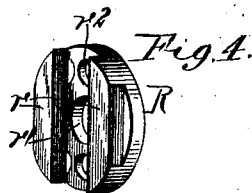
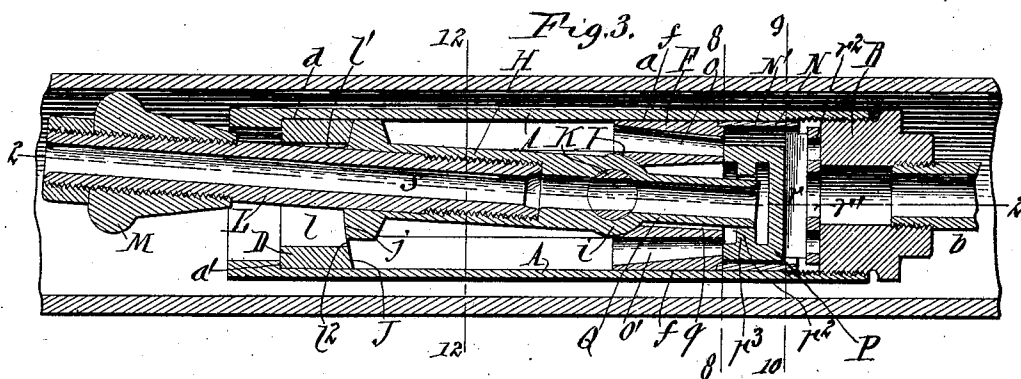
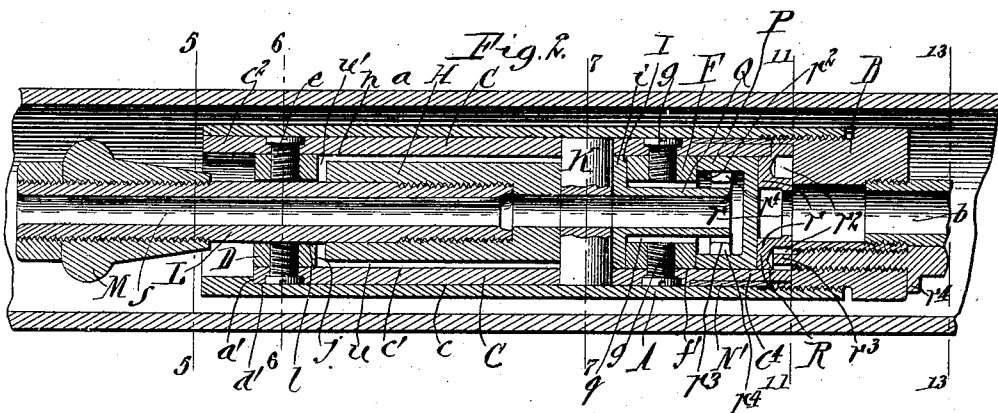


933,519.



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J. ZILLIOX.
BOILER TUBE CLEANER.
APPLICATION FILED MAR. 9, 1909.

933,519.

Patented Sept. 7, 1909.
2 SHEETS—SHEET 2.

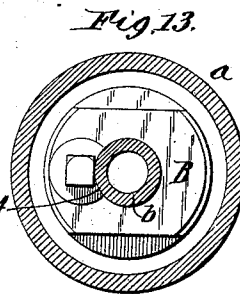
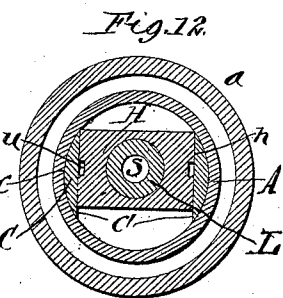
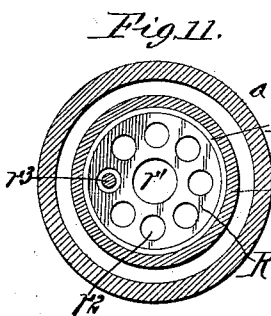
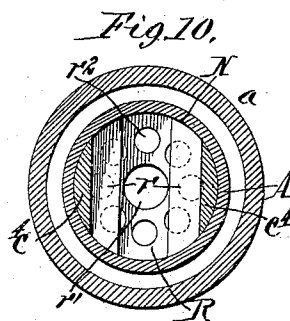
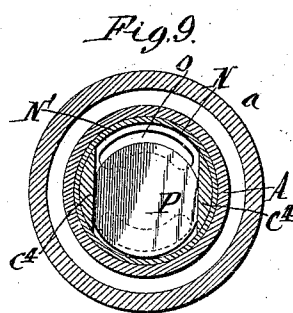
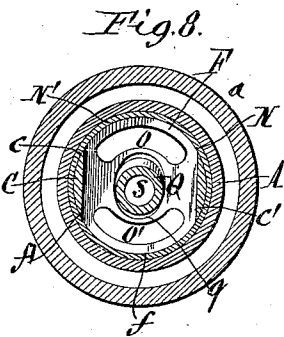
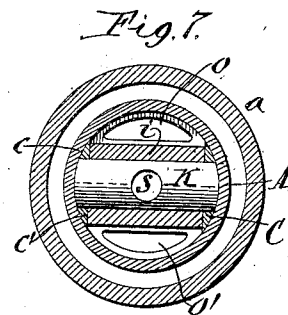
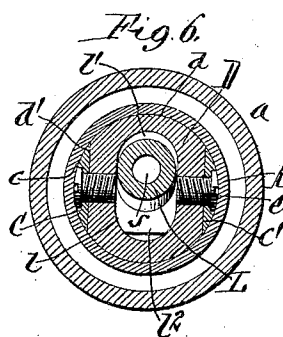
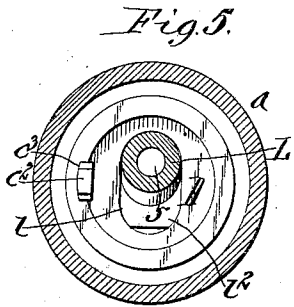
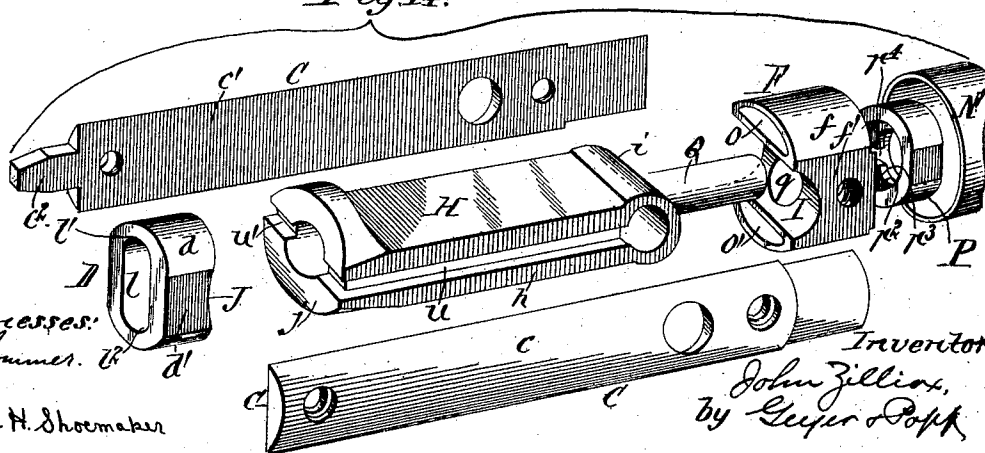


Fig. 14.



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UNITED STATES PATENT OFFICE.

JOHN ZILLIOX, OF BUFFALO, NEW YORK.

BOILER-TUBE CLEANER.

933,519.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed March 9, 1909. Serial No. 482,227.

To all whom it may concern:

Be it known that I, JOHN ZILLIOX, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Boiler-Tube Cleaners, of which the following is a specification.

This invention relates to a boiler tube cleaner of that type in which the scale or incrustation is removed from the inner and outer sides of such tubes by hammer-like blows and more particularly to a cleaner of this character in which the scale loosener is actuated by a motor driven by steam, compressed air, water or similar motive medium.

The object of my invention is the provision of a compact and powerful boiler tube cleaner of this class having a large and extensive piston-area in proportion to the diameter of the cleaner, rendering it possible to deliver effective blows with a comparatively short transverse stroke of the piston and especially adapting the tool for cleaning small boiler tubes, although its improved construction is equally advantageous in large cleaners.

In the accompanying drawings consisting of 2 sheets: Figure 1 is a longitudinal sectional elevation of the cleaner, showing the same inserted in a boiler tube. Fig. 2 is a longitudinal section in line 2—2, Fig. 3. Fig. 3 is a similar section at right angles to Fig. 2 and taken in line 3—3, Fig. 1. Fig. 4 is a perspective view of the locking washer. Figs. 5, 6, 7 and 8 are cross sections on the correspondingly numbered lines in Figs. 2 and 3. Figs. 9 and 10 are cross sections on line 9—10, looking in opposite directions. Figs. 11, 12 and 13 are cross sections on the correspondingly-numbered lines in Figs. 2 and 3. Fig. 14 is a perspective view of parts of the cleaner detached from one another.

Similar letters of reference indicate corresponding parts throughout the several views.

The body of the cleaner comprises an outer cylindrical shell or casing A adapted to enter the boiler tube *a* and provided at its rear end with a hollow plug B to which is secured the supply pipe or conduit *b* whereby steam or other motive medium is supplied to the cleaner. As shown in the drawings, the plug is secured in the casing by a screw joint and the supply pipe is secured by a similar joint to the plug, but if desired these parts may be otherwise connected.

C, C represent two longitudinal bars arranged within the casing on opposite sides of the center thereof and having their outer sides *c* curved and fitted against the bore of the inclosing casing while their opposing inner sides *c'* are flat and parallel, as shown. Within the front part of the casing is arranged a transverse head D provided on diametrically opposite sides with curved concentric faces *d* which fit the bore of the casing and at right angles to said curved faces with flat faces *d'* which engage the flat inner sides of the longitudinal bars. This front head and the longitudinal bars are secured together by transverse screws *e*, as shown in Figs. 2 and 6.

Within the rear part of the casing is arranged a transverse head or partition F provided on diametrically opposite sides with curved faces *f* which fit the bore of the casing and at right angles to said curved faces with flat faces *f'* which engage the opposing inner flat sides of the longitudinal bars. This rear head, like the front one, is secured to the longitudinal bars C preferably by screws *g*, but any other suitable means may be employed for fastening said front and rear heads to the bars. These longitudinal bars and heads are held against forward displacement by a stop or shoulder *a'* in the front part of the casing A against which the front ends of said bars and the front head abut, as shown in Figs. 1, 2 and 3. The body formed by these bars and heads is held against rotation in the casing by a key or tongue *c''* projecting forwardly from one of said bars and interlocking with an internal groove *c'''* of the casing, as shown in Fig. 5. Other suitable means may be employed for this purpose, if desired.

The inclosing casing, the longitudinal bars C and the front and rear heads D, F form a piston chamber which is elongated lengthwise of the casing and which has two flat longitudinal sides formed by the inner parallel sides of the longitudinal bars, two transversely curved longitudinal sides arranged at right angles to the flat sides and formed by the bore of the casing and two transverse ends formed by the inner sides of the front and rear heads. Within the piston chamber is arranged a piston H which extends lengthwise of the chamber and is mounted to oscillate transversely therein. As shown in the drawings, the longitudinal edges *h* of the piston bear against the

parallel faces of the longitudinal bars C. The piston is provided at its rear end with a semi-cylindrical face or knuckle *i* seated in a corresponding socket or bearing I arranged centrally in the inner side of the rear head F, and at its front end with a curved face *j* which bears against a correspondingly curved face J on the inner side of the front head D. The cooperating curved faces of the piston and said front and rear heads are concentric and closely fitted, so that a tight joint is maintained between these parts. As an additional means of pivoting the piston on the body, a circular pivot pin K is employed which passes through the piston and the longitudinal bars C concentrically with the curved faces of the piston and the front and rear heads, as shown in Figs. 2 and 3.

Upon admitting a motive agent, such as steam, into the piston chamber alternately on opposite sides of the piston and exhausting the same therefrom, the piston will be transversely oscillated therein. Attached to the free front end of the piston is a scale loosener of any suitable construction, that shown by way of example in the drawings consisting of a longitudinal arm or shank L screwed into a socket in the front end of the piston and carrying a hammer-head M. This shank projects forwardly through a transverse slot *l* in the front head D. The admission of the motive fluid to and its escape from the piston chamber is controlled by valve mechanism of any suitable construction, but I prefer to employ the mechanism shown in the drawings which is constructed as follows:

N represents a valve chamber arranged in the rear portion of the casing and separated from the piston-chamber by the rear head or partition F. The side walls of this valve chamber are formed by the reduced rear portions of the bars C and a ring or sleeve N¹ embracing said portions and closely fitting the bore of the casing A. The motive agent is conducted from this valve chamber into opposite sides of the piston-chamber by two ports *o*, *o*¹ extending through the rear head F on opposite sides of the piston, as shown in Fig. 3.

P represents a transversely-reciprocating slide-valve which bears with its flat face *p* against a corresponding valve-seat formed by the flat rear side of the head F. When this valve is moved to one end of its stroke, one of the steam inlet ports *o*, *o*¹ is uncovered and the motive fluid is admitted into the corresponding side of the piston-chamber, while the other port is covered and cuts off the motive fluid from the other side of said chamber; while when the valve is moved to the other end of its stroke, the motive fluid is cut off from the first mentioned side of the piston chamber and admitted to the other side thereof. The slide valve is actuated by a tail

or extension Q projecting rearwardly from the piston through a central opening *q* of the rear head F and engaging against opposite sides of a cavity or recess *p*² formed in the front side of the valve. By this means, the valve is shifted automatically in a direction opposite to the piston and causes the motive agent to be alternately admitted to opposite sides of the piston-chamber, in the manner before described. The valve is guided between the rear ends of the longitudinal bars C which extend rearwardly beyond the head F for this purpose, as shown at *c*⁴, in Figs. 2 and 9. A washer R interposed between the back of the valve and the front end of the screw plug B, serves to confine the valve to its seat.

Preferably the motive fluid is exhausted from the piston chamber principally through an exhaust passage *s* extending lengthwise through the tail Q, piston H and hammer-shank L which latter is made hollow for this purpose, as shown in Figs. 2 and 3. The recess *p*² of the valve into which the tail Q extends forms an exhaust cavity with which the rear end of the passage *s* constantly communicates and this cavity and the face of the valve are so constructed or of such a size that when the valve is at either extremity of its stroke, one end thereof uncovers the adjacent port *o*, or *o*¹, allowing the motive fluid to pass from the valve chamber N into the piston chamber on that side of the piston, while the other of said ports is cut off from the valve chamber and connected with the exhaust cavity *p*² of the valve, as shown in Fig. 3, allowing the fluid on the advancing side of the piston to exhaust through the last named port, said exhaust cavity and the exhaust passage *s*. The latter is of comparatively large diameter to afford a free and prompt exhaust of the fluid and insure a full stroke of the piston and a proper action of the tool.

In its preferred construction, the slide valve has a relatively large exhaust cavity which is provided between its top and bottom with a raised annular rib *p*³ into which the tail Q is loosely fitted, and against which it bears in actuating the valve. This rib has a number of transverse notches or passages *p*⁴ to permit the motive fluid to pass freely from the mouth of the valve-cavity into the exhaust passage *s*.

If desired, the slot *l* in the front head D through which the hammer-arm L projects may be of such a length that its ends form auxiliary exhaust ports *l*¹, *l*² which are alternately uncovered by the front end of the piston. As shown in Fig. 3, the exhaust port *l*¹ formed by the upper end of the slot is covered by the upper part of the piston, so that the motive agent, which at this time is entering the upper side of the piston chamber through the upper inlet port *o*, cannot escape

and is compelled to exert its pressure against that side of the piston, while the exhaust port l^2 formed by the lower end of said slot is uncovered by the piston, to permit the spent motive agent on the lower side of the piston to escape.

In order to prevent the motive agent from passing around the longitudinal edges of the piston from one side of the piston-chamber to the other, the piston is preferably provided in said edges with longitudinal relief channels or grooves u and in its front end with similar transverse channels u^1 which latter connect said longitudinal channels with the exhaust slot l . By this provision, any steam passing through the joints between the piston and the longitudinal bars C escapes forwardly through the relief passages u , u^1 and the slot l , thereby preventing back pressure in the piston chamber and obtaining the greatest efficiency of the motive agent.

The screw plug B forces the bars C and front head D against the shoulder a' of the casing through the medium of the washer R which bears against the rear ends of said bars, as shown in Fig. 2. This washer is held from turning relatively to said bars and the casing by transverse ribs r arranged on its front side and bearing at their outer edges against the flat inner sides of said bars, as shown in Figs. 2 and 10. The washer has a central aperture r' through which the incoming motive fluid enters the valve chamber N, and also a circular row of openings r^2 with one of which a lock-screw or bolt r^3 of the plug B is adapted to engage for positively preventing rotation and loosening of the plug. As shown in Fig. 2, this lock-screw is arranged in a longitudinal opening of the plug opposite the row of recesses or openings r^2 , so that the screw may be interlocked with any one of the same according to the position of the plug when tightened. It will be noted that inasmuch as the washer is held from turning by its ribs r , it in turn holds the plug from rotation when its lock screw engages a recess of the washer. As shown in Fig. 13, the head of the screw is preferably provided with a locking notch r^4 which receives the adjacent side of the supply pipe b , thus reliably holding the screw from turning. Obviously, this pipe must be detached from the cleaner before the screw can be turned to lock or unlock the plug B. This adjustable locking feature of the plug is desirable, as it is necessary to tighten the plug from time to time to take up longitudinal looseness between the casing and the bars C due to expansion or elongation of the casing.

Inasmuch as the oscillating piston and its chamber may be extended lengthwise of the casing to any extent, it is possible to obtain a large piston area relative to the diameter of the tool, producing a cleaner which com-

bines great power with compactness and rendering it especially suitable for cleaning boiler tubes of small diameter. These advantages, as well as the reliable and uninterrupted operation of the tool when in service, result principally from the use of an oscillatory piston arranged lengthwise of the casing combined with a separate valve operated by the piston and the arrangement of the inlet ports in a partition between the piston chamber and the valve chamber.

I claim as my invention:

1. A tube cleaner, comprising a body containing a piston-chamber and a valve-chamber in rear thereof and provided with inlet ports connecting said valve-chamber with the opposite sides of the piston-chamber, a pivoted piston arranged lengthwise of said body in the piston-chamber, a valve in said valve-chamber controlling said ports, means for transmitting motion from the piston to said valve, and a scale-loosener connected with said piston.

2. A tube cleaner, comprising a body containing a piston-chamber and a valve-chamber arranged in rear thereof, and a partition separating said chambers, said partition containing inlet ports connecting the valve-chamber with the opposite sides of the piston-chamber, a pivoted piston arranged lengthwise of the said body in the piston-chamber, a valve in the valve-chamber controlling said ports and operatively connected with the piston, and a scale-loosener connected with the said piston.

3. A tube cleaner, comprising a body containing a piston-chamber arranged lengthwise thereof, a valve-chamber and ports connecting said chambers, a pivoted piston arranged lengthwise in the piston-chamber and having a longitudinal exhaust passage therein, a valve in said valve-chamber adapted to connect opposite sides of the piston-chamber alternately with said valve-chamber and said exhaust passage, and a scale-loosener connected with the piston.

4. A tube cleaner, comprising a body containing a piston chamber, a valve-chamber in rear thereof and ports connecting said chambers, an oscillating piston arranged lengthwise in the piston chamber and having therein a longitudinal exhaust passage, a valve in the valve chamber adapted to connect opposite sides of the piston chamber alternately with said valve chamber and said exhaust passage, and a scale loosener actuated by said piston.

5. A tube cleaner, comprising a body containing a piston chamber, a valve chamber in rear thereof and ports connecting the valve chamber with opposite sides of the piston-chamber, an oscillating piston arranged lengthwise in the piston chamber and extending into said valve chamber, the piston having a longitudinal exhaust passage there-

in extending from its rear to its front end, a valve controlling said ports, operatively connected with the piston and adapted to connect opposite sides of the piston chamber alternately with the valve chamber and said exhaust passage, and a scale loosener actuated by the piston.

6. A tube cleaner, comprising a body containing a piston-chamber arranged lengthwise thereof and a valve-chamber arranged in rear of the piston-chamber, said chambers being separated by a partition containing ports arranged to connect the valve-chamber with opposite sides of the piston-chamber, an oscillating piston arranged lengthwise in the piston-chamber and pivoted at its rear end, a scale-loosener connected with the front end of the piston, a valve arranged in the valve-chamber, controlling said ports and having an exhaust cavity, and means for shifting the valve consisting of a tail projecting rearwardly from the piston through said partition and into the exhaust cavity of the valve, said tail, piston and scale-loosener having an exhaust-passage extending there-through and communicating with said valve-cavity.

7. A tube cleaner, comprising a body containing a longitudinal piston-chamber provided at its front end with an exhaust opening, an oscillating piston arranged lengthwise in said chamber and provided in its lateral edges with longitudinal exhaust channels communicating with said exhaust opening, a scale-loosener operatively connected with the piston, and means for alternately admitting a motive fluid to said chamber on opposite sides of the piston.

8. A tube cleaner, comprising a body containing a longitudinal piston-chamber provided at its front end with an exhaust opening, an oscillating piston arranged lengthwise in said chamber and provided in its lateral edges with longitudinal exhaust channels and in its front end with transverse exhaust-channels connecting said longitudinal channels with said exhaust opening, a scale-loosener operatively connected with the piston, and means for alternately admitting a motive fluid to said chamber on opposite sides of the piston.

9. A tube cleaner comprising a body having a cylindrical outer shell or casing, heads arranged within the front and rear parts of the shell and longitudinal bars arranged within opposite sides of the shell and connecting said heads, a transversely vibrating piston arranged in the chamber formed by said shell, heads and bars, means for admitting a motive medium to the chamber on opposite sides of the piston and exhausting the same therefrom, and a scale loosener connected with said piston.

10. A tube cleaner comprising a body having a cylindrical outer shell or casing, heads

arranged within the front and rear parts of the shell and each having two curved faces on opposite sides of its periphery which fit the bore of the shell and two flat faces on its opposite sides at right angles to the curved faces thereof, a pair of longitudinal bars arranged within the shell on opposite sides thereof and each having a curved outer side which fits the bore of the shell and a flat inner side secured at opposite ends against the corresponding flat faces of said heads, a piston vibrating transversely in the chamber formed by said shell, heads and bars and having flat longitudinal faces on its opposite sides which engage the flat faces of said bars, means for admitting a motive medium to the chamber on opposite sides of the piston and exhausting the same therefrom, and a scale loosener connected with said piston.

11. A tube cleaner comprising a body containing a piston chamber provided on its opposite longitudinal sides with two parallel flat longitudinal faces and at its front and rear ends with concentric curved faces the axes of which are arranged at right angles to the plane of said flat longitudinal faces, a transversely oscillating piston arranged in said chamber and pivoted at its rear end adjacent to the rear end of said chamber concentric with said curved faces and having its opposite longitudinal sides provided with parallel flat faces which engage the corresponding faces of the chamber and provided at its front and rear ends with concentric curved faces which engage the corresponding faces at the front and rear ends of said chamber, a scale loosener connected with the front end of the piston, and means for admitting a motive medium to the chamber on opposite sides of the piston and exhausting the same therefrom.

12. In a tube cleaner, the combination of a casing having a stop, a body in the casing abutting against said stop, a scale loosener mounted on said body, a screw plug engaging the end of the casing and operating to clamp said body against said stop, a non-rotary part interposed between said plug and said body and having a series of locking recesses, and a locking member carried by the plug and arranged to engage said recesses.

13. In a tube cleaner, the combination of a casing having a stop, a body in the casing abutting against said stop, a scale loosener mounted on said body, a screw plug engaging the end of the casing and operating to clamp said body against said stop, a washer interposed between said plug and body and held against rotation on the latter, said washer having a circular row of locking recesses, and a lock-screw arranged in a longitudinal opening of the plug and adapted to interlock with one or another of said recesses.

14. In a tube cleaner, the combination of
a casing having a stop, a body in the casing
abutting against said stop and having spaced
longitudinal bars, a scale loosener mounted
5 on said body, a screw plug engaging the end
of the casing and operating to clamp said
body against said stop, a washer interposed
between said plug and body and having ribs
fitting between said bars, said washer hav-
10 ing a circular row of locking recesses, and a

lock screw arranged in a longitudinal open-
ing of the plug and cooperating with said
recesses.

Witness my hand this 6th day of March,
1909.

JOHN ZILLIOX.

Witnesses:

C. F. GEYER,

E. M. GRAHAM.