No. 640,822. Patented Jan. 9, 1900.

C. L. SMITH.

DEVICE FOR CLEANING BOILER TUBES.

(Application filed Mar. 11, 1898.)

(No Model.)

FIG. 1

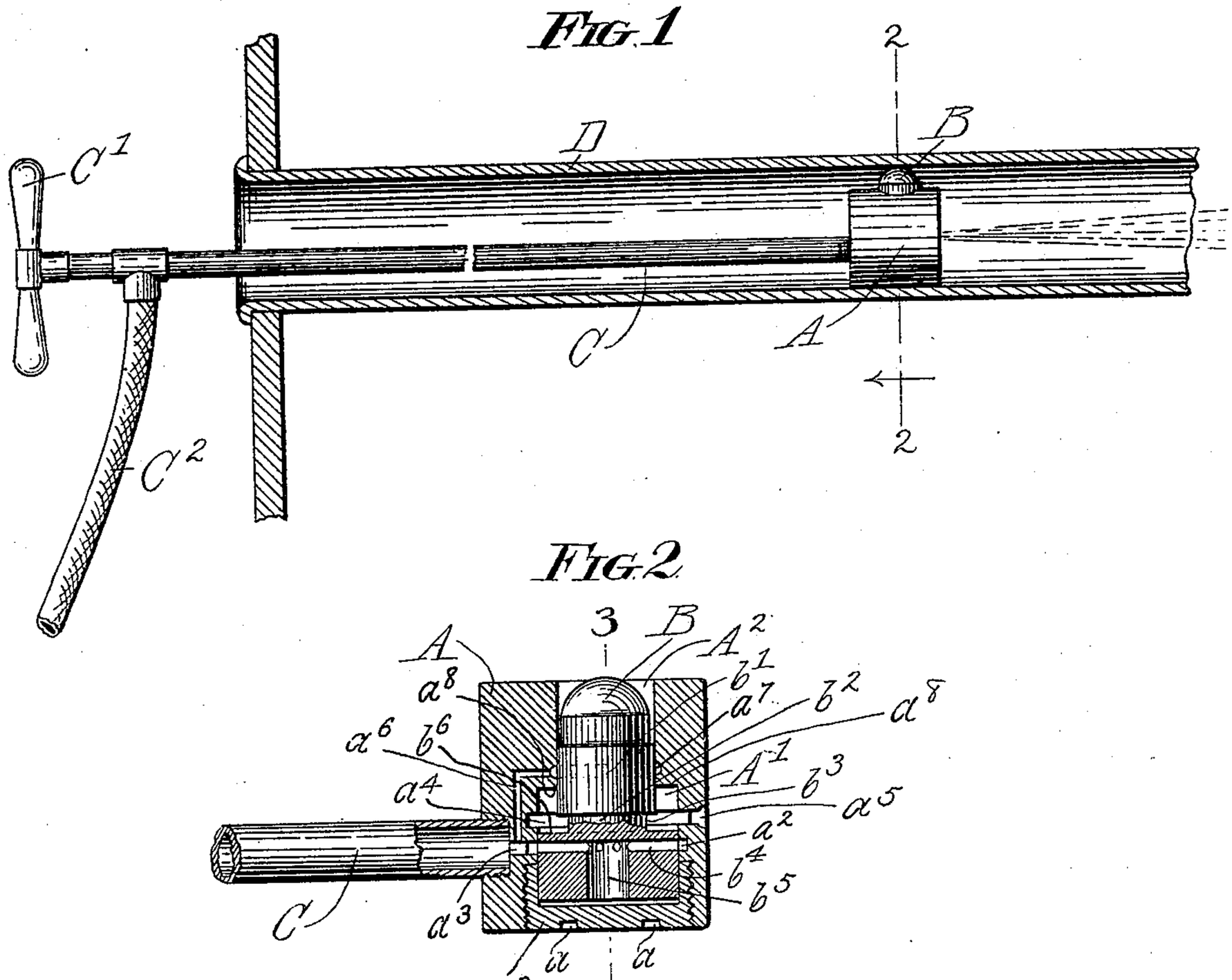


FIG. 2

FIG. 3

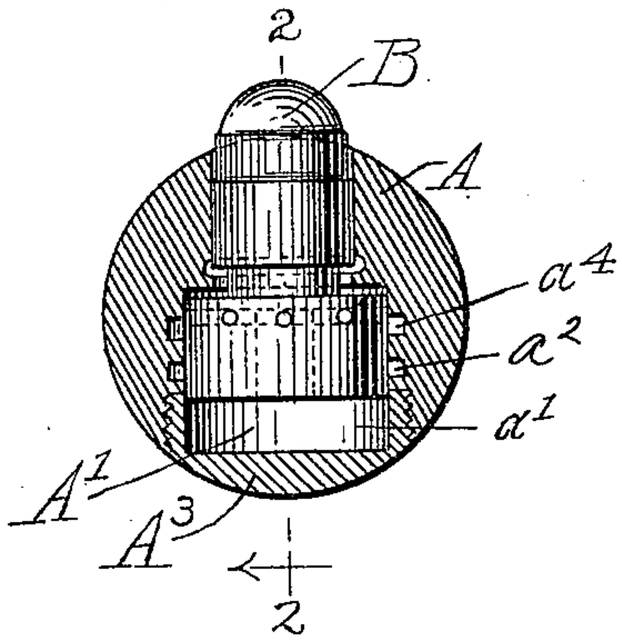
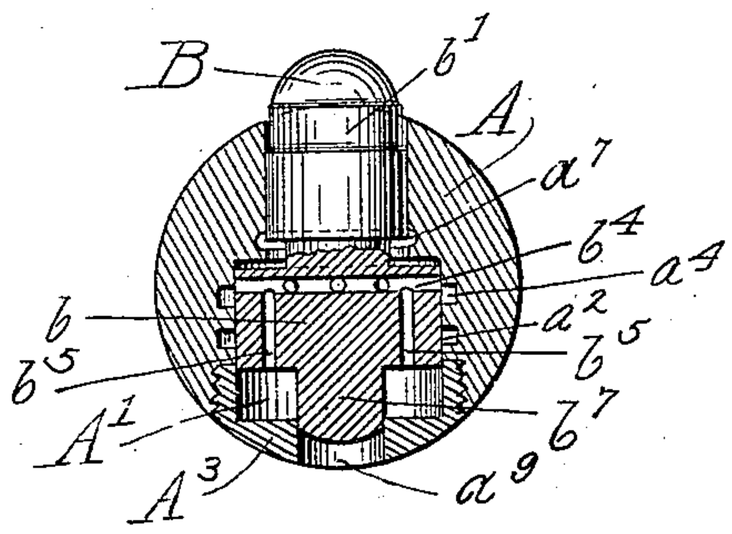


FIG. 4



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UNITED STATES PATENT OFFICE.

CARLTON L. SMITH, OF CHICAGO, ILLINOIS.

DEVICE FOR CLEANING BOILER-TUBES.

SPECIFICATION forming part of Letters Patent No. 640,822, dated January 9, 1900.

Application filed March 11, 1898. Serial No. 673,526. (No model.)

To all whom it may concern:

Be it known that I, CARLTON L. SMITH, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Devices for Cleaning Boiler-Tubes, &c., of which the following is a specification.

This invention relates to devices for cleaning boiler-tubes, flues, and the like both externally and internally by the concussion due to the repeated blows of a fluid-actuated hammer or tappet arranged to vibrate within the tube and operating to jar loose the accumulated deposit of scale and sediment on the water side of the tube and of soot, &c., on its combustion side.

The object of the invention is to provide a simple, efficient, and economical construction of the character referred to which can be operated by any suitable fluid-pressure supplied either from the boiler itself or from some other available source of steam, compressed air, or similar power.

The invention consists in the matters hereinafter set forth, and particularly pointed out in the appended claim.

In a construction embodying my invention the vibratory tappet is placed within a cylinder whose dimensions are made such that it may be thrust bodily into the tube or flue which is to be cleaned. The actuating fluid is admitted to this cylinder through an attached tubular stem, which may conveniently serve also as a handle by which the cylinder may be moved in or out and turned or rotated as desired to direct the blows of the tappet against the various parts of the wall of the tube. In an approved form, also, the exhaust from the cylinder will be emitted on the opposite side thereof from the stem or operating-handle and will serve to blow out of the far end of the tube and away from the operator the soot, scale, and dust detached from the inside of the tube, the deposit falling from the outer surface of the tube being collected and removed in any convenient manner, the exact nature of which must obviously depend on the design and construction of the boiler operated upon, whether a water-tube or fire-tube boiler, horizontal or vertical, &c.

Further features of the invention consist in the particular construction and arrangement of the tappet and cylinder and their inlet and outlet ports, which in this instance are such that the tappet acts as its own valve in controlling the flow of the actuating fluid instead of requiring a separate valve or valves for this purpose; but it will be understood that in its broad aspect the invention is not limited to this or any particular form or valvular arrangement of the tappet. The latter, moreover, may be arranged to strike the tube directly at one or both ends of its throw or may operate indirectly through an interposed part, which serves to transmit the concussion to the tube, as will all be fully understood from the following consideration of the construction set forth in the accompanying drawings, in which—

Figure 1 is a general view, in sectional elevation, of one form of cleaning-tool embodying my invention and showing it in operative position. Fig. 2 is a sectional detail of the tappet and cylinder, taken on line 2 2 of Fig. 1. Fig. 3 is a similar view taken on line 3 3 of Fig. 2. Fig. 4 shows a modified form of construction.

In said drawings, Figs. 1, 2, and 3, A designates the cylinder of the device, B its vibrating tappet, and C the tubular stem or handle, through which the actuating fluid is admitted and by which the cylinder is moved and turned to direct the blows of the tappet in every direction. As herein shown, this stem C, which is made of any desired length, terminates at its outer end in a transverse handle-bar C′, by which it and the cylinder are readily manipulated, and the connection from the stem to the source of fluid power consists of a flexible hose C^2, that readily permits such manipulation.

The approved form of tappet B herein shown consists, essentially, of a short end portion b of large diameter and an opposite end portion b' of smaller diameter, connected by a reduced neck b^2, which leaves an annular groove b^3 between the end portions b and b' at the neck. The large end or head of the tappet reciprocates within a cylindric chamber A′ of the same diameter as said head, but somewhat longer, while the smaller end of the tappet reciprocates through a reduced bore

A², leading from the chamber A′. A screw-plug A³ permits the insertion of the tappet in the cylinder and serves to close the chamber A′ after such insertion. This plug is herein shown as provided with spanner-holes *a*, by which it may be screwed in and out, and to enable it to be firmly seated without materially increasing the length of the cylinder in the direction of the tappet movement this plug is made long enough to insure an ample screw-joint and then bored out on its inner end, as shown at *a′*, to form, in effect, one end of the chamber A′, within which the head of the tappet reciprocates. One or more ports b^4 lead inwardly from the surface of the head *b* of the tappet and connect with a longitudinal port b^5, which leads to the end of the tappet and opens into the outer end of the chamber A′. When the tappet is at the inner end of its movement, the ports b^4 register with an annular groove a^2 in the cylinder A, which groove communicates with the tubular stem C through an inlet-port a^3, and the actuating fluid is thus admitted through the ports a^3, b^4, and b^5 to the chamber A′ to force the tappet outward. In this outward movement the admission of fluid is soon cut off by the passage of the ports b^4 away from the groove a^2, and as the tappet approaches the outer end of its throw the ports b^4 come into register with a second annular groove a^4, opening into an outlet-port a^5, through which the fluid is exhausted. The return of the tappet is accomplished by admitting the actuating fluid to the groove b^3 through an inlet-port a^6, leading from the inlet a^3 to an annular groove a^7, located in the reduced bore of the cylinder close to its inner end. When the tappet reaches the outer end of its movement, the groove b^3 overlaps the groove a^7, as shown in Fig. 3, and the actuating fluid enters between the annular inner end a^8 of the chamber A′ and the opposing annular shoulder b^6 on the inner end of the enlarged head *b* of the tappet and forces the latter back to the inner end of its movement. When in this return movement the inner edge of the tappet end *b* reaches the groove a^4, the fluid thus last admitted will exhaust through the port a^5 and leave the tappet free to be moved back again by the succeeding admission of fluid from the port a^3 when the ports b^4 again come into register therewith.

With this construction it is obvious that as soon as the actuating fluid is admitted to the stem C the tappet will begin to vibrate with great rapidity and will so continue until the supply of fluid is again cut off. By a proper design and proportioning of the ports and cooperating parts any desired amount of cushioning may be obtained at each end of the tappet or piston movement; but it will be understood that little or no cushioning will be provided for in a construction in which a forcible blow is aimed at, as in the present case. In the form shown in the views, Figs. 1, 2, and 3, the smaller end *b′* projects from the bore A² and impinges directly against the wall of the tube; but the enlarged end *b* of the tappet is entirely inclosed within the chamber A′, and the blow of the tappet in this direction takes effect indirectly through the whole cylinder A when the end *b* of the tappet strikes the plug A³. In Fig. 4, however, I have shown a construction in which the plug A³ is apertured centrally to receive a central cylindric lug or head b^7, projecting from the end of the tappet and adapted to strike the wall of the tube directly through the aperture a^9 of the plug. In this case the tappet delivers a direct blow at each end of its movement.

In Fig. 1 the device is shown in operative position within a boiler-tube D. The cylinder A is made of correct size to fit loosely into the tube, and by means of the stem C and handle C′ is moved back and forth and turned in various directions until every portion of the inner surface of the tube has been subjected to the impact of the tappet, which will ordinarily vibrate at the rate of several hundred strokes per minute. In the case of a fire tube or flue the concussion due to the action of the tappet will crack and loosen the scale deposited on the outside of the tube and cause it to drop down to the bottom of the boiler, to be afterward removed as desired. The vibrations of the tappet will also serve to loosen the soot and other products of combustion deposited on the inner surface of the tube, and these will then immediately be blown out of the far end of the tnbe by the force of the exhaust, which will issue from the port A⁵ in a practically continuous blast. In a water-tube boiler the action will be substantially similar, except that the scale will be removed from the interior of the tube and the soot from the exterior thereof. The external shape of the cylinder A may obviously be varied as desired, but in this instance is made cylindrical on an axis transverse to the axis of the tappet and parallel to the axis of the tube when inserted therein. The tappet B and corresponding apertures or chambers in the cylinder A may also be made otherwise than circular in cross-section without altering the essential construction or operation of the device, although the circular cross-section is obviously most desirable, as lending itself most readily to the requirements of economical manufacture. Both as to its external and internal shape, therefore, the term "cylinder" as applied to the casing A will be understood in its broad sense as designating simply a suitable inclosing casing within which the tappet is acted on by the actuating fluid, which maintains its vibrations. It will also be understood that while in a broad sense any construction of vibrating tappet or hammer will come within the spirit and terms of my invention so far as concerns the production of an operative cleaning-tool for the purposes described the particular valveless tap-

pet construction shown is deemed especially advantageous not only for the service intended in this instance, but also for any other service or in any connection for which it may be adapted.

I claim as my invention—

A valveless, vibratory-tappet mechanism, comprising the cylinder A having a transverse expansion-chamber and a reduced bore or passage extending therefrom to one side of the cylinder, and inlet-ports a^3 and a^6 communicating respectively with the expansion-chamber and reduced bore, and an exhaust-passage leading from the end of the expansion-chamber near where it connects to the smaller bore, a tubular operating-handle connected to the cylinder and communicating with the inlet-ports, and a tappet having a large head b fitting and working in the expansion-chamber and having ports b^4 and b^5 leading from the side of the head to its outer end, said ports b^4 being located near the inner end of the head, a smaller end or head b' connected to said head b by a reduced neck and working in the smaller bore leading from the expansion-chamber, whereby when an actuating fluid is admitted through ports a^3 and a^6 the tappet will be rapidly reciprocated without the employment of a valve, the ports a^4 communicating with inlet-port a^3 when the tappet is at one extremity of its movement and the inner end of the head b cutting off or closing inlet a^3 as the tappet advances, and said reduced end b' closing inlet-port a^6 during the opposite movement of the tappet, and the recess formed by said reduced neck communicating with port a^6 upon the extremity of the outward stroke of the tappet.

In testimony that I claim the foregoing as my invention I affix my signature hereto, in the presence of two subscribing witnesses, this 28th day of February, 1898.

CARLTON L. SMITH.

Witnesses:

HENRY W. CARTER,

ALBERT H. GRAVES.