(No Model.)

J. MOORE.

MINE DRAINING MACHINERY.

No. 322,955. Patented July 28, 1885.

FIG. 1

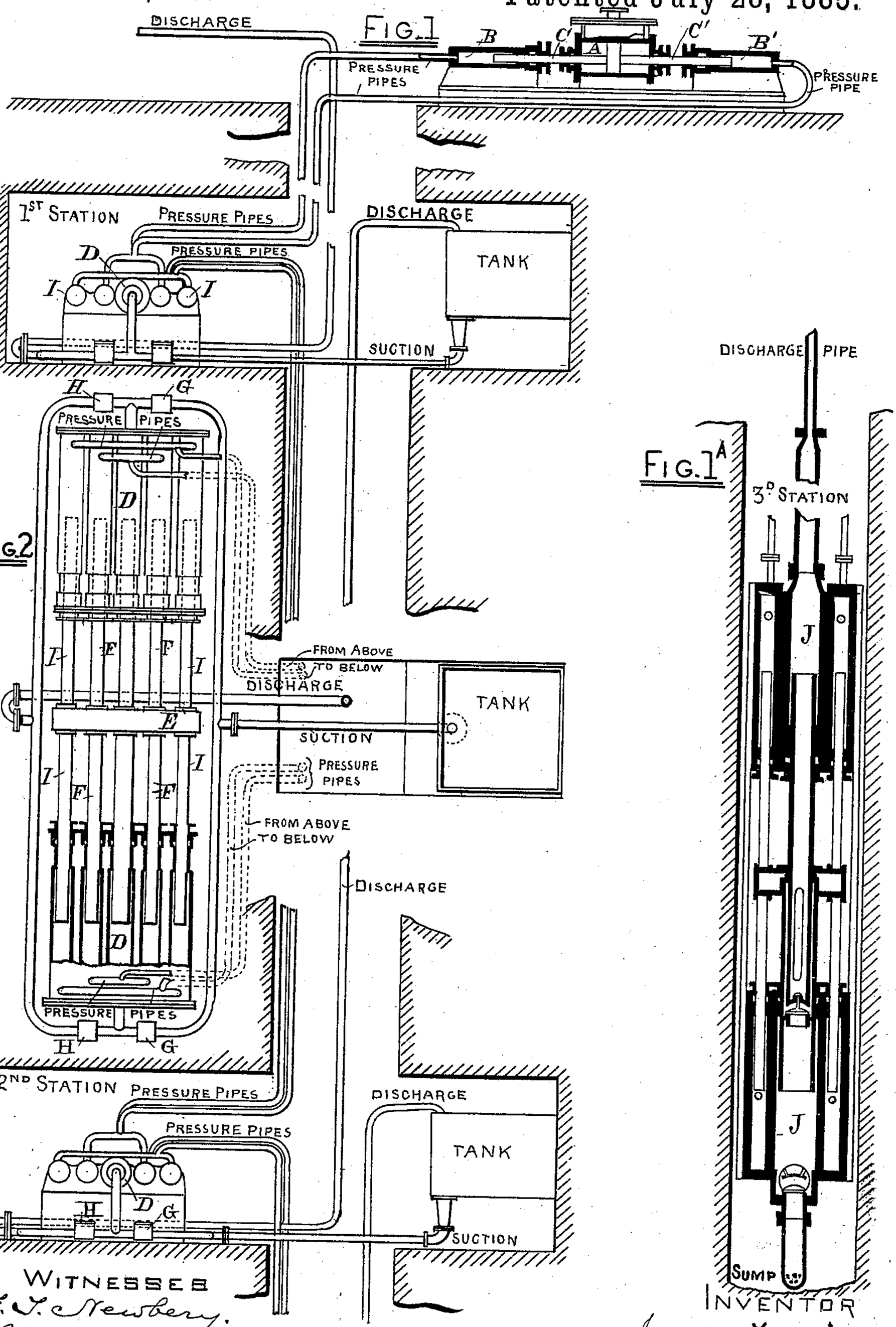

FIG. 2

FIG. 1A

WITNESSES

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JOSEPH MOORE, OF SAN FRANCISCO, CALIFORNIA.

MINE-DRAINING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 322,955, dated July 28, 1885.

Application filed November 28, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH MOORE, a citizen of the United States, and a resident of San Francisco, State of California, have invented a new and useful Improvement in Mine-Draining Machinery, of which the following is a specification.

The invention relates to an improved system of operating hydraulic mine draining machinery when there are two or more pumping-stations in the mine; and it has for its object the avoidance of those high pressures on the leading-pipes which occur when the lower-level pumps are operated by a pressure-column reaching to the mouth of the shaft, and which pressure on the lower levels has heretofore been due to the sum of the pressure due to the depth of the shaft and the pressure necessary to work the pump, whereas in the present invention the total pressure is never more than the sum of the pressure due to the height of the station next above and the pressure necessary to operate the pumps, thus saving the pipes from that amount of pressure which would be due to the height of the mouth of the shaft above the last station, where the pressure was generated.

The invention consists in a certain combination or arrangement of actuating rams and pumps and their connecting pipes, by which one set operates both the pump and another set of rams on the same frame, to produce a pressure of any suitable degree to operate other pumping machinery, either farther down the shaft or elsewhere situated in the mine, thus saving the expense and inconvenience of massive machinery and pipes, such as is required under the present system of operating with the full hydraulic pressure at all points in the shaft, computed as being the sum of the pressures due to the height of the column plus the working pressure.

For more elaborate description of parts in detail of the machinery and apparatus to which the present invention is applied, see Patent No. 294,859, dated March 11, 1884.

In the accompanying drawings, forming part of my specification, Figure 1 1^{A} is a sectional elevation of a mining-shaft having three pumping-stations, the lowest being where the sinking-pump operates. Fig. 2 is a plan of the actuating-rams and a pump, as at the first and second station.

In all the figures like letters of reference represent like parts.

A, Fig. 1, is the prime mover of all the machinery—generally a steam-engine of the compound pattern capable of supplying the entire power necessary to pump the water from the lowest depths.

B B′ are two cylinders, containing rams C C′, which, being alternately pushed into and withdrawn from their respective cylinders by the steam-engine, the piston-rod of which is but a connection between, operate to produce a pressure per square inch upon the water contained therein equivalent to the total pressure in pounds upon the piston or pistons of the steam-engine, divided by the cross-sectional area of the rams—that is to say, if the total pressure upon the piston or pistons of the engine be sixteen thousand six hundred and fifty pounds and the area of the rams is fifty inches, then the rams will exert a pressure equal to 16,650 pounds÷50=333 pounds per square inch. This pressure, let us suppose, would be sufficient to operate the pump D, located on the first level below the surface.

This double-acting pump D is simply a couple of common Cornish pumps placed opposite each other (see Fig. 2) on a single frame, their respective plungers being connected with a single cross-head, E, which receives a reciprocating motion from the alternate advancing and receding of the plungers F F of the hydraulic rams. The only valves necessary are those of the pump, the chambers containing which are shown on the drawings, G being the suction-valve chamber, and H the discharge-valve chamber. It is unnecessary to show the exact construction of these valves, for any suitable kind will do.

There will be certain resupply-valves to provide for recharging the ram-cylinders when leakage has occurred; also certain equalizing-valves to regulate the stroke of the pump and rams; but these form no part of my present invention, and, as they are not absolutely necessary, I will omit the description of them here.

If no pumping is done below the first level, the engine may operate at a low steam-press-

ure, just sufficient to create a pressure on the rams to lift the amount of water required, and only the cylinders of the plungers F F are supplied with water, the outside cylinders of plungers I I being as yet empty and unprovided with either packing in stuffing-boxes or connecting-pipes.

The capacity of the engine and rams on the surface is calculated with a view of supplying any required power, accordingly as the shaft of the mine progresses in depth, so that when there is a lower level to be pumped from the steam-pressure is increased to correspond.

Now, let us say that another pumping-station is established farther down the shaft, just twice the depth of the first station, with the same quantity of water to pump as before. The pressure on the surface is now increased to double the former pressure, and the rams I I are brought into service, they having previously lain idle, by making the pipe-connections with the station below, as shown in drawings, by packing the cylinder stuffing-boxes and by charging the cylinders and connecting-pipes with water. The four rams next to the pump on the first station have now not only to operate the pump, but must operate to produce a pressure in the outside ram-cylinders equivalent to the new work to be performed. These outside ram-cylinders are now filled with water and properly connected by pipes to a set of rams below on the next pumping-station, or, as the case may be, in some other part of the mine, which, precisely as before, operate another pump. If the hydraulic rams be of the same size, the pressure of course will be the same—that is, if the first ram, which produces the pressure, has an area of fifty inches and acts directly upon one of the same area, the pressure will be the same; but if the ram acted upon only has an area of twenty-five inches the pressure per square inch will be doubled. It being desirable to maintain a uniform operating pressure from the surface to the sump or lowest level, the rams will be proportioned accordingly—that is to say, the rams which operate the pumps must have an area sufficiently increased above the outside rams, which simply transmit the unexpended power, to enable them to do both the pumping and the transmitting, so to speak. For some time it may be sufficient to pump from two stations; but, again, the shaft having been deepened or another station established, more pumps are required; again, the surface-pressure is increased, say, to a thousand pounds per square inch, which would be three hundred and thirty-three pounds for the first station and the balance for the first-station actuating-engine, for it has now a double duty to perform—viz., to supply a power for two stations instead of one. Upon the second station the rams next to the pump only have been operated. Now, as the last pump, J, (the sinking-pump,) is brought into use, the outside cylinders of the second station are supplied with a charge of water, and the rams are moved to transmit power to this sinking-pump at the bottom. Thus it will be seen that the grand total pressure is applied to the first station and such portion as is necessarily there used in pumping, the remainder being transmitted elsewhere, as required, the first station only having a pressure due to the working pressure plus the pressure due to the height to the surface, the previous practice being to have one general pressure-column leading from an accumulator at the mouth of the shaft to the different stations below, as required.

In some cases the quantity of water pumped from one level may be largely in excess of that pumped from another—as, for instance, while the first and second levels may be comparatively free from water the lower levels may be constantly flooded. Therefore, inasmuch as the upper-level pumps have finally to discharge all the water from the mine, they must be proportioned accordingly. If at first they have little to do, they may be run slowly or even periodically; but they must always be large enough to do the entire work. Of course in some cases the pumping is so nearly equal at all the stations that it may be found more convenient to make the pumps of uniform size. These are matters which can be varied to suit each particular case.

There may be a connecting-pipe between any of the opposing sets of rams, with stop-cock upon it, so that when this stop-cock is opened the rams will cease to create any pressure, the water simply circulating from one set to the other.

The system admits of the application of displacement-sleeves in the pumps and rams, as commonly practiced, to vary their capacity, so that if it is required to pump little the displacement-sleeve continues from the end of the main plunger through a stuffing-box in the rear of the cylinder it works in, to occupy part of its cubical contents. When the pump or ram cylinder is required to be of larger cubical capacity, the displacement-sleeve is removed.

The sinking-pump J is shown in the drawings to be a differential plunger-pump, which discharges through its plunger, the lower plunger being double the area of the upper one, so that as the plunger falls the displacement of the lower plunger is equal to the displacement of the upper plunger, which necessarily recedes with it, plus the quantity of water it is to discharge at each stroke, the two quantities corresponding with the amount lifted by suction on the upstroke, upon which alone the supply is taken in. When the upstroke is made, the displacement of the upper plunger in the upper cylinder forces the water up the discharge-pipe. The discharge is constant and the suction intermittent.

The tanks are shown at the different levels to accumulate the water pumped from the stations below, and from which the pump at the same level takes its supply.

The details of construction of either the pumps or rams is no part of the present invention. The system of applying the power is all that is intended to be claimed.

What I claim as my invention, and desire to secure by Letters Patent, is as follows:

A hydraulic pumping apparatus comprising a combination of, first, a hydraulic-pressure generator; second, a set of hydraulic actuating-rams operated by said pressure-generator, and through suitable connections transmitting their motion to adjacent pumps; and, thirdly, a set of pressure-generating rams, also operated by the first set of actuating-rams, to produce and transmit their pressure through leading-pipes to other actuating-rams to operate further pumping machinery distantly located, the whole arranged and operating substantially as herein described.

JOSEPH MOORE.

Witnesses:
GEORGE PARDY,
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