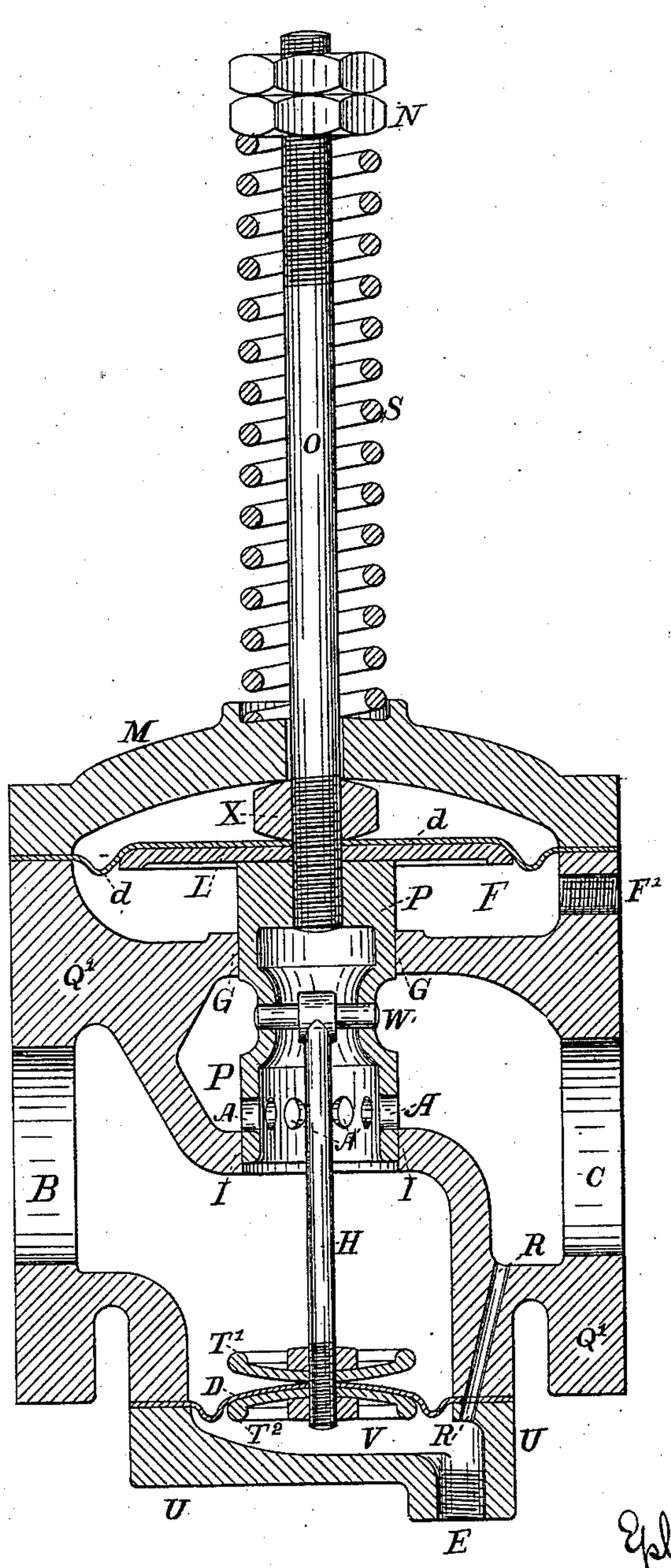
(No Model.)

E. R. DINGLEY.

VACUUM REGULATOR FOR STEAM CONDENSERS.

No. 308,756. Patented Dec. 2, 1884.



WITNESSES:

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EPHRAIM R. DINGLEY, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO JAMES A. CROUTHERS.

VACUUM-REGULATOR FOR STEAM-CONDENSERS.

SPECIFICATION forming part of Letters Patent No. 308,756, dated December 2, 1884.

Application filed January 23, 1884. (No model.)

To all whom it may concern:

Be it known that I, EPHRAIM R. DINGLEY, a citizen of the United States, and a resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Vacuum-Regulators for Steam-Condensers, of which the following is a specification.

The object of my invention is to automatically regulate the weight of vacuum desired to be carried in a condenser and to keep such weight of vacuum practically constant.

In the accompanying drawing, which represents a vertical section, N is a nut on the valve-stem O.

S is a spiral spring around O.

M is a cap perforated.

d is a diaphragm made of any suitable pliable or elastic substance.

L is a plate to support *d*.

F is a vacuum-chamber having opening at F′ connected by a pipe to the condenser.

P is a piston-valve fitting closely in openings or valve-seats I I and G G, so as to allow it to play back and forth therein. This piston-valve is preferably hollow and annular, and upon its sides or periphery are the openings or ports A A, extending into its hollow interior. The ports A A are so placed with reference to I I that I I act as cut-off when the piston-valve P assumes the position hereinafter described. When the ports A A are not cut off by I I, they open into the chamber C, which is connected by pipe with the injecting or circulating engine, or directly with the condenser, according to the kind of condenser employed, as hereinafter explained.

H is a stem or rod which connects the piston-valve P with another diaphragm, D, supported between plates T′ T².

Q′ Q′ are the sides of the chest or chamber in which the valve-gear works.

B and C are each ports or openings in this chamber.

U is a cap fastened by suitable means to Q′ over another opening in such manner as to leave a chamber, V, under the diaphragm D.

E is a port or opening leading into chamber V, and R is a small relief-passage extending from V to C, for the purposes hereinafter indicated. The diaphragm *d* separates the chamber contained by Q′ Q′ from M, and is preferably clamped by and between the edges of contact of Q′ and M, which edges are bolted together. The diaphragm D separates the chamber contained by Q′ Q′ from chamber V, and is preferably clamped by and between the edges of contact of Q′ and U, which edges are bolted together. I preferably make the diaphragm D larger in area than the area of the section of the piston-valve P at right angles to its line of motion.

W is a pin which fits loosely into the head of rod H, and fastens it to the piston-valve P. The nut N is to regulate the tension of spring S. The valve-stem O connects the piston-valve P with N, and passes through the diaphragm *d* and through the plate L, which rests upon P.

X is a nut or plug acting as a stop.

Piston-valves can be used instead of diaphragms *d* D.

I will now describe the operation of my invention when employed with a steam-engine having an injection-condenser or a surface-condenser upon which the cooling-fluid is thrown by steam-power. The steam to the injecting or circulating engine is introduced from the boiler through the port B. E is connected by a pipe to the cylinder of the main engine. C is connected by pipe to the steam-chest of the injection or circulating engine. F′ is connected by pipe to the condenser.

When commencing operations, the condenser being filled with steam not yet condensed, and steam being admitted at B, the force of the spring S and of the upward pressure of the steam from B holds the piston-valve P in such a position that the ports A A are open, and the steam passes through them into C, and from thence to the steam-chest of the injecting or circulating engine, which injects the cooling-fluid into the condenser or upon the condensing-surfaces, and thereupon the condensation of the steam in the condenser commences, and a vacuum is thereby formed. This condensation and vacuum varies directly in proportion to the amount of cooling-fluid injected and the time of continuance of the injection, and the amount and time of contin-

uance of the injection of the cooling-fluid varies directly in proportion to the admission of steam through the ports A A. When a vacuum has been formed in the condenser, the same weight of vacuum is communicated to the chamber F through the pipe F′, and thereupon the atmospheric pressure upon the diaphragm *d*, communicated through the plate L to the piston-valve P, is exerted to overcome the force of the spring S and of the steam within P. When the vacuum in F becomes of sufficient weight to overcome these two last-mentioned forces, the piston-valve P is forced down in its seat, so that the ports A A are closed, partly or wholly, by the surfaces I I, and thereby the supply of steam to the injection or circulating engine is partly or wholly cut off, and so continues until the weight of vacuum in the condenser decreases, when P is again raised and the ports A A are opened. Such is the operation of the mechanism thus far described, and it alone will accomplish the object sought; but I prefer in many cases to use the other parts of my invention, which I have shown, and the operation of which I will describe.

I have mentioned that the opening E is connected by pipe with the cylinder of the main engine. The effect of this is that when the engine is working the steam from the cylinder passes through E into the chamber V, and exerts an upward pressure through the diaphragm D and its plates T′ T² and the rod H upon the piston-valve P, which pressure is auxiliary to the other forces aforementioned in lifting or depressing P and opening or closing the ports A A, it being, of course, obvious that the force exerted upon P through H is the difference between the forces exerted upon T′ T², respectively. When the main engine stops work, the auxiliary pressure upon T² ceases, and, consequently, a lighter vacuum in the condenser closes the ports A A, and less condensation is the result, until the main engine again starts, when the normal differentiation of the different forces acting upon the piston-valve P is again assumed. (When the main engine stops working, the chamber V becomes, by means of R, a vacuum-chamber.) The relief-passage R is of course a necessity when E is connected with the cylinder of the main engine, as without it too great a resistance would be offered to the upward movement of P when the main engine was not working.

It is obvious that when preferable I can remove the rod H, the diaphragm D, and plates T′ T², and substitute for U a close cap, which entirely closes the openings E and R.

I will now proceed to describe the operation of my invention when surface, exhaust, injector, ejector, or other kind of condenser is used in which or upon which the water or air or cooling-fluid is not injected by steam-power, but by the flow of the fluid from a reservoir or Artesian well or other natural source. In these cases the water enters at the opening B, and, when the ports A A are open, passes through them into C, and thence to the condenser or upon the condensing-surface, whereby the steam is condensed and a vacuum formed in the condenser and in chamber F, which vacuum, when of sufficient weight, causes the atmospheric pressure to depress the piston-valve in its seat, and thereby close the ports A A, partly or wholly, until the vacuum is lightened and, the valve P ascending, the ports A A are again opened.

When my invention is practiced in the manner last described, I sometimes prefer to use a revolving valve or cock, with one or a few ports, A, instead of the slide-valve P; but as the substitution of the one for the other requires no invention, I claim the right to use either a revolving, sliding, lifting, or hinged valve, as I may desire, the valve being opened and closed by means of the valve-gear hereinbefore fully described—that is to say, by the rod O, actuated by the differential forces mentioned, and either with or without rod H, and the forces acting upon it, and also mentioned.

It is obvious that by adjusting the tension of the spring S by the nut N any required weight of vacuum can be attained in the condenser, and that the same or nearly the same weight will be automatically retained without any practical variations.

The operation of adjustment which I prefer is as follows: Having determined what weight of vacuum I wish to carry in the condenser, I screw down the nut N until the vacuum-gage indicates the weight required. I then unscrew N until the piston-valve P drops and closes the ports A A.

When I speak of "weight of vacuum," I mean to use the term as synonymous with "perfection of vacuum." The more perfect the vacuum the greater the weight of vacuum.

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

1. In a vacuum-regulator, the combination of a piston-valve, P, a vacuum-chamber, F, having an opening to be brought into communication with a condenser, and a flexible diaphragm, *d*, connected with the stem of valve P, and separating chamber F from a chamber above it, whereby when the requisite vacuum is created in chamber F the pressure upon diaphragm *d* from the upper chamber will assist in lowering the valve, substantially as described.

2. In a vacuum-regulator, the combination of a piston-valve, P, formed with ports A, steam-inlet port B, for the admission of steam below the valve, steam-exit C on the opposite side of the valve, and adapted to be brought into communication with a condenser, and cut-offs I intermediate of the inlet and exit ports, substantially as described.

3. In a vacuum-regulator, the combination of the valve P, formed with ports A, the inlet-

port B below said valve, steam-exit C on the opposite side of said valve, vacuum-chamber F above ports B and C, and adapted to be brought into communication with a condenser, valve-stem O, and spring S, substantially as described.

4. In a vacuum-regulator, the combination of the rod H, diaphragm D, chamber V, passage E, passage R, and piston-valve P, substantially as described.

5. In a vacuum-regulator, the combination of port B, piston-valve P, having ports A, cut-offs I, outlet C, vacuum-chamber F, valve-stem O, spring S, rod H, diaphragm D, chamber V, and passages E and R, substantially as described.

6. In a vacuum-regulator, the combination of the diaphragm *d*, spring S, piston-valve P, and diaphragm D, substantially as described.

Signed at the city of New York, in the county of New York and State of New York, this 5th day of December, A. D. 1883.

EPHRAIM R. DINGLEY.

Witnesses:

HENRY ARDEN,

HENRY FROMME.