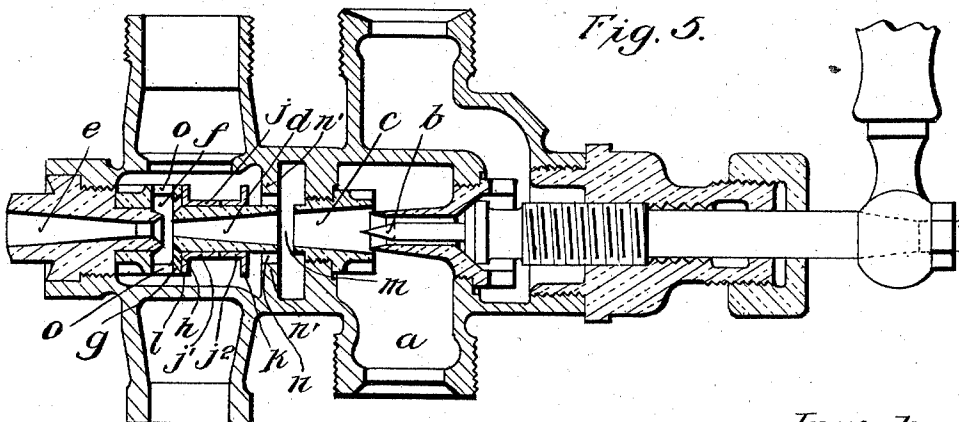
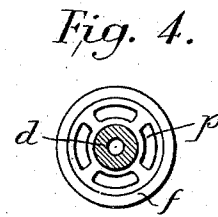
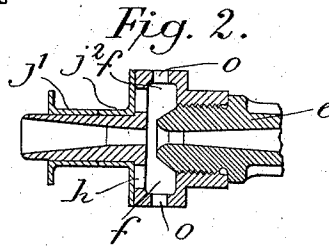
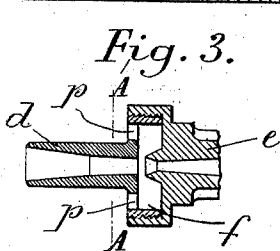
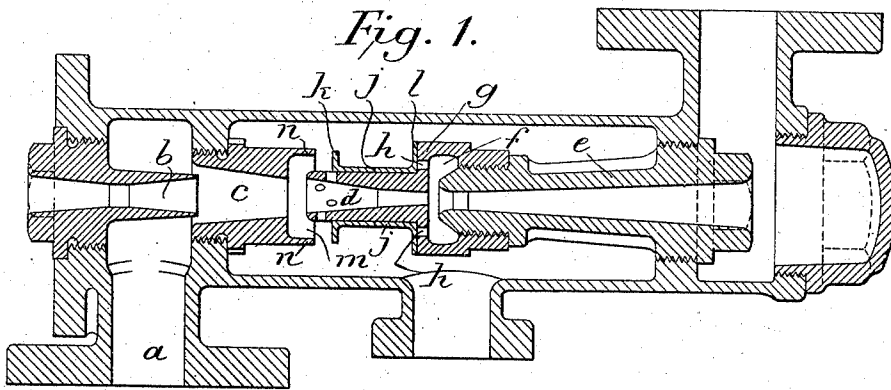


R. G. BROOKE.
INJECTOR.

APPLICATION FILED JULY 22, 1907.

967,717.

Patented Aug. 16, 1910.



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UNITED STATES PATENT OFFICE.

ROBERT GRUNDY BROOKE, OF MACCLESFIELD, ENGLAND.

INJECTOR.

967,717.

Specification of Letters Patent.

Patented Aug. 16, 1910.

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To all whom it may concern:

Be it known that I, ROBERT GRUNDY BROOKE, a subject of the King of Great Britain and Ireland, residing at Macclesfield, in the county of Chester, England, have invented Improvements in Injectors, of which the following is a specification.

This invention relates to steam injectors of the type wherein a gap or supplementary overflow between two portions of the combining nozzle is automatically closed on the starting of the injector by a closing device that is free to slide on the lower or forward portion of the combining nozzle and the main overflow outlet is provided with a separate main overflow valve.

In the accompanying illustrative drawings, Figure 1 shows in longitudinal central section, an injector embodying the present invention. Fig. 2 is a detached view of a portion of the injector showing a slight modification in the construction of the overflow chamber. Fig. 3 is a similar view to Fig. 2 showing a further modification, and Fig. 4 is a cross section on the line A A of Fig. 3. Fig. 5 shows the invention applied to a slightly modified construction of injector.

a is the water inlet branch, *b* the steam nozzle, *c* and *d* the two parts of a divided combining nozzle, and *e* the delivery nozzle of the injector.

j is a tube, mounted to fit closely and slide endwise upon the part *d* of the combining cone.

In the examples shown, the injectors are arranged to work horizontally but they may of course be arranged to work vertically.

Arranged between the lower or forward part *d* of the combining nozzle and the delivery nozzle *e* and within the injector casing is an overflow chamber *f*, the upper or rear wall *g* of which has extending there-through holes or passages *h* which may be arranged parallel to the line of flow of the jet of water and steam flowing through the injector, as shown in Figs. 1, 2 and 3, or be slightly inclined to the axis of such jet, as shown in Fig. 5, the total cross sectional area of the holes or passages *h* being less than that of the interior of the overflow chamber *f*. The upper or rear surface of the wall *g* of the said chamber may, as shown, be in the form of a flat seating, or it may be otherwise shaped, and on or against which the tube *j* can rest when the

injector is not operating. The said tube is free to slide on while closely fitting the portion *d* of the combining nozzle and is provided at its opposite ends with flanges *k* and *l*. The flange *l* closes the openings *h* in the overflow chamber *f* when the tube *j* is in its lowered position, or in the position farthest away from the supplementary gap or overflow *m*, and the other flange *k* is forced into close contact with a single seating *n* to close the gap or supplementary overflow *m* when the injector is started and the tube *j* raised or moved by the action of the overflow water passing through the said passages *h* and impinging against its adjacent flanged end *l*. The seating *n* may be formed either on the end of the part *c* of the combining nozzle, as shown in Fig. 1, or, when a special partition is employed for the tube to abut against, as shown at *n*¹ in Fig. 5, the seating may be formed on such partition. The part *d* of the combining nozzle upon which the tube *j* slides is quite plain, that is to say, is without any shoulder or collar against which the said tube could abut when moving into its closed position.

The action is as follows:—On starting the injector, the steam passing from the nozzle *b* through the part *c* of the combining nozzle and escaping through the supplementary overflow *m*, first forces the sliding tube *j* away from the said supplementary overflow. On the formation of a combined jet of steam and water in the combining nozzle *c, d*, the overflow from the overflow chamber *f* is directed through the openings *h* against the adjacent flanged end *l* of the said tube *j* and operates the latter to close the supplementary overflow *m*. The vacuum caused by the jet, when the latter is established, holds the said tube in the last mentioned position against the seating *n*, and in the case of a vertical injector, overcomes the force of gravity which tends to cause the tube to leave the seating.

If desired, the overflow chamber *f* may have one or more additional openings *o* (see Figs. 2 and 5) extending in a direction or directions other than that of the opening or openings *h* through which the overflow that actuates the tube passes, so that a portion only of the overflow is directed against the adjacent flanged end of the tube. In this case, the said opening or openings *o* may be restricted in area to insure the passage of sufficient water through the other opening or

openings h to actuate the tube. If desired, the tube j can be divided transversely into two portions j^1, j^2 (see Figs. 2 and 5) each of which may be free to move independently of the other when in certain positions. The part d of the combining nozzle $c-d$ and the delivery nozzle e may also be made in separate parts and arranged in such a manner in relation to each other, as shown for example in Figs. 3 and 4, as to provide a series of slot-like apertures p together approximating to a single annular opening between the external diameter of the combining tube and the internal diameter of the overflow chamber m , but of less cross sectional area than the said chamber. The overflow chamber may be formed in one piece with the delivery nozzle e , as shown in Fig. 3, or be attached to such nozzle, as shown in Figs. 1, 2 and 5.

The construction and arrangement above described, enables a long tube j to be employed that closely fits the part d of the combining nozzle so as to more effectually prevent air or vapor from passing between these parts than heretofore.

What I claim is:—

1. In a steam injector of the kind herein referred to having separate main and supplementary overflow outlets, and a main overflow valve, a fluid ejecting device surrounding and in communication with the main overflow outlet between the combining and delivery nozzles and a device adapted to open and close the supplementary overflow outlet, said outlet opening and closing device being arranged wholly external to and independent of said fluid ejecting device but capable of being moved into a position to close said supplementary overflow outlet by the action of fluid issuing from said fluid ejecting device.

2. In a steam injector of the kind herein referred to having separate main and supplementary overflow outlets and a main overflow valve, a fluid ejecting device comprising a chamber surrounding the main overflow outlet between the combining and delivery nozzles and a relatively long sliding tube adapted to open and close the supplementary overflow outlet, said tube being arranged wholly external to said chamber and having one end adapted to close the supplementary overflow outlet and its other end enlarged and arranged to be acted upon by jets of fluid issuing from the perforated rear side of said chamber for the purpose specified.

3. In a steam injector of the kind herein referred to having separate main and supplementary overflow outlets and a main overflow valve, of a sliding tubular device having enlarged ends one of which is adapted to close the supplementary overflow outlet, and a main overflow chamber surround-

ing the main annular overflow outlet between and combining and delivery nozzles and having in its rear wall an aperture that can be closed by the other end of said tubular device and through which fluid from the main overflow outlet can issue against the said closing device which is at all times outside of said chamber and is adapted to be moved by the issuing fluid into a position to close the said supplementary overflow outlet.

4. In a steam injector of the kind herein referred to having main and supplementary overflow outlets and a main overflow valve, a supplementary outlet closing device consisting of a relatively long tube flanged at each end and arranged to slide freely on the exterior only of the combining nozzle of the injector, and a main overflow chamber surrounding the main overflow outlet between the combining and delivery nozzles and having a fluid exit directed toward said closing device, said closing device being arranged external to said chamber and opposite the water exit therein, as set forth.

5. In a steam injector of the kind herein referred to having main and supplementary overflow outlets and a main overflow valve, the combination with separate combining and delivery nozzles of a main overflow chamber surrounding the overflow outlet between said nozzles and carried by said nozzles, and a tubular device arranged to slide freely on the exterior only of the combining nozzle and close the supplementary outlet therefrom, said overflow chamber having a fluid exit on its rear side adjacent to and directed toward one end of said tubular device which is arranged wholly outside of said chamber, substantially as described for the purpose set forth.

6. A steam injector of the kind herein referred to having a combining nozzle made in two parts with a gap or supplementary overflow outlet between such parts, one of said parts of the combining nozzle having an annular flanged portion concentric with the other part of the combining nozzle and adapted to form an annular seat, an overflow chamber arranged between and carried by the second portion of the said combining nozzle and the delivery nozzle independently of the injector casing and having fluid exit outlets in its rear wall, and a tube arranged to slide on the second portion of the combining nozzle and having its ends adapted to bear respectively against the perforated rear wall of the overflow chamber and the seating surrounding the supplementary overflow outlet and formed on one part of the combining nozzle.

7. A steam injector having a combining nozzle made in two parts with a gap or supplementary overflow outlet between such parts, an overflow chamber arranged be-

tween the second portion of the said combining nozzle and the delivery nozzle and having one or more fluid exit outlets in its rear wall, and a supplementary outlet closing device comprising two tubes arranged end to end and mounted to slide on the second portion of the combining nozzle and having the ends that are remote from each other adapted to bear respectively against the perforated rear wall of the overflow chamber and a seating surrounding the supplementary overflow outlet.

8. A steam injector having a combining nozzle made in two parts with an annular supplementary overflow outlet between such parts, a main overflow chamber arranged between the second part of the combining nozzle and the delivery nozzle and formed with two sets of overflow openings, one set extending through the rear wall of the said chamber, and a tube mounted to slide on the second part of the combining nozzle and flanged at each end, one of the flanged ends being adapted to seat itself against the perforated rear wall of the overflow chamber and the other against a seating around the supplementary overflow outlet.

9. A steam injector having a combining nozzle made in two parts with an annular supplementary overflow outlet between such parts, one of said parts being screwed into the body of the injector and the other being enlarged at its forward end and screwed

to the rear end of the delivery nozzle and adapted to form therewith a main overflow chamber having fluid exit apertures through its rear wall, and a tube flanged at each end and mounted to slide on the second part of said combining nozzle, between the perforated wall of the overflow chamber and the supplementary overflow outlet.

10. A steam injector having a combining nozzle made in two parts one of which is carried by the injector body and has a forwardly extending circular rim arranged coaxial with the other part of the combining nozzle and forming therewith an annular supplementary overflow outlet, a main overflow chamber arranged between and carried by the second part of the combining nozzle and the delivery nozzle independently of the injector casing and having fluid exit apertures through its rear wall and a tubular opening and closing device flanged at its ends and mounted to slide upon the second part of said combining nozzle between the forwardly extending circular rim and the perforated rear wall of the main overflow chamber.

Signed at Manchester, England this tenth day of July 1907.

ROBERT GRUNDY BROOKE.

Witnesses:

ERNALD SIMPSON MOSELEY,
MALCOLM SMETHURST.