

No. 649,445.

Patented May 15, 1900.

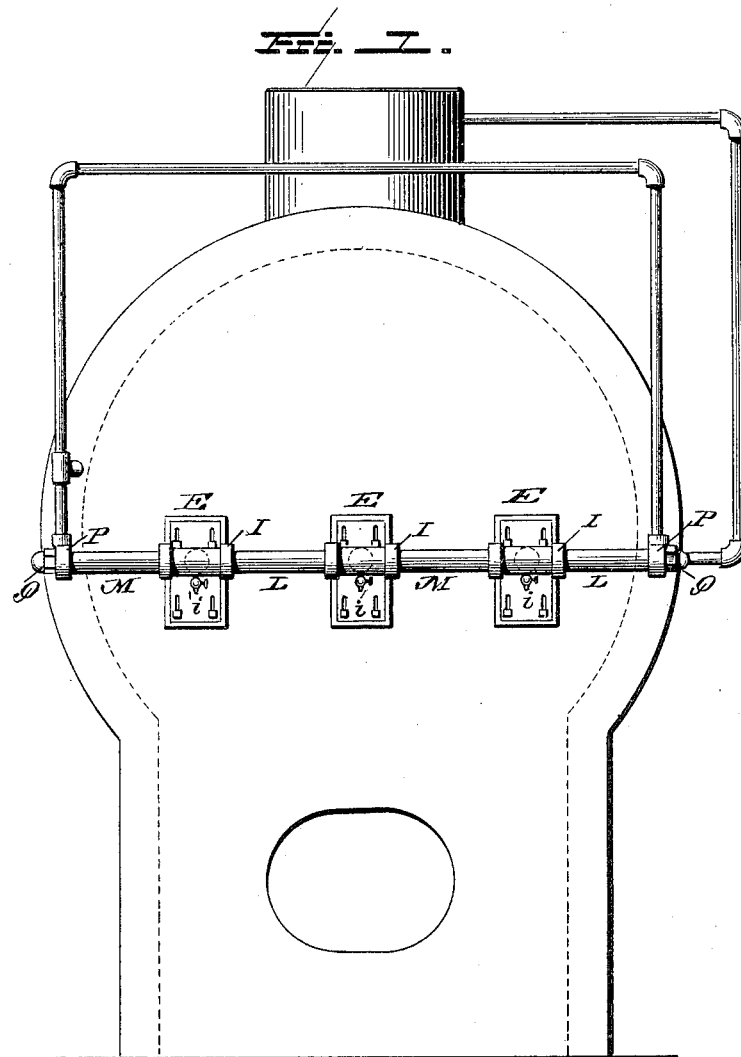
J. A. GREEN.

STEAM INJECTOR FOR FIRE BOXES OF STEAM BOILERS.

(Application filed Aug. 31, 1899.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses  
L. C. Hills.  
K. H. Butler.

334

Inventor;  
James Alpheus Green,  
Cha. H. Fowler;

Attorney

**No. 649,445.**

**Patented May 15, 1900.**

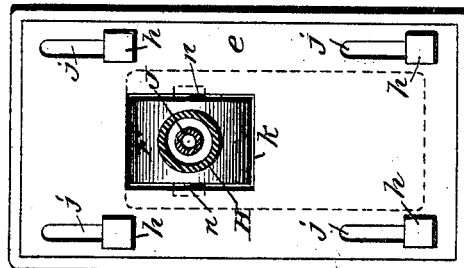
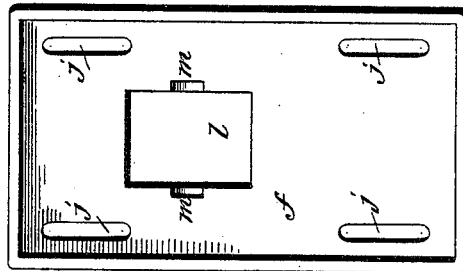
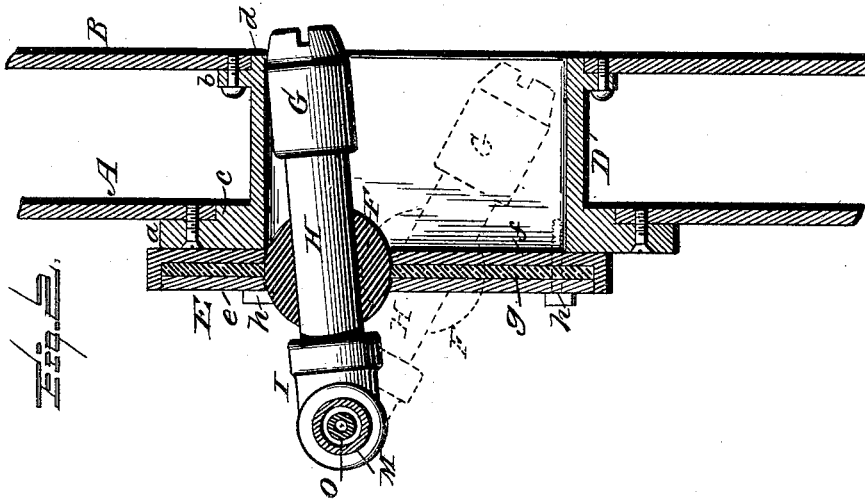
**J. A. GREEN.**

## STEAM INJECTOR FOR FIRE BOXES OF STEAM BOILERS.

(Application filed Aug. 31, 1899.)

(No Model.)

**4 Sheets—Sheet 2.**



Witnesses  
L. C. Hills  
K. H. Butler

Witnesses  
L. C. Hills  
K. H. Butler

K. H. Butler

Inventor:  
*James Alpheus Green,*  
by *Chas H. Fowler.*

*James Alpheus Green,*

by Chas H. Fowler.

Attorney

**No. 649,445.**

**Patented May 15, 1900.**

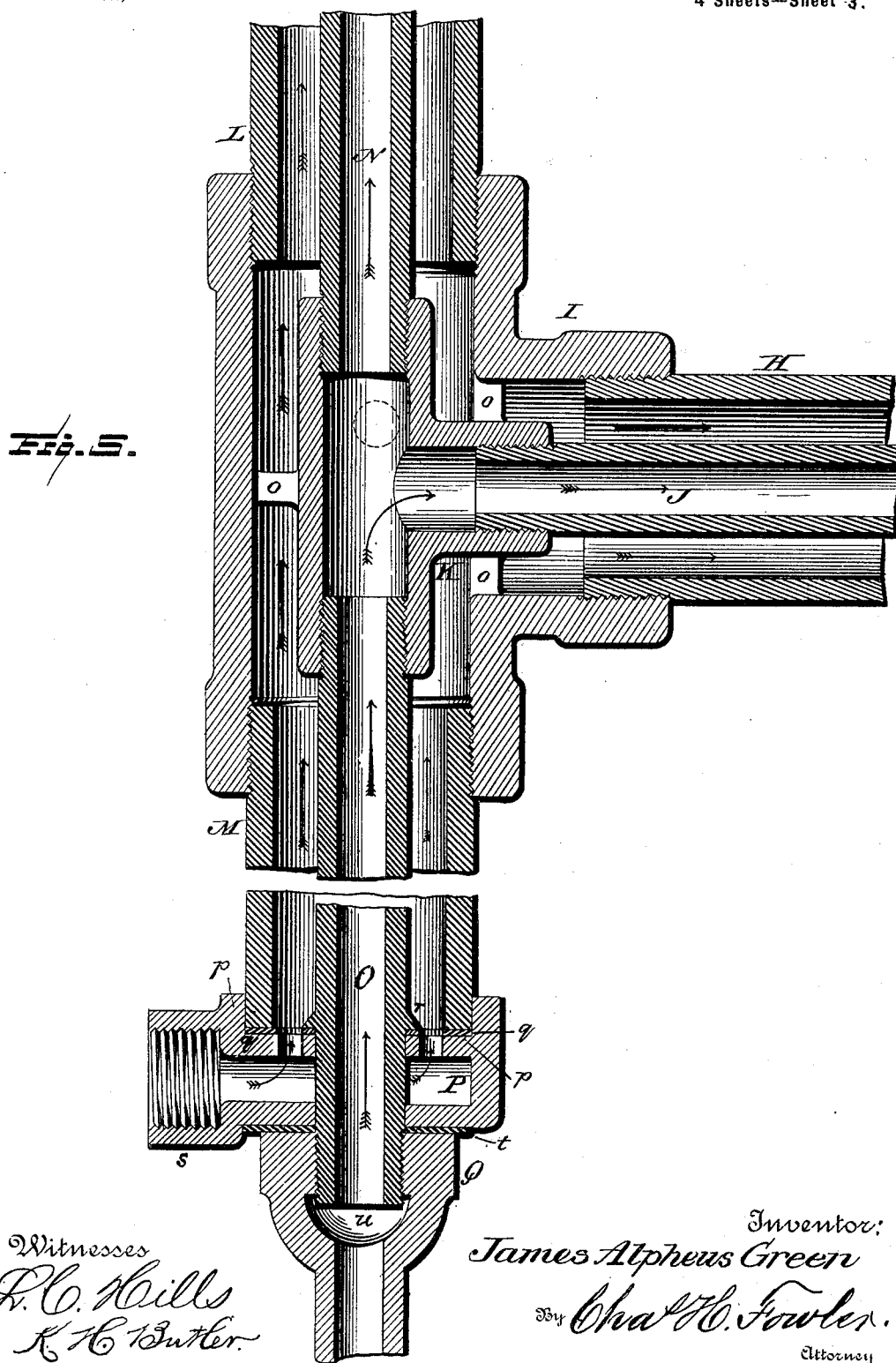
**J. A. GREEN.**

## STEAM INJECTOR FOR FIRE BOXES OF STEAM BOILERS.

(Application filed Aug. 31, 1899.)

(No Model.)

4 Sheets--Sheet 3.



Witnesses  
D. C. Mills  
K. H. Butler.

Inventor,  
James Atpheus Green  
By Cha<sup>s</sup> H. Fowler.  
Attorney

No. 649,445.

Patented May 15, 1900.

J. A. GREEN.

STEAM INJECTOR FOR FIRE BOXES OF STEAM BOILERS.

(Application filed Aug. 31, 1899.)

(No Model.)

4 Sheets—Sheet 4.

Fig. 5.

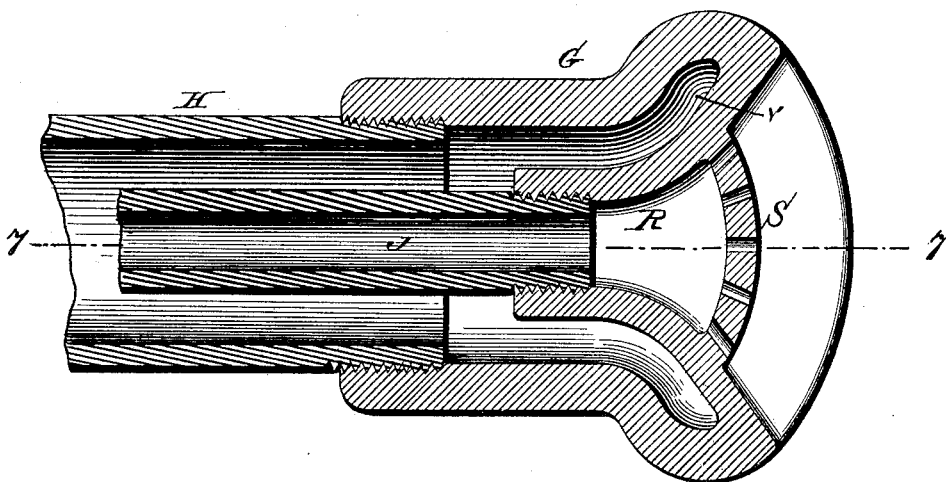


Fig. 7.

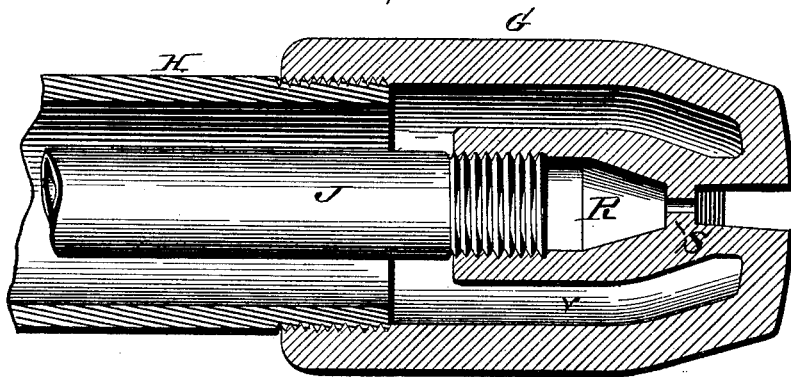
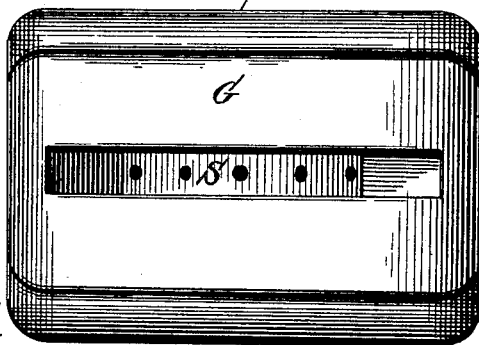


Fig. 8.



Witnesses  
L. C. Hills  
K. H. Butler.

Inventor  
James Alpheus Green,  
by  
Chas. H. Fowler.

Attorney

# UNITED STATES PATENT OFFICE.

JAMES ALPHEUS GREEN, OF MILLDALE, VIRGINIA.

## STEAM-INJECTOR FOR FIRE-BOXES OF STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 649,445, dated May 15, 1900.

Application filed August 31, 1899. Serial No. 729,112. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES ALPHEUS GREEN, a citizen of the United States, residing at Milldale, in the county of Warren and State of Virginia, have invented certain new and useful Improvements in Steam-Injectors for Fire-Boxes of Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters of reference marked thereon.

The present invention has for its object to provide a simple and durable as well as convenient and effective means for injecting steam into the fire-box of engine or other steam-boilers for aiding combustion, such means constituting a portion of smoke consumers or preventers; and the invention consists in the several details of construction, substantially as shown in the drawings and hereinafter described and claimed.

Figure 1 of the drawings is an end view of an engine-boiler with fire-box, showing my invention applied thereto; Fig. 2, a sectional elevation showing the port-hole or opening in the fire-box, the slidable cover, the carrying-head, and the nozzle in elevation connected thereto; Fig. 3, a front elevation of the slidable cover and its connecting parts, showing the end of the nozzle in section; Fig. 4, an elevation showing the inner side of the rear clamping-plate which forms one of the sections of the slidable cover; Fig. 5, a sectional view showing the system of steam and water pipes and their couplings; Fig. 6, a detailed sectional view, on an enlarged scale, of the jet-nozzle; Fig. 7, a sectional view at right angles to Fig. 7, taken on line 7 7; Fig. 8, an end view of the nozzle-head.

In the accompanying drawings, A B represent the usual boiler-plates used in double-cased boilers, the end of the boiler being shown in Fig. 1 of the drawings to illustrate the application of my invention thereto. A suitable opening is formed through the plates A B, around which is secured a suitable frame D, which forms the walls of the port-hole or opening, as shown in Fig. 2 of the drawings. The frame D may be either cast or forged, as found desirable, and has

outwardly - projecting flanges *a b*, by which means the frame may be conveniently secured to the plates A B by rivets, screws, or other convenient means. The flanges *a b* have shoulders *c d*, respectively, which support the ends of the plates, as shown in Fig. 1 of the drawings. The opening or port-hole is closed by a suitable slidable cover E, which cover comprises the two plates *e f*, with an intermediate filling *g*, of magnesia, asbestos, or any other suitable substance which will serve as a non-conductor of heat. The two plates *e f*, which comprise in part the slidable cover E, are detachably connected together by suitable screw-bolts *h*, having square or other form of heads. These bolts extend through elongated openings or slots *j* in the two plates *e f* and clamp tightly between them the filling *g*, the screw-threaded ends of the bolts engaging screw-threaded holes in the frame D, the bolts remaining stationary while the cover E is moved up or down. The plates *e f* have openings *k l*, respectively, as shown in Figs. 2 and 3 of the drawings, and upon the inner side of each plate are semicircular bearings *m* to form together bearings for the short journals *n* upon the sides of a circular carrying-head F. This carrying-head being circular in form also serves as a valve to shut off the air from entering the furnace through the port-hole.

The nozzle is connected to the carrying-head F, which forms a pivotal connection with the slidable cover, thereby enabling the nozzle to be raised or lowered to any degree by the up or down movement of the cover and the nozzle also brought to any desired angle from a horizontal, this adjustment upon the arc of a circle being shown in dotted lines of Fig. 2 of the drawings. This compound adjustment of the nozzle enables the same to adapt itself to boilers of different sizes in ejecting the steam into the fire-box at any desirable height and angle, thereby placing the steam at any point with relation to the fire or fire-arch, as circumstances require.

When it is desired to adjust the position of the cover E by raising or lowering the same, and thus adjust the height of the nozzle, the bolts *h* are loosened and the cover moved up or down, as the case may be, after which the

bolts are screwed back, as before, to hold the cover in its adjusted position by frictional contact with the outer face of the flange *a*.

I do not wish to be understood as limiting myself to any special construction of slidable cover or means employed for rendering the same vertically adjustable, as the construction of the cover and means used for its adjustment may be variously modified or changed without departing from the principle of the invention.

In Fig. 5 of the drawings are shown the several pipes which connect with the nozzle, said nozzle comprising the nozzle-head *G* and neck *H*, the latter consisting of a pipe of any desirable length screw-threaded at its ends to connect the nozzle-head thereto and the opposite end of the pipe or neck connecting with a T-shaped coupling *I*. A central pipe *J* connects with the central portion of the nozzle-head and with a T-shaped coupling *K*, located in the T-shaped coupling *I*. These T-couplings are cast one within the other and held in relation to each other by suitable webs *o*, and upon the under side of the outer wall of the T-coupling *I* is a suitable drain *i*, as shown in Fig. 1 of the drawings, to let off the water when an adjustment is required in the elevation of the nozzle, as said adjustment will require a slight loosening of the parts herein-after referred to. Connected to the screw-threaded ends of the outer T-shaped coupling *I* are pipes *L M*, and to the T-shaped coupling *K* are connected the pipes *N O*, which are located in the pipes *L M*, respectively, thereby forming a water-space around the pipes *J N O*.

Any number of the T-shaped couplings and any number of nozzles may be used, as found desirable, although only one of the nozzles, with the couplings, is shown in Fig. 5 of the drawings.

The outer ends of the pipes *L M* are provided with suitable means for connecting with the boiler or other source of supply, whereby water is fed to the water-space around the pipes *N, O*, and *J* and to the nozzle-head *G*. The means preferably shown consists in the tubular coupling *P*, having flanged seats *p* for the end of the pipe *M* and the interposed packing *q*, the pipe *O* having a circumferential flange *r*, by which a tight joint is formed between the tubular coupling *P* and the pipes. The tubular coupling *P* has a screw-threaded neck *s* for connecting thereto a suitable pipe communicating with the steam-boiler and having the usual cut-off cock. To the end of the pipe *O* is connected a tubular coupling *Q* for connecting with a supply-pipe communicating with the boiler above the water-line, said pipe having the usual cut-off cock. Through this pipe steam is supplied to the pipes *O N J* and to the nozzle-head *G*, both the direction of the water and steam being indicated by the arrows in Fig. 5 of the drawings. A suitable packing *t* is interposed between the

tubular coupling *P* and the tubular coupling *Q* to form a tight joint between the same. The tubular couplings *P Q* are the same at each end of the pipes, although only one set of couplings are shown in the drawings. When it is necessary to adjust the elevation and angle of the nozzle, said adjustment is effected by closing the cut-off cocks connecting with the boiler, then opening the drain of the water-course, after which relax the tension of the screws *h* of the adjustable cover *E*, and then relaxing the tension of the bearings between the fixed portions and the adjustable portions of the entire pipe system. This relaxing or loosening of the parts is effected by turning the coupling *Q* by a wrench or other suitable tool in the proper direction. Then the adjustment is completed by raising or lowering the slidable cover *E*, after which the parts must be tightened to their proper tension and the cut-off cocks turned on again.

In describing the construction shown in Fig. 5 of the drawings it is evident that many changes may be made in the pipe system herein described, and such modifications or changes as would come within ordinary mechanical skill may be resorted to without in any manner affecting the essential feature of the invention. The tubular coupling *Q* may be formed with a socket *u* or may be constructed in any other preferred manner that would serve the purpose intended. The interior screw-threaded T-shaped couplings, with the several pipes connecting therewith, the tubular couplings at the ends of the pipes, in addition to the nozzle and its connecting parts, form together a simple and practical system for injecting steam into the fire-box capable of ready adjustment.

In Figs. 6, 7, and 8 I have shown in detail and on an enlarged scale the nozzle-head and its pipe connections to more clearly illustrate its construction. This nozzle-head is of peculiar construction, being cast or otherwise formed with a central tubular neck *R*, extending inwardly and axially with the nozzle-head a sufficient distance to form a water-space *v*. This water-space, as will be noticed, extends forward on a plane beyond that of the perforated partition or plate *S*, through which the steam is forced into the fire-box, thereby affording perfect protection to the perforated partition or plate, and thus preventing the metal between the holes from burning out from the heat in the fire-box, this being considered an important feature in the construction of the nozzle-head. The outer wall of the nozzle-head has interior screw-threads for connecting thereto the pipe *II*, which constitutes the neck of the nozzle, and the neck *R* is also provided with interior screw-threads for connecting thereto the pipe *J* for conducting the steam from the boiler to the nozzle-head, at which point it is discharged into the fire-box. The pipe *II*, which encircles the pipe *J*, forms thereby a water-space

around the pipe, both of said pipes connecting with the pipe system hereinbefore described.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An adjustable nozzle and a water-jacket surrounding the same extending into the fire-box of the boiler, a system of steam-pipes and a system of water pipes or jackets surrounding the same, said steam-pipes and the water pipes or jackets connecting respectively with the nozzle and the water-jacket thereof, and means for rendering the nozzle capable of adjustment, consisting of an axially-adjustable tubular coupling with flanged seat for making an adjustable connection between the water-pipe of jacket and with the boiler or other source of supply, substantially as and for the purpose set forth.

2. A nozzle adapted for adjustment on the arc of a circle and also in a vertical direction, a water jacket or pipe surrounding the nozzle, a system of steam-pipes and a system of water pipes or jackets surrounding the same and connected respectively with the nozzle and with the jacket thereof, and means for rendering the nozzle capable of adjustment, consisting of an axially-adjustable coupling, substantially as and for the purpose described.

3. An adjustable nozzle and a water-jacket surrounding the same, a system of steam-pipes and a system of water pipes or jackets surrounding the system of steam-pipes, T-shaped couplings to which the ends of the pipes are connected, said couplings arranged one within the other, and an adjustable connection between the pipes and source of supply, consisting of an axially-adjustable tubular coupling with flanged seat, substantially as and for the purpose specified.

4. An adjustable nozzle extending into the fire-box of the boiler, a water jacket or pipe surrounding the nozzle, a system of steam-pipes and a system of water jackets or pipes surrounding the steam-pipes, said steam-pipes and the water jackets or pipes connecting respectively with the nozzle and with the jacket thereof, T-shaped couplings for the pipes, adjustable connections between the ends of the pipes and source of supply, consisting of tubular couplings connected to the outer ends of the steam-pipes between which and the water-pipes are axially-adjustable tubular couplings having flanged seats, substantially as and for the purpose set forth.

5. A nozzle and a water jacket or pipe surrounding the same, said nozzle being adjustably connected to a vertically-slidable cover for closing the opening in the fire-box, and a system of water-jacketed steam-pipes, and an adjustable coupling between the pipes and source of supply whereby the nozzle is enabled to be adjusted, substantially as and for the purpose described.

6. A vertically adjustable and slidable cover

to close the opening in the fire-box of the boiler, a nozzle adjustably connected thereto, a water jacket or pipe surrounding the nozzle, and a system of steam and water jackets or pipes connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose described.

7. A vertically adjustable and slidable cover to close the opening in the fire-box, said cover comprising two plates and an intermediate filling of suitable material, a nozzle pivotally connected with the cover, a water jacket or pipe surrounding the nozzle and a system of steam and water pipes connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose set forth.

8. A vertically adjustable and slidable cover to close the opening in the fire-box, set or clamping screws for holding the cover in its adjusted position, a carrying-head pivoted to the cover, a nozzle connecting with the carrying-head, a water-jacket surrounding the nozzle, and a system of steam and water pipes connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose described.

9. A suitable frame extending around the opening in the fire-box of a boiler having flanges and shoulders for connecting the frame to the double plates of the boiler, a vertically-slidable cover to close the opening in the fire-box, a nozzle adjustably connected thereto, a water-jacket surrounding the nozzle, and a system of steam and water pipes connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose specified.

10. A vertically adjustable and slidable cover to close the opening in the fire-box constructed of double plates with an intermediate filling of suitable material, means for holding the cover in its adjusted position, a carrier-head pivotally connected with the cover, a nozzle connecting with the carrier-head, a water-jacket surrounding the nozzle, and a system of steam and water pipes connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose set forth.

11. A flanged and shouldered frame connected to the double boiler-plates, a vertically adjustable and slidable cover comprising double plates with an intermediate filling of suitable material, said plates being detachably connected together, means for connecting the cover with the flanged and shouldered frame and holding it in its adjusted position, a carrying-head journaled or pivoted between the double plates, a nozzle connecting with the carrying-head, a water-jacket surrounding the nozzle, and a system of steam and water pipes connected together substantially as shown and connecting respectively with the nozzle and with the water-jacket thereof, substantially as and for the purpose described.

12. A nozzle for injecting steam into a fire-  
box of a boiler, the head of the nozzle having a  
tubular inwardly-extending neck with screw-  
threads for attaching a steam-pipe thereto, a  
5 perforated partition-plate, and a water-space  
around the inwardly-extending neck, which  
water-space extends forward on a plane be-  
yond that of the perforated partition, the  
outer wall of the nozzle-head having screw-

threads for attaching thereto the water-pipe, 10  
substantially as and for the purpose set forth.

In testimony that I claim the above I have  
hereunto subscribed my name in the presence  
of two witnesses.

JAMES ALPHEUS GREEN.

Witnesses:

F. W. RITTER, Jr.,

GEO. M. COPENHAVER.