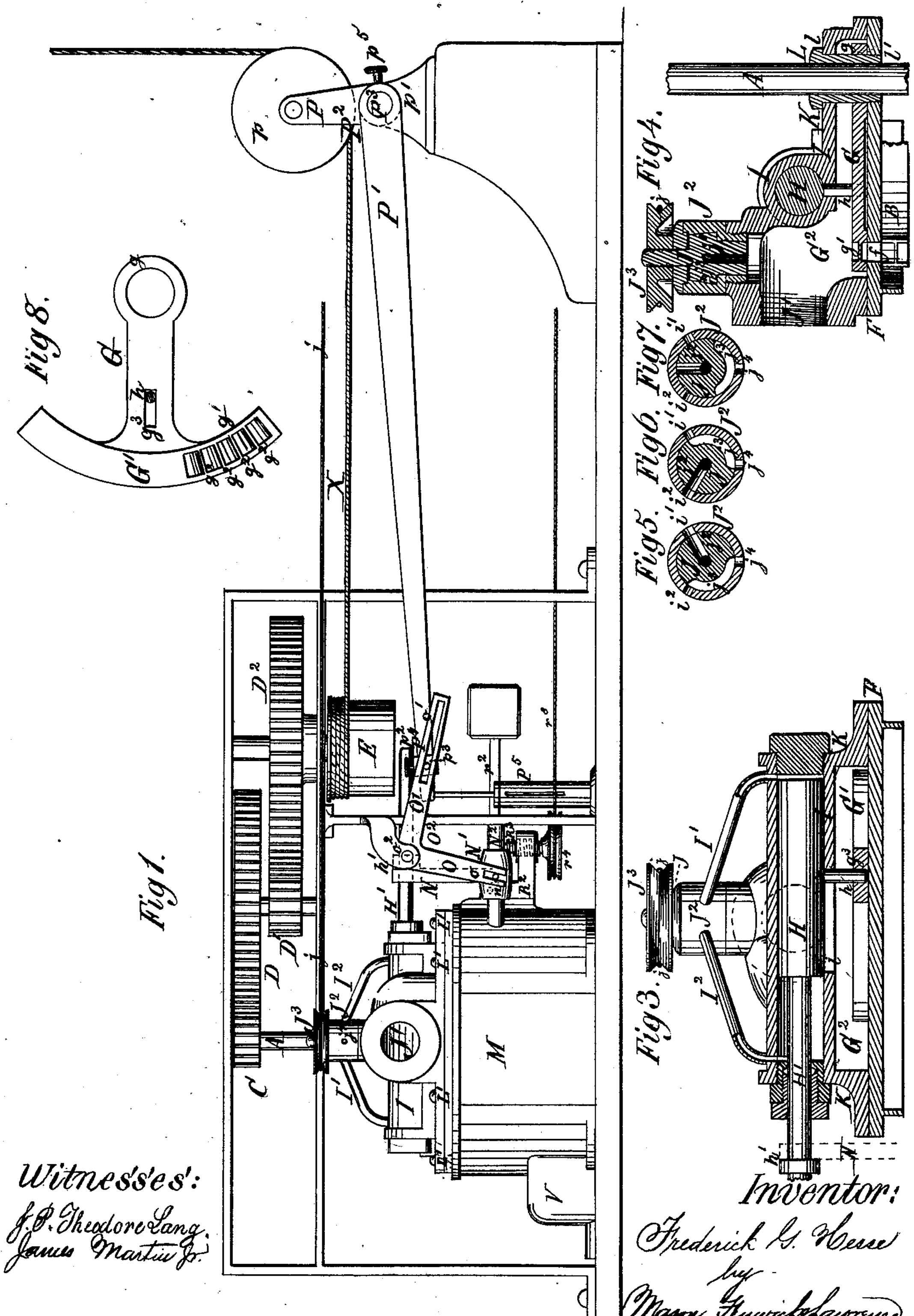
3 Sheets—Sheet 1.

F. G. HESSE.

HOISTING-MACHINE (HYDRAULIC.)

No. 191,529. Patented June 5, 1877.



Witnesses:
J. P. Theodore Lang,
James Martin Jr.

Inventor:
Frederick G. Hesse
by
Mason, Fenwick & Lawrence

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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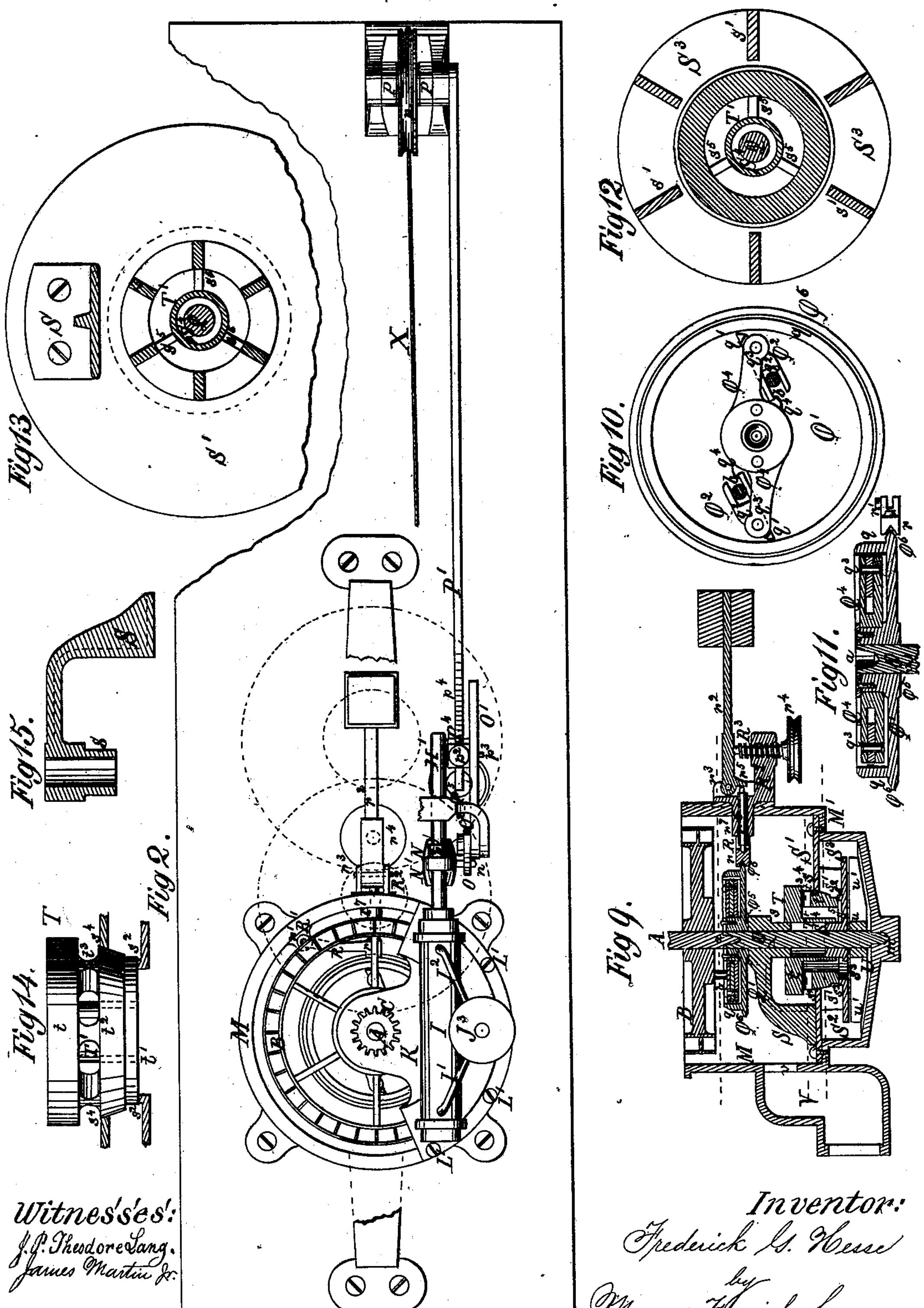

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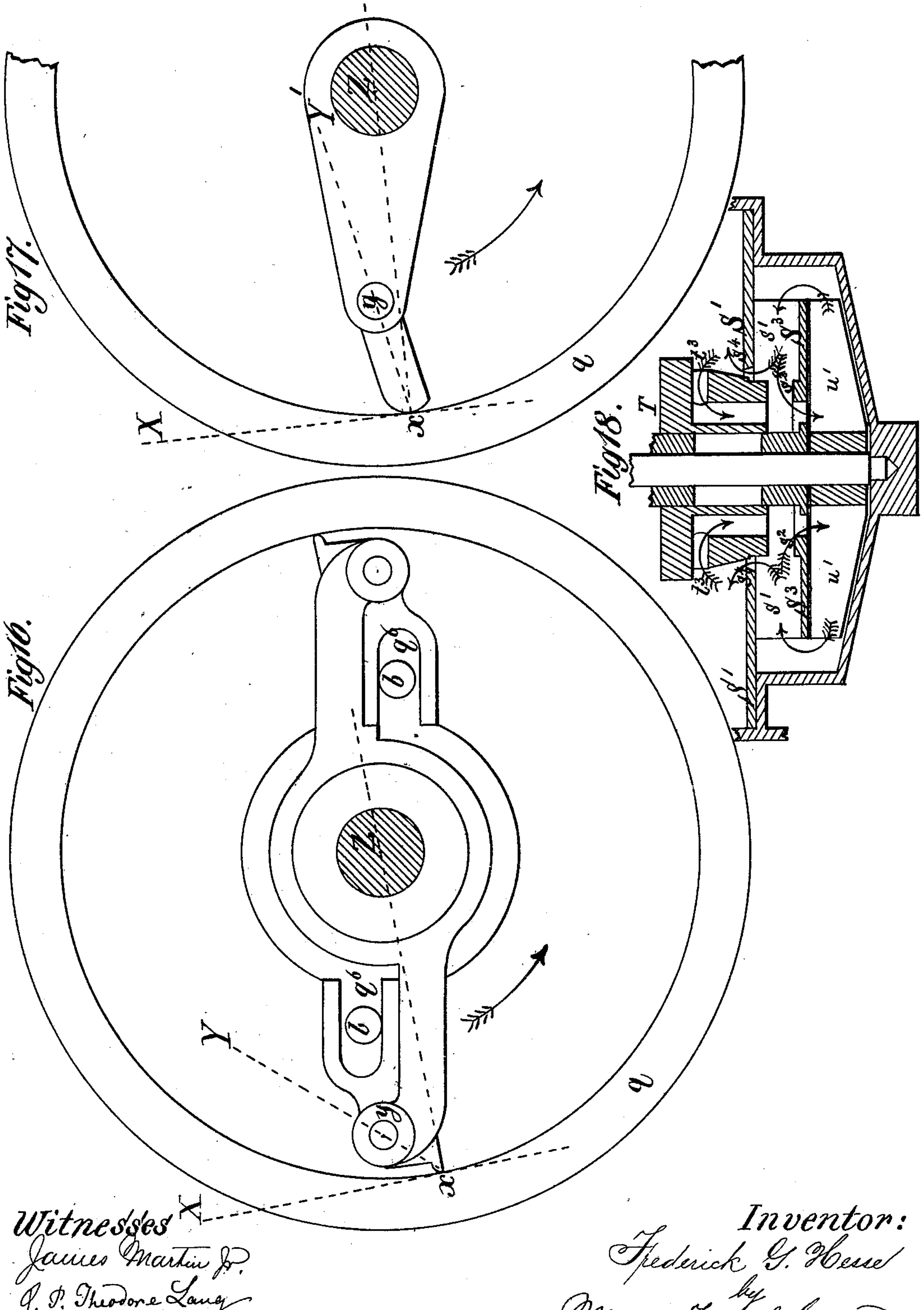

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UNITED STATES PATENT OFFICE.

FREDERICK G. HESSE, OF OAKLAND, CALIFORNIA.

IMPROVEMENT IN HOISTING-MACHINES, (HYDRAULIC.)

Specification forming part of Letters Patent No. **191,529**, dated June 5, 1877; application filed March 30, 1877.

To all whom it may concern:

Be it known that I, FREDERICK G. HESSE, of Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Hoisting-Machines, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is an elevation of my improved hoisting-machine. Fig. 2 is a top view of the same. Fig. 3 is a rear vertical central longitudinal section of the valve-gear of my turbine wheel which operates the hoisting apparatus. Fig. 4 is a vertical transverse section of the same. Figs. 5, 6, 7 are horizontal sections in different positions of the auxiliary valve for the operation of the valve-gear. Fig. 8 is a top view of the main valve. Fig. 9 is a vertical central section through the motor, brake, and stopping mechanism of my improved hoisting-machine. Fig. 10 is a top view of a friction-clutch coupling, whereby the turbine wheel and brake mechanism are connected. Fig. 11 is a vertical central section of the same. Fig. 12 is a horizontal section of a valve forming part of the brake mechanism. Fig. 13 is a horizontal section of the same valve at a higher elevation and through its inlet-ports. Fig. 14 is an elevation of the said valve. Fig. 15 is a vertical central section of the bearing and centering arm of the turbine and brake wheel shafts. Fig. 16 is an enlarged diagram of my improved friction-clutch used for coupling the turbine shaft with the centrifugal water-brake below. Fig. 17 is a similar diagram, illustrating the old mode of construction; and Fig. 18 is a sectional diagram, illustrating the course of the water in the centrifugal water-brake when the regulating-valve is lifted.

The nature of my invention consists in certain constructions, combinations, and arrangements of parts, hereinafter described and specifically claimed, whereby a hoisting-machine with automatically-adjustable supply of water-power with an automatic brake and with a friction-stoppage is produced, which, by its compactness, is especially suitable for establishments where the scarcity of room necessitates economy, and which, as a substitute for steam-hoisting machines, avoids the danger of fire, explosion, damage to walls and roofs by exhaust steam, and expense for fuel and engineer's wages.

The object of my invention is, first, to regulate or adjust the supply of water to the motor according to and through the weight to be lifted thereby during the operation of lifting; second, to regulate the above-regulated supply according to the existing head or pressure, which in most cases is variable, and especially so when the said supply is obtained by means of public water-works, whereby ordinarily-constructed hydraulic hoisting apparatus is often rendered inoperative.

In the drawings, A represents the main shaft of a turbine wheel, B, which, by means of pinion C and the intermediate geared wheels D D^1 D^2, drives the cable-drum E with the cable X upon it. Water is admitted to the wheel B by means of a swinging valve, G, through one end g of which the main shaft A is passed, and the other end G^1 of which forms a sector of an annulus, and has near its one end an opening, g^1, with a number of guide-plates, g^2, directly above the wheel B. The said valve G is fitted upon the bottom F of its chamber G^2, and has a port, f, corresponding in size and shape with the valve-opening g^1, through which opening f water is permitted to pass to the wheel below. By swinging the valve forward or backward the port f is either opened or closed, and thus the wheel B is either started or stopped.

The valve G is operated from a piston, H, within a cylinder, I, by means of a pin, h, fastened to the said piston, and projecting into a slot, g^3, in the valve G. The cylinder I has a slot, i, through which the pin h passes, and by which the full stroke of the piston H is determined, the piston being of sufficient length to cover the slot i at any position of the piston. The cylinder I is suitably closed at the ends in the manner of a steam-engine cylinder, and it has two pipes, I^1 I^2, for the purpose of communication between the extreme ends of the cylinder-space and a reversing and exhaust valve, J, above the inlet J^1. The inlet J^1 and the cylinder I are, in practice, all united with the top K of the valve-chamber G^2, which contains the valve G, by being cast in one piece. The top K and bottom F are fastened together, and secured around the main shaft A by means of a sleeve, L, with a stepped head, l, above, and a screw-thread, l', below, screwed into the said bottom. Near their periphery the said top K and the bottom F are fastened together, and upon the top flange of a cylinder, M, by means of screws L′. The valve J is a rotary valve, and is secured by suitable means to its valve-seat J^2, and is operated by a pulley, J^3, and a cord, j. It is provided with a vertical port-hole, j^1, which opens into the valve-chamber G^2, and has a horizontal branch, j^2, on the same level with the ports i^1 i^2 of the pipes I^1 I^2 in the valve-seat J^2. Opposite the branch j^2 the valve J is provided with a channel, j^3, and opposite the ports i^1 i^2 the valve-seat J^2 is provided with an exhaust-port, j^4.

The arrangement of the ports i^1 i^2 j^4 and the channel j^3 and branch j^2 is such that, when water is supplied to one end of the cylinder I, the other is exhausted, and vice versa, and that, when both supplies are cut off or closed, the exhaust is also closed, as Figs. 5, 6, 7 fully represent. Thus, by turning the valve J one way or the other, the piston H will be moved correspondingly, and thereby the valve G will either open or close the port-hole f with the above-stated results to the wheel B. The piston H has a piston-rod, H′, with a fixed collar, h', outside the cylinder I. Behind the said collar h' the end of an arm, N, encircles the piston-rod, and the said arm has a sleeve, N^1, which slides upon a fixed rod, N^2, arranged parallel with the piston-rod. A pin, n, on the sleeve N^1 serves to receive motion, by means of a slot, o, in the end of a lever-arm, O, which, with another arm, O^1, slotted at o^1, forms a crank-lever, O^2, with a fixed fulcrum, o^2.

The piston-rod H′ has to be very loosely encircled by the arm N, so as to prevent jamming by friction during the independent movements of the said parts, as hereinafter described. The sleeve N^1 is to be made long enough to prevent its becoming locked between its extreme corners and upon the rod N^2. The hoisting-cable X passes from the drum E toward and over the pulley p fastened to the forked vertical arm P of a crank-lever, P^2, which has a horizontal arm, P^1, and fixed fulcrum-stand p^1. The arm P^1 extends toward the crank-lever O^2, and is provided with an adjustable sliding head, P^4, with a set-screw, p^2, and a pin, p^3, which latter passes through the slot o^1 of the crank-lever O^2. The arm P^1 is rigidly connected with a rock-shaft, P^3, upon which the arm P is fitted, and kept steady by a set-screw, p^5. The strain exerted by the hoisted weight upon the cable X tends to throw the lever-arm P^1 down, which tendency may be partly counteracted by a spring cushion or spring balance, P^5, attached to the said lever-arm, which might also be made to serve as an indicator of the weight supported by the cable. The change of strain upon the cable effects a change of elevation of the end of the lever-arm P^1, and, consequently, a change of position of the crank-lever O^2, which in turn moves the sleeve N^1 and arm N either forward or backward, thereby allowing the collar h' and the therewith-connected piston H more or less length of stroke, with the final result of more or less opening the port-hole f, and furnishing a proportionate amount of water to the wheel B.

The sliding head P^4 may be moved nearer to or farther from the crank-lever O^2 to meet the requirements of a change in the pressure of the supply-water by a change of position of the arm N, and the consequent change of position of the main valve G. The said movement or change of position of the sliding head P^4 is done by hand, and according to observations made in regard to the operation of the hoisting machinery under a periodical change of pressure; and the effect of it is to allow a more or less copious supply in connection with the same conditions of automatic adjustment.

By this construction I obtain, under all circumstances, the exact amount of supply-water necessary for properly operating the hoisting apparatus, and all waste of the supply-water, as it happens with machines of ordinary construction, is avoided.

To facilitate the adjustment of the sliding head P^4 the part of the lever P^1 upon which it slides is provided with a scale, p^4, graduated according to the different amounts of pressure prevailing at the different times of the season. The foot of the main shaft A has a spindle-bearing, a, in the upright shaft Q of a brake-pulley, Q^1. This pulley Q^1 has a cylindrical rim, q, upon which the heads q^1 of two forked levers, Q^2, impinge. Each lever Q^2 is provided with a slot, q^2, and a fulcrum-pin, q^3, which latter are fastened to the ends of two parallel arms, Q^4, between which the levers Q^2 are placed.

The arms Q^4 are provided with a hub, Q^5, which freely revolves around the hub of the pulley Q^1, and has two lugs, q^4, whereby the back swing of the levers Q^2 is limited.

The turbine-wheel B is provided with a couple of downward pins, b, which enter the slots q^2 of the levers Q^2, and thereby operate them.

When the turbine-wheel B moves forward the pins b keep the levers Q^2 against the lugs q^4 and the heads q^1 off the rim q of the pulley Q^1, consequently the pulley Q^1 is not moved. When, in lowering, the turbine-wheel is moved backward, the pins b press the levers Q^2 toward the arms Q^4 and the heads q^1 against the rim q, in consequence whereof the pulley Q^1 is tightly clutched and caused to revolve with the turbine wheel.

In Fig. 16 I have illustrated the principle of the described clutch, which differs from the ordinary method of construction chiefly in the impinging angle. The said angle is obtained by drawing a tangent, X x, at the point of impingement x to the inner surface of the rim q, and then to draw a straight line, x Y, from the said point x through the fulcrum q^3 of the lever Q^2. The so-formed angle of impingement X x Y is about thirty-five or forty degrees, while in the ordinary construction, as represented in Fig. 17, the angle of impingement X x Y′ is almost equal to a right angle. In the latter case the pressure at x upon the rim q is generally excessive, and is attended by speedy wear of the clutch. The greatest effect of my improved friction-clutch is secured by making the complement Y x Z of the angle of impingement larger than forty-five degrees. The slots q^6 of the levers Q^2 should be radial, as seen in Fig. 16, when the clutch is operating, to be most effective.

The pulley Q^1 has a V-shaped horizontal rim, Q^6, at its base, upon which the head r of a friction or brake lever, R, is fitted, and which has its fulcrum r^1 in a lug, R^1, on the inner side of the cylinder M. A bracket, R^2, fastened to the outside of the said cylinder, supports a weighted lever, r^2, by means of a fulcrum, r^3, and the lever r^2 is further supported in a horizontal position by means of a screw, R^3, which passes through the lower part of the bracket R^2, and is, at its lower extremity, provided with a cord-pulley, r^4. A vertical lug, r^5, on the lever r^2, near its fulcrum, serves to force a thrust-pin, r^6, in a tubular bearing, r^7, of the bracket R^2 against the brake-lever R, whereby the motion of the pulley Q^1 is either retarded or stopped. By turning the screw R^3 more or less by means of a cord, r^8, one or the other way, the friction of the brake-lever R may be so adjusted as to lower the hoisting apparatus with the exact speed desired. The maximum friction produced by the weighted lever r^2 is so regulated by the weight and its distance from the fulcrum of the said lever that a sudden application of full pressure of the brake cannot arrest the motion in so short a space of time as to allow a dangerous strain to be thrown upon the revolving parts.

The shaft Q has a tubular bearing, s, on a bracket, S, which is fastened to a removable bottom, S^1, of the cylinder M. The main bottom M′ of the said cylinder has a spindle-bearing, m, for the shaft Q. The bottom S^1 forms a chamber, S^2, with the bottom M′, which is subdivided by a horizontal disk, S^3, supported by the removable bottom S^1 by means of stays s^1, as shown in section in Fig. 12. The disk S^3 is of smaller diameter than the lower part of the cylinder M, and has a horizontal valve-seat, s^2, around an opening, s^3. The removable bottom S^1 has a tapering valve-seat, s^4, into which a valve, T, is inserted. The disk S^3 is connected, by means of radial arms s^5, with a tubular bearing, S^4, fitted on the shaft Q.

The top of the valve T is a heavy solid disk, t. The valve proper is a hollow cylinder, T′, provided with a horizontal foot-bearing, t^1, and a conical bearing, t^2, of larger diameter than the bearing t^1. Between the disk t and the bearing t^2 the valve is provided with apertures t^3, which open into the inner space of the valve. The disk t is also provided with a tubular bearing, T′, which is fitted and slides upon the bearings s and S^4, and thereby guides the valve in its operation.

The lower subdivision of the chamber S^2 is occupied by a winged wheel, U, which consists of a hub, u, fastened to the shaft Q, and a number of radial arms, u'. The revolution of the wheel U imparts a rotary motion to the water, which produces, by means of centrifugal action, a difference of pressure at the outer circumference and center of the wheel U. This pressure or centrifugal head extends throughout the upper part of the chamber S^2, between S^3 and S^1, on account of the stationary wings or stays s^1, which prevent the rotation of the water, which would otherwise balance the revolving column of water in wheel U, thereby preventing the circulation desired. The weight of the valve T is so regulated as to balance the pressure due to a given number of revolutions of the wheel U corresponding to the desired velocity of descent of the hoisting-platform. A slight increase of the said speed will increase the pressure of the water and lift the valve. The lift of the valve provides two outlets for the water between S^1 and S^3, one at the upper valve-seat s^4, and the other at the lower valve-seat s^2. The water passing up between the valve T and its upper valve-seat s^4 increases the volume of water upon the bottom S^1 so that it begins to flow through the openings t^3 of the valve, and passes through its interior space and through the openings s^3 of the disk S^3, into the wheel U. The water which passes between the foot of the valve T and its lower valve-seat s^2 passes downward through the openings s^3 into the wheel U. As soon as the valve T has left its valve-seats s^2 s^4 its area of pressure from below is greatly reduced, as only the area below the bottom S^1 is effective in holding the valve suspended, and consequently the pressure or centrifugal head must be greatly increased to keep the valve suspended, and it is seen that thereby any excess of descending speed of the hoisting-platform is very quickly checked by a very small movement of the valve T. The cylinder M has a side opening, v, and a discharge-pipe, V. The said side opening v is at such elevation from the bottom S^1 that the water discharged by the wheel B cannot run off until it has filled the chamber S^2 through the apertures t^3 of the valve T.

Operation: Everything being in readiness for raising the elevator, water is admitted from a supply-pipe through the opening J^1 into the valve-chamber G^2. The main valve G being closed, the operator pulls the valve-cord j, and thereby turns the valve J in the position shown in Fig. 6, permitting the water in the valve-chamber G^2 to enter the passages j^1 j^2 of the valve J, and pass through the port i^2 into the pipe I^2, and thence into the cylinder I. The piston H is thereupon pushed toward the end of its stroke until the collar h' comes in contact with the arm N, the position of which has already been determined by the weight upon the hoisting apparatus by means of the levers

P^2 and O^2 and their connecting parts. By the said movement of the piston H the main valve G is so moved that its opening *g* comes to be above the opening *f* in the bottom F, and the water in the chamber G^2 thereupon flows through the said openings into the wheel B. The wheel B now revolves with the proper speed and hoists the load. If the operator wants to stop, he pulls the cord *j* in the opposite direction, and thereby changes the position of the valve J into the position shown in Fig. 5, thus reversing the position of the piston H and closing the valve G.

The first backward movement of the turbine wheel, caused by the load on the hoisting apparatus, throws the heads q^1 of the friction-clutch within the pulley Q^1 against the rim *q*, and locks the turbine with the pulley Q^1, which latter is prevented from turning by the head *r* of the friction-stopping device. If the cord r^8 is so pulled as to move the screw R^3 upward, the lever r^2 is lifted and the head *r* freed from strain, by which action the turbine B revolves backward, and the load on the hoisting apparatus is thereby lowered. In the latter case the speed of the apparatus is regulated by the centrifugal water-brake above described.

I may here state that in practice I provide my hoisting-machine, as near the main valve as practicable, with a very sensitive safety-valve, whereby I avoid the bad consequence of a sudden shock upon the parts, caused by the quick closing of the said main valve.

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

1. A hoisting apparatus, in combination with a water wheel, the supply of water to which wheel is regulated by the weight of the load upon the hoisting apparatus, substantially as set forth.

2. A hoisting apparatus, in combination with an automatic centrifugal water-brake, substantially as and for the purpose set forth.

3. The combination of a hoisting apparatus with an automatic centrifugal water-brake and an adjustable friction-stop, substantially as set forth.

4. The combination of the cable X, the levers P^2 O^2, the sliding arm N, and the piston H, having a collar, *h'*, on its piston-rod, substantially as set forth.

5. The combination of the cord *j*, the valve J, having passages j^1 j^2 j^3, the valve-seat J^2, having ports i^1 i^2 j^4, the valve-chamber G^2, and the piston H, substantially as set forth.

6. The combination of the piston H, having a collar, *h'*, and a pin, *h*, and the valve G, substantially as set forth.

7. The valve G, having an opening, g^1, and guide-plates g^2, in combination with the bottom F, having an opening, *f*, and the piston H, substantially as set forth.

8. The wheel B, having pins *b*, in combination with the slotted locking-levers Q^2, the arms Q^4, the pulley Q^1, the shaft Q, and the wheel U, substantially as set forth.

9. The shaft Q, having a wheel, U, in combination with the bottom S^1, the disk S^3, and the valve T, substantially as set forth.

10. The wheel B, having pins *b*, in combination with the locking-levers Q^2, the arms Q^4, the pulley Q^1, having the rims *q* and Q^6, the friction-lever R, pin r^6, and weighted lever r^2, substantially as and for the purpose set forth.

Witness my hand in the matter of my application for a patent for an improved hoisting-machine this 10th day of March, 1877.

Oakland, Alameda county, California, March 10, 1877.

FREDERICK GODFREY HESSE.

Witnesses:
J. R. CAPELL,
F. S. SUTTON,
W. M. GRAHAM.