No. 834,306. PATENTED OCT. 30, 1906.

A. F. KRAUSE.

AUTOMATIC BOILER TUBE CLEANER.

APPLICATION FILED SEPT. 11, 1903.

Fig 1

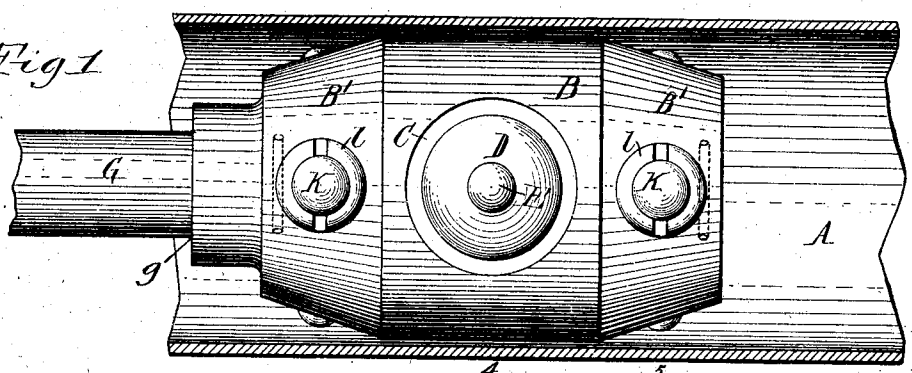


Fig 2

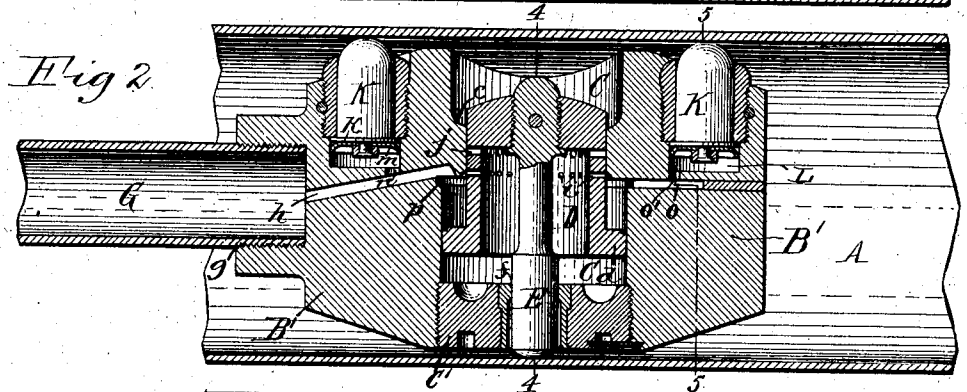


Fig 3

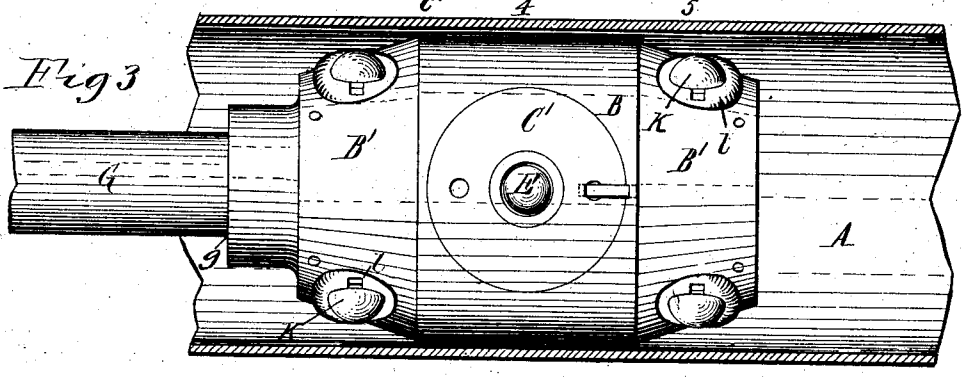


Fig 4

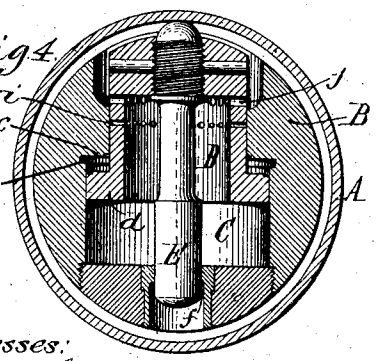
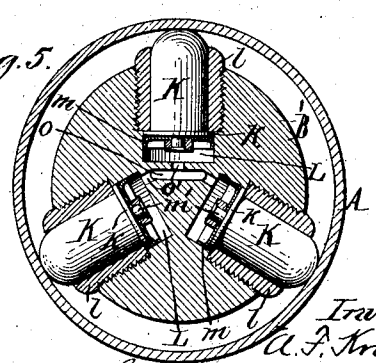


Fig. 5.



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AUTOMATIC BOILER-TUBE CLEANER.

No. 834,306. Specification of Letters Patent. Patented Oct. 30, 1906.

Application filed September 11, 1903. Serial No. 172,732.

To all whom it may concern:

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

This invention relates generally to automatic boiler-tube cleaners comprising a head or casing adapted to be inserted in the tubes, a hammer or scale-loosener for removing the adhering scale or incrustation from the tubes, and a piston for vibrating the scale-loosener which is driven by a suitable motive fluid, such as steam or compressed air.

My invention has more particular reference to a cleaner intended to detach scale from the outer sides of boiler-tubes by the concussion of its hammer or loosener against the inner sides of the tubes.

The principal object of my invention is to simplify the construction and reduce the cost of this type of cleaners.

A further object is to provide the cleaner with simple and effective means for centering the same in the boiler-tubes.

In the accompanying drawings, Figure 1 is an elevation of the cleaner, showing the same inserted in a boiler-tube, which latter is shown in section. Fig. 2 is a longitudinal central section of the cleaner arranged in a boiler-tube. Fig. 3 is an elevation of the cleaner viewed from the side opposite to that shown in Fig. 1. Figs. 4 and 5 are transverse sections in lines 4 4 and 5 5, Fig. 2.

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

A indicates a boiler-tube, and B the head or casing of the automatic cleaner which preferably has a cylindrical central portion of somewhat smaller diameter than the internal diameter of the tubes to be cleaned and tapering end portions B′ for facilitating the entrance and withdrawal of the cleaner.

C is a cylindrical chamber arranged transversely in the central portion of the head and opening at one end through the side of the head and closed at its opposite end by a plug C′, preferably screwed into the chamber. This chamber is contracted between its ends to form an annular abutment *c*. In this chamber is arranged a hollow piston D, which opens into the chamber at the end facing the plug C′ and which is closed at its opposite end. The body of the piston is closely fitted in the contracted portion of the chamber C and provided at its open end with a projecting annular flange or shoulder *d*, which fits the large portion of the chamber.

The piston carries a duplex hammer or knocker E, adapted to strike alternately against opposite sides of the boiler-tube for jarring off any scale adhering to the outer side of the same. This hammer consists of a rod suitably secured near one end in a central opening formed in the head of the piston and guided near its other end in a bearing or opening *f* in the plug C′, in which it is closely fitted. One end of this hammer-rod extends a short distance beyond the head of the piston, while the remaining portion of the rod extends through the hollow body of the piston and the opening *f* and is considerably smaller in diameter than the bore of the piston, so as to leave an intervening fluid space or passage between the rod and the inner side of the piston. While the rod is preferably extended beyond the face of the piston-head, to form one striking-face of the duplex hammer, as shown, the piston-head itself could obviously be utilized in place of the projecting end of the rod.

G indicates a supply-pipe for the steam or other motive fluid, which is screwed or otherwise secured in a socket *g* at the rear end of the casing B, and *h* is a main supply-passage leading forwardly from this socket and communicating with the side of the cylindrical chamber C at or near the inner side of its abutment *c*, so as to supply the motive fluid to the space between said abutment and the shoulder of the piston. The piston is provided in its cylindrical wall between its ends with an annular row of inlet-ports *i*, through which the motive fluid enters the piston and passes behind its shouldered rear end. Beyond the inlet-ports *i* the piston is provided with a similar row of exhaust-ports *j*, which are adapted to communicate with the open-ended portion of the chamber C beyond the abutment *c* for exhausting the motive fluid.

In the position of the piston shown in Fig. 2 the same is at what may be regarded as the "rear" end of its stroke, the piston having just caused the rear end of the duplex hammer to strike the boiler-tube. The exhaust-ports *j* of the piston are covered by the abutment *c*, and its inlet-ports *i* have just been

opened. The motive fluid now continues to exert its pressure against the front side of the piston-shoulder *d* and also enters the hollow piston through the inlet-ports *i* and exerts its pressure against the closed end of the piston and the rear side of said shoulder. As the combined area of the two last-named surfaces exceed the area of the front side of the piston-shoulder, the pressure against those two surfaces preponderates over the pressure against the front side of the shoulder, and the piston is therefore driven toward the open end of the fluid-chamber C, causing the front end of the hammer to strike the boiler-tube. At the moment that the piston reaches the front end of its stroke its exhaust-ports *j* clear the abutment *c*, as shown in Fig. 4, relieving the pressure within and against the rear end of the piston, and the pressure against the front side of the piston-shoulder being now unopposed drives the piston in the opposite direction, when the above operation is repeated. In this manner the piston is reciprocated at a high rate of speed so long as the motive fluid is supplied to the cleaner, thus delivering comparatively light blows in quick succession against the inner side of the boiler-tube and effectually dislodging any scale adhering to the outer side of the same without injury to the tube.

As the piston forms its own cut-off, no separate valve mechanism is required, thereby greatly simplifying the construction of the device. The piston is the only part of the cleaner subjected to wear, and the liability of breakages and necessity for repairs is therefore reduced to the minimum.

The devices for centering the cleaner in the boiler-tube consist of radially-movable pins or plungers K, which are forced outward against the surrounding tube by the motive fluid supplied to the cleaner. A set of these plungers is arranged in each of the conical end portions of the casing, each set preferably comprising three plungers arranged equidistant around the casing, as shown. Each plunger is arranged in a cylindrical centering-chamber L, preferably provided in its outer portion with a steel bushing *l*, in which the plunger is closely fitted. The outward movement of each plunger is limited by an annular shoulder or enlargement *k*, arranged at its inner end and adapted to strike the stop or shoulder formed by the inner end of the bushing *l*. Each plunger is also provided at its inner end with a packing *m*, consisting, preferably, of a flanged or capped copper disk suitably secured upon a central stud *m'*, projecting from the inner end of the plunger. The radial chambers L of the rear set of centering-plungers communicate constantly with the supply-passage *h* by radial ports, one of which is shown at *n* in Fig. 2, while the corresponding chambers of the front set of centering-plungers communicate constantly with the main piston-chamber C through an auxiliary longitudinal supply-channel *o* and radial ports *o'*, similar to the ports *n*. By this construction upon supplying steam or other motive fluid to the cleaner a portion of the fluid enters the radial chambers L behind the plungers K and forces all of the latter outward against the surrounding boiler-tube, thereby causing the plungers to support the cleaner centrally in the tube and insuring the delivery of practically uniform blows of the hammer against opposite sides of the tube.

By enlarging the inner portions of the centering-chambers L and providing said plungers with enlarged inner ends arranged in the enlargements of the chambers, as shown, the area of the plungers against which the pressure fluid acts is correspondingly increased.

In order to prevent the chambers of the front centering-plungers K from being cut off from the supply-passage *h* in case the shouldered end of the piston D should for any reason cover said passage, the piston-chamber C is provided with an annular groove or by-pass *p*, which communicates with the main supply-passage *h* and the auxiliary supply-passage *o* and through which the motive fluid may freely pass around the piston and into the auxiliary passage. This channel also permits an equal pressure of the fluid on all sides of the piston when the shouldered end of the piston covers the inner end of the main supply-passage, thereby preventing binding of the piston.

It will be observed that the open end of the fluid-chamber C forms a lateral exhaust port or aperture for the motive fluid. By thus exhausting the fluid laterally through one side of the casing B instead of forwardly the inner side of the boiler-tube is subjected to the cleaning or scouring action of the escaping fluid, thereby effectually detaching and blowing out any soot adhering to the inner side of the tube.

I claim as my invention—

1. In a boiler-cleaner, the combination of a casing provided with a transverse fluid-chamber having an end opening which extends through the side of the casing and forms a lateral exhaust-port for the motive fluid, a piston arranged in said chamber, means for controlling the supply of the motive fluid to opposite sides of the piston, and a scale-loosener actuated by the piston and arranged to pass through the side of the casing, substantially as set forth.

2. In a boiler-tube cleaner, the combination of a casing having a transverse fluid-chamber provided with an internal abutment and an end opening which extends through the side of the casing and forms a lateral exhaust-port for the motive fluid, a hollow shouldered piston arranged in said chamber, opening at its shouldered end into the cham-

ber and closed at its opposite end, said piston having means for alternately connecting the interior thereof with the space between said abutment and the shoulder of the piston and with said lateral exhaust-port, a supply-passage arranged in the casing and communicating constantly with said space, and a scale-loosener extending through the side of the casing and actuated by the piston, substantially as set forth.

3. In a boiler-tube cleaner, the combination of a casing having a transverse fluid-chamber provided with an internal abutment, said chamber being closed at one end and provided at its other end with an opening which extends through the side of the casing and forms a lateral exhaust-port, a hollow shouldered piston reciprocating in said chamber, opening at its shouldered end into the chamber and closed at its opposite end by a head, said piston having an exhaust-port arranged to connect its interior with the open-ended portion of the fluid-chamber and an inlet-port connecting its interior with the space between said abutment and the shoulder of the piston, a supply-passage arranged in the casing and leading to said space, and a hammer-rod carried by said piston-head and extending through the hollow body of the piston and the closed end of the fluid-chamber and separated from the piston-walls by an intervening fluid-passage, substantially as set forth.

4. In a boiler-tube cleaner, the combination of a casing having a fluid-supply passage and centering-chambers extending through the sides of the casing and having enlarged inner portions which communicate with said passage, and centering-plungers sliding in said chambers and each provided with an enlargement fitting the enlarged portion of the corresponding chamber, substantially as set forth.

5. In a boiler-cleaner, the combination of a casing having a fluid-supply passage and centering-chambers extending through the sides of the casing, bushings arranged in the outer portions of said chambers, the inner portions of the chambers being of greater diameter than the bore of said bushings, and plungers arranged in said bushings and chambers and provided at their inner ends with enlargements adapted to strike the corresponding ends of the bushings, substantially as set forth.

6. In a boiler-cleaner, the combination of a head or casing having a main fluid-chamber, radial fluid-chambers arranged on the front and rear sides of said main chamber and a supply-passage leading to said main chamber, said front chambers connecting with said main chamber and said rear chambers connecting with said supply-passage, a piston arranged in said main chamber, means for controlling the admission of the motive fluid to opposite sides of the piston, a scale-loosener actuated by the piston, and centering pins or plungers fitted in said radial chambers, substantially as set forth.

7. In a boiler-tube cleaner, the combination of a head or casing having a fluid-supply passage and radial fluid-chambers communicating with said passage, centering pins or plungers sliding in said chambers and adapted to project beyond said head and bear against a surrounding boiler-tube, cupped packing-disks applied to the inner ends of said plungers, and means for limiting the outward movement of said plungers in their chambers, substantially as set forth.

8. In a boiler-tube cleaner, the combination of a head or casing having a transverse fluid-chamber and radial fluid-chambers arranged on the front and rear sides of said transverse chamber, a main supply-passage leading to said transverse chamber and connected with the rear radial chambers, an auxiliary passage extending forwardly from said transverse chamber and connected with the front radial chambers, a piston reciprocating in said transverse chamber, means for controlling the supply of the motive fluid to opposite sides of the piston, a scale-loosener actuated by said piston, and centering pins or plungers fitted in said radial chambers, substantially as set forth.

9. In a boiler-tube cleaner, the combination of a head or casing having a transverse fluid-chamber provided with an internal annular groove or channel and radial fluid-chambers arranged on the front side of said transverse chamber, a main supply-passage leading to said groove, an auxiliary passage leading from said groove to said radial chambers, a piston reciprocating in said transverse chamber, means for controlling the supply of the motive fluid to opposite sides of the piston, a scale-loosener actuated by the piston, and centering pins or plungers fitted in said radial chambers, substantially as set forth.

Witness my hand this 5th day of September, 1903.

ALBERT F. KRAUSE.

Witnesses:
CARL F. GEYER,
EMMA M. GRAHAM.