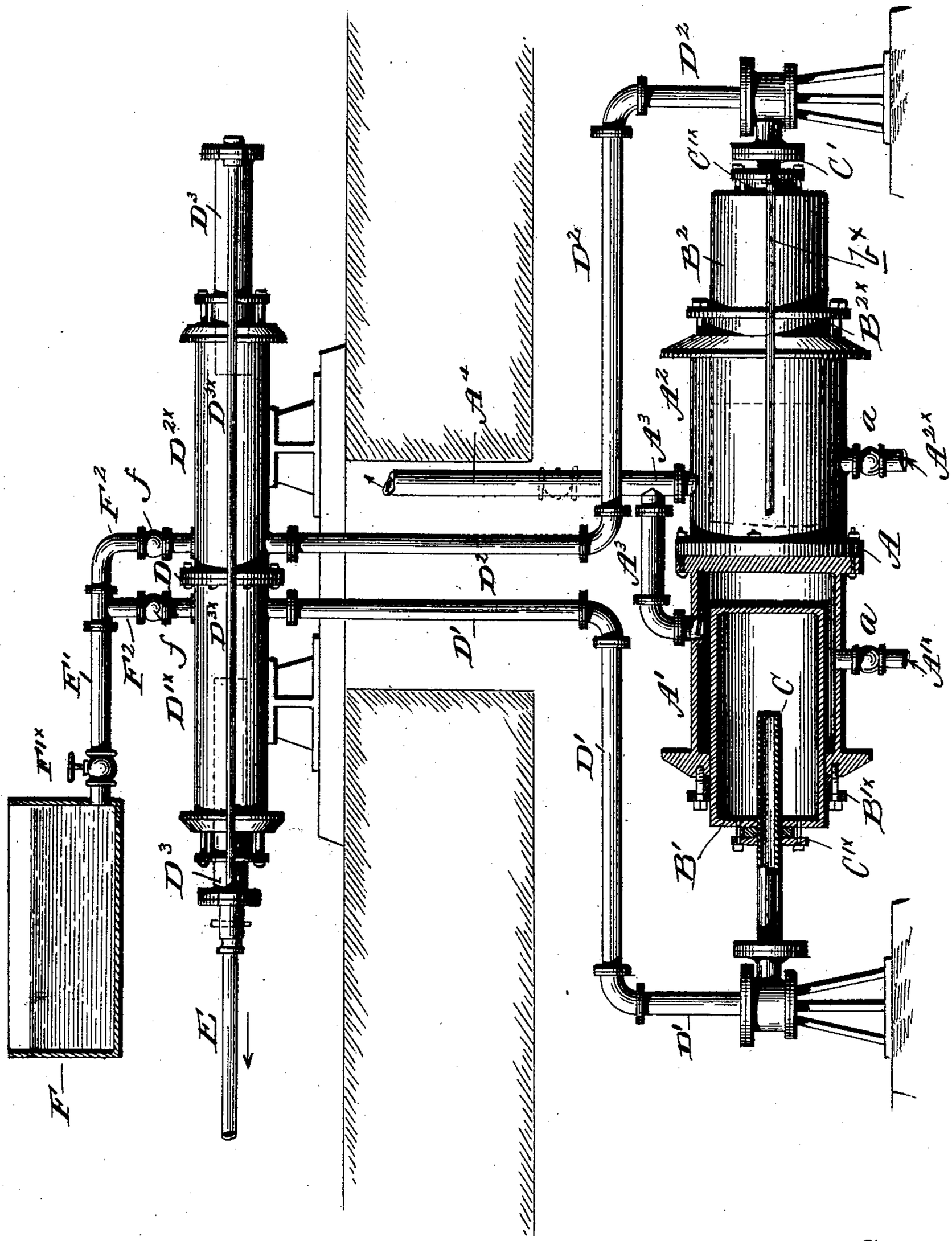
(No Model.)

W. A. ROCKLIFF & J. P. FOLEY.

HYDRAULIC MINING PUMP.

No. 482,810. Patented Sept. 20, 1892.



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UNITED STATES PATENT OFFICE.

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HYDRAULIC MINING-PUMP.

SPECIFICATION forming part of Letters Patent No. 482,810, dated September 20, 1892.

Application filed March 8, 1892. Serial No. 424,196. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. ROCKLIFF and JOHN P. FOLEY, citizens of the United States, residing at Rumsey, in the county of Deer Lodge, State of Montana, have invented certain new and useful Improvements in Hydraulic Mining-Pumps, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to certain new and useful improvements in hydraulic mining-pumps; and it has for its object, among others, to improve generally in this class of devices and to provide a more complete and reliable pump and motor to be located within the mine, the pump and submerged pump and motor operatively connected by means of two water-columns.

Other objects and advantages of the invention will appear in the following description, and the novel features thereof will be particularly pointed out in the claim.

The invention is clearly illustrated in the accompanying drawing, which, with the letters of reference marked thereon, forms a part of this specification, and in which our invention is shown in side elevation with parts in section.

Referring now to the details of the drawing by letter, A designates the submerged pump, shown as located within the mine and consisting of the two cylinders A′ A^2, bolted together, as shown, and having no communication with each other internally. Each cylinder is provided with a water-inlet pipe $A'^{\times}$ $A^{2\times}$, respectively.

B′ B^2 are the plungers of the cylinders A′ A^2 respectively, which plungers are designed to work in and out of the cylinders alternately. They are connected upon the outside by rods $f^{\times}$ in the usual manner of connecting the pistons of double-plunger pumps—as, for instance, is shown, and as is also illustrated in the pump arranged upon the surface in the accompanying drawing. These pistons or plungers pass through the stuffing-boxes and glands $B'^{\times}$ $B^{2\times}$, as shown, and are designed to act upon the fluid to be raised, which is drawn in through the inlet-pipes $A'^{\times}$ $A^{2\times}$. These plungers or pistons are hollow, as shown at the left of the drawing, and the power which operates these plungers is applied to the inside thereof, said power being preferably water under pressure, the same being supplied or applied to the inside of the plungers through the hollow pipes C C′, the pressure being supplied by the double-acting plunger-pump D, which is located on the surface, as shown, being suitably supported, the two cylinders thereof being connected with the hollow pipes C C′ by means of the two pipes or columns D′ D^2, so that the two cylinders $D'^{\times}$ and $D^{2\times}$ of the pump D are connected by means of these two separate columns to the insides of the plungers B′ B^2, as will be readily understood. The plungers B′ and B^2 are movable upon the pipes C and C′, suitable stuffing-boxes $C'^{\times}$ being provided therefor.

The cylinders A′ A^2 are each provided with a discharge-pipe A^3, which unite with the common discharge-pipe A^4, through which the fluid is discharged above the surface alternately from the two cylinders.

D^3 are the pistons or plungers of the pump D, and they are connected in any suitable manner—as, for instance, by the rods $D^{3\times}$—so as to move in unison. Power is applied to the plungers D^3 through the medium of the rod E, which is connected therewith in any suitable manner, and the power is furnished to said rod in any manner desired, either hydraulic, steam, or electricity, it only being required that the said rod should be given the necessary reciprocatory movement.

F is a supply-tank having a discharge-pipe F′, provided with a valve $F'^{\times}$ and with branch pipes F^2, communicating one with each cylinder of the pump or motor D, and provided with ordinary check-valves *f*. The object of this tank is to replace any of the fluid contained in the cylinders of the motor D, and in the columns D′ D^2, and in the inside of the hollow plungers B′ and B^2, that may escape by reason of leaky joints or in any other manner, the said tank being placed at an altitude high enough above the cylinders of the motor or pump on the surface to have pressure enough to cause the fluid contained in said tank to flow through the check-valves *f* into the cylinders $D'^{\times}$ $D^{2\times}$ and thereby supply any deficiency that may be caused therein by leaks.

The cock $F'^{\times}$ is provided for the purpose of allowing the escape of any air that might

prevent the entrance of the fluid at the time the plungers are retreating from their respective cylinders. This fluid may consist of cheap lubricating-oil. It may be water or it may be water mixed with some cheap lubricating-oil—such as West Virginia black oil—to keep the plungers from rapid wear where they pass through the stuffing-boxes. It will also lessen the friction at those places and preserve the packing from rapid wear. No exhaust of this fluid takes place, as it is used over and over again for an indefinite period.

The operation will be readily understood from the foregoing description when taken in connection with the annexed drawings. Briefly stated, it is as follows: Motion is imparted to the rod E in any suitable manner, moving the same in the direction of the arrow. The plunger at the right commences to move into its cylinder, and at the same time the plunger D^3 at the left commences to emerge from its cylinder. These plungers, being connected together, cannot act independently, but must move in unison. As the plunger at the right advances into its cylinder it forces the liquid contained therein down through the column D^2, through the pipe C′, into the inside of the plunger B^2, the fluid acting upon the inside of the face of the plunger, and the fluid inside of the cylinder A^2, that is to be pumped to the surface, offers the resistance to be overcome, it acting upon the outer face of the plunger. Thus when the fluid entering the inside of the plunger meets with this resistance its pressure increases until the pressure acting on the inside face of the plunger more than equals the pressure acting on the outer face, this being due to the discharge-column's altitude, and the plunger continues to move inward into the cylinder and displaces the fluid therein to be raised and forces it through the discharge-pipe and through the discharge-column A^4 to the surface. At the same time the plunger B^3 at the left retreats from the inside of its cylinder, the space being filled by the fluid contained in the inside of the hollow plunger B′, this plunger moving out of its cylinder, and of course at the same time the pipe C is entering farther into the inside of the plunger, and the fluid thus displaced passes through the pipe and up through the column and fills the space behind the retreating plunger, thus acting as a solid body to transmit the power from the plunger on the motor on the surface to the pump in the mine. While the plunger retreats from its cylinder it causes a vacuum therein, which causes the suction-valves *a* of the pump to open and admit to the cylinder the fluid to be raised after the manner of any ordinary plunger-pump.

It will be observed that our construction embodies simplicity of construction with minimum parts, and those conveniently arranged and not liable to get out of order. We dispense with rods and heavy balance-weights moving up and down in the shaft as well as long lines of steam-pipes with their unavoidable loss of power from the condensation of steam and the expense involved in keeping the same in good condition and free from leaks caused by sudden changes of temperature. It occupies but little space. It presents a feasible way of utilizing a natural power—such, for instance, as water-power. The parts subject to hydraulic pressure are free from moving valves or cut-off mechanism. It requires less amount of attendance to keep it in running order. It will work as well under one thousand feet of water as when placed ten feet above it. The loss from friction in transmitting the power is also very small, as the fluid in the two columns only moves a few feet at each stroke of the pump. The two columns of water that furnish the motive power are both of the same height and balance each other, so that no power is absorbed in moving them other than that necessary to overcome the slight amount of friction in the pipes, thus doing away with the loss consequent upon having to raise exhausted water to the surface again, as in other hydraulic devices. There is also an absence of any system of pipes and receivers under pressure at all times, pressure being present only when work is being done, except what is due to the head, and only then the amount of pressure necessary to cause the plungers to move at the desired speed.

Modifications in detail may be resorted to without departing from the spirit of the invention or sacrificing any of its advantages.

What we claim as new is—

The combination of two cylinders, each having a closed end secured to the closed end of the other and opposite open ends provided with pistons, rods connecting the pistons of the two cylinders, and means for reciprocating said pistons with a system of piping connecting each of the closed ends of the said cylinders with a second pair of closed-end cylinders arranged at a lower level, each being provided with a hollow piston communicating with one of the first-mentioned cylinders, suction-pipes, one each for each closed cylinder, and discharge-pipes extending from each of said closed cylinders and provided with suitable check-valves, substantially as specified.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM A. ROCKLIFF.
JOHN P. FOLEY.

Witnesses:
ROBERT BROWNING,
GEORGE ROBERTS.