

No. 648,040.

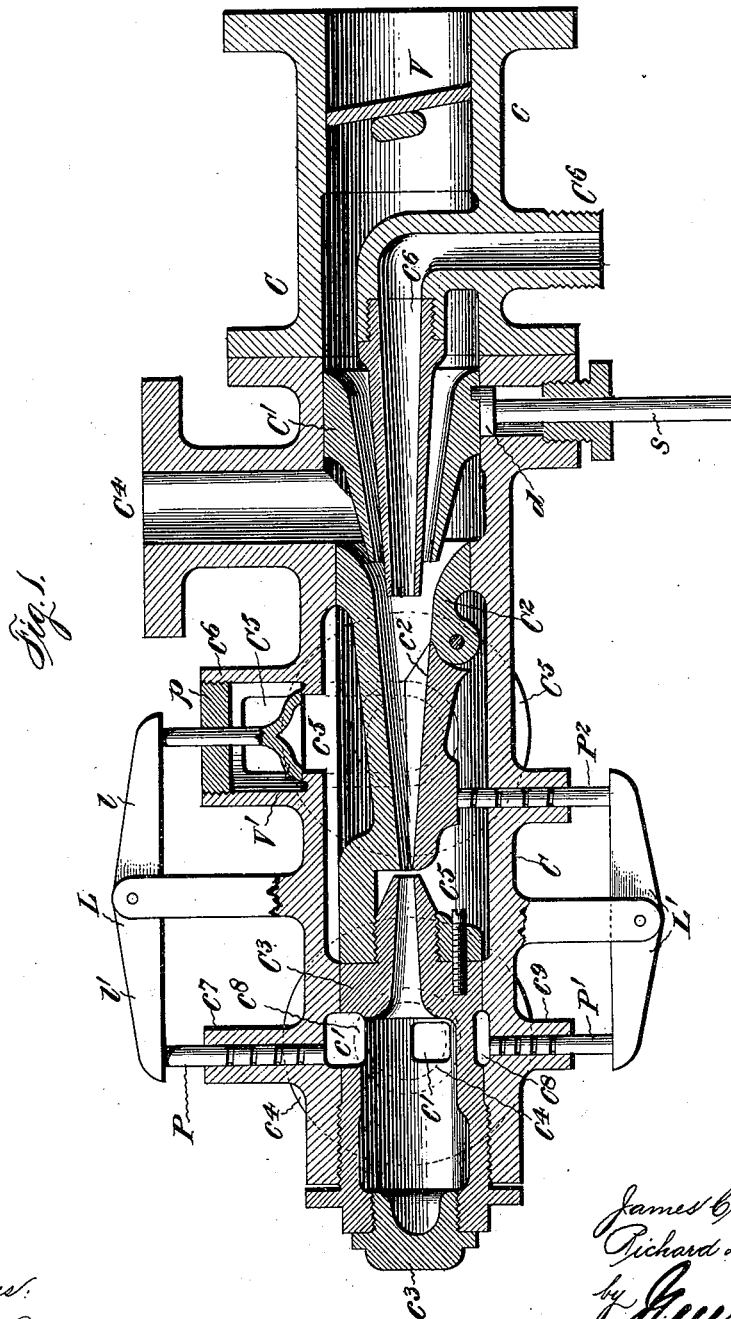
J. C. & R. D. METCALFE.
INJECTOR.

Patented Apr. 24, 1900.

(Application filed Jan. 3, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:
Attest.
Wm. Sommers

Inventors:
James Brown Metcalfe.
Richard David Metcalfe.
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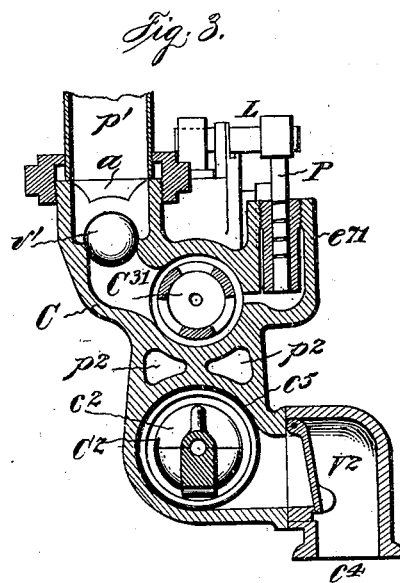
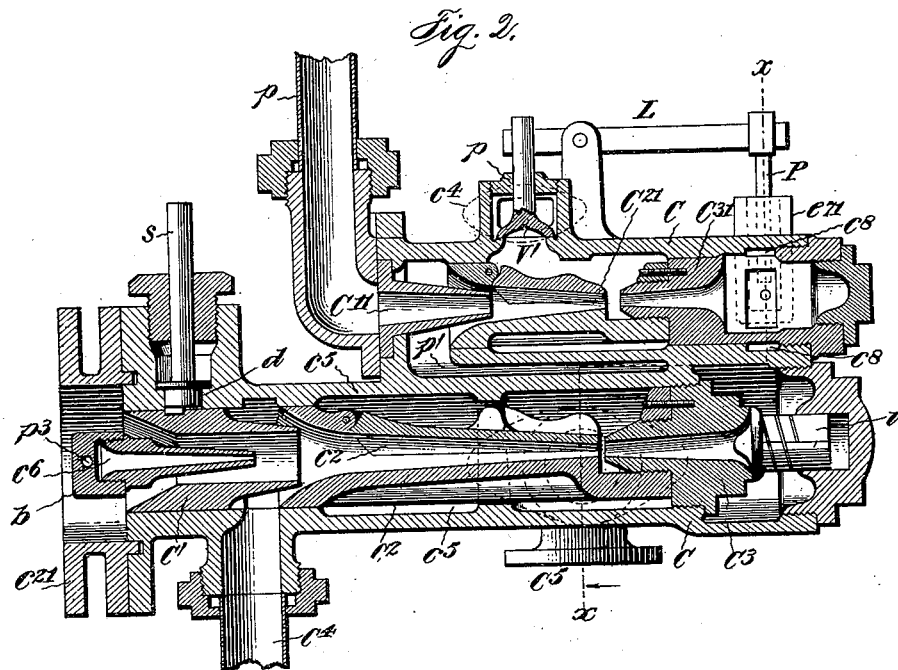
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(No Model.)



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UNITED STATES PATENT OFFICE.

JAMES CROXON METCALFE AND RICHARD DAVID METCALFE, OF
ABERYSTWTH, ENGLAND.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 648,040, dated April 24, 1900.

Application filed January 3, 1900. Serial No. 243. (No model.)

To all whom it may concern:

Be it known that we, JAMES CROXON METCALFE and RICHARD DAVID METCALFE, subjects of the Queen of Great Britain, residing at Aberystwith, county of Cardigan, England, have invented certain new and useful Improvements in Injectors; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Our invention has relation to steam-boiler injectors, applicable also to combined exhaust and supplementary live steam injectors.

It has been the custom before our present invention to control the overflow through the medium of a diaphragm-controlled piston-headed valve unseated by low pressure in the overflow-chamber in starting and seated to close the overflow branch by high pressure in the delivery-chamber after the jet has been fully established. By "low" pressure we mean that pressure which generally exists in the overflow-chamber of an injector from the starting to the time when the jet is fully established and varying from a pressure below the working pressure of the injector to a partial vacuum, and by "high" pressure we mean that pressure which exists in the delivery-chamber after the jet has been fully established and the injector is working against boiler-pressure. The disadvantages of diaphragms for controlling a valve are well understood. The greatest objection thereto, irrespective of their rapid wear, is that after they have been in use for a comparatively-short time they become more or less unreliable in action owing to their expansion or stretching, the chamber in which the diaphragm is contained being necessarily shallow, the overflow-valve having usually but very slight play from and to its seat.

One of the objects of our invention is to avoid the disadvantages inherent to diaphragm-controlled overflow-valves, and this we attain by using instead of a diaphragm a lever acting on the stem of the overflow-valve

and a piston influenced by the high or working pressure acting upon said lever.

In that type of injectors operated by exhaust-steam in which the combining-cone has a flap or portion hinged to open into the overflow-chamber under the influence of low or starting pressure for purposes well understood and known as "flap combining-cones" the flap is liable to fly open or partially open after the injector is fully started under a sudden inrush of exhaust-steam, which is more liable to occur in heavy-blast-locomotive injectors, and this, as is well known, materially interferes with the proper working of the injector.

The further object of our invention is to prevent the flying open or the partial opening of the combining-cone flap under a sudden inrush of exhaust-steam, and this we attain by means of a piston influenced by high or working pressure and suitable means, as a plunger operated by said piston and acting upon the flap of the cone, to hold said flap to its seat; but that our invention may be fully understood we will describe the same in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal axial section of an injector having a flap combining-cone and embodying our improvements. Fig. 2 is a similar view illustrating our improvements applied to a combined exhaust and supplementary live steam injector, and Fig. 3 is a section taken on line *xx* of Fig. 2.

Referring to Fig. 1, C indicates the casing; c, the exhaust branch; V, the usual throttle-valve therein; C', the steam-cone; C², the flap combining-cone, having the usual flap portion c², and C³ the delivery-cone, said combining and delivery cones being screwed together and into the delivery end of the casing C, said delivery-cone having its outer open end closed by a screw-plug c³ and provided with ports c' in communication with the delivery branch c⁴. (Shown partly in dotted lines and partly in full lines.)

C⁴ indicates the water branch; C⁵, the overflow branch, and C⁶, a live steam branch carrying a nozzle c⁶, extending through the exhaust-steam cone C' into the flap combining-

cone C^2 , so that in the absence of exhaust-steam the injector can be worked with live steam.

The exhaust-steam cone C' for well-known purposes is adjustable toward and from the combining-cone C^2 by means of a spindle s , usually provided with a hand-wheel (not shown) and working in a stuffing box gland and carrying a crank-disk d , whose crank-pin works in a cross-groove in the periphery of said exhaust-steam cone.

The construction of the injector thus far described is a well-known one, and our improvements thereon consist in forming in the passage leading from the overflow-chamber c^5 a valve-seat for a valve V' , whose stem extends through a discoidal plug p , screwed into an opening in the aforesaid passage c^6 . The stem of the valve V' abuts against one arm l of a centrally-fulcrumed rock-lever L , and against the other arm l' of said lever abuts the rod of a piston P , that works fluid-tight in the bore of a cylindrical projection c^7 from the casing C , said bore communicating with an annular recess or channel c^8 , formed in the inner periphery of casing C . The channel c^8 communicates with the interior of the delivery-cone C^3 through one of its ports c' , thus forming a pressure-chamber between said cone and the casing C .

In starting the injector, whether by means of exhaust or live steam, the pressure in the delivery-cone C^3 will of course be lower than in the overflow-chamber c^5 , so that the valve V' , controlling the overflow, can open freely under said pressure. As soon, however, as the jet is established and the injector begins to work the pressure in the overflow-chamber drops to a partial vacuum, while in the annular chamber c^8 the pressure will have risen to working pressure, which, acting on the piston P and through the lever L on the stem of the valve V' , will move the latter to and hold the same firmly on its seat as long as the injector is working properly, thus obviating the use of a diaphragm for controlling the overflow-valve.

As shown, the piston P is a comparatively-long one and has annular grooves formed therein from distance to distance and is ground to fit the bore in its cylinder fluid-tight. Although this arrangement is preferred, yet we may use a piston and piston-cylinder not ground true and provide a packed piston. On the other hand, instead of the pressure-chamber c^8 between the casing C and delivery-cone C^3 in communication with the interior of the latter, it is obvious that the piston-cylinder may be formed on or placed in communication with the delivery branch, as will be readily understood.

In order to prevent the flap c^2 of the combining-cone C^2 from flying open or being partially opened by an abnormal rush of steam into the injector, we provide a piston P' , similar to piston P , working in the bore of a projection c^9 on casing C , said bore being like-

wise in communication with the aforesaid annular chamber c^8 between said casing and the delivery-cone C^3 , said piston P' controlling a plunger P^2 through a lever L' , similar to lever L , and said plunger P^2 acts upon the flap c^2 of nozzle C^2 in the same manner as the lever L acts upon the stem of valve V' and under similar conditions of pressure.

In the application of our invention, in so far as it relates to the overflow-valve, to a combined exhaust and supplementary live steam injector (shown in Figs. 2 and 3) the same symbols of reference indicate like parts, the casing C for both injectors being made in one casting, the delivery-cone C^3 being normally closed by a spring-actuated check-valve v . The live-steam pipe p for the supplementary injector communicates with the live-steam cone C^{11} , C^{21} indicating the flap combining-cone and C^{31} the delivery-cone. The overflow-valve V' for the supplementary injector is hung from one end of the short arm of a lever L , while the controlling-piston P is hung from the longer arm of said lever and works in the bore of a branch c^{71} in communication with an annular chamber c^8 between the casing C and the delivery-cone C^{31} for precisely the same purposes as above described. In the delivery-pipe p' of the supplementary injector there is a valve-chamber for a ball check-valve v' , the lift of which is limited by a suitable abutment a .

The overflow branch c^4 for the exhaust-steam injector (shown partly in full lines and partly in dotted lines in Fig. 2 and in full lines in Fig. 3) has a suitably-loaded check flap-valve v^2 to prevent access of air to the overflow-chamber c^5 .

The combined fluids from the exhaust-steam injector pass from the delivery-cone C^3 through passages p^2 p^2 in the casing C , Fig. 3, which passages lead to a passage p' , Fig. 2, in communication with the receiving end of the flap combining-cone C^{21} of the supplementary live-steam injector.

With the exception of the appliances for controlling the overflow-valve the combined exhaust and supplementary live steam injector is also of a well-known construction.

The live-steam nozzle c^5 for the exhaust-steam injector is arranged axially in a flanged part c^{21} , interposed between the exhaust-pipe and the flanged exhaust-steam inlet of the injector, live steam being admitted through a passage p^3 in an axial bearing b for said live-steam nozzle c^5 . The exhaust-steam cone C' is adjustable toward and from the flap combining-cone C^2 of the exhaust-steam injector by means such as hereinabove described in respect of the like cone of the injector shown in Fig. 1. Obviously the overflow branch for the supplementary live-steam injector may be connected with the like branch for the exhaust-steam injector.

Having thus described our invention, what we claim as new therein, and desire to secure by Letters Patent, is—

1. In an injector, the combination with the overflow-valve and the delivery-cone, of a piston-cylinder in communication with the interior of said cone, a piston in said cylinder, and a rock-lever acted upon by the rod of said piston and acting upon the stem of the overflow-valve, for the purpose set forth.

2. In an injector provided with a flap combining-cone, means influenced by working pressure in the injector and operating to hold the flap of said cone to its seat, for the purpose set forth.

3. In a combined exhaust and supplementary live steam injector, the combination with the overflow-valve of the supplementary injector and its delivery-cone; of a piston-cylinder in communication with the interior of said cone, a piston in said cylinder, and a rock-lever acted upon by the rod of said piston and acting upon the stem of the overflow-valve, for the purpose set forth.

4. In an injector, the combination with the casing, the overflow branch and valve, the delivery-cone and an annular chamber be-

tween said casing and cone in communication with the interior of the latter; of a piston-cylinder opening into said chamber, a piston in said cylinder and a lever operated by the piston and acting upon the stem of the overflow-valve, for the purpose set forth.

5. In an injector provided with a flap combining-cone, the combination with the casing, the delivery-cone, an annular chamber between said casing and delivery-cone in communication with the interior of the latter, a piston-cylinder opening into said chamber, a piston in said cylinder, a rock-lever connected with said piston and a plunger connected with the rock-lever and acting upon the flap of the combining-cone, for the purpose set forth.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

JAMES CROXON METCALFE.

RICHARD DAVID METCALFE.

Witnesses:

PETER J. LIVSEY,

WILLIAM FAULKNER.