J. B. ROOT.

CONDENSER.

No. 171,175. Patented Dec. 14, 1875.

Fig. 1.

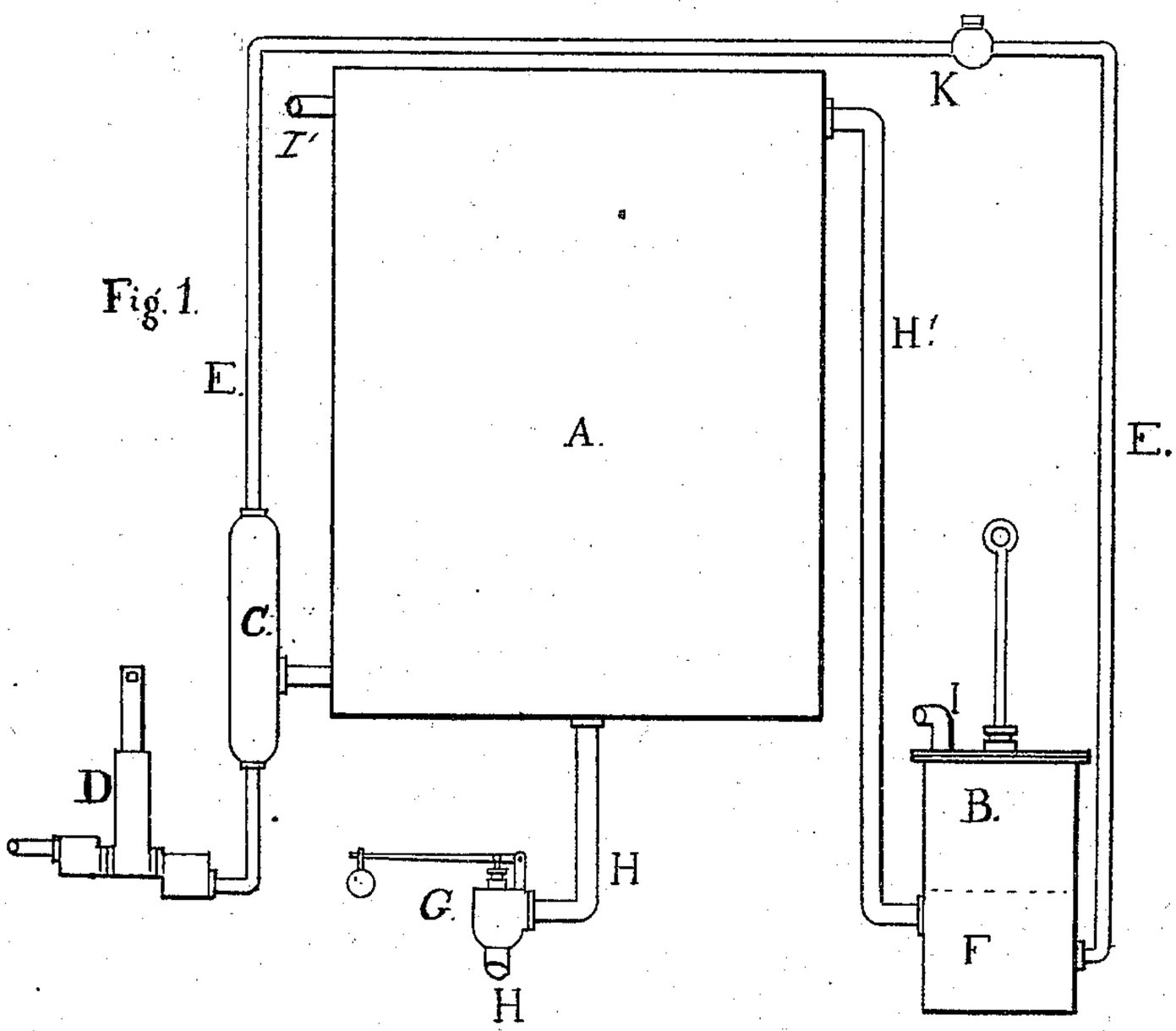
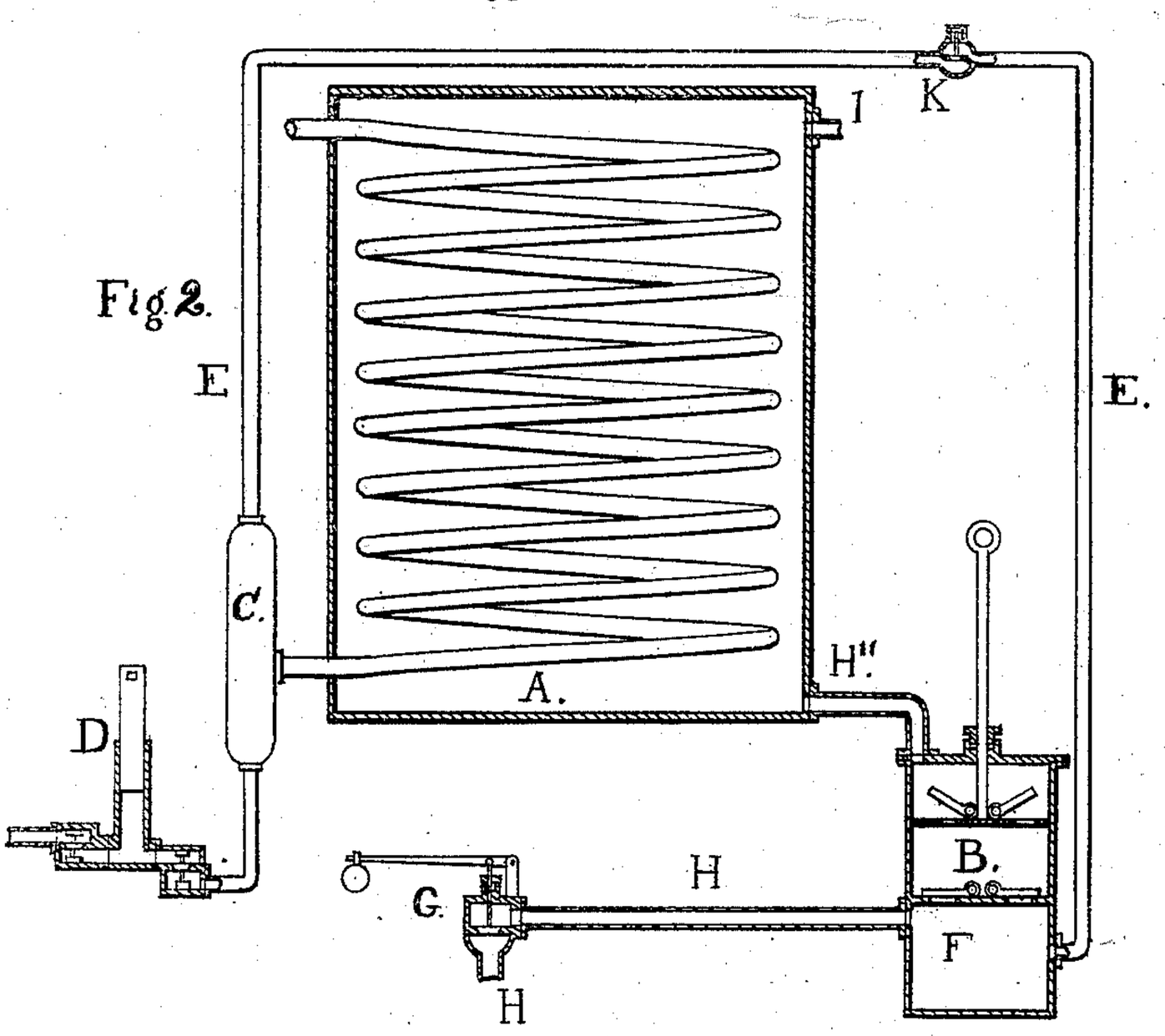


Fig. 2.



WITNESSES

INVENTOR.

UNITED STATES PATENT OFFICE.

JOHN B. ROOT, OF NEW YORK, N. Y.

IMPROVEMENT IN CONDENSERS.

Specification forming part of Letters Patent No. **171,175**, dated December 14, 1875; application filed May 18, 1875.

To all whom it may concern:

Be it known that I, JOHN B. ROOT, of the city, county, and State of New York, have invented a new and useful Improvement in Condensers for Steam or Vapor; and that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing and to the letters of reference marked thereon, making a part of this specification.

This invention is in the nature of an improvement in a condenser for steam or vapor; and the invention consists in a surface-condenser provided with a pump constructed to not only withdraw the air and vapor from the condenser, but also to operate as a circulating-pump, and at the same time keep the condensing-water free from the water of condensation.

In the accompanying sheet of drawings, Figure 1 is a side elevation of my condensing apparatus, and Fig. 2 a longitudinal section of same.

Similar letters of reference indicate like parts in both figures.

A represents a tank or other vessel, within which is placed a coiled pipe, J. The upper end of this coiled pipe, *a*, is connected with the exhaust of an engine, and the lower end of the coil enters into a separating-chamber, C. Extending upward from the separating-chamber C is a pipe, E, one end of this pipe entering into and near the bottom of a pump, B. From the top of this pump B extends a pipe, H′, and from the pump B extends another pipe, H. This last-mentioned pipe H extends into a gland, G, into which is placed a valve, *b*, connected with a weighted lever, *c*. From the lower end of the separator C is a pipe, *e*, which enters into the valve-chest *f* of a pump, D. Within the pump B is fitted a diaphragm, *g*, with two valves, *h h′*, and a piston, *k*, with valves.

My condensing apparatus being constructed substantially as I have above described, it is operated in the following manner: The upper end *a* of the coil J is connected with the exhaust of the engine. The exhaust steam passing within the coil is condensed by reason of the cold surface of the same, the coil being surrounded with cold water by the action of the pump B, which draws the same through the pipe H, by the action of its piston *k*, forcing the water through the pipe H′ into the tank A, filling the tank and surrounding the coil with cool water. The steam thus entering from the exhaust into the coil J passes through the coil, together with the water formed by condensation, and finds exit through the last branch of the coil into the receiving-chamber C. Upon entering this chamber such vapor as may enter therein, by reason of its levity, ascends through the pipe E, whence it is drawn by the action of the pump B into the vacuum-chamber F of the pump, the water from the condensed steam passing downward, through the pipe *e*, into the valve-chamber, and is returned to the boiler, into which it is forced, by the action of the pump D, as feed-water.

From the foregoing description of the construction and operation of my condensing apparatus, it is apparent that not only is the steam condensed within the coil J, but a vacuum is formed in the coil by the action of the pump B, so that the engine, which may be attached to my condenser, can have all the advantages to be derived from exhausting in a vacuum.

The pump B, it will be seen, from its construction, operates in such manner as to draw the cold condensing-water from its source, force it into the tank surrounding the condenser, and at the same time maintain a vacuum in the lower part of its barrel or chamber, into which chamber is drawn, in the manner before stated, the air and uncondensed vapor within the coil J, producing, therefore, a complete and satisfactory vacuum within said coil. This vacuum in the chamber F of the pump B is maintained by the action of the diaphragm *g* with the valves therein, for, as the piston *k* ascends, these valves will open, admitting the air, &c., to pass through the piston, and also permitting the water to enter through the pipe H. This water is at once drawn through the diaphragm *g*, and thence upward through the valves *h h′* in the piston *k*, and, through the pipe H′, into the tank A.

When the piston ascends, the water is drawn directly through the pipe H, and, to prevent the water from flowing continuously from said pipe and filling up to its entire capacity the vacuum-chamber F, I place a valve, *b*, suita-

bly weighted, so that it will counterbalance the pressure of the atmosphere and prevent the water from flowing through the pipe H into the chamber, excepting only when the pump-piston is ascending, and then, as before stated, the water is drawn directly through the diaphragm in the manner before described. As the uncondensed vapor enters into the chamber F it is met by the stream of incoming water through the pipe H, which condenses it in precisely the same manner as in the ordinary jet-condenser.

The condensing-water may be drawn through the supply-pipe H directly into the suction-chamber F, and discharged, by the pump B, through the surface-condenser A, by the outlet I, as shown in Fig. 2; or it may be drawn by the action of the pump B through the condenser J and the pipe H′, and discharged from the outlet I′, as shown in Fig. 1. In either case it is obvious that the suction-chamber F becomes practically a jet-condenser, by which term I mean any form of compartment in which the condensing-water and steam or vapor are brought into actual contact.

The valve *b*, besides regulating the inflow of water through the pipe H, also throttles the supply-pipe, so as to cause the pump B to partially fill with air from the tank A. It is obvious that if the valve *b* is weighted so as to require a pressure upon the under side of the valve of ten pounds per square inch to raise it, there would have to be a vacuum produced in the suction-chamber F, the pipe E, the separating-chamber C, and the steam-space of the condenser A, that would exceed ten pounds per inch before water could be drawn through the valve *b*. The pipe E may be extended to a sufficient height to prevent the water from being drawn through it by a vacuum in the separating-chamber C, or, if it is not convenient to carry it to such a height, a check-valve, K, may be placed in the pipe in such a manner as to prevent the passage of water from the suction-chamber F to the separating-chamber C, and yet allow the air and vapor to pass in a contrary direction through the pipe E.

The separating-chamber C may be made a separate chamber, as shown, or in any other manner adapted to the form in which the tank and coil are constructed.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a jet-condenser with a surface-condenser and a combined air and lift pump, substantially in the manner and for the purpose described.

2. In a combined jet and surface condenser, the combination of a separating-chamber, C, with a combined air and lift pump and a feed-pump, substantially as and for the purpose described.

3. In a combined jet and surface condenser, the combination of a combined air and lift pump with an automatic valve fitted or placed in the pipe, through which is conducted the condensing-water, substantially as and for the purpose described.

JOHN BENJAMIN ROOT.

Witnesses:
WM. H. LEITCH,
ALOHA VIVARTTAS.