(No Model.)

# L. SCHUTTE.

## STEAM JET CONDENSER.

No. 330,157. Patented Nov. 10, 1885.

Fig. 1

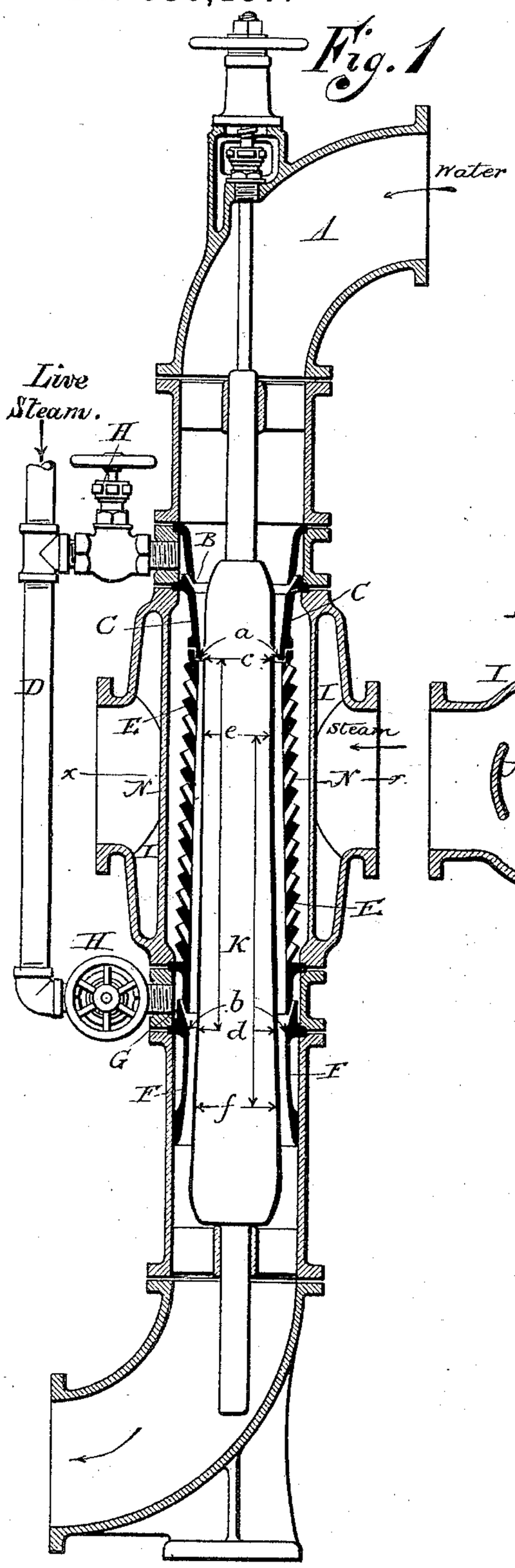



Fig. 3. on line x-x

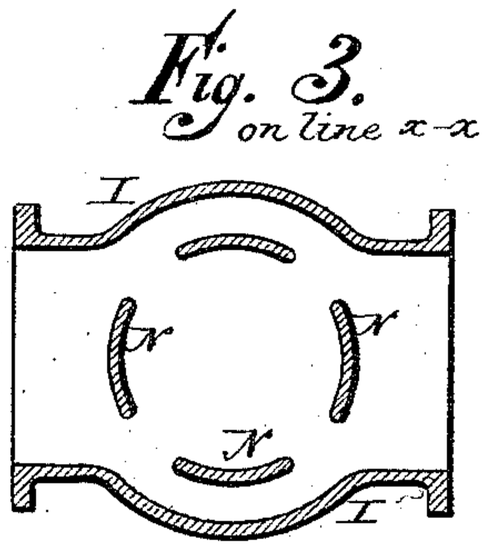
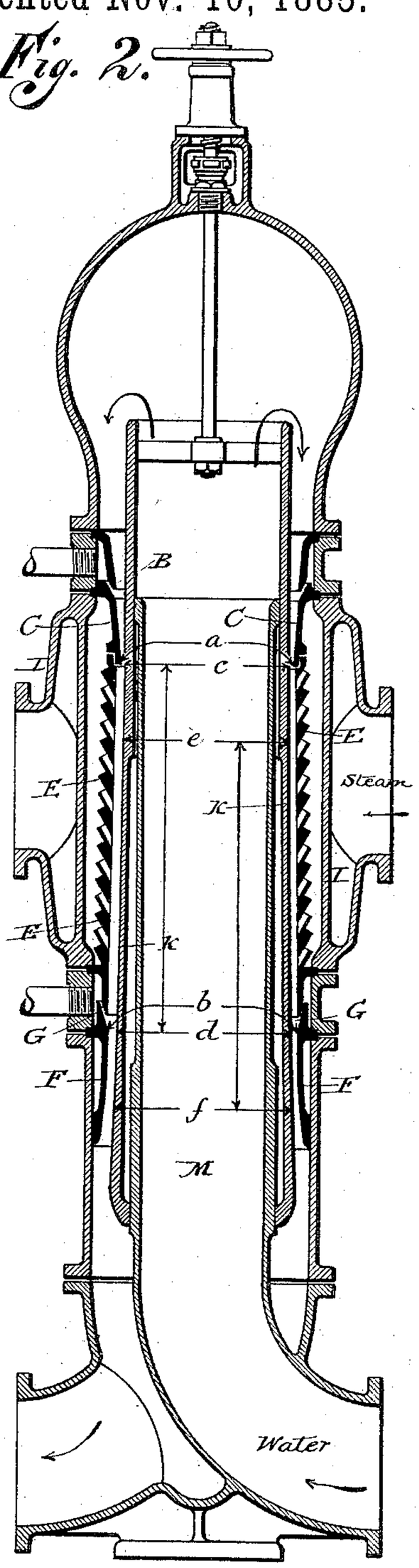



Fig. 2.

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# UNITED STATES PATENT OFFICE.

LOUIS SCHUTTE, OF PHILADELPHIA, PENNSYLVANIA.

## STEAM-JET CONDENSER.

SPECIFICATION forming part of Letters Patent No. 330,157, dated November 10, 1885.

Application filed January 24, 1885. Serial No. 153,874. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS SCHUTTE, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain Improvements in Steam-Jet Condensers, of which the following is a specification.

This invention has reference to that class of condensers the action of which is based on induced currents secured either by the pressure of the water or by live steam, or by the inductive action of the exhaust-steam to be condensed; and the improvements apply particularly to those forms of apparatus in which the current of condensing-water is surrounded by the exhaust-steam acting to induce its flow. Condensers of this character have hitherto been of a fixed capacity—that is to say, the quantity of water which they consumed remained practically constant, notwithstanding the changes in the quantity of steam condensed. They permitted but a trifling variation in the water-supply before their effect as air-ejectors was destroyed and their operation defeated. The necessity or desirability for means of regulating the capacity of a condenser is particularly apparent in the case of an exhaust-steam-induction condenser in which the current of water is maintained solely by the action of exhaust-steam, and in which the volume of water should not be in excess of what can be controlled by the remaining energy of the steam.

The principal parts of an exhaust-steam-induction condenser as commonly known in the art, are a centrally-located water-nozzle, a condensing tube or chamber into which the water is delivered, provided with openings or inlets through which the surrounding steam is admitted to the central condensing-jet of water, and a discharge-nozzle. To secure and maintain the practical operation of the induced current of water, it is necessary that the area of the water-nozzle shall bear a certain proportion to the area of the smallest part or throat of the discharge-tube. A variation in the capacity of the apparatus requires, therefore, a means for reducing in equal proportions the area of the water-nozzle and the area of the throat of the discharge-tube simultaneously, and at the same time maintaining such other necessary proportions as not to disturb the action of the current. I effect this simultaneous reduction or increase in the area of the water-nozzle and of the throat of the discharge-tube by the insertion of a longitudinally-adjustable spindle or ram of such form that the proportion of its sectional areas at any two points distant from each other equal to the distance from the water-nozzle to the discharge-throat will be the same.

In the accompanying drawings, Figure 1 is a longitudinal central section of a condenser having my improvement embodied therein, the connection for water-supply being located at the top. Fig. 2 represents a similar view of another form of condenser with the improvement applied thereto, the water-connection being in this instance at the base. Fig. 3 is a cross-section on the line *x x*.

Referring to Fig. 1, A represents a water-inlet pipe, C the water-nozzle, E the condensing tube or chamber provided with numerous slits or holes extending inward through the same in the direction of delivery, and F is the discharge-tube. The annular slit B in the water-nozzle and the annular slit G in the discharge tube are for the purpose of admitting live steam, when necessary, from the two branches of pipe D. The introduction of live steam into the water-nozzle at B or into the discharge-tube at G may occur for the purpose of inaugurating the action of the apparatus or of assisting the current. Either of these jets may be used for both purposes separately, or both at the same time for separate or collective functions, and when not required steam from one or both of these sources may be shut off by means of the valve H, provided for the purpose. When water is supplied to the condenser under pressure, the use of live steam will generally not be required, and in that case the steam-opening in the water-nozzle at B and in the discharge-tube at G will be dispensed with.

The condensing-tube E is surrounded by a body or chamber, I, through which the exhaust-steam is admitted to the apparatus, and from which it passes in an oblique forward direction through the numerous slits or holes into the interior of the condensing-tube E, thereby inducing the inward flow of water,

with which it combines and by which it is condensed.

The foregoing parts are operated and constructed in substantially the same manner as the original patent.

In applying my improvement to this form of apparatus I introduce axially within the chamber the tapered spindle K, movable in an endwise direction.

Referring to the proportion of the various parts, let *a* represent the diameter of the water-nozzle; *b*, the diameter of the throat of the discharge-tube; *c*, the diameter of the spindle, when adjusted in the particular position shown, at the plane of the water-nozzle; *d*, the diameter of the spindle at the plane of the throat of the discharge-tube, and *e f* the diameters of the spindle at any other points whose distance from each other is equal to the distance from *a* to *b*. The proportion should then be: (area *a*—area *c*): (area *b*—area *d*)= (area *a*—area *e*): (area *b*—area *f*). It follows, therefore, that if the spindle or ram be of increasing or decreasing areas, by its movement upward or downward the areas between the inlet-nozzle and the spindle and the discharge-throat and the spindle will be increased or diminished, maintaining, however, a constant ratio or proportion. Means of any suitable character may be employed to effect the adjustment of the spindle. I recommend, however, as a simple device for the purpose, journals at its two ends seated in guides in the body and connected at the top with a hand-screw extending to the exterior.

Referring now to the apparatus represented in Fig. 2, it differs from that already described in that the water enters at the base through a central tube, M, from the top of which it overflows and descends to the inlet-nozzle C. The upper end of this central inlet-tube is surrounded by a hollow spindle or ram, the exterior surface of which is shaped and proportioned to the other parts in the same manner as the surface of the spindle illustrated and described in the first form of the apparatus. This apparatus is identical in its mode of action with that first described, the only difference consisting in the fact that the water is introduced from the base through the central tube and through the interior of the ram instead of being admitted directly at the top.

The ram or spindle in the second apparatus is connected with and adjusted by means of a hand-screw, at the top as in the previous example. It is to be understood, however, that these screws may be replaced by rack and pinions, levers, or other devices such as are commonly used for like purposes.

For the purpose of effecting a uniform distribution of the inflowing steam, I propose to construct the body or jacket I with internal partitions or deflectors, as shown at N, Fig. 3.

I am aware that injectors actuated by a central jet of high-pressure steam and designed to deliver water against a counter-pressure have been provided with central spindles of various forms to control the steam admission and the discharge-throat, and also that lifting feed-water injectors actuated by a central steam-jet have been provided with a conical spindle to control the water-outlet, and to such constructions I lay no claim, my apparatus differing therefrom in construction and mode of action and in the results secured.

The primary object of my apparatus is the condensation of steam for the production of a vacuum, or for other purposes, and not the lifting or forcing of the water. Its motive energy, instead of being derived from high-pressure steam in limited quantities, is secured by low-pressure steam in great quantities. The water is admitted in the center and in advance of the steam instead of in a reverse order, as in injectors. The steam, instead of being admitted in the center in a solid jet, is admitted through numerous openings to the central water-jet. The steam-admission openings are all constant instead of variable size.

While I no not claim to be the first to use a tapered spindle in a jet apparatus, I do believe myself to be the first to combine with a condenser of the type herein described a central spindle serving to regulate the water-nozzle and the discharge-nozzle, and to maintain a constant ratio between them.

Having thus described my invention, what I claim is—

1. In a jet-condenser of the type herein described, the usual water-nozzle, condensing-tube, and discharge-tube, in combination with a movable ram or spindle, constructed as described, to change the areas of the water-nozzle and discharge-nozzle, but maintain a constant ratio between them.

2. In a jet-condenser of the type herein described, the central water-inlet extending from the base or delivery end through the discharge-tube and water-nozzle.

3. In a jet-condenser having the central water-inlet tube extending through the discharge-tube, the hollow movable ram or spindle, substantially such as described, surrounding the inlet-tube.

4. In a jet-condenser of the type herein described, the combination, with the water-inlet nozzle, the condensing-tube, and the discharge-tube, of the tapered movable spindle extending through the nozzle and discharge-tube.

In testimony whereof I hereunto set my hand this 10th day of January, 1885, in the presence of two attesting witnesses.

LOUIS SCHUTTE.

Witnesses:

DANL. HILDRETH,

FRANK SPILLIN.