; in Germany June 2, 1893, No. 68,818, and in Austria-Hungary October 6, 1893, No. 36,922 and No. 47,939.

To all whom it may concern:

Be it known that I, WILHELM HARTMANN, a subject of the King of Prussia, Emperor of Germany, residing at Offenbach-on-the-Main, Germany, have invented certain new and useful Improvements in Mechanism for Governing or Regulating the Operation of the Driving-Eccentrics or Crank-Shafts of Pumping and other Engines, (for which patents have been obtained in the following countries on the following official dates, to wit: Belgium, No. 100,563, dated July 30, 1892; Germany, No. 68,818, dated June 2, 1893; France, No. 223,099, dated October 28, 1892; Great Britain, No. 13,230, dated July 19, 1892; Austria-Hungary, No. 36,922 and No. 47,939, dated October 6, 1893, and Switzerland, No. 5,641, dated February 15, 1893;) and I do hereby declare the following to be a full, clear, and exact desciption of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to mechanism for governing or regulating the operation of the driving-eccentric or crank-shaft of a pumping or other engine and for starting and stopping the operation of the same.

The invention has for its object the controlling of the operation of pumping and other engines either by hand or automatically by varying the position of the eccentric or crank-pin relatively to the axis of the shaft, whereby the speed or reciprocation of the element connected with and controlled by said eccentric or crank-pin is correspondingly varied or stopped when said eccentric or crank-pin is brought to a position coaxial with its shaft.

The invention has for its further object the provision of means whereby the displacement or adjustment of the eccentric or crank-pin relatively to the axis of its shaft is controlled, as in the case of pumping-engines, by the pressure of the liquid forced thereby.

To these ends the invention consists in structural features and in the combination of coöperating elements, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation illustrating my invention in its application to pumping-engines. Fig. 2 is a sectional end elevation of the devices for controlling the operation of the pump-shaft through the medium of the pressure of the liquid forced by the pump. Fig. 3 is a sectional plan view of Fig. 1, and Figs. 4, 5, 5^a, 5^b, and 5^c are detail views.

In the above drawings, a indicates the pump, in this case supposed to be a twin pump, and a' a^2 the cranks on the pump-shaft a^3.

Upon a suitable frame from which the pump is or may be supported is mounted in suitable bearings a driving-shaft e and a crank-shaft C. The latter shaft is constructed in two sections c and $c^\times$, the proximate inner ends of which are respectively provided with a circular flange c' and with a toothed rim or flange d, rigidly connected together and forming between them a circular chamber d'. The driving-shaft e carries, besides the usual belt-pulley e', a pinion f in gear with the toothed rim d on shaft-section $c^\times$, both shaft-sections being provided with bearings eccentric to their major axes for crank-spindles g. Each of said spindles g has at its outer end a disk h, provided with a wrist-pin h', and at its inner end, which projects into chamber d', a toothed wheel i. The relative arrangement of the spindles g and their wrist-pins h' is such that the latter will move synchronously to and from the center of rotation of the crank-shaft C when said spindles are revolved in one or the other direction by the pinions i through the medium of the toothed rim d, as hereinafter described, said wrist-pins being suitably connected to the cranks a' and a^2 on the shaft of the pumps a.

The aforesaid toothed wheels i gear with a pinion k, whose spindle l has bearings in the flange c' of the section c of crank-shaft C, through which flange said spindle projects and carries a ratchet-wheel m', Figs. 3, 5, and 5^a, secured to or formed integral with a star-wheel m, Figs. 3 and 5, rigidly secured to spindle l, said star-wheel being locked against rotation by the ratchet-wheel and a pawl z,

pivoted to said flange c' and held in engagement with the teeth or notches in said ratchet by a spring z', Fig. 5ª. On the framework b is arranged a slide-bar n in the plane of the star-wheel and its ratchet and pawl, said bar being T-shaped, or substantially so. At one end of the cross-head of the bar is formed a lug or projection x and at the other end an arm x', that has two inwardly-projecting lugs $x^2 x^3$, so that when the bar n is properly positioned either the lug x or the lug x^3 can be brought into the path of the teeth of the star-wheel m. When lug x lies in the path of the star-wheel m, lug x^3 will be in the path of the pawl z. When, on the contrary, lug x^3 lies in the path of said star-wheel, lug x^2 will be in a position to act upon said pawl.

The outer end of the slide-bar n is connected by a bell-crank lever o with the rod or stem of a float p, contained in an air-chamber q, which latter is connected with the force-pipe p' of the pump a, as shown in Figs. 1 and 2, the float-rod being preferably secured to a more or less flexible or resilient diaphragm D, clamped between the upper end of air-chamber q and its head, the latter being provided with a suitable tubular guide-bearing for said rod.

As shown at r, Fig. 2, the float-rod is weighted, the load determining the pressure under which the fluid forced by the pump is to be discharged—as, for instance, when such fluid is forced through a filter the pressure under which the fluid is to be filtered.

Supposing the float p, Fig. 2, and the bar n, Fig. 3, to be in their normal positions, the fluid being forced through a filter, for instance, at a pressure determined by the load r, it is evident that a corresponding pressure must be exerted upon the float by the liquid forced to the filter. Should this increase, the float will rise, thereby moving the vertical arm of the bell-crank lever outwardly or toward the air-chamber, and with it the bar n, so that the lugs x^2 x^3 will lie in the path of the pawl z, Fig. 5ᵇ, and the teeth of the star-wheel m, respectively.

Since wheel d, star and ratchet wheels m and m', and pawl z revolve with shaft C, as soon as the free arm of the pawl z and a tooth of the star-wheel come within reach of the lugs x^2 and x^3 the lug x^2 will release the pawl z, while the lug x^3 will cause said star-wheel to revolve a distance equal to that between two of its teeth. This partial rotation is imparted to the pinion k and through the latter to the toothed wheels i i, the crank-spindles g and their disks h causing the wrist-pins h' to approach the axis of the crank-shaft C (in the direction of arrow 2, Fig. 5ᶜ) and the pump to slow up. This operation is repeated at each revolution of the crank-shaft C until the axis of the wrist-pins h' is coaxial with the said shaft C, when the operation of the pump is stopped. This gradual stoppage of the pump results in a corresponding reduction of the pressure in the force-pipe p' and air-chamber q, and consequently in a fall of the level of the liquid and of the float therein, causing the bar n to move back into its normal position, so that the star-wheel m will again remain stationary, the pump remaining idle. It must, however, be borne in mind that so long as there is pressure in the pipe leading to the filter liquid will pass therethrough, and as the volume of such pumped into the force-pipe is gradually reduced, while the volume of liquid flowing through the filter remains practically the same, the wrist-pins h' of the cranks h will, as a rule, not reach a position with their axes coaxial with that of the shaft C—that is to say, the operation of the pump is not likely to be completely interrupted before the pressure in the chamber q upon the float p and a corresponding fall in the level of the liquid, and consequently of the float, will take place, whereby the bar n is returned into its normal position.

As the flow of liquid through the filter continues while the pump is forcing liquid thereto at a reduced rate, the level of the liquid in the chamber q continues to fall, thereby moving the bar n into a position in which the lug x will lie in the path of the star-wheel m, while the lug x^3 will act upon the pawl to disengage the same from its ratchet m', Fig. 5ᶜ, and as the shaft C continues to revolve the said star-wheel and pinion k, and therethrough the wheels i and spindles g, will be revolved step by step in a reverse direction from that above described or in the direction of arrow 3, Fig. 5ᶜ, whereby the wrist-pins of the cranks h are moved back toward or to their full-stroke position, causing the pump to force an increased or full supply of liquid to the filter. These operations are automatically repeated whenever there is a variation between the pressure of the liquid upon the float and that exerted by the load of the latter, as will be readily understood.

It is obvious that the slide-bar n may be actuated in any other desired manner—as, for instance, by hand, or by the pressure of a fluid other than that forced by the pump—or said slide-bar may be controlled by the speed of the crank-shaft C, the movements of the pump-shaft a^3 being controlled through the medium of intermediate mechanisms, such as gearing operated by the crank-shaft, the application and arrangement of such intermediate motion-transmitting mechanisms being within the province of any skilled mechanic and requiring no inventive genius. Hence the regulating or stopping and starting devices are not necessarily limited in their use to pumping-engines, but may be used on other engines or machines for controlling the speed of a driving crank-shaft, or that of a shaft driven thereby, or for controlling the gate or sluice of water-wheels or the regulating devices of turbines or of a steam-engine.

Instead of the float p a piston fitting a cylinder more or less fluid-tight may be employed, such piston being constantly exposed

to the pressure of the fluid in the force-pipe during the operation of the pump.

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

1. A crank-shaft composed of two sections revoluble synchronously, said sections provided with a bearing parallel with but eccentric to their axes of rotation, a crank-spindle revoluble in each of said bearings, a pinion on the proximate ends of said spindles, a gear meshing with both pinions, a ratchet and pawl adapted to lock the gear against rotation, and a star-wheel on the gear-shaft, said elements revoluble with the crank-shaft; in combination with adjustable abutments adapted to be moved into the path of the star-wheel on one or the other side thereof and into the path of the pawl, respectively, for the purpose set forth.

2. A crank-shaft composed of two sections revoluble synchronously, said sections provided with a bearing parallel with but eccentric to their axes of rotation, a crank-spindle revoluble in each of said bearings, a pinion on the proximate ends of said spindles, a gear meshing with both pinions, a ratchet and pawl adapted to lock the gear against rotation, and a star-wheel on the gear-shaft, said elements revoluble with the crank-shaft; in combination with adjustable abutments adapted to be moved into the path of the star-wheel on one or the other side thereof, and into the path of the pawl, respectively, the movements of said abutments being controlled by a driven element, for the purpose set forth.

3. In a pumping-engine, the combination with the force-pipe and the pump-shaft, of a crank-shaft connected with the pump-shaft, said crank-shaft provided with a bearing parallel with, but eccentric to its axis of rotation, a crank-spindle revoluble in said bearing, a gear-wheel on said spindle, a driving-pinion in mesh with said wheel, a pawl and ratchet adapted to lock the pinion against rotation, a star-wheel on the pinion-shaft, said pinion, ratchet and pawl, and star-wheel revoluble with the crank-shaft, and abutments adapted to be moved into the path of the star-wheel on one or the other side thereof, and into the path of the pawl, respectively, the movements of said abutments controlled by variations of the pressure in the force-pipe, for the purpose set forth.

4. A crank-shaft provided with a bearing parallel with but eccentric to its axis of rotation, a crank-spindle revoluble in said bearing, a gear-wheel on one end of said spindle, a driving-pinion in gear with said wheel, a ratchet and a star wheel fast on the pinion-shaft, and a pawl normally in engagement with the ratchet, said pinion, ratchet and star wheel revoluble with the crank-shaft; in combination with a bar, as n, having motion in a plane perpendicular to the plane of rotation of the star and ratchet wheels and provided with a lug x on one side, and lugs x^3 x^2 on the opposite side, said lugs x x^3 and x^3 x^2 adapted to be brought into the path of the star-wheel and pawl respectively when the bar is moved in one or the other direction, for the purpose set forth.

5. A crank-shaft composed of two sections respectively provided at their proximate ends with a disk and toothed rim rigidly connected together and forming between them a circular chamber, each of said sections having a bearing parallel with but eccentric to their axes of rotation, a crank-spindle in each of said bearings, and a gear-wheel on the inner proximate ends of said spindles within the aforesaid chamber, a driving-pinion also within the chamber in gear with both wheels, a ratchet and star wheel fast on the pinion-shaft outside of the chamber, and a spring-actuated pawl normally in engagement with said ratchet; in combination with an actuating device, as the bar n, provided with lugs x x^3 x^2, said bar having motion in a plane perpendicular to the plane of rotation of the star and ratchet wheels, said lugs x x^3 and x^3 x^2 adapted to be brought into the path of the star-wheel and pawl respectively, when the aforesaid bar is moved in one or the other direction, substantially as and for the purpose set forth.

6. In a pumping-engine, the combination with the crank-shaft provided with a bearing parallel with but eccentric to its axis of rotation, a crank-spindle revoluble in said bearing, a gear-wheel on said spindle, a driving-pinion in gear with said wheel, a ratchet and star wheel fast on the pinion-shaft, and a spring-actuated pawl normally in engagement with the ratchet; of a bar, as n, having motion in a plane perpendicular to the plane of rotation of the star-wheel, and provided with lugs x x^3 x^2, said lugs x x^3 and x^3 x^2 adapted to be moved into the path of the star-wheel and pawl respectively, when the bar is moved in one or the other direction, the force-pipe of the pump, a chamber in communication therewith, and an actuating device, as a float, in said chamber, adapted to move the bar in one or the other direction according as the level of the liquid rises and falls in said chamber, substantially as and for the purpose set forth.

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