(Model.)

E. KÖRTING.

JET CONDENSER.

No. 285,822. Patented Oct. 2, 1883.

Fig. 1.

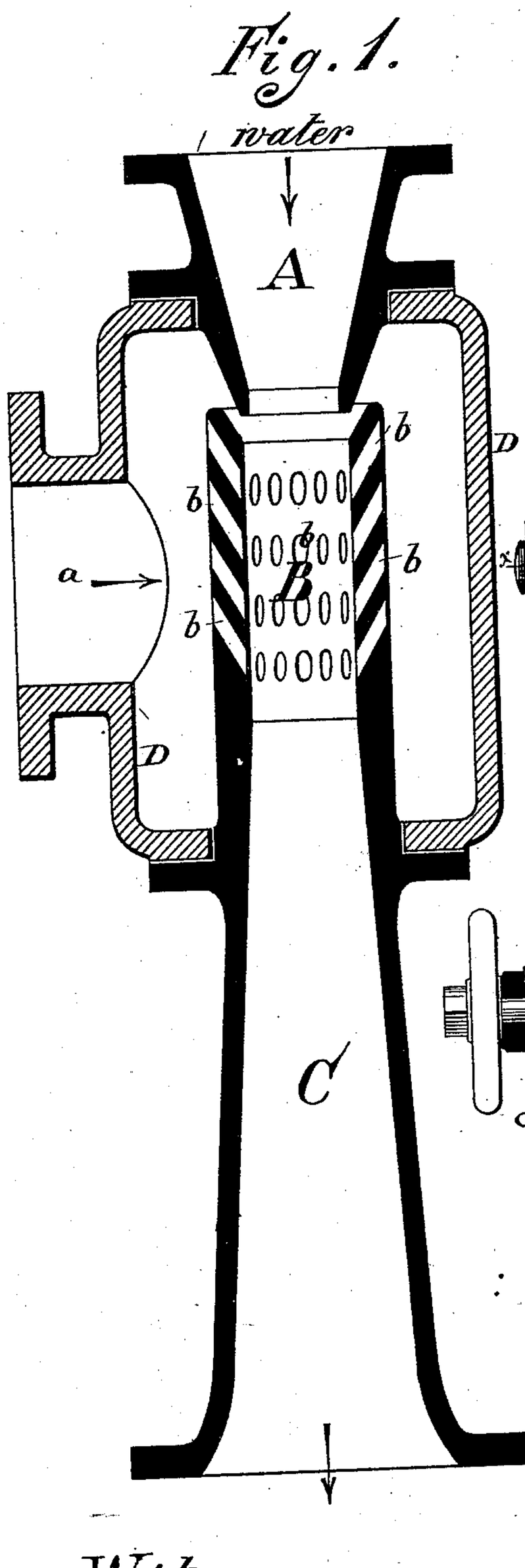

Fig. 2.

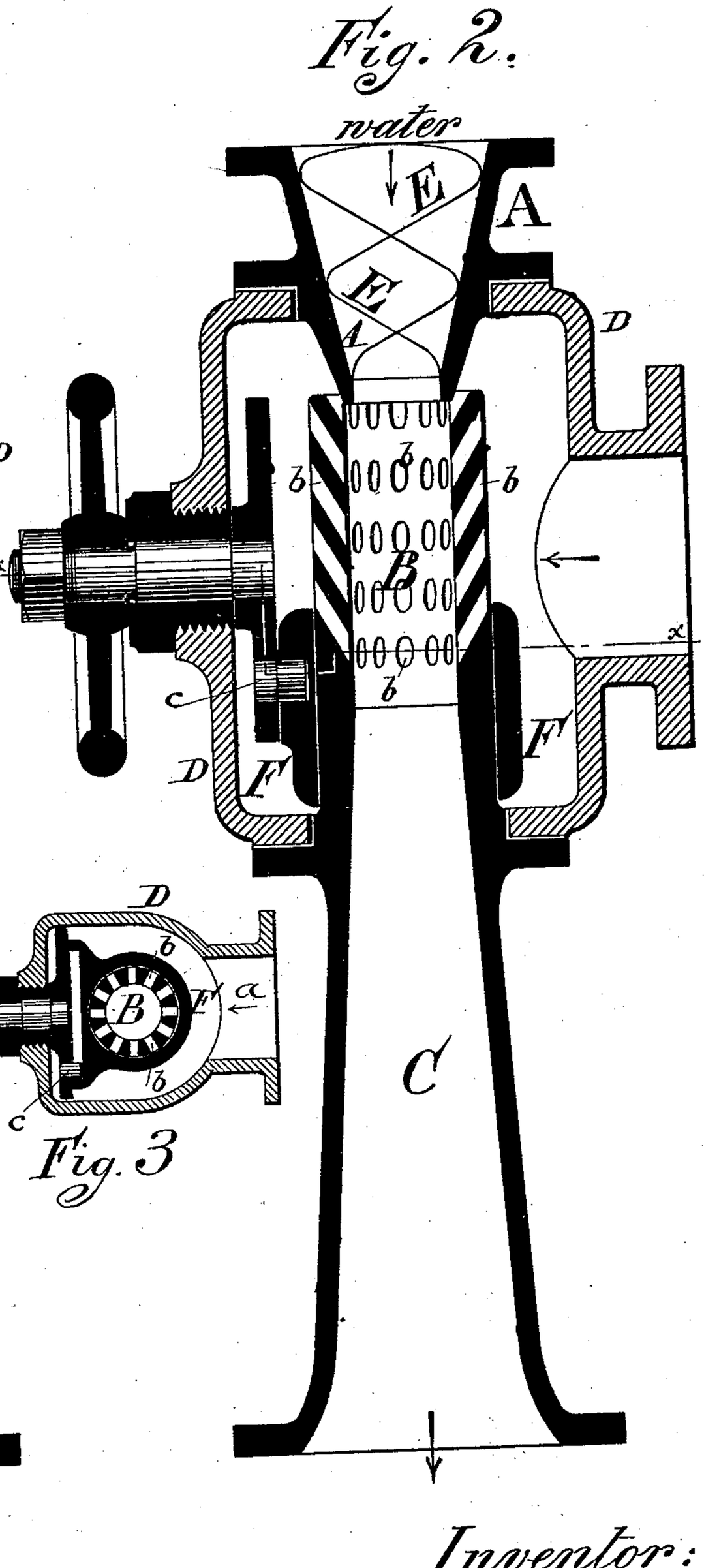

Fig. 3

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ERNST KÖRTING, OF HANOVER, BRUNSWICK, GERMANY.

JET-CONDENSER.

SPECIFICATION forming part of Letters Patent No. 285,822, dated October 2, 1883.

Application filed October 11, 1882. (Model.)

To all whom it may concern:

Be it known that I, ERNST KÖRTING, of Hanover, Brunswick, Germany, have invented certain new and useful Improvements in Jet-Condensers, of which the following is a specification.

This invention has special reference to that class of condensers wherein a jet of fluid delivered from one nozzle is caused to pass through one or more succeeding nozzles and combined with a second fluid entering spaces through or between the successive nozzles, the combined fluids finally escaping through a discharge-tube, which is enlarged toward the delivery end to permit the expansion of the fluid and a consequent decrease of pressure.

It is the special aim of the invention to effect a more thorough and economical combination of the two fluids—such as steam and water—and to render steam at low pressures practically available for the purpose of propelling or assisting to propel water or other condensing-fluid.

To this end it consists, essentially, in an apparatus embracing in combination the following elements: a centrally-located nozzle, through which the water-jet is delivered; a mixing or combining tube which has a bore or passage of substantially cylindrical form, with numerous small slits or openings entering the same from the exterior with a forward inclination; a delivery tube or nozzle communicating with the mixing-tube and enlarging toward the delivery end, and an encircling body or its equivalent, through which the steam or other vapor may be permitted to surround the mixing-tube and pass inward through its openings.

The action of the apparatus is based upon the same general principles which are involved in the ordinary steam-jet apparatus, which is familiar in a great variety of forms to all persons skilled in the art. My present apparatus differs, however, from those hitherto produced in the essential particular that the mixing-tube has its bore or central passage of uniform or substantially uniform diameter from end to end; that it presents an approximately continuous surface on the interior, and that it contains a large number of small inlet-openings, whereby it is caused, when used in combination with the central supply-nozzle and the expanding delivery-tube, to give better and far more satisfactory and economical results than can be obtained by jet apparatus of the ordinary kind when worked under low pressures.

I am aware that a jet apparatus has been constructed with a series of nozzles arranged to discharge one into another, the nozzles being made of tapering form on the interior, and being arranged in such manner as to leave annular inlets between them. I am also aware that an air-pump condenser has been proposed, with a cylindrical water-passage provided with numerous oblique inlets and with a surrounding steam-jacket, the combination being one, however, in which the movement of the water was secured by the positive action of a pump and in which the action was not secured by or dependent upon the action of the steam upon the water-jet. To a structure such as mentioned I lay no claim, my invention being restricted to an apparatus in which the perforated mixing-tube, of uniform diameter, is combined with a supply-nozzle and with an expanded discharge-tube.

Referring to the accompanying drawings, Figure 1 represents a longitudinal central section of my condenser in its most simple form. Fig. 2 is a similar view of the same provided with a regulating or controlling sleeve and with means for imparting a spiral motion to the inflowing water. Fig. 3 is a cross-section on the line *x x* of Fig. 2.

Referring to the drawings, A represents a centrally-located tapering nozzle, through which the water or other liquid employed for the purpose of condensation is delivered.

B represents the mixing or combining tube, arranged opposite the inner end of the water-nozzle and in line therewith. This tube B is made, as shown, of uniform diameter internally from end to end, and is provided with numerous small perforations or inlets, *b b*, extending through it from the exterior to the interior, with a forward inclination in the direction of the discharge. While these openings may be varied in form, it is essential that they shall have the forward inclination, and it is desirable that the tube shall present thin sharp edges at the points where the openings emerge

through the inner surface. It is also desirable that the tube shall present an approximately-continuous surface in the interior from end to end, thus presenting a practically-continuous throat or passage, as contradistinguished from the throat or passage having numerous annular enlargements, such as would be formed by the combination of a series of tapered nozzles inserted one within another with spaces between them.

C represents the discharge-tube joined to the end of the mixing-tube B, but enlarged thence toward the delivery end in a form and manner common in other classes of jet apparatus.

D represents a body or chamber, provided with an inlet-neck on one side, and surrounding the delivery end of the water-nozzle A and the mixing-tube B at a suitable distance from the latter, in order to leave an annular space, so that the steam may completely encircle the mixing-tube.

In the operation of the apparatus, the water or other liquid enters the nozzle A, and is delivered thence through the mixing-tube, past the inlets and the thin metallic edges, through the delivery-tube C. In passing the inlets *b* the liquid is subjected to the action of numerous small jets of steam entering under pressure through the inlets, the steam thus entering being delivered in a forward direction and acting to urge the liquid column forward in a very efficient manner. The large number of inlets and the corresponding number of inflowing jets secure a thorough admixture of the steam with the inflowing liquid.

In practice it is found that, by means of the large number of openings and the consequent distribution of the elastic force of the steam or other fluid over the surface of the liquid, greatly improved results are secured as compared with the ordinary form of apparatus, in which a like distribution of the pressure is not secured. The distribution of the fluid-pressure over the surface of the liquid is advantageous both in securing a more perfect admixture, and consequently a more economical condensation, and also in that the pressure is more effectively applied to drive the fluid column forward.

For the purpose of shattering or atomizing the liquid as it enters the apparatus, in order that the steam may combine more intimately and quickly therewith, I introduce into the water-nozzle A a spiral blade, E. The inflowing water, encountering this blade, is caused to pursue a spiral or gyratory motion, the effect of which is to break up or shatter the inflowing column, thereby permitting the steam to pass more readily between its drops or atoms, and thus permeate the entire body of liquid.

While it is preferred to employ the spiral device E, any other equivalent form of device which will have the effect of breaking up or atomizing the liquid column to permit the fluid to permeate the same may be employed.

As a means for opening and closing a greater or less number of the inlets *b*, as circumstances may require, a sliding sleeve, F, may be mounted upon the throat or mixing tube, as in Fig. 2. When this slide is moved forward, all the inlets are uncovered and are operative; but by moving the sleeve backward any required number of the openings may be closed and rendered inoperative. Any suitable means to be operated from the exterior may be employed for adjusting the sleeve; but I prefer, as shown in Figs. 2 and 3, to provide an external hand-wheel having a spindle extended inward through the side of the body, and provided at the inner end with a disk bearing a crank-pin, *c*, which enters a transverse groove in the sleeve, so that by turning the hand-wheel the crank-pin is caused to move the sleeve forward and backward. The regulating-sleeve F, is more desirable in an apparatus where the elastic force of steam, air, or gas is to be employed as the actuating force.

It will be readily perceived by one skilled in the art that the apparatus herein represented may be variously employed as an exhauster for moving steam, air, or gas as a means of condensing steam or other vapors for the purpose of setting air in motion, and also that it may be employed with equal efficiency where the elastic force of steam, air, or gas is utilized to create or augment the speed of a water-jet, as in ordinary jet injectors or elevators.

Where the water-discharge is required to overcome a counter-pressure from the commencement—as for example, when the apparatus is used as a boiler-feeder—it will be provided with the well-known overflow between the combining-tube and the discharge-tube, or with a starting-valve in the pressure or discharge pipe. These devices being well understood by those skilled in the art, and being represented in various forms in numerous patents hitherto granted to me, it is deemed unnecessary to illustrate them herein.

If the water be not delivered to the apparatus under pressure, but require to be elevated or drawn thereto, provision must be made to first bring the water to the apparatus and induce a current therein. This may be done in any suitable manner—as for example, by a second nozzle passing through the water-nozzle and entering the combining-tube, the second nozzle being supplied with water, steam, or other fluid under pressure; or it may be done by means of a suction apparatus placed in the discharge-pipe, or by an apparatus connected with the water-supply, by means of which water under pressure may be supplied and a current established. These means, however, for establishing a primary supply of water constitute no part of this invention.

The present invention is restricted to those matters and things which are hereinafter claimed, and as to all matters which may be described or shown, but which are not claimed,

the right is reserved to make the same the subject of a separate application.

Having thus described my invention, what I claim is—

1. In a jet-condenser, the combination of a liquid-supply nozzle, a combining-tube of uniform or substantially uniform diameter from end to end, with numerous inlets having an inclination in the direction of the discharge, a delivery-tube enlarged or expanded in the direction of the discharge, and means for supplying steam or other fluid through the exterior of the combining-tube.

2. In a jet apparatus, the combination, with an expanded delivery-tube, of a mixing-tube provided with numerous inlets inclined in a forward direction, a water-nozzle, means for supplying vapor to the exterior of the mixing-tube, and a spiral blade or agitator located in the water-nozzle, substantially as described, to shatter or atomize the inflowing liquid.

3. In a jet apparatus, the combination of the central water-nozzle, A, the expanded delivery mouth or tube C, the body D, and the combining throat or passage, of substantially uniform diameter from end to end, with numerous restricted inlets having a forward direction or inclination.

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