N. W. DUNLAP.

Safety Device for Steam-Pumps.

No. 220,753. Patented Oct. 21, 1879.

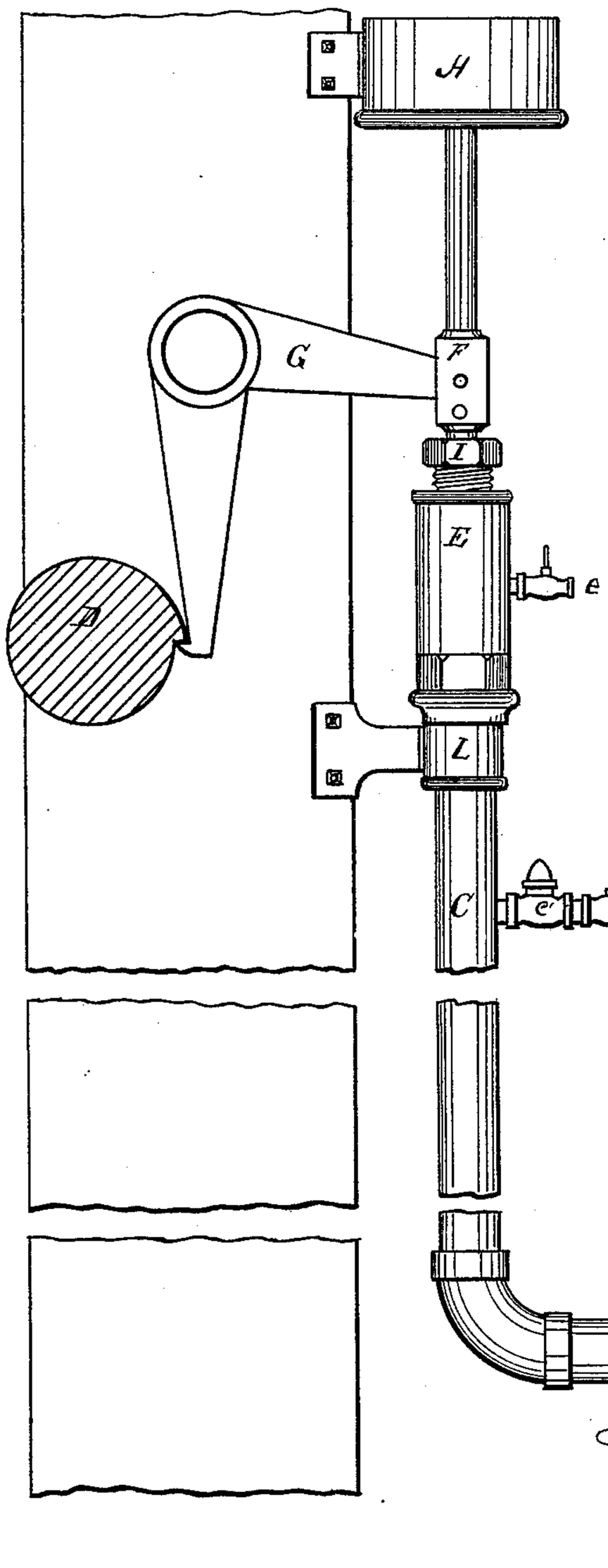


Fig 1

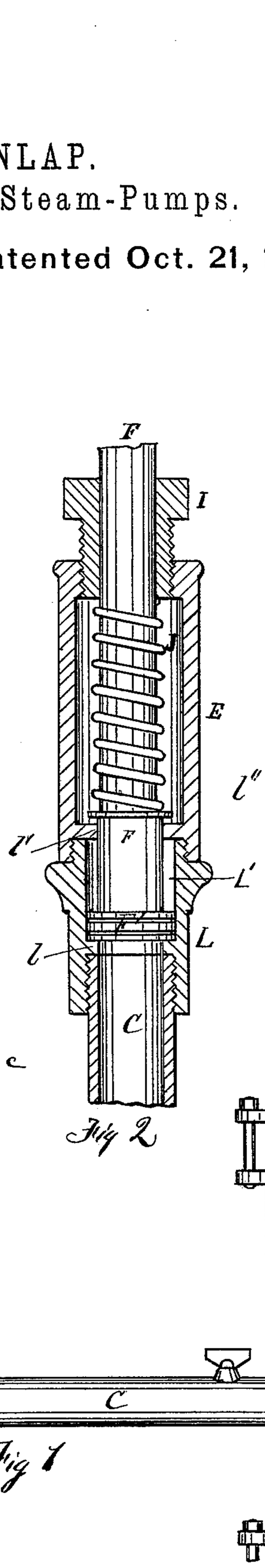
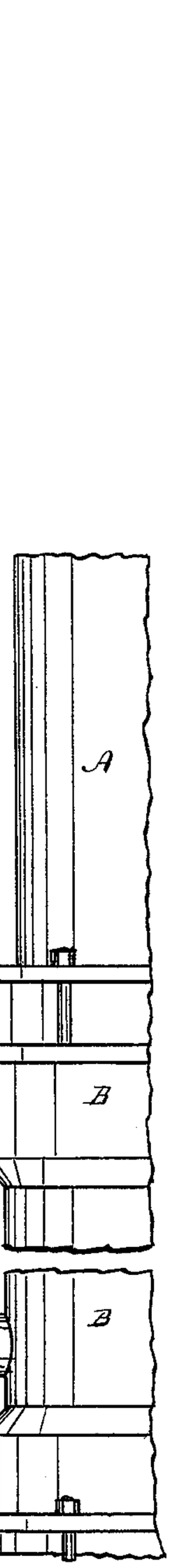


Fig 2



WITNESSES.

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NOAH W. DUNLAP, OF ERIE, PENNSYLVANIA.

IMPROVEMENT IN SAFETY DEVICES FOR STEAM-PUMPS.

Specification forming part of Letters Patent No. **220,753,** dated October 21, 1879; application filed February 24, 1879.

To all whom it may concern:

Be it known that I, NOAH W. DUNLAP, of Erie, in the county of Erie and State of Pennsylvania, have invented a new and useful Safety Device for Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to that class of engines used in pumping water from mines, or for water-supply, in which the downward stroke of the piston is effected by gravity and the upward stroke by the action of steam. In these engines the water is drawn into the pump-barrel by the upstroke of the piston, and is expelled therefrom by the downward stroke. In operating such engines great damage often occurs by the dropping of the plunger. This only occurs when the receiving-valve becomes choked and fails to hold the water in the pump, but allows it to become displaced from under the plunger by running back into the induction-pipe.

The object of my invention is to provide a device which will prevent the descent of the plunger, except when the valves are in proper condition and the water is in place in the pump-barrel. This I do by regulating the movement of the engine or steam-valves through a device which receives its movement by being connected with the water-chest of the pump. The means I employ is a catch device which engages with the equilibrium valve mechanism of the engine, which catch device I operate by a piston device, which is operated upon by a column of water taken from the water-chest of the pump. What I mean by the water-chest is the chamber between the receiving and discharging valves and the plunger of the pump. Hence it will be seen that the column of water I use to operate my piston device will have a fluid-pressure of the same degree as the fluid in the water-chest of the pump.

In order that persons skilled in the art to which my invention relates may be able to construct the same, I will now proceed to fully describe it.

In the drawings, which form a part of this specification, Figure 1 is a side elevation of my device and of a fragment of the pump and a cross-section of the equilibrium rock-shaft of the engine. Fig. 2 is a transverse vertical section of the piston device of my invention.

A represents a fragment of the pump-plunger, and B of the pump-barrel.

D represents the equilibrium rock-shaft of the engine, which shaft forms a part of the equilibrium valve-gear.

E F G H are parts of my device, and C is the pipe which connects the piston-chamber of my device with the water-chest of the pump.

Such are the relations held by the parts to each other no matter how they may be arranged, or in what form they may be constructed.

My device consists of, first, a piston, F′, to be operated by the pressure of fluid from the pump-barrel B through the pipe C; second, a latch or catch device, G, to be operated by the movements of the piston F′, and to engage with a catch on the rock-shaft D; third, of necessary adjuncts to the foregoing to make them operate properly, which may be varied in construction as skill and experience may dictate.

As shown in the drawings, these parts are constructed as follows: L is a small cylinder screwed to the tube C, in which is a piston-chamber, L′, in which the piston F′ works. F is a piston-rod extending upward from the piston F′. The piston F′ seats on the ledges *l* and *l′*. E is a spring-box above the piston-chamber L′, and J is a spring arranged therein. This spring seats on the ledge *l″* and a temper-nut, I, by which its tension is regulated. The upper end of the piston-rod F terminates in a dash-pot, H.

The tube C is provided with a cock and check-valve, *c c′*, which are set so as to branch from the said pipe and serve for the purpose of admitting a small quantity of air to act as a cushion between the top of the column of water in the tube C and the piston F′.

When the air is not thus admitted above the water in the tube C, the action of the column of water as it moves up against the piston is so rigid or unyielding that it acts like the stroke of a hammer. To avoid this I provide for the admission of a small quantity of air, as above stated, which, of course, finds its

way to the top of the column of water, and, being very elastic, serves to cushion the stroke of the water column upon the piston.

The construction and operation of this air-admitting device are as follows: The check-valve opens into the pipe C, and consequently is closed by any pressure in the said tube. When the pump-plunger ascends, there is no pressure in the tube C; but, on the contrary, a sinking of the water in the tube occurs, and a vacuum occurs under the piston F′. The check-valve should be put near the upper end of the tube, so that it will, when the pump-plunger rises, be as nearly relieved of pressure from within as possible. The result is, a flow of air occurs, by reason of atmospheric pressure, through the check-valve into the tube C. The purpose of the cock, in conjunction with the check-valve, is to regulate the volume of air to be admitted. When the downward stroke of the pump-plunger occurs, and the air thus admitted is performing its function of a cushion, it, the said air, is partially forced out by the piston, as I find it best, for avoiding friction, to make the piston F′ rather loose. When the engine is first started, the body of air contained in the tube C will escape gradually past the piston F′ and through the pipe *e*, or, if desired, the check-valve may be loosened so as to allow it to escape freely. No special device is necessary for the purpose of relieving the tube C of the air it contains at first starting.

The spring-box E is provided with an escape, *e*, for wasting any water that may work above the piston F′.

The operation of my device is as follows: When the piston F′ is seated on the ledge *l* the catch device G is engaged with the rock-shaft D. When a pressure from the column of water in the tube C is exerted upon the piston F′ the catch G will be disengaged from the rock-shaft. Hence the rock-shaft cannot rock except when there is a pressure from the tube C against the piston F′. Such a pressure can only occur when the plunger A is seated upon the column of water in the water-chest or pump-barrel B. When the plunger A rises there is no upward pressure in the tube C.

When the plunger reaches the upward limit of its stroke, if the steam-valves are not shifted, it will be held in suspension, but will settle a little. If the receiving-valve of the pump is in position to check the water, the plunger will of course settle upon the column of water in the barrel. This slight settling will produce the pressure in the tube C which is required to raise the piston F′, which, as soon as it occurs, loosens the catch device and allows the rock-shaft to move and by its connections shift the steam-valves. As soon as this takes place the plunger is free to gravitate and force the water through the discharging-valve.

From the above it is clear that if at the time the plunger is kept in suspension by the non-movement of the steam-valves there should be any choking of the receiving-valve, and the water in the pump-barrel should, in consequence, begin to recede of its own gravity, the plunger would not settle upon it, and consequently no pressure would occur on the piston F′, and hence no movement of the steam-valves would take place, and the stoppage of the engine and pump would at once occur, the plunger would be prevented from dropping, and the disastrous consequences incident to such dropping would be averted.

I have found, by actual use, that my device operates perfectly, and that, besides preventing the dropping of the plunger, it also serves to prevent the jarring which otherwise takes place when the plunger first sets against the water in its downward movement, for with my device in use the plunger always settles gradually upon the column of water.

The object and purpose of the spring J are to so weight the piston F′ that it will not move until the full pressure of the plunger is upon the column of water in the pump-barrel. This is done to prevent a premature unlocking of the catch.

The tube C may connect with the pump at any point between the receiving and discharging valves as well as with the pump-barrel, as shown.

The essential feature of my invention consists in connecting a piston device with the space between the receiving and discharging valves and the plunger of the pump in such a manner that the upward movement of said plunger will allow said piston to move in one direction, and the downward pressure of said plunger will move said piston in an opposite direction; and, further, the connection of said piston device with a catch device which will engage and disengage with the equilibrium valve mechanism of the engine; hence

What I claim is as follows:

1. In a gravity pumping-engine, the combination, with the water-chest of the pump and the valve mechanism of the engine, of a tube leading from said chest to a cylinder, having therein a piston which is connected with a catch device, which operates upon the said valve mechanism, all of said parts being arranged to operate substantially as and for the purposes mentioned.

2. The combination of the rock-shaft D, catch-lever G, piston-rod F, piston F′, tube C, and water-chest B, substantially as and for the purposes set forth.

3. The combination, with the piston F′, tube C, and water-chest B, of an air-admitting device opening into said tube below said piston, and arranged to operate substantially as and for the purposes set forth.

In testimony whereof I, the said NOAH W. DUNLAP, have hereunto set my hand.

NOAH W. DUNLAP.

Witnesses:
JNO. K. HALLOCK,
JACOB F. WALTHER,