(No Model.) 2 Sheets—Sheet 1.

M. C. BULLOCK.

HYDRAULIC FEED FOR DRILLING MACHINES.

No. 462,393. Patented Nov. 3, 1891.

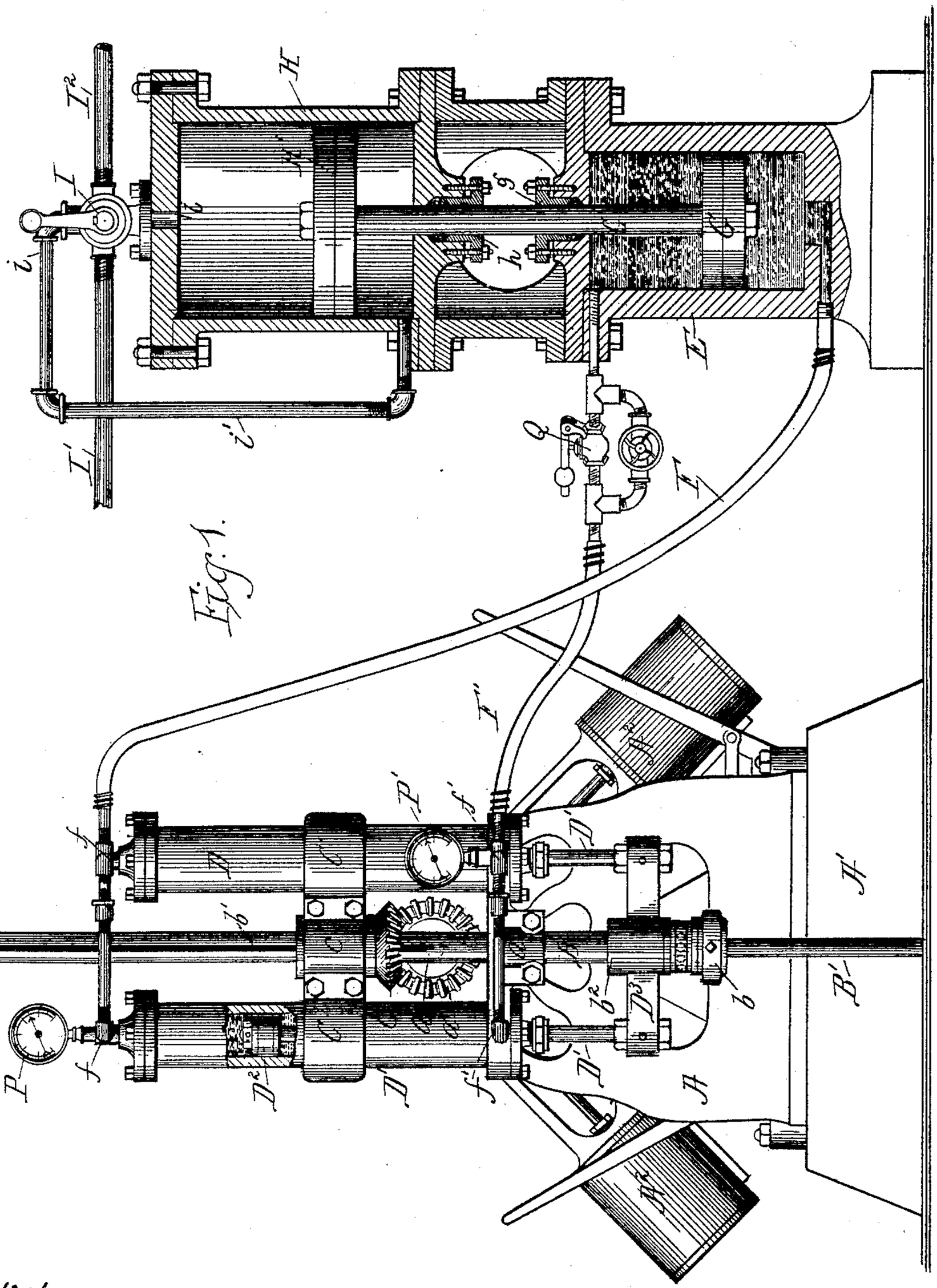

Fig. 1.

Witnesses
Wm. M. Sheem.
Louis M. F. Whitehead.

INVENTOR
Milan C. Bullock
by Dayton, Poole & Brown
Attorneys

(No Model.) 2 Sheets—Sheet 2.

M. C. BULLOCK.

HYDRAULIC FEED FOR DRILLING MACHINES.

No. 462,393. Patented Nov. 3, 1891.

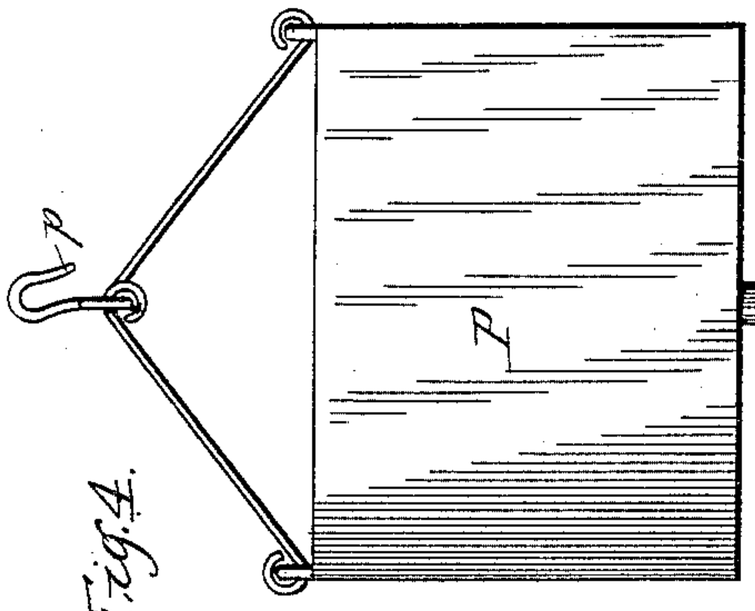

Fig. 4.

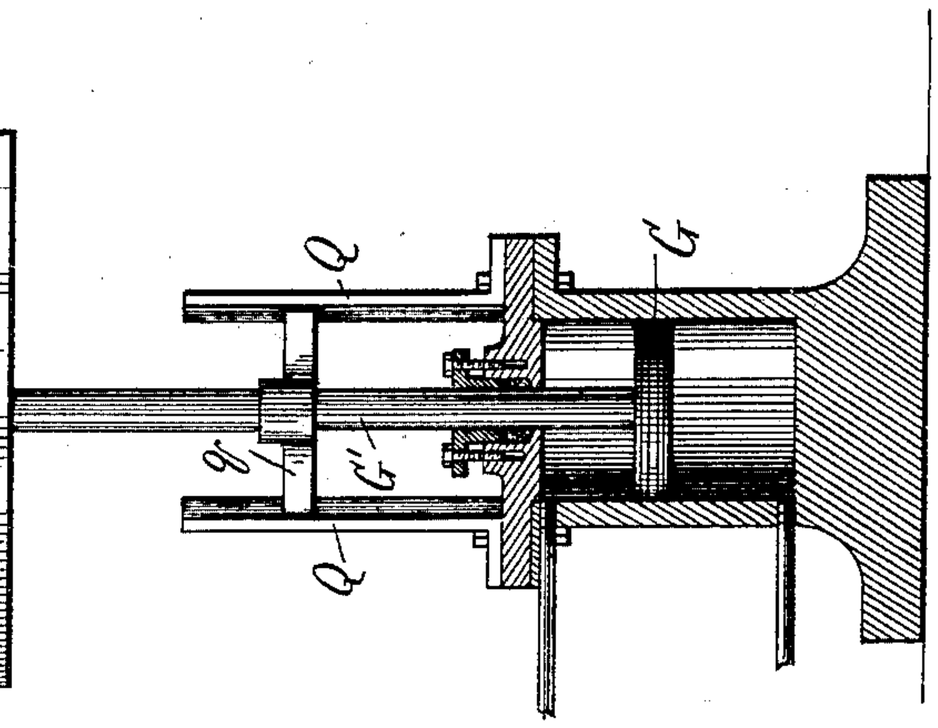

Fig. 3.

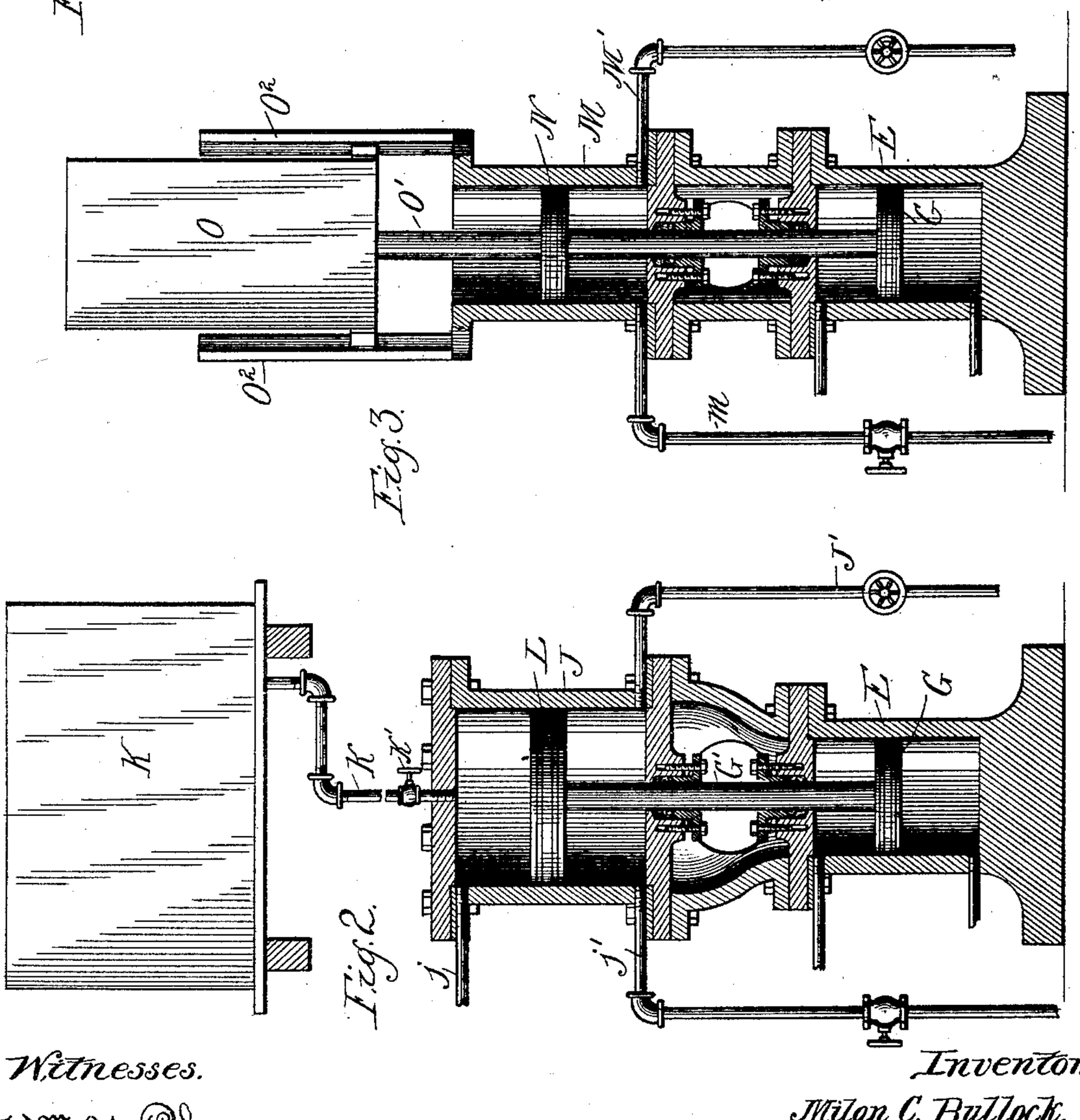

Fig. 2.

Witnesses.

Wm. M. Rheem.

Louis W. Whitehead.

Inventor.

Milan C. Bullock.

By Dayton, Poole & Brown

Attys

UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK, OF CHICAGO, ILLINOIS.

HYDRAULIC FEED FOR DRILLING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 462,393, dated November 3, 1891.

Application filed April 14, 1891. Serial No. 388,909. (No model.)

To all whom it may concern:

Be it known that I, MILAN C. BULLOCK, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydraulic Feed for Drilling-Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a novel feed mechanism for revolving or diamond drills used in rock or earth boring, and more especially to improvements in that class of feed devices known as "hydraulic feed," or that in which the drill is fed or carried forward by the pressure of water or other fluid.

The invention consists in the matters hereinafter set forth, and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is an elevation of an apparatus showing one form of my invention, the accumulator being shown in vertical section. Fig. 2 is a sectional view of an accumulator adapted for operation by water-pressure. Fig. 3 is a sectional view of an accumulator adapted for operation by a weight in one direction and force-pump in the other. Fig. 4 is a sectional view of an accumulator adapted for actuation by a weight in one direction and a hoisting apparatus in the other direction.

As shown in the drawings, A represents the frame, and A′ the base, of a combined drilling-machine and hoisting-engine of a kind commonly used in well-boring and prospecting.

A^2 A^2 indicate the steam-cylinders of the engine, and *a* the main crank-shaft, (shown in dotted lines in Fig. 1,) which is provided with a bevel gear-wheel *a′*, through which motion is communicated from the shaft to the drilling mechanism.

B is a tubular driving-spindle, which is provided at its lower end with a chuck *b*, which serves to attach to the same the drill-rod B′, which is fed downwardly through said spindle. Said spindle B is supported below the gear-wheel *a′* in a bearing a^2 upon the machine-frame, and rotary motion is imparted thereto from the said gear-wheel by means of a bevel-gear *c*, which intermeshes with the wheel *a′* and is attached to a sleeve C, through which the spindle B passes, and which is provided with a spline or feather engaging a longitudinal groove *b′* in the shaft. The sleeve C is mounted in a stationary bearing *c′*, upon a cross-piece C′, suitably sustained upon the machine-frame, in the instance illustrated by means of the feed-cylinders of the machine.

D D are the feed-cylinders, which are located at opposite sides of the spindle B and parallel therewith. Said cylinders may be attached to or supported on the frame A in any suitable manner. As herein illustrated, they are attached at the lower ends to the upper part of the vertical frame-standard of the machine.

D′ D′ are piston-rods, which pass through the lower ends of the cylinders and are attached to pistons D^2 within the cylinders in the usual manner. The said pistons are attached at their lower ends to a cross-head D^3, which is connected at its central part with the lower end of the revolving spindle B by a thrust-bearing D^4, arranged to transmit downward pressure from the cross-head to said spindle. Said thrust-bearing may be of any approved construction, but is preferably a roller-bearing, as indicated in dotted lines in the drawings. The cross-head D^3 is shown as provided with a central hub b^2, through which the spindle B passes, said spindle being secured rigidly to the hub, so that the spindle is moved or carried with the hub in both its upward and downward movements.

At any suitable point adjacent to or upon the frame of the drilling apparatus is located an accumulator, which may be of any approved construction, the form shown being chosen merely for the purpose of illustration. In this construction E represents the hydraulic or pressure cylinder of the accumulator, which is connected at its opposite ends with the opposite ends of the feed-cylinders D by means of pipes F F′, having branches *f f′* leading to the ends of said pressure-cylinders.

G is a piston within the cylinder E, and G′ is a piston-rod attached thereto and extending through a suitable gland *g* in one end of the cylinder.

H indicates a steam-cylinder mounted on and arranged in line with the cylinder E and provided with a gland *h*, through which the piston-rod G′ passes, said piston-rod being provided with a piston H′ to fit the same.

I indicates a four-way valve, with which are connected the steam-supply pipe I′, the exhaust-pipe I^2, a pipe *i*, leading to the top of the cylinder H, and a pipe *i′*, leading to the bottom of the said cylinder. This valve is of well-known construction and serves not only to either turn on or shut off the flow of steam, but also in the former case to connect either one of the pipes *i* and *i′* with the supply-pipe I and at the same time connect the other one of said pipes with the exhaust. Any other approved valve mechanism may be used for controlling the steam-supply of the cylinder H. The supply-pipe I′ will be preferably connected with the same source that supplies the hoisting-engine. At opposite ends of the feed-cylinders and in communication with the same are located pressure-gages P P′, said pressure-gages being for convenience attached to the pipes *f f′* at points adjacent to the cylinders.

Q represents a safety-valve located upon the pipe F′, which latter is provided with a by-pass *q*, having a valve Q to control the same. These parts—the safety-valves and pressure-gages—operate substantially as set forth in an application filed by me July 12, 1889, Serial No. 317,321, and therefore need no extended description here, it being only necessary to note that the opening of the by-pass valve during the return or upward stroke of the pistons in the feed-cylinders obviates the necessity of releasing or opening the safety-valve.

When the apparatus is in readiness for operation, both of the feed-cylinders are filled upon both sides of the piston with water or other liquid, as hereinafter pointed out, and the pressure-cylinder is similarly filled at both sides of the piston therein. When the several cylinders are thus filled, steam may be admitted to the upper end of the cylinder H, and will force the piston H′ therein downward, the piston G being of course carried downward to a like extent and transmitting its motion through the water or other liquid to the pistons D^2 of the feed-cylinders, which latter will, through the described connecting mechanism, advance the drill-rod to its work. Steam admitted to the other end of the cylinder H will serve to impart a reverse motion to the several parts mentioned to raise the drill-rod, the direction and rate of feed being controlled by the valve I.

Heretofore when hydraulic feed mechanism has been employed to feed drills of this class a pump has been employed, connected directly with the feed-cylinders, the same pump being used to supply to the bits the water used to facilitate their cutting operation and to remove upwardly through the hole the débris made by the bit. This dual use of the pump is frequently a great disadvantage, since it renders it impossible to regulate the supply of water for the one purpose independently of the supply for the other, so that when employing a given pressure to the feed-cylinders a quantity of water greater or less than the circumstances require is frequently being fed to the bit. Moreover, the action of a pump is commonly a pulsating or throbbing one, and the advance of the drill when fed forward by the direct pressure from the pump is correspondingly irregular, a fact which constitutes a serious objection to the employment of a pump directly connected with the feed-cylinders. These objections are all obviated by the employment of an accumulator for the purpose of supplying pressure to the feed-cylinders, as the pressure thus obtained is an even non-pulsating one and is entirely independent of the water-supply for the bit, so that the required pressure may be used to force the drill into the rock and at the same time any desired variation in the supply of water to the bit may be made without affecting this pressure. Moreover, it will be noticed that the pressure-transmitting liquid circulates back and forth between the pressure-cylinder and feed-cylinders, the exhaust-liquid of one stroke becoming the supply-liquid of the next, so that there is no loss of the liquid, except the slight one due to leakage. This enables me to use brine, oil, glycerine, or other non-freezing liquid, thereby preventing the apparatus from being affected by a low temperature. It would manifestly be impracticable to use these comparatively expensive liquids in an apparatus of the ordinary type where the exhaust-liquid is discharged and wasted after each stroke.

As heretofore stated, I have shown a steam-actuated accumulator solely for the purpose of illustration, and my invention is not limited to the employment of this particular form of accumulator, inasmuch as there are many other well-known forms of accumulators which may be employed with the same result and without departure from the principle of my invention. As, for instance, water-pressure may be applied to actuate the accumulator in a direction to feed forward the drill, while the steam-pump may be used to retract the same, or a weight may be used to actuate the accumulator in feeding forward the drill, and the weight may be lifted and the drill retracted either by a steam-pump applied to force water into a cylinder having a piston connected with the weight or by the direct action of the hoisting mechanism on the weight.

In Fig. 2, for example, I have shown an accumulator-cylinder E and a water-cylinder J, arranged in the same manner as the cylinder hereinbefore described. K is a water-tank connected with the top of the cylinder J by a pipe *k*, which is provided with a valve *k′*. An exhaust-pipe *j* is connected with the top of said cylinder J, and to the bottom of the

same is connected a pipe J′, leading from a force-pump, and also an exhaust-pipe *j′*. Within the cylinder E is a piston G, connected by a piston-rod G′ with a piston L in the cylinder J. In the operation of this form of accumulator water under pressure from the tank K is allowed to enter the cylinder J above the piston therein and acts with a steady and uniform pressure to actuate the piston G, and thereby force or feed forward the drill. When the drill has reached the lower limit of its stroke, the valve K′ is operated to cut off the water-supply, the valve in the exhaust-pipe *k′* is opened, and water then forced through the supply-pipe J′ from a steam-pump to lift the piston L and retract the drill-rod. It is of course understood that by the use of the steam-pump the drill-rod may be lifted much more rapidly or quickly than it is moved when advanced.

As shown in Fig. 3, the cylinder E and the piston therein are arranged in the same manner as before described. M is a hydraulic cylinder open at its top and containing a piston N, said cylinder being provided with a water-supply pipe M′ leading from a steam-pump and with an exhaust-pipe *m*. O is a tank or receptacle for containing water, stones, or other material and acting as a weight to operate the accumulator for advancing the drill-rod. The said tank or receptacle O is shown as connected with the piston N by the rod O′, and as being held or guided in its vertical movement by guides O^2 O^2. In this construction steady or uniform pressure is given by the weight when the drill-rod is fed forward, and the latter is retracted by means of pressure of water pumped into the lower part of the cylinder M through the supply-pipe M′.

In Fig. 4 is shown an accumulator-cylinder like that hereinbefore described, and having a piston G and piston-rod G′. To the top of said piston-rod is attached a receptacle P for containing water or stone to form an actuating-weight, and said receptacle is provided at its top with a hook *p*, by which the hoisting-gear of the drilling apparatus may be engaged therewith to lift the weight and the piston G, and thereby accomplish the withdrawal of the drill-rod from the hole. The rod G′ is shown as provided with the cross-head *q*, working on guides Q Q; but these details form no part of the present invention.

What I claim is—

1. The combination, with a rotary drill and a motor for actuating the same, of a feed mechanism comprising a feed-cylinder, and an accumulator provided with a pressure-cylinder and piston, and connected from opposite sides of said piston with the ends of the said feed-cylinder, substantially as described.

2. The combination, with a rotary drill and a motor for actuating the same, of a feed mechanism comprising a feed-cylinder having its piston connected with the drill-rod to feed the same, and an accumulator provided with a pressure-cylinder and a piston and having its ends connected with the opposite ends of the feed-cylinder, substantially as described.

3. The combination, with a rotary drill and a motor for actuating the same, of a feed mechanism comprising a feed-cylinder, and an accumulator having a pressure-cylinder connected with said feed-cylinder and actuating a piston, and means for imparting to said piston an even non-pulsating advancing movement, substantially as described.

4. The combination, with a rotary drill and a motor for actuating the same, of a feed mechanism comprising a feed-cylinder, and an accumulator consisting of a pressure-cylinder connected with said feed-cylinder and provided with a piston, and a steam-cylinder connected with said piston to operate the same, substantially as described.

5. The combination, with a rotary drill and a motor for actuating the same, of a feed mechanism comprising a feed-cylinder, and an accumulator composed of a pressure-cylinder connected with the feed-cylinder, a steam-cylinder in line with the pressure-cylinder, and a piston-rod common to both of said cylinders and provided with a piston in each cylinder, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

MILAN C. BULLOCK.

Witnesses:
C. CLARENCE POOLE,
GEORGE W. HIGGINS, Jr.