2 Sheets--Sheet 1.

E. KORTING.

Improvement in Combined Injector Feed Water Heater and Condensers.

No. 123,264. Patented Jan. 30, 1872.

Fig 1.

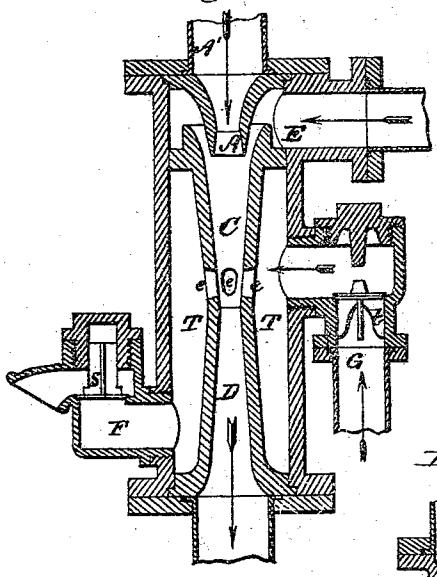


Fig 2.

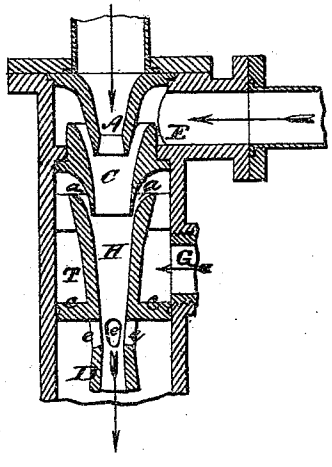
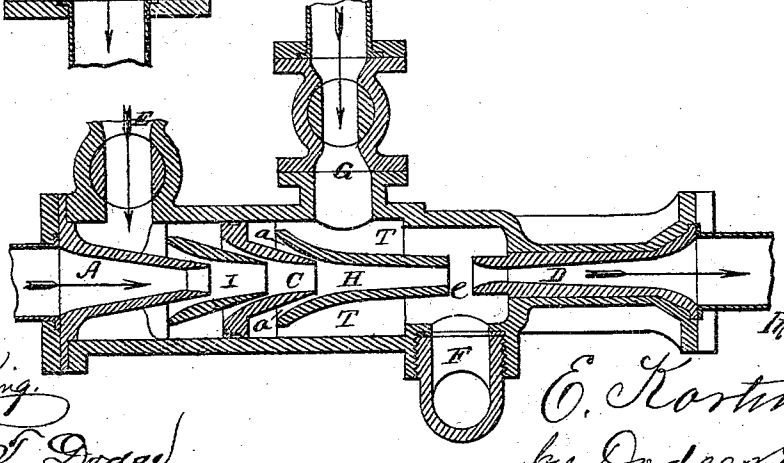


Fig 3.



Witnesses

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AM. PHOTO-LITHOGRAPHIC CO. N.Y. (OSBORNE'S PROCESS)

2 Sheets--Sheet 2.

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Fig 4.

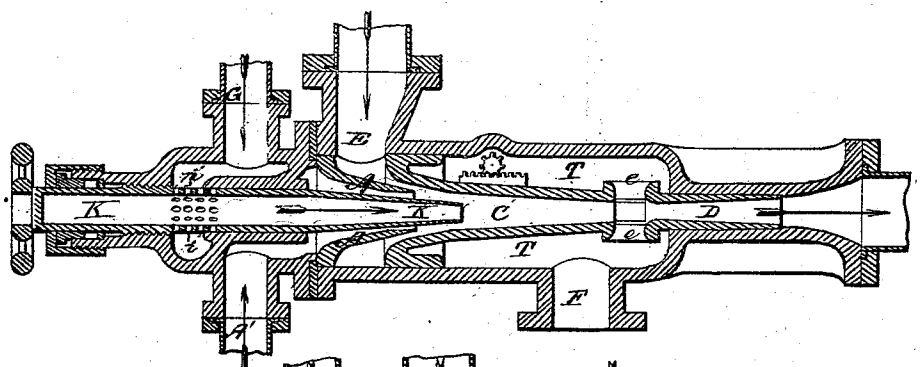


Fig 6

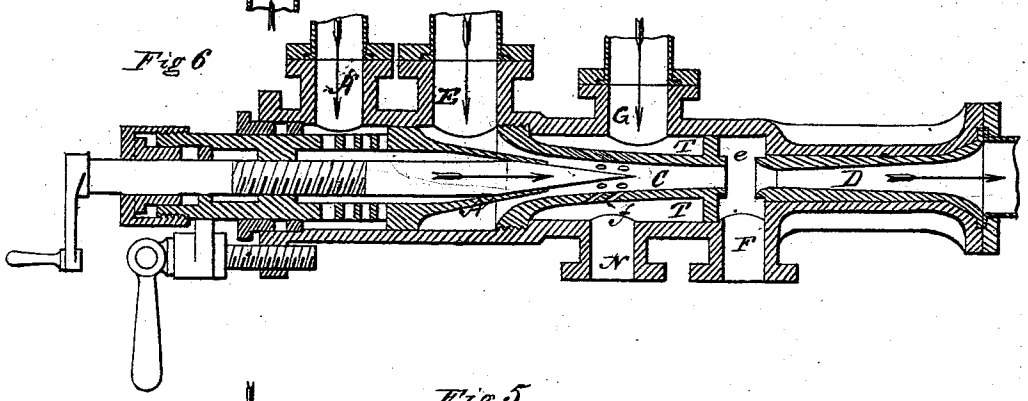
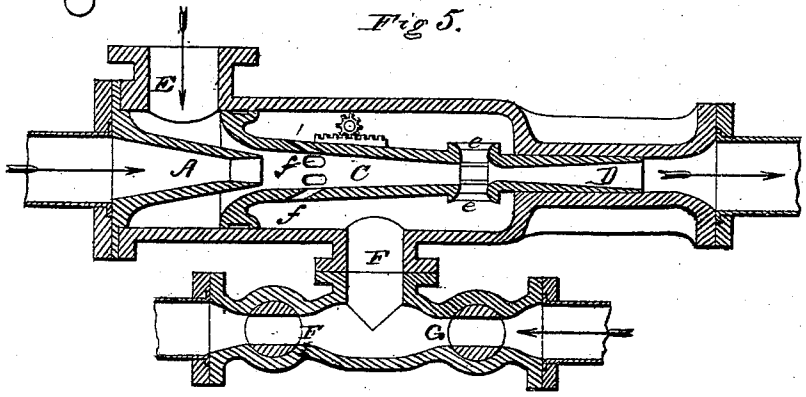


Fig 5.



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UNITED STATES PATENT OFFICE.

ERNST KORTING, OF VIENNA, AUSTRIA.

IMPROVEMENT IN COMBINED INJECTORS, FEED-WATER HEATERS, AND CONDENSERS.

Specification forming part of Letters Patent No. 123,264, dated January 30, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, ERNST KORTING, of Vienna, in the Empire of Austria, have invented certain Improvements in Combined Injector, Feed-Water Heater, and Condenser, of which the following is a specification, reference being had to the accompanying drawing.

My invention relates to water-injectors for feeding steam-boilers; and consists in so constructing the injector and connecting it with the engine that the exhaust steam from the latter is brought in contact with the water-jet of the injector, whereby the exhaust steam is condensed and the feed water heated; and the invention further consists in a novel manner of constructing certain portions of the injector, by which it is caused to operate more perfectly, and also enabled to start quickly. My improvements can be applied to all forms and styles of injectors with but little alteration in their construction.

Figures 1 to 7, inclusive, represent sections of different styles of injectors having my improvements embodied.

Fig. 1 represents an injector with fixed nozzles; A representing the steam-nozzle, fed from the pipe A′ connecting with the boiler; C, the condensing-nozzle; D, the pressure-cone; E, the water-supply pipe; F, the overflow-pipe; and G, the pipe which I apply for bringing the exhaust steam from the engine into the injector. This pipe enters and admits steam into the annular space T around the outside of the nozzles C D, so that the steam can flow through the overflow-openings *e* and come in contact with the jet of water.

The operation of the injector is as follows: Steam, being admitted through pipe A′, blows out through nozzle A and through nozzles C D, and draws the feed water in around nozzle A and forces it through into the boiler in the usual manner. As soon after starting as the injector operates properly—that is, without waste at the overflow—an inward draught or suction is produced through the overflow-openings *e*, and thus a vacuum produced in the surrounding chamber T, so that the exhaust steam is drawn in through the overflow-openings *e* and comes in contact with the water-jet, which condenses the steam and carries it forward into the boiler.

A check-valve, *s*, is placed in the overflow-pipe F, opening from the injector, to prevent air from entering and coming in contact with the exhaust steam, and a check-valve, *t*, opening toward the injector, is placed in the exhaust-steam pipe G to prevent water from entering the same when starting the injector. While in the injector thus arranged the exhaust steam is utilized for heating the feed water, no improvement is effected in starting the injector.

The advantages gained, as regards the utilization of the exhaust steam, are not considerable, owing to the imperfect vacuum formed in chamber T and the small surface of the jet, which is brought in contact with the exhaust steam; but the arrangement recommends itself on account of the facility with which it may be adapted to the ordinary injectors in use, it being merely necessary to apply a check-valve to the overflow-pipe and to connect the pipe between the injector and the engine.

Fig. 2 represents an injector with fixed nozzles, similar in construction to the one above described, except that an additional nozzle, H, is inserted between the condensing-nozzle C and the pressure-cone D, so as to leave an annular space or opening, *a*, for the entrance of the exhaust steam to the water-jet. The injector thus arranged is started in the usual way, and, as soon as it works properly, a strong inward suction will be produced at the opening *a* and the exhaust steam from pipe G will flow in through said opening and come in contact with the water-jet, which will condense the steam and carry it into the boiler, as in the previous case. A division or diaphragm, *c*, is also placed in this injector around the condensing-nozzle C, as shown, so as to cut off communication between the exhaust steam and the overflow-openings *e*, and thus obviate the necessity for a check-valve in the overflow-pipe, as was described in the previous instance. Instead of the single nozzle H, two or more of them may be used so as to obtain a large contact surface between the exhaust steam and the water-jet.

An injector of this construction possesses the advantages of a strong suction for drawing the exhaust steam inward into contact with the water, and of a large surface of water to act upon the exhaust steam, whereby a very considerable portion of the steam is condensed.

Fig. 3 represents an injector constructed in

a manner very similar to the one shown in Fig. 2, the principal difference being that the division *c* is removed, so that the exhaust steam comes in contact with the water-jet, both at the annular space *a* and at the overflow-openings *e*. A represents the steam-nozzle; C, the condensing-cone or nozzle; D, the pressure-cone; E, the feed-water supply-pipe; F, the overflow-pipe; G, the exhaust-steam supply-pipe; and H, the extra nozzle for bringing the exhaust steam in contact with the water-jet. I is an extra nozzle, placed in the injector, but relating in no way to my improvements. In this injector the steam, entering the space T, comes in contact with the water-jet at the overflow-openings *e*, and also at the annular space *a*. The inner end of the condensing-nozzle C I make of greater internal diameter than the steam-nozzle A, so that there is no tendency of nozzle C to choke or fill up with steam when starting the injector. The waste-pipe F is also left open or with a valve opening outward, so that, when starting the injector, the steam, instead of filling the interior and preventing the steam-jet from drawing the water forward, can escape through the overflow-openings *e* and the space *a*, and pass out through pipe F into the atmosphere. Under this arrangement there is no pressure formed in the nozzle to prevent the action of the steam-jet, and consequently the injector will draw water immediately upon being started.

This construction of the injector gives the advantage of quickness in starting and certainty of action; but, having two openings through which the steam is brought in contact with the water-jet, only a slight inward suction is produced, and consequently the condensation of exhaust steam is not as great as in the form shown in Fig. 2.

Fig. 4 represents an injector with a movable condensing-nozzle and pressure-cone. A is the steam-nozzle; C, the condensing-cone; D, the pressure-cone; E, the water-supply pipe; F, the overflow-pipe; G, the exhaust-steam supply-pipe; and K, the exhaust-steam nozzle. In this instance, the exhaust steam is carried into the condensing-nozzle C through a central nozzle, K, which passes in through the center of the steam-nozzle A, the exhaust steam being thus discharged into the center of the water-jet. The nozzle or tube K may be fixed or movable by any suitable means, in which latter case it also serves for regulating the steam in the same manner as the spindle of the Giffard injector, shown in Fig. 6. The steam from the exhaust-steam pipe G enters the nozzle K through holes or perforations *i* made in its back portion, as shown in the drawing. The nozzles thus arranged enable the injector to draw water immediately upon being started.

The purposes of the nozzles may be reversed and steam passed through K while water is drawn through A. This injector is started in the ordinary manner. The steam, blowing through the nozzle A past the nozzle K, causes a strong draught or suction inward through the latter, and the exhaust steam, entering through pipe G, flows through the holes *i i* into the hollow spindle or nozzle K, and through the same into the water-jet, by which it is condensed.

By this arrangement of parts I produce a strong suction for bringing the exhaust steam in contact with the water, and thus condense and utilize a large portion of the exhaust steam.

Fig. 5 shows an injector of still different arrangement, having movable condensing-nozzle and pressure-cone. A is the steam-nozzle; C, the condensing-cone; E, the water-supply pipe; F, the overflow-pipe; and G, the exhaust-steam pipe. The condensing-cone C is provided, near its large end, with a series of holes or perforations, *f*, and the exhaust-steam pipe is arranged to discharge into the space T around said cone, so that the exhaust steam comes in contact with the water-jet, both at the overflow and by passing in through the holes *f*. The operation and the advantages of this form of device are the same as in the form represented in Fig. 4.

Fig. 6 represents the common Giffard injector with my improvements applied. A is the steam-nozzle; C, the condensing-cone or nozzle; D, the pressure-cone; E, water-supply pipe; F, the overflow-pipe; G, the exhaust-steam supply-pipe; N, the waste-pipe for the excess of exhaust steam; and *f f*, holes through which the exhaust steam enters the condensing-cone. The annular space T outside of the condensing-cone and the overflow-openings both communicate with the external atmosphere through the pipes N and F, so that when the injector is being started the steam, instead of obstructing the nozzle C, can pass out therefrom and escape into the air, so as to leave the nozzle C clear and permit the injector to draw water at once. As soon as the injector is fairly in operation the overflow of water and the waste of steam ceases, and a strong inward suction is produced through the overflow-openings *e* and the holes *f*, and the exhaust steam thereby drawn inward into contact with the jet, which condenses the steam and carries it forward into the boiler.

Fig. 7, an injector with fixed nozzles arranged to draw the water immediately upon being started. A is the steam-nozzle; C, the condensing-cone; D, the pressure-cone; E, the water-supply pipe; F, the overflow-pipe; G, the exhaust-steam pipe; H, the nozzle through which the exhaust steam is brought in contact with the water-jet; E, the water-supply pipe; F, the overflow-pipe; G, the supply-pipe for exhaust steam; and N, the waste-pipe for the surplus of exhaust steam, and which also serves as an overflow-pipe when starting.

The operation of this injector, when starting and while in operation, is the same as the one shown in Fig. 3—viz., the steam, entering through nozzle A, escapes freely at both ends of nozzle C and passes out into the air, so that a suction is at once produced and the water drawn forward. When the injector first com-

mences to operate water will overflow and escape through the overflow-pipe F, and also through the pipe N; but as soon as it works properly the overflow will cease, and a strong inward suction will be produced at the outer end of nozzle C, and the exhaust steam will be drawn inward with the jet and condensed thereby and carried along into the boiler.

Where quickness in starting is one of the principal objects sought, and when it is not desirable to make the nozzles of different diameters, as in Fig. 2, the construction shown in Fig. 7 is recommended.

All of the constructions above described may be combined in other forms and applied to other injectors. It is best in every case to fit a valve in the exhaust-steam pipe to be closed when the engine is not running. Where it is no object to utilize the exhaust steam the pipes G may be removed, and still the injector will possess the advantage of starting or commencing operation very quickly.

Although the various injectors shown and described vary in construction, still in each case the exhaust steam is brought in contact with the feed water, and thereby the feed water heated and the steam condensed. In the forms shown in Figs. 3, 5, and 6, where a free communication is left between the interior of the condensing-nozzle and the atmosphere, great readiness or quickness in starting is attained, the readiness being increased when the condensing-cone is made larger inside than the steam-nozzle, as before mentioned.

By means of my improvement the exhaust steam of steam-engines can be utilized for heating the feed water for the boiler, thereby obviating the necessity for any other heater, and in addition the injector is caused to operate with greater certainty, and is enabled to commence drawing water instantly and without changing the area of the steam-nozzle, as has heretofore been necessary.

Having described my invention, what I claim is—

1. In combination with an injector constructed substantially as described, I claim the check-valve *t*, arranged in the steam-pipe G, as and for the purpose set forth.

2. I also claim the check-valve *s*, located in the overflow-pipe F, as described, to prevent the admission of air when starting the injector, as set forth.

3. The central nozzle K, whether fixed or movable, arranged to deliver the exhaust steam in the center of the stream of water in the condensing-nozzle, substantially as described.

ERNST KORTING.

Witnesses:
JOHN P. SCOTT,
C. DONHOE.