S. L. KNEASS.

INJECTOR.

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906,723. Patented Dec. 15, 1908.

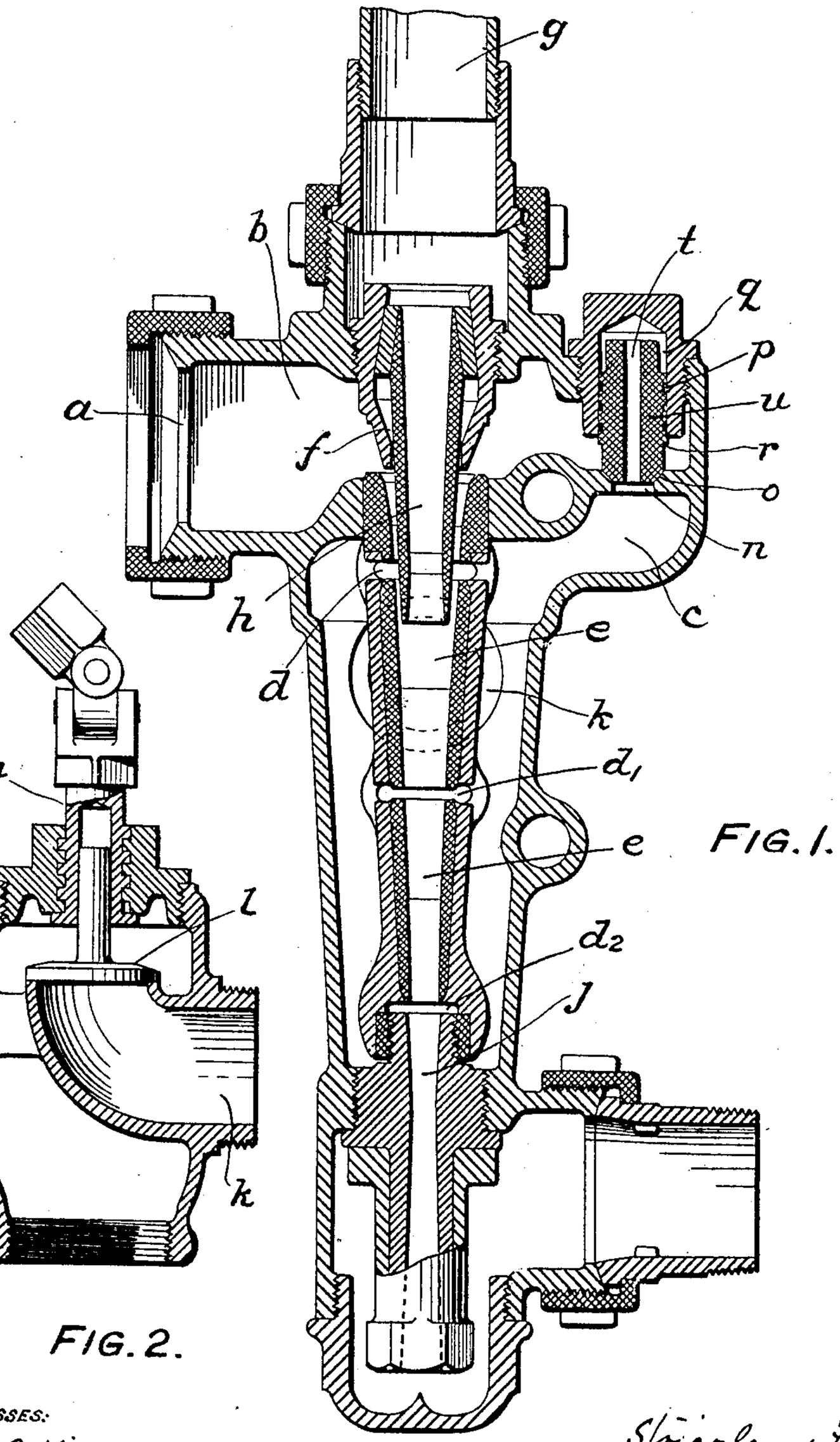

FIG. 1.

FIG. 2.

WITNESSES:

Robt R Ritchie.

A. M. Strean

INVENTOR

Strickland L. Kneass

BY

Wanderling & Wanderling

ATTORNEYS.

UNITED STATES PATENT OFFICE.

STRICKLAND L. KNEASS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO WILLIAM SELLERS AND COMPANY, INCORPORATED, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

INJECTOR.

No. 906,723. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed July 31, 1908. Serial No. 446,233.

To all whom it may concern:

Be it known that I, STRICKLAND L. KNEASS, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Injectors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention applies to all forms of injectors provided with a lateral opening in the combining tube between the discharging end of the steam nozzle and the minimum diameter of the delivery tube, inclosed in an overflow chamber sealed against the admission of air during the operation of the device and provided with a port communicating with the water supply chamber.

When an injector is connected by piping to a steam boiler and is in operation, the flow of steam through its guiding nozzle increases as the pressure of the steam is raised, and the supply of water should be proportionally augmented in order that the efficiency be maintained. In all forms of injectors in which the relative positions of the tubes and nozzles are fixed and are non-adjustable, it has been found advantageous, in order to obtain this result, to provide a water admission port to admit a supplemental flow from the water supply to the overflow chamber surrounding the combining tube, which is indrawn through the lateral openings of the combining tube by means of the internal partial vacuum caused by the condensation of the actuating steam jet. In order that there be no back flow of steam to the water supply chamber during priming or starting the injector, it is essential that this port be closed during these operations. To this end has been used a gravity check valve for a lifting injector, or a check valve balanced against the head or pressure of the water supply, by means of a spring or piston subject to atmospheric pressure.

The object of my invention is to raise the limiting steam pressure of injectors.

It is a further object to increase the maximum capacities at the higher steam pressures carried on locomotive boilers without enlarging the diameters of the tubes or amount of steam used.

A further object is to widen the range of steam pressures through which an injector may operate under a head, without tendency to spill at the waste pipe.

It is a further object to supply all injectors operating under a head with a balanced valve controlling a supplemental water port without the use of a balancing spring or piston in direct contact with the atmosphere which is liable to admit air or permit leakage of the water supply, interfering with the efficient performance of the device.

It is a further object to simplify the construction and facilitate both the manufacture and the repair.

To this end my invention consists in a balanced valve controlling a supplemental inlet port between a water supply and an overflow chamber, sealed against the admission of air by an outwardly opening check valve, the balanced valve closing by gravity in the direction of the flow of water into the overflow chamber and rising against the flow of water by the partial vacuum within the overflow chamber when an insufficient supply of water to meet the requirements of the injector enters at the mouth of the combining tube.

I will now describe the embodiment of my invention illustrated in the accompanying drawings and then point out the invention in the claims.

In the drawings: Figure 1 is a general sectional view of my improved injector. Fig. 2 is a sectional view of the overflow valve.

a is the water supply pipe, *b* the water supply chamber, *c* the overflow chamber, *e* the combining tube provided with the lateral openings *d*, *d'*, *d²* contained in the overflow chamber *c*.

f is the annular steam nozzle in communication with the steam supply pipe *g* and *h* is the forcing steam nozzle.

k is the waste outlet port from the overflow chamber and *l* a valve controlling said port. This valve is a gravity valve and opens outwardly, closing by gravity, and which may be forced tightly to its seat, when desired, by screw *m*.

n is a port from the water supply chamber to the overflow chamber controlled by valve *u*. This valve has the seat portion *o* and the guiding piston portion *p* in the guiding chamber *q*. It has also the ledge *r* acted upon by the water to lift. The area of this portion *r* is insufficient to lift against gravity acting normally upon the valve, but when a vacuum

or partial vacuum is created in chamber *q* above guiding piston portion *p* the valve rises. *t* is a passage through said valve *u*.

The operation of the injector is as follows: Water is supplied through the water branch *a*. Steam is admitted to the steam nozzle *f* by opening a valve in the supply pipe *g*. If the tubes are correctly designed at their several admission orifices in proportion to the relative pressures of water and steam, the injector will feed the boiler without wasting and operate at its maximum efficiency, and a supplemental supply through the inlet port *n* will be unnecessary and the balanced inlet valve will be closed and inoperative, held to its seat by gravity, because its weight is equal to or slightly greater than the upward pressure of the water acting upon the excess area of its guide piston over the area of its seat.

If the steam pressure be raised without augmenting the head of water or reducing the height of lift, there will be a tendency to reduce the efficiency of the apparatus. To prevent this, the balanced inlet valve *u* rises from its seat and admits a supplemental supply of water to the overflow chamber. This lifting of the valve is caused by the transmission of the partial vacuum within the overflow chamber through the passage *t* to the guiding chamber *q* at the top of the valve *u*, and the passage *t* may be through the valve or included in the body. The reduced pressure acting upon the guiding piston portion of the valve enables the water pressure acting upon its excess area over that of the seat raises the valve against the action of gravity, and opens the inlet port and admits a supplemental supply of water to the lateral openings of the combining tube.

If the water supply is temporarily shut off, steam will flow into the overflow chamber, producing sufficient pressure to open the overflow valve *l* and at the same time pass through the passage *t* to the guiding chamber and act upon the top of the valve *u*, and hold it firmly to its seat, preventing back flow through this port to the water supply chamber. If the lateral openings of the combining tube, and the area of the overflow valve be sufficiently large to permit free outflow of the steam jet, the high velocity of discharge into the mouth of the combining tube will tend to exhaust the air from the suction or water supply pipe and enable the injector to restart automatically as soon as the supply of water be resumed, for the steam from the overflow chamber cannot pass through the inlet port into the water chamber on account of closure of the inlet valve *u*. The action of the improved inlet valve is therefore automatic under all conditions, opening when a supplemental supply is necessary to improve the efficiency of the device and closing when a separation of the water supply and overflow chambers is necessary for the proper performance of the function of the injector.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In an injector, a water supply chamber, an overflow chamber containing an opening of the forcing combining tube, there being a port between said supply chamber and overflow chamber, in combination with a gravity check valve controlling said port closing in the direction of the flow of the water and rising by forming a partial vacuum on the upper surface of the valve through communication with the overflow chamber.

2. In an injector, a water supply chamber, an overflow chamber containing an opening of the forcing combining tube, there being a port between said supply chamber and overflow chamber, in combination with a gravity check valve controlling said port and seating in the direction of the flow of the water, a supplemental chamber containing the upper end of said valve and communication between said chamber, from above the valve to the overflow chamber.

3. In an injector, a water supply chamber, an overflow chamber containing an opening of the forcing combining tube, there being a port between said supply chamber and overflow chamber, in combination with a gravity check valve controlling said port and seating in the direction of the flow of the water, a chamber containing the upper end of said valve, and a passage from the overflow chamber to said supplemental chamber above said valve.

4. In an injector, a water supply chamber, an overflow chamber containing an opening to the forcing combining tube, there being a port between said supply chamber and overflow chamber, in combination with a gravity check valve controlling said port and seating in the direction of the flow of the water, a supplemental chamber containing the upper end of said valve, and a passage through said valve forming a communication between the supplemental chamber and the overflow chamber.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this 29 day of July, 1908.

STRICKLAND L. KNEASS.

Witnesses:

FRANK G. GRIER,

I. P. PEDRICK.