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C. S. KNIGHT.

BOILER TUBE CLEANER.

APPLICATION FILED JULY 15, 1904.

Fig. 1.

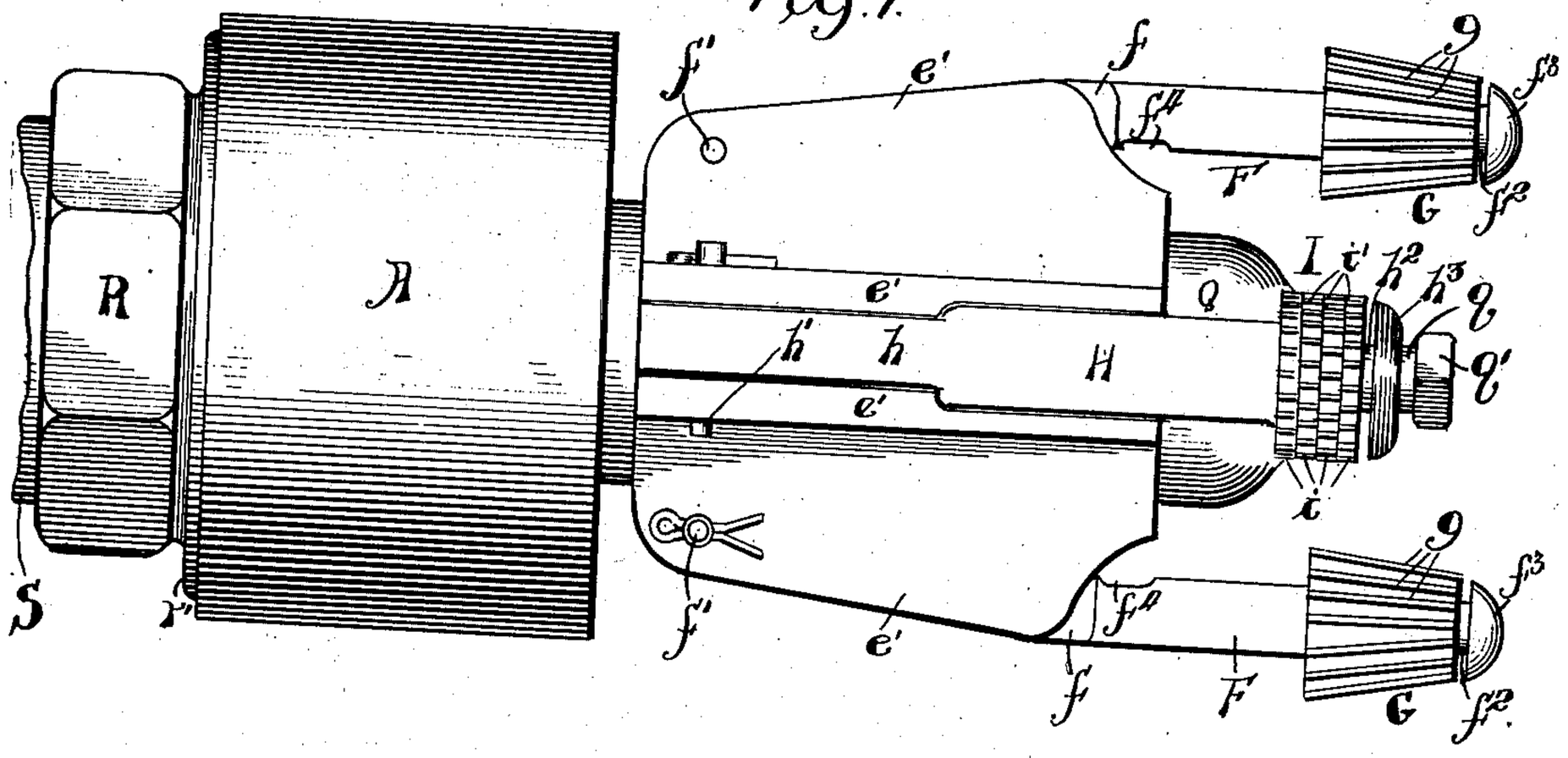


Fig. 2.

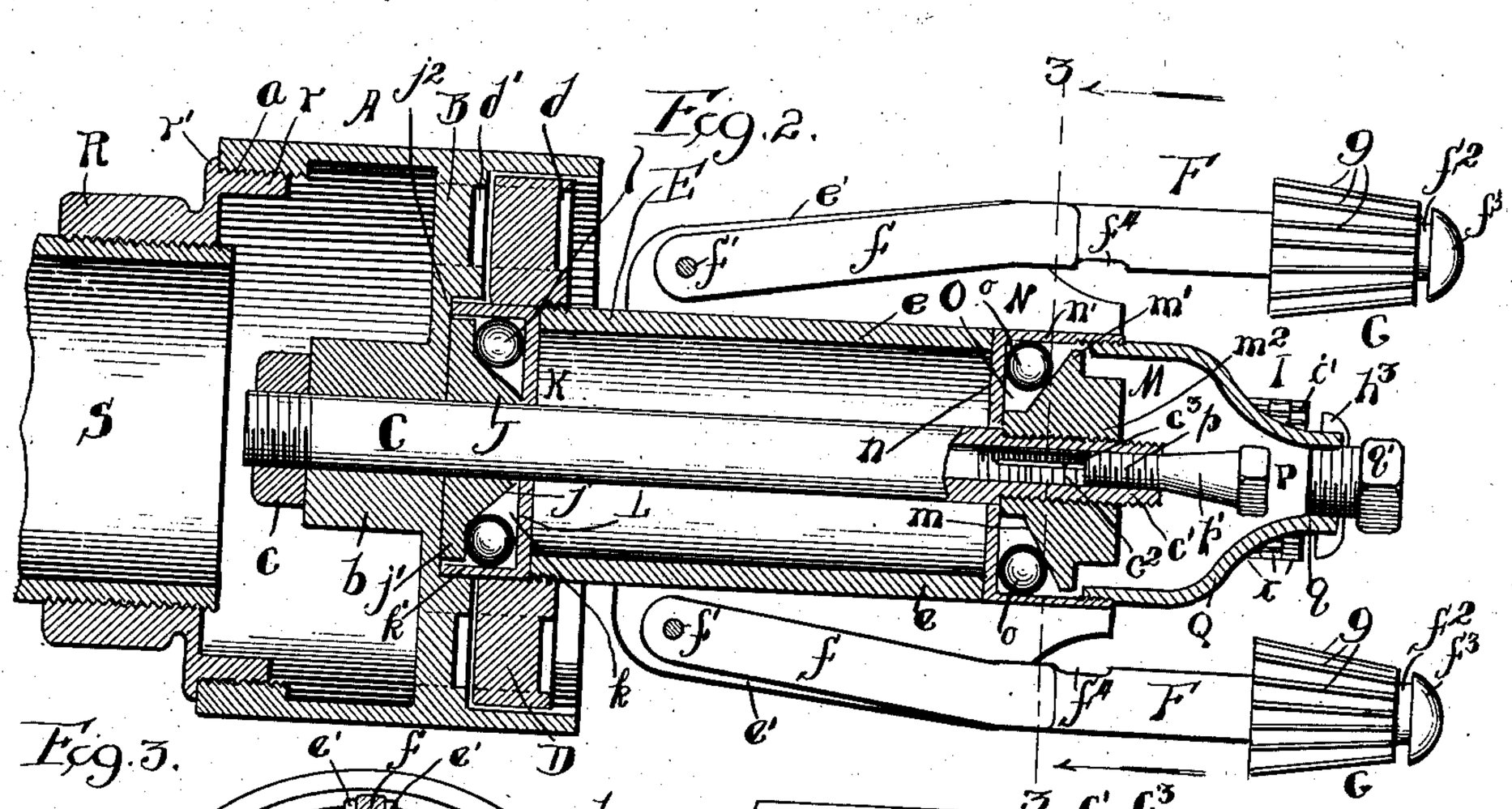


Fig. 3.

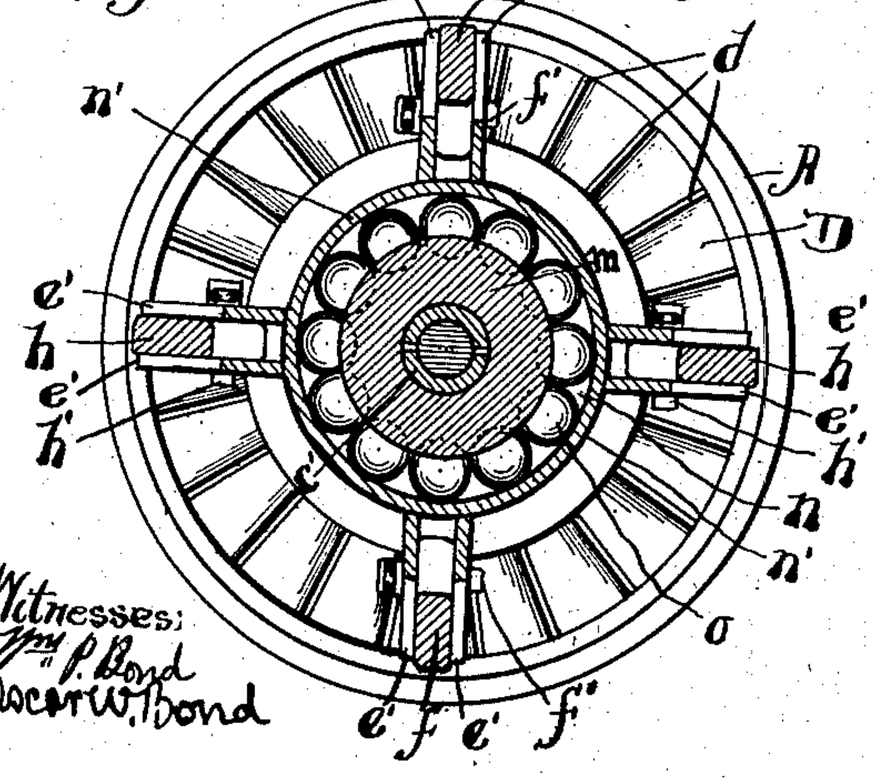


Fig. 4.

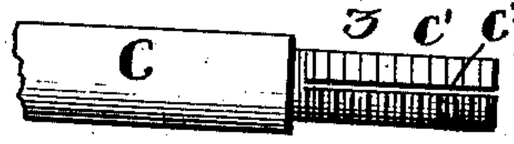


Fig. 5.

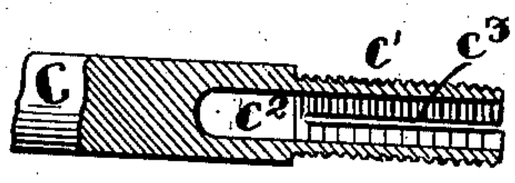
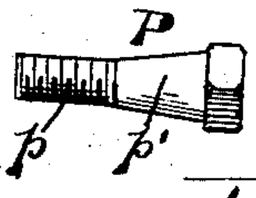


Fig. 6.



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UNITED STATES PATENT OFFICE.

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BOILER-TUBE CLEANER.

No. 840,221. Specification of Letters Patent. Patented Jan. 1, 1907.

Application filed July 15, 1904. Serial No. 216,755.

To all whom it may concern:

Be it known that I, CHARLES S. KNIGHT, a citizen of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Boiler-Tube Cleaners, of which the following is a specification.

This invention relates to that class of cleaners for use in removing incrustations from the interior of boiler-tubes and to that particular type of such cleaners employing a rotary head carrying cutters adapted to engage and remove the scale and deposits, which head is rotated through the medium of a turbine-wheel driven by steam or other fluid or by water or other liquid.

It is desirable that the cutters should have a firm support and bearing and should also have a free rotation.

The objects of the present invention are to improve the construction and arrangement of the main shell or casing, in which the turbine-wheel is located and operates, as regards the support and bearing for the turbine-wheel; to furnish a support and bearing for the cutter-head extending approximately the entire length of the head and including the turbine-wheel; to furnish a ball-bearing for the turbine-wheel and a ball-bearing for the advance or forward end of the head carrying the cutters, with races adapted for the reception of large balls and so arranged as to furnish a support for the turbine-wheel and the head of the cutters extending the full length of the wheel and head; to enable a cross-bearing to be obtained for the cutter-head of approximately the full diameter of the head, thereby preventing wabbling or lateral movement of the head in the operation of the cutters; to furnish an adjustment for the bearings by entering the cone of the forward bearing on a fixed rod or stem and slotting the outer end of the rod or stem and entering thereinto a wedge-screw, by the advancing and receding of which the outer cone can be adjusted to take up wear; to improve the construction and arrangement of the cutters and their carrying-head, and to improve generally the construction and operation of the several elements entering into the cutter as a whole.

The invention consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of the cutter of the invention; Fig. 2, a longitudinal sectional elevation of the same; Fig. 3, a cross-section through the outer ball-bearing, taken on line 3 3 of Fig. 2 looking in the direction of the arrow; Fig. 4, a detail of the slotted outer end of the fixed rod or stem; Fig. 5, a longitudinal section of the outer end of the fixed rod or stem; and Fig. 6 a detail, being a side elevation of the locking-screw for the outer end of the fixed rod or stem.

The main shell or casing A in the construction of Figs. 1, 2, and 3 is made of brass, with an exterior diameter to permit of the passage of the shell or casing into the tube to be cleaned. The main shell or casing A, as shown in Fig. 2, has formed therewith a cross-partition B, having a centrally-extending hub or boss *b*, into which is entered the inner or rear end of a rod or stem C, the extreme end of which is threaded and receives a nut *c*, by means of which the stem or rod is held in a fixed relation. A turbine-wheel D, preferably made of brass, is located in the chamber of the shell or casing A in advance of the cross wall or partition B, which wheel has the usual openings *d* for the passage of the fluid or liquid by which it is driven, such fluid or liquid acting on the wheel by being projected through openings *d'* in the cross wall or partition B, as usual in driving turbine-wheels from the force of a liquid or fluid.

The turbine-wheel D is threaded or otherwise entered onto the inner end of a long head E, which consists of a wall *e* with projecting wings or ears *e'* arranged in pairs on opposite sides of the wall, four pairs of wings being employed in the construction shown. Two of the pair of ears or wings *e'* have entered between them the shank *f* of a rod or stem F, and the shank is pivotally mounted between the ears by a suitable pin or pivot *f'*, so that the rod or stem is free to vibrate on the pin or pivot as a support. Each rod or stem F at its outer end has mounted thereon a cutter G, each cutter, as shown, of a cone shape and having its exterior provided with cutting ridges or teeth *g*, and each cutter is mounted on a pin f^2, which may be a continuation of the stem F, and is held by an upset or head f^3 against end withdrawal.

The two other pairs of ears *e'* each have entered between them the shank *h* of a rod or

stem H, and the shank is mounted between the ears e' by a suitable pin or pivot h', so that the rod or stem H is free to vibrate on the pin or pivot as a support. The outer end of each rod or stem H has mounted thereon a cutter I, each cutter consisting of a plurality of disks i, each disk having a series of cutting points or teeth i', and each cutter I as a whole is mounted on a pin or journal h^2, which may be a continuation of the rod or stem H and is held by an upset or head h^3 or otherwise against end displacement. The cutters G act in advance to break and disintegrate the scale and incrustations, and the cutters I act to finish the removal of the scale and incrustations from the inner face of the tube.

The fixed stem or rod C has thereon or therearound the cone-section J of a ball-bearing race, which section consists of a cone j and a wide plate or flange j', laterally and circumferentially extending from and around the base of the cone, and this wide plate or flange j' is entered into a recess j^2 in the face of the cross wall or partition B of the main shell or casing. The companion or cup section K of the ball-bearing race consists of a wide plate k with a circumferential rim or flange k' extending therefrom in the direction of the plate or flange j', so that between the cone j and the plate or flange j' and the plate k, with its rim or flange k', is formed a race L, in which are located large balls l, furnishing a broad bearing for the turbine-wheel, by which the wheel and the cutter-head are given a lateral support and are free to revolve, which support is approximately the full diameter of the wall of the cutter-head and is made firm and solid through the wide bearing and the large balls.

The outer or forward end of the fixed stem or rod C is of less diameter than the body of the rod, and this end c' of the rod or stem has an exterior screw-thread on which is entered the cone-section M of a ball-bearing race for the outer end of the cutter-head, which section M consists of a cone m, extending from an annular rim or flange m' with both formed integral with a body or nut m^2, the cone and the body or nut having a screw-threaded hole for entering the section as a whole onto the threaded end of the fixed rod or stem.

The companion or cup section N of the outer race consists of a wide plate n with a circumferential rim or flange n', extending, as shown, to the outer end of the wall e of the cutter-head and having, as shown, an interior screw-thread at its outer end. The cone m, with the flange or rim m', together with the plate n and the rim n', form a race O, in which are located large balls o, which furnish a broad bearing for the outer end of the cutter-head, by which the cutter-head and the turbine-wheel are given a lateral support and are free to revolve under conditions of firmness and solidity by reason of the wide bearing and large balls. It will thus be seen that the turbine-wheel has a ball-bearing support at its inner side or face, which furnishes a ball-bearing support for the inner end of the cutter-head, and that the cutter-head has at its outer end a ball-bearing support, with the result that the cutter-head is given a solid and firm lateral support and bearing for its entire length, by which it will be held in place and at the same time have a free rotation, which support is attained by the wide bearings and large balls of the ball-bearings.

The cone-section M of the outer race is adjustable on the threaded end c' of the stem or rod C for the purpose of taking up slack in case of wear between the ball-bearings. This section M when adjusted must be locked firmly in its adjusted position. The outer end c' of the stem or rod C has an axial hole c^2 and the wall surrounding the hole has slots c^3, which permit of the expansion of the wall to lock and hold the cone-section M in its adjusted position. The slotted wall of the end c' is spread by a screw P, having a threaded end p and a tapered portion p', so that by advancing the screw in the axial hole of the rod or stem the wall of the end c' will be forced outward, impinging the exterior threads of the end against the threads of the cone-section M and locking the section in an adjusted position. The section can be advanced on the end c' to take up wear by receding the screw P until the bite or impingement between the wall of the end of the rod or stem and the section M is releaesd, when the section M can be advanced as required to take up wear, and when properly adjusted it can be locked and held in its adjusted position by advancing the screw P to restore the bite or impingement of the threads of the end c' and the cone-section M of the race. The inner screw-thread of the annular rim or wall n' receives the end of a cover or top Q, having a neck q, into which is entered a closing-plug q' for the cover to furnish an oil-receptacle, by which the ball-bearings are kept properly lubricated.

The inner or rear end of the main shell or casing A has on its interior a ledge a, into which is threaded a coupling-plug R, which plug, as shown, has an annular wall r with an exterior screw-thread, to enter the inner or rear end of the shell or casing and a circumferential flange or rim r' to abut against the end face of the shell or casing and make a tight joint. The coupling-plug R has an interior screw-thread in the construction shown, into which is threaded the end of a supply-pipe S for the fluid or liquid by which the turbine-wheel is revolved.

The operation will be readily understood. The shell or casing is attached to the end of the supply-pipe S for the fluid or liquid, and

the shell or casing, with the cutter-head and cutters, is entered into the end of the boiler-tube to be cleaned. The driving fluid or liquid is admitted to the shell or casing and by its force revolves the turbine-wheel, which in turn revolves the cutter-head, causing the cutters to revolve and remove the scale and incrustations from the interior of the tube, as is usual in boiler-tube cleaners of this class.

The construction of the cleaner is exceedingly simple and at the same time is strong and durable, the cutter-head having a long bearing, virtually the full length of the cutter-head and the turbine-wheel. The turbine-wheel is supported so as to be free to revolve, as is also the cutter-head, and the ball-bearings for this purpose furnish a solid and firm support derived from the wide bearing-plates and large balls, by which the end thrust will be in direct line with the wall of the cutter-head, or approximately so, from front to rear of the cutter. The support is the full length of the wall of the cutter-head instead of a support only at the inner end of such head, and by having the ball-bearing sup port with large balls at the extreme ends of the cutter-head such support will hold the cutter-head and the cutters in a straight line without any appreciable lateral play. The cross-section for the ball-bearing support is one which enables large balls to be used without weakening or affecting the strength and rigidity of the cutter-head and the turbine-wheel. The adjustable cone-section of the outer race or ball-bearing enables end wear or play to be readily taken up, it only being necessary to advance the outer cone-section and when advanced lock it in a fixed relation by advancing the wedge-screw, which can be very readily and quickly accomplished without requiring the taking apart of the cutter. The cap entered onto the outer ball-bearing furnishes a chamber for containing oil or other lubricant by which the ball-bearing and the other parts will be kept lubricated or oiled.

The cones, bearing-plates, cups, and balls of the ball-bearings are all made of hardened steel, so as to insure long wear, and the wide cups and wide bearing-plates furnish a race for the reception of larger balls than have heretofore been used in boiler-tube cleaners, giving an increased lateral bearing and greater firmness and rigidity to resist the thrust and strain arising from the use of the cutter in removing scale and incrustations from boiler-tubes. The stems F and H in order to prevent contact with the edge of the cup N are notched out or cut away to form a recess f^4, which prevents the stems from striking against the edge of the cup and breaking down or chipping the wall n', thereby insuring the maintenance of the cup intact and in proper working condition.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a boiler-tube cleaner, the combination of a main shell having a cross-wall, a fixed stem forwardly extending from the center of the cross-wall and having a reduced forward end with an exterior screw-thread thereon and having in the reduced forward end cross-slots on opposite sides and having in the reduced forward end and in the end of the body of the stem a central longitudinal hole screw-threaded at its inner end, a cutter-head having a side wall encircling the stem, a bearing for the forward end of the cutter-head, said bearing consisting of a cup and cone with the cone threaded onto the reduced front end of the fixed stem, and an expanding-screw having a threaded advance end engaging the threaded section of the hole in the forward end of the stem and having a tapered body entered into the hole of the reduced slotted end of the fixed stem, for the advance of the screw to cause the tapered body to act and expand the reduced slotted end of the fixed stem and lock the cone thereon in adjutsed position, substantially as described.

2. In a boiler-tube cleaner, the combination of a central fixed stem having a reduced forward end with an exterior screw-thread and having slots on opposite sides of the reduced forward end and having a hole terminating in a screw-thread within the end proper of the stem, a cutter-head having a side wall encircling the fixed stem, a bearing for the front end of the cutter-head, said bearing consisting of a cup and a cone with the cone threaded onto the reduced forward end of the stem, and a screw having a threaded advance end and a tapered body and entered into the hole in the forward end of the stem for the thread to advance the screw and cause the tapered body to act and expand the reduced slotted end of the fixed stem and lock the bearing-cone thereon in an adjusted position, substantially as described.

3. In a boiler-tube cleaner, the combination of a cutter-head having a side wall, a plurality of ears integral with the side wall of the cutter-head and arranged in opposing pairs, each pair of ears laterally projecting from the side wall of the cutter-head and the forward end of each ear extending beyond the end proper of the side wall, a bearing-cup at the front end of the cutter-head entered between the projecting forward ends of the ears, and abutting against the end proper of the wall of the cutter-head and having a forwardly-projecting rim, and a cap having a body and a neck with the inner end of the body entered into the rim of the cup, for the cup and cap to furnish a receptacle for a lubricant, substantially as described.

4. In a boiler-tube cleaner, the combination of a cutter-head having a side wall, a plu-

rality of ears integral with the side wall of the cutter-head and arranged in opposing pairs, each pair of ears laterally projecting from the side wall of the cutter-head and the forward end of each ear extending beyond the end proper of the side wall, a bearing-cup at the front end of the cutter-head entered between the projecting forward ends of the ears, and abutting against the end proper of the wall of the cutter-head and having a forwardly-projecting rim, a cap having a body and a neck with the inner end of the body entered into the rim of the cup, for the cup and cap to furnish a receptacle for a lubricant, and a bearing-cone on the forward end of the stem inclosed within the receptacle formed by the cup and cap, substantially as described.

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