(Model.)

L. W. LOMBARD & W. CONNOR.

INJECTOR.

No. 401,753. Patented Apr. 23, 1889.

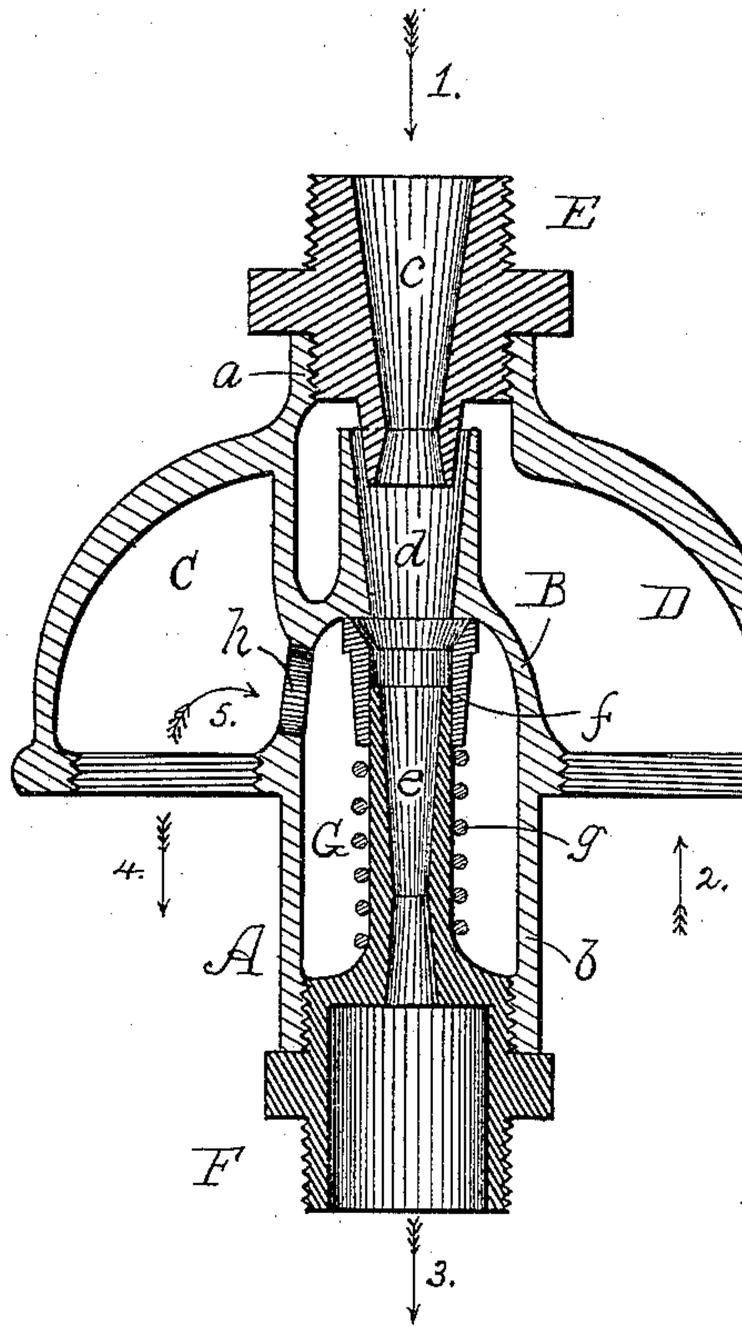

Fig. 1.

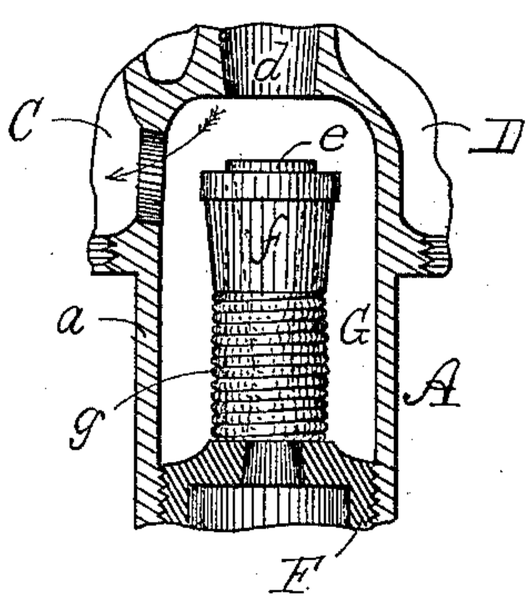

Fig. 2.

Witnesses.
E. K. Boynton
A. F. Hayden.

Inventors.
Levi W. Lombard.
William Connor.
by H. E. Lodge Atty.

UNITED STATES PATENT OFFICE.

LEVI W. LOMBARD AND WILLIAM CONNOR, OF BOSTON, MASSACHUSETTS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 401,753, dated April 23, 1889.

Application filed April 2, 1888. Serial No. 269,356. (Model.)

To all whom it may concern:

Be it known thatwe, LEVI W. LOMBARD and WILLIAM CONNOR, citizens of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, 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 or figures of reference marked thereon, which form a part of this specification.

This invention relates to injectors, more particularly that class termed "lifter-injectors," which are adapted to draft and lift their own supply in lieu of having said supply delivered to them under more or less pressure. Injectors of the class above premised are supplied with a "relief-valve" and "overflow-chamber," so called, and during the interval which lapses between the admission of steam to the injector and the flow of fluid consequent thereupon said steam is allowed to escape by means of the relief-valve when starting or restarting the apparatus.

The primary feature in our invention consists in the position and operation of the relief-valve, the latter being mounted upon the receiving end of the discharge-cone.

Furthermore, our invention consists in the general arrangement of the injector by which it is simplified in form, being composed of only three principal pieces, which are easily and readily put together, thereby largely reducing the expense of manufacture.

The drawings herewith annexed represent in Figure 1 a vertical central section through an injector embodying our invention. Fig. 2 is a similar sectional portion in which the relief-valve is shown open.

In said drawings the body of the injector is shown as composed of a central cylindrical tube or shell, A, interiorly screw-threaded at each end and centrally provided with a partition, B, cast therein, which divides it into an upper and lower portion, respectively, *a b*. Said partition further separates two chambers, C D, circular in cross-section, which are formed by two hollow arms cast diametrically opposite upon the body A of the injector.

C represents the overflow-chamber co-operating with the relief-chamber and valve,when the latter is open.

D represents a chamber connecting with the fluid-supply.

At the upper end portion, *a*, of the injector is disposed a screw-threaded nipple, E, provided with a contracted bore, *c*, double cone shape in longitudinal section, and which is termed the "steam-cone." This nipple E connects with the steam-supply from the boiler. Longitudinally aligned therewith, centrally of the bore of tube A and cast integral with the partition B, is disposed the combining-cone *d*, which extends upwardly beyond the lower end of the steam-cone, which is in part inclosed therein, leaving an annular opening between the two for the passage of the fluid from the supply-chamber D.

At the lower end portion, *b*, of the tube A, and in engagement therewith, is disposed a nipple, F, having cast thereon a tubular projection, *e*, cylindrical exteriorly, and with a cone-shaped bore tapered downward. Said projection is termed the "discharge-cone." About the upper end of said discharge-cone *e* we have loosely mounted the relief-valve *f*, which consists of a section of a tube open at both ends, and with its upper end flared and adapted to be seated against the partition B and in alignment with the lower end of the combining-cone *d*. A spring, *g*, coiled exteriorly about the discharge-cone *e*, serves to actuate the relief-valve and also limit its downward movement when opening.

An aperture, *h*, connects the overflow-chamber C with the relief-chamber G, always open to the atmosphere, and the latter chamber has no communication whatsoever with the supply-fluid when the injector is in operation.

The flow of steam is indicated at arrow 1, the fluid-supply at arrow 2; discharge of said liquid to the boiler at 3. The entrance of the end of the steam-cone *c* a certain distance within the combining-cone is to produce a better condensation and consequently a more efficient result with greater forcing and lifting properties.

The operation of the injector is as follows, the various component parts being shown, as in Fig. 1, with the relief-valve closed, and the injector being required to lift its own supply.

Upon admission of steam through the steam and combining cones, no liquid being present, the pressure of said steam pushes down the relief-valve by impinging upon its flared mouth, and the steam is thus allowed to escape through the relief-chamber G, aperture *h*, and overflow-chamber C, as indicated. (See Fig. 2, and arrow 4 in Fig. 1). The valve is thus held open until the air in the supply-pipe is expelled, when a rush of fluid occurs in direction of arrow 2 through the combining-cone *d*, and thence into the discharge-cone *e*. When said fluid-supply is established through the injector, a sucking action occurs about the upper end of the discharge-cone *e*, and the relief-valve *f*, aided by its spring *g*, quickly rises and is seated against the partition. Since the relief-chamber G is open at all times to the atmosphere by its aperture *h*, and while the injector is in active operation, with the fluid-supply passing to the boiler, a suction or a tendency to an inflow of air about the relief-valve (now seated upon the partition B) is produced, (see arrow 5,) and the resultant action only serves to hold said valve more securely in place and closed. When the steam is shut off and the fluid-supply ceases, the valve remains closed, as shown; in fact it is open only in the act of starting the injector, and when an outlet is required for the steam before the fluid-supply commences to flow.

What we desire to claim is—

1. In general combination, the injector composed of the tubular body A, the partition B, with the combining-cone *d*, the supply and overflow chambers D C, the aperture *h*, the relief-chamber G, the discharge-cone *e*, located therein, and the relief-valve *f*, with its spring *g*, as and for purposes set forth.

2. In an injector provided with a relief-chamber constantly open to the external air, a discharge-cone, *e*, located therein, the relief-valve *f*, movable upon said cone and adapted to engage with the outlet-mouth of the combining-cone, in combination with a discharge-cone, *e*, and the steam-cone *c*, aligned therewith, projecting within and partially inclosed by said combining-cone, for purposes stated.

In testimony whereof we affix our signatures in presence of two witnesses.

LEVI W. LOMBARD.
WILLIAM CONNOR.

Witnesses:
H. E. LODGE,
R. W. LODGE.