No. 878,286. PATENTED FEB. 4, 1908.

R. O. HODGE.

BOILER TUBE CLEANER.

APPLICATION FILED MAY 31, 1906.

Fig. 1.

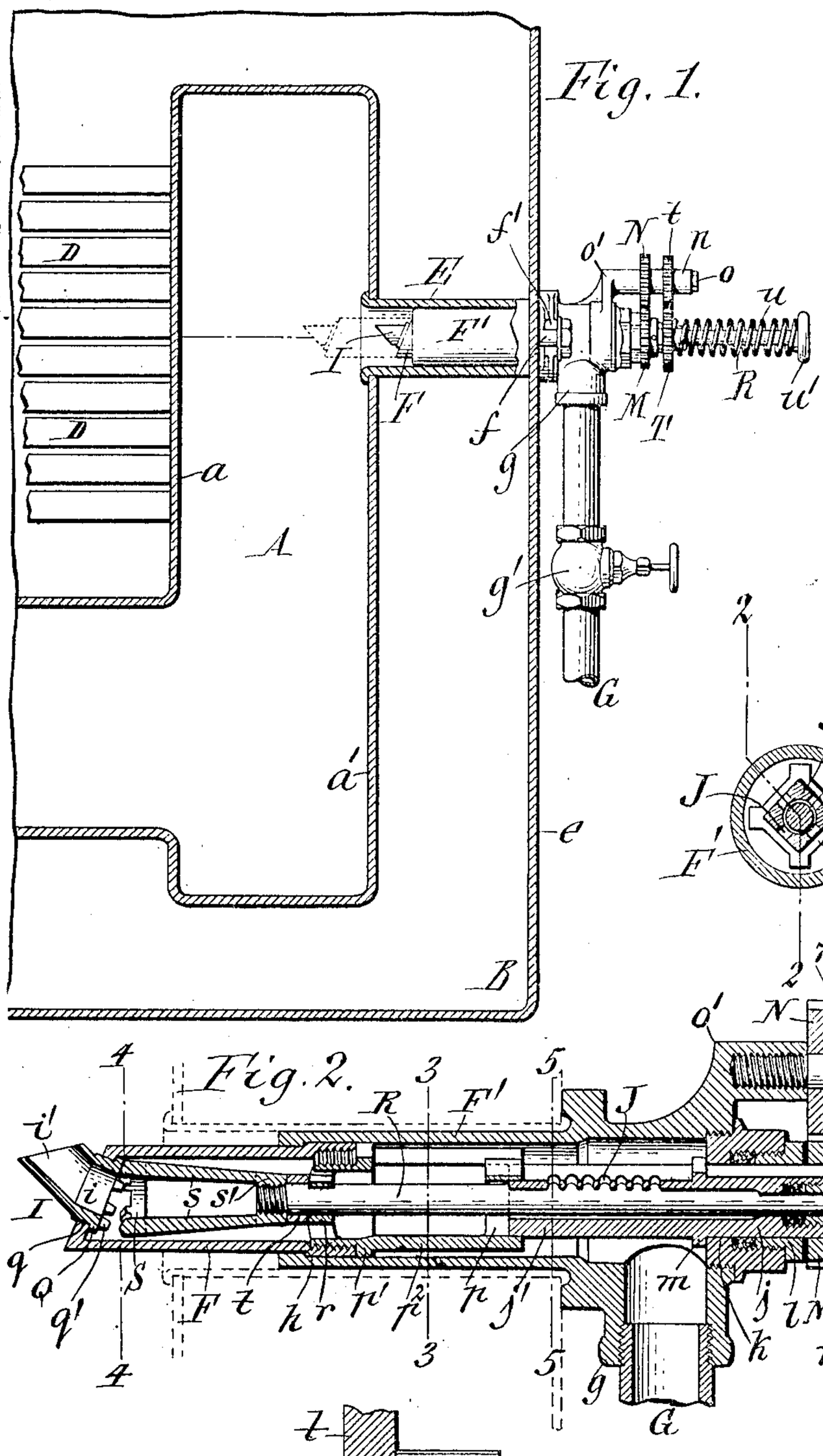


Fig. 3.

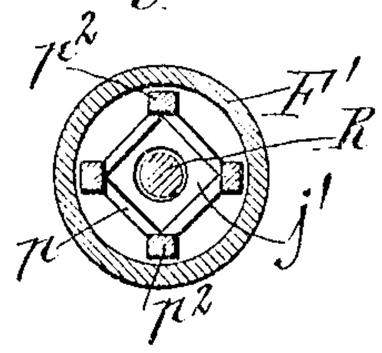


Fig. 4.

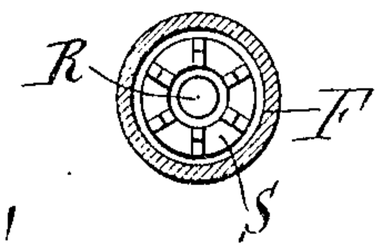


Fig. 5.

Fig. 2.

Fig. 7.

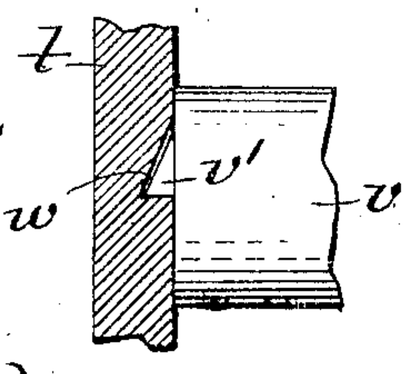
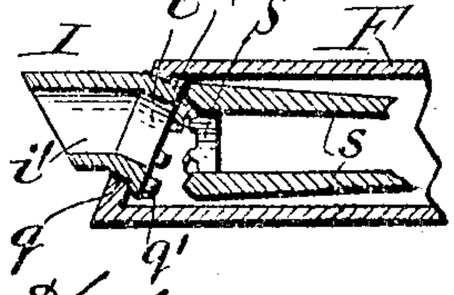


Fig. 6.



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UNITED STATES PATENT OFFICE.

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BOILER-TUBE CLEANER.

No. 878,286. Specification of Letters Patent. Patented Feb. 4, 1908.

Application filed May 31, 1906. Serial No. 319,504.

To all whom it may concern:

Be it known that I, ROBERT O. HODGE, 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 that class of boiler tube cleaners or flue blowers which are adapted to deliver a jet of steam from the combustion chamber into the rear ends of the tubes or flues and drive the soot forwardly through these tubes and out through the chimney.

A boiler tube cleaner of this description is shown in Letters Patent of the United States No. 720,252, dated February 10, 1903, and No. 793,834, dated July 4, 1905.

In the flue cleaners constructed in accordance with the above mentioned patents a radial fan-shaped steam jet was produced the pressure of which was greater against the flues axially in line with the body of the cleaner than against the flues outside of this axis, causing an unequal distribution of the steam over the flue area and non-uniform cleaning of the flues.

One of the objects of this invention is to provide a boiler tube or flue cleaner having a nozzle which delivers the steam in a compact or concentrated body and also shifted radially relatively to the main axis of rotation for delivering the jet of steam in a concentrated form and successively into all of the flues.

My invention has the further object to improve the boiler tube cleaner in several details.

In the accompanying drawings: Figure 1 is a fragmentary vertical section of the rear end of a marine boiler equipped with my improved tube cleaner or flue blower and showing the movable parts of the cleaner or blower in their retracted or inoperative position. Fig. 2 is a vertical longitudinal section of the cleaner on an enlarged scale in line 2, 2, Fig. 5, and showing the movable parts in the position which they occupy when the cleaner is in use. Figs. 3, 4, and 5 are vertical cross sections in the correspondingly numbered lines in Fig. 2. Fig. 6 is a fragmentary sectional view showing the nozzle of the cleaner in a position different from that shown in Fig. 2. Fig. 7 is a fragmentary horizontal section, on an enlarged scale, in line 7—7, Fig. 2.

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

Although my improved flue cleaner is applicable to boilers of various constructions that shown in the drawings is a marine boiler having a smoke box or combustion chamber A within the rear part of the shell B, a furnace C connected with the lower end of the combustion chamber and flues D connected with the upper part of the inner wall *a* of said chamber in the usual manner of this type of boilers.

In order to permit of using my improved tube cleaner on this boiler, a horizontal thimble, nipple or short section of tubing E is extended across the water space between the rear walls *e*, *a*' of the shell and the combustion chamber and secured in openings in these walls by upsetting the ends of the thimble. A single thimble of this kind is located opposite the center of the flue area in a small boiler but if the boiler is of very large capacity and has a correspondingly larger flue area, two or more of such thimbles are employed and distributed uniformly over the flue area each of which is adapted to receive one of my improved flue cleaners which is constructed as follows: The body of the cleaner consists of two telescopic tubular sections F, F' which are adapted to slide one upon the other for extending the same into the combustion chamber when in use or retracting the same out of the combustion chamber when not in use, thus preventing the fire from unnecessarily burning parts of the cleaner. As shown in the drawings, the outer or rear section F' of the tubular body is arranged within the outer part of the thimble and rigidly secured in place by means of bolts *f* connecting laterally projecting lugs *f*' on its outer section with the adjacent rear wall of the boiler shell. Steam is conducted into the rear end of the outer body section by means of a pipe G connecting with a laterally projecting nipple *g* at the rear end of the outer body section, the steam supply being controlled by a valve *g*' in the pipe. The inner or front section F of the body is movable axially or lengthwise into and out of the outer section. The inward or forward movement of this inner section is limited by means of an enlargement or external shoulder *h* formed at the outer end thereof and engaging with an internal shoulder at the inner end of the rear body section. In addition to mov-

ing forward and backward in the rear body section, the front body section is also capable of rotary movement in the rear body section for the purpose hereinafter to be explained.

I represents a steam delivery or discharge nozzle arranged at the inner end of the front body section and adapted to deliver a jet of steam successively into the rear ends of the several flues of the boiler. This nozzle consists of a rear inlet or receiving portion *i* and a front outlet or delivery portion i^1. The receiving portion is pivotally connected with the inner end of the front body section so as to rotate on an axis which is arranged at an angle to the axis of rotation of the front body section. The outlet end of the nozzle is arranged at an angle to the axis on which its inlet end turns on the front body section. Upon rotating the front body section while the outlet of the nozzle mounted thereon projects laterally at the greatest angle relatively to the axis of the front body section, as shown in Fig. 2, the steam issuing therefrom will be delivered in a circular path successively into the outermost flues of the flue area. Upon turning the nozzle in the front body section so that the outlet end of the same is parallel with and substantially in axial alinement with the front body section, as shown in Figs. 1 and 6, the steam issuing from the nozzle will be directed into the flues at the center of the flue area. By turning the nozzle on the front body section so that its outlet is at a greater or lesser angle to the axis of the front body section the circular path of the steam jet may be increased or decreased in diameter between the two extremes which it is possible to adjust the nozzle and thus enable each of the flues to be reached by the steam jet. The steam issues from the nozzle in a compact or solid body and enters each of the tubes individually and all of them in succession by the combined rotary and lateral movement of the nozzle relatively to the front body section, thereby concentrating the full steam pressure into each flue and obtaining the maximum effect of the same for removing the soot from the tubes or flues.

The mechanism for rotating the front body section and the nozzle is so constructed that these parts are rotated in the same direction but at a different rate so that the outlet end of the nozzle constantly changes its angle relatively to the front body section during the rotary movement of these parts in the same direction. By this means the steam issuing from the nozzle is delivered against the flue area in a spiral path beginning at the center of the flue area when the nozzle is in the position shown in Fig. 6 and gradually working outwardly in spiral lines as the nozzle during its rotary movement with the front body section is shifted from the position shown in Fig. 6 to that shown in Fig. 2.

If the rotation of the parts continues the nozzle after reaching its outermost position will cause the steam to be delivered in a spiral patl against the flue area beginning at the outermost part of this area while the nozzle is in the position shown in Fig. 2 and gradually working inwardly along spiral lines to the center of the flue area as the nozzle shifts its position from the angle shown in Fig. 2 to the angle shown in Fig. 6.

The preferred mechanism shown in the drawings for operating the front body section and the nozzle in the manner described is constructed as follows: A hollow main shaft is arranged axially in the sections of the body and composed of a cylindrical rear or outer section *j* and a square or flat sided front or inner section j^1. The rear cylindrical section of this shaft is journaled in a bearing formed in a cap or bonnet *k* which closes the outer end of the rear body section. At its outer end this cap is provided with a stuffing box the gland *l* of which surrounds the main shaft and forms a tight joint between the same for preventing the escape of steam at this point. The main shaft is held against axial or longitudinal movement in the cap by means of a shoulder or collar *m* formed on its inner part and bearing against the inner side of the cap, and a driven gear wheel or collar M secured to the outer part of this shaft and bearing against the outer end of the gland *l*. N represents a driving gear wheel meshing with the driven gear wheel M on the main shaft and forming part of the means for turning the latter. The driving gear wheel N is formed on the front end of a hub *n* which is journaled on a stud, arbor or screw *o* arranged parallel with the main shaft and secured to a bracket o^1 on the rear body section. A coupling is employed for connecting the inner end of the main shaft with the front section of the body in such manner that this last mentioned section is compelled to turn with said shaft but is free to move axially thereon. This coupling preferably consists of an outer or rear head *p* having a flat sided bore fitting the correspondingly-shaped exterior of the front part of the main shaft, a front head p^1 connected by a screw joint with the rear end of the front body section and longitudinal bars p^2 connecting the front and rear heads of the coupling.

The nozzle is journaled at its rear or inlet end in the circular bearing or opening of a head *q* at the front end of the front body section and is provided within said section with an external annular flange Q bearing against the inner side of said head and with an annular row of gear teeth q^1 forming practically a gear wheel. R represents a nozzle shifting rod or shaft arranged centrally within the front and rear body sections, the coupling and in the main shaft. At its front end this rod is supported by a ridge *r* in the bore

of the coupling while its rear or outer end is supported in the outer part of the main shaft. The bore of the inner part of the main shaft is larger than the diameter of the shifting rod, and steam is admitted into this space by means of openings J formed in this portion of the main shaft, thereby increasing the area of the steam conduit in the cleaner from the inlet to the outlet thereof. At the outer end of the main shaft the same is provided with a stuffing box having a gland r^1 which surrounds the shifting rod to prevent the escape of steam between these parts.

S represents a gear wheel or toothed rim which meshes with the gear teeth or wheel on the rear end of the nozzle. This wheel or rim has rearwardly projecting arms s which are connected at their rear ends by a collar, sleeve or hub s^1. The latter is connected by a screw joint with the front end of the shifting rod or shaft as shown in Fig. 2. A washer or spacing sleeve t is preferably interposed between the hubs s^1 of the gear wheel S and the bridge r of the coupling. Upon turning the central shifting rod or shaft R the nozzle is caused to turn with the same by means of the gearing between these parts, and upon moving the front body section forward or backward, the central shaft slides through the main shaft without disturbing the driving connection between the front body section and the main shaft.

T represents a driven gear wheel mounted on the outer part of the nozzle shaft and meshing with the driving gear wheel t on the rear end of the hub n. The driven gear wheel T is connected by a spline t^1 with the nozzle shaft so as to permit the latter to slide lengthwise through said driven gear wheel T but compel the same to turn therewith.

u represents a spring surrounding the outer end of the nozzle shaft and bearing with its front and rear ends against the outer side of the driven gear wheel T and a head, collar or button u^1 at the outer end of the nozzle shaft. This spring operates to yieldingly draw the nozzle shaft outwardly together with the front body section, nozzle and other parts connected therewith, so that the front ends of the nozzle and front body section are retracted within the inner end of the thimble when the tube cleaner is not in use, thereby preventing the nozzle and front body section from being burned or injured unduly by the heat in the combustion chamber. This spring is however sufficiently weak so that upon opening the steam valve g^1, the steam entering the body of the cleaner will be able to push the front body section forwardly into its extreme position in which the nozzle and the front end of the front body section project beyond the inner end of the thimble, as shown in full lines in Fig. 2. When the steam is again turned off, the resilience of the spring u automatically retracts the parts connected therewith, so that the front ends of the nozzle and the front body section are again in their protected position within the thimble.

While the steam is turned on the operator turns the driving gear wheels N, t and the latter by intermeshing with the driven gear wheels M, T turn the main hollow shaft and the central nozzle shaft together with the front body section and nozzle which are operatively connected with the front ends of these shafts, respectively.

The pair of intermeshing gear wheels which rotate the main shaft are constructed of such a size relatively to the pair which rotate the central or nozzle shaft that a differential in the rotary movement of these two shafts is produced although the driving gear wheels of the two pairs rotate in unison. By this means the front section of the body is caused to rotate at a different rate from that of the nozzle, although moving in the same direction, whereby the nozzle, while sweeping with a circular motion over the area of the flue sheet, is also caused to gradually move laterally toward the center in the manner heretofore described for directing the steam jet successively into each one of the group of flues. It is immaterial whether the relation of the two pairs of driving and driven gear wheels is such that the front body section rotates faster or slower than the nozzle so long as there is a differential between the movements of these parts. In the drawings, the driving gear wheel t of the nozzle is smaller than the driving wheel N of the front body section and the driven gear wheel M of the latter is smaller than the corresponding wheel T of the nozzle, which relative dimensions of these gear wheels causes the front body section to rotate faster than the nozzle. By increasing or decreasing the differential between these two pairs of gear wheels, any desired difference between the rotatory movement of the nozzle and the front body section may be obtained.

The rotation of the driving gear wheels may be effected by any suitable means but preferably by means of a crank having a socket in its hub v which fits over the hub n of the driving gear wheels and is provided at its front end with a tooth v^1 engaging with a recess w in the outer side of the nozzle driving gear wheel t. The hub of this crank is of such length that the arm V thereof can only be turned when the steam has been turned on and the head u^1 at the outer end of the central shaft has been moved forwardly out of the path of the crank arm, as represented in Fig. 2. When the steam is turned off the expansion of the spring u moves the central shaft together with its outer head into the path of the crank arm, thus serving as an indicator for the attendant that the steam has not been turned on if he should attempt to

rotate the flue cleaner without first turning on the steam.

Inasmuch as the central shaft is connected by a screw joint with the hub s^1 the gear rim or wheel S, these parts are liable to become detached by turning the shaft in the direction which would unscrew this joint. In order to avoid this, the coöperating front sides of the tooth v^1 and its companion recess w in the gear wheel t are made abrupt while the rear sides thereof are made inclined, as shown in Fig. 7. By this means a driving connection can be produced between the crank and the driving gear wheels only in the direction in which the central shaft is turned with a movement which would tighten the screw joint between the same and the hub s^1 instead of loosening the same.

By varying the angle of the axis of the nozzle pivot relatively to the axis of the rotary body section, the range or extreme distance which it is possible to throw the steam by means of the nozzle can be varied to suit the particular area of the flue sheet which must be covered by the steam jet. In order to enable the nozzle to distribute the steam most effectively over a certain flue area, the angle of the axis about which the nozzle rotates should be half way between the two extreme positions or angles which the nozzle should assume in directing the steam against the center of the flue area and against the outermost part of the same.

I claim as my invention:

1. A boiler tube cleaner comprising a rotary body or carrier having a steam inlet, and a steam delivery nozzle mounted on said body and capable of being shifted into different angles relatively to the axis of the body, substantially as set forth.

2. A boiler tube cleaner comprising a rotary body or carrier having a steam inlet, and a steam delivery nozzle rotatable on the body about an axis which is arranged at an obtuse angle to the axis of the body and adapted to be rotated with the body and also movable radially relatively thereto in all directions, substantially as set forth.

3. A boiler tube cleaner comprising a rotatable body having a steam supply and rotatable discharge nozzle pivoted on said body at an angle to the axis thereof and having its outlet arranged at an angle to the axis of its pivot, substantially as set forth.

4. A boiler tube cleaner comprising a rotatable body having a steam supply at its rear end and a head at its front end which is inclined at an angle to the axis of the body, and a rotatable nozzle having a rear or inlet portion which is pivoted in said head and adapted to rotate in the plane thereof and a front or outlet portion which is arranged at an angle to the plane of rotation of the nozzle, substantially as set forth.

5. A boiler tube cleaner comprising a rotatable body having a steam supply, a rotatable discharge nozzle pivoted on said body at an angle to the axis thereof and having its outlet arranged at an angle to the axis of its pivot and means for rotating said body and nozzle at different rates, substantially as set forth.

6. A boiler tube cleaner comprising a rotatable body having a steam supply at its rear end and a head at its front end which is inclined at an angle to the axis of the body; a rotatable nozzle having a rear or inlet portion which is pivoted in said head and adapted to be rotated in the plane thereof and a front or outlet portion which is arranged at an angle to the plane of rotation of the nozzle, and means for rotating said body and nozzle in the same direction at different rates, substantially as set forth.

7. A boiler tube cleaner comprising a rotary body having a steam inlet, a discharge nozzle pivoted on said body at an angle to the axis thereof and having an outlet nozzle which is arranged at an angle to the axis of its pivot, means for rotating the body, and means for rotating the nozzle including intermeshing gears one of which rotates concentric with the axis of the body and the other concentric with the axis of said nozzle, substantially as set forth.

8. A boiler tube cleaner comprising a rotary body having a steam inlet, a discharge nozzle pivoted on said body at an angle to the axis thereof and having an outlet nozzle which is arranged at an angle to the axis of its pivot, means for rotating the body, a shaft arranged axially within said body, and inter meshing gear wheels connected with said nozzle and shaft, substantially as set forth.

9. A boiler tube cleaner comprising a rotatable body having a steam supply at its rear end and a head at its front end which is inclined at an angle to the axis of the body, a rotatable nozzle having a rear or inlet portion which is pivoted in said head and adapted to rotate in the plane thereof and a front or outlet portion which is arranged at an angle to the plane of rotation of the nozzle, an external flange arranged at the inner end of said nozzle and bearing against the inner side of said head, a shaft arranged axially in said body, and provided at its front end with an open head, and intermeshing gears arranged on said open head and flange, substantially as set forth.

10. A boiler tube cleaner comprising a rotatable body having a steam supply at its rear end and a head at its front end which is inclined at an angle to the axis of the body, a rotatable nozzle having a rear or inlet portion which is pivoted in said head and adapted to rotate in the plane thereof and a front or outlet portion which is arranged at an angle to the plane of rotation of the noz-

zle, a shaft operatively connected with the body, another shaft operatively connected with the nozzle, and means for turning said shaft differentially, substantially as set forth.

11. A boiler tube cleaner comprising a rotatable body having a steam supply at its rear end and a head at its front end which is inclined at an angle to the axis of the body, a rotatable nozzle having a rear or inlet portion which is pivoted in said head and adapted to rotate in the plane thereof and a front or outlet portion which is arranged at an angle to the plane of rotation of the nozzle, a shaft operatively connected with the body, another shaft operatively connected with the nozzle, and means for turning said shaft differentially, consisting of a pair of different sized driving gear wheels meshing with a pair of different sized driven gear wheels on said shafts, respectively, substantially as set forth.

12. A boiler tube cleaner comprising a tubular body composed of a rear fixed section and a front section capable of longitudinal and rotary movement relatively to the rear section, a hollow main shaft arranged axially in the rear body section, means constructed to compel said front body section to turn with the hollow shaft but permit the same to move lengthwise thereof, a nozzle pivoted on said front body section at an angle to the axis thereof and having its outlet arranged at an angle to the axis of its pivot, a nozzle shaft arranged within the hollow shaft, and gearing connecting the nozzle and nozzle shaft, substantially as set forth.

13. A boiler tube cleaner comprising a tubular body composed of a rear fixed section and a front section capable of longitudinal and rotary movement relatively to the rear section, a hollow main shaft arranged axially in the rear body section, means constructed to compel said front body section to turn with the hollow shaft but permit the same to move lengthwise thereof, a nozzle pivoted on said front body section at an angle to the axis thereof and having its outlet arranged at an angle to the axis of its pivot, a nozzle shaft arranged within the hollow shaft, gearing connecting the nozzle and nozzle shaft, and differential driving mechanism connected with said shaft, substantially as set forth.

14. A boiler tube cleaner comprising a tubular body composed of a rear fixed section, and a front section capable of longitudinal and rotary movement relatively to the rear section, a hollow main shaft arranged axially in the rear body section, means constructed to compel said front body section to turn with the hollow shaft but permit the same to move lengthwise thereof, a nozzle pivoted on said front body section at an angle to the axis thereof and having its outlet arranged at an angle to the axis of its pivot, a nozzle shaft arranged within the hollow shaft, gearing connecting the nozzle and nozzle shaft, and a spring operating to yieldingly hold said nozzle shaft and connecting parts in their outermost position, substantially as set forth.

15. A boiler tube cleaner comprising a tubular body composed of a rear fixed section and a front section capable of longitudinal and rotary movement relatively to the fixed section, a hollow main shaft journaled in the outer end of the fixed section but held against axial movement, a coupling connecting the front section of the body and the hollow shaft and constructed to compel the front section to turn with the hollow shaft but permit the same to move lengthwise independent thereof, a nozzle pivoted on the front body section at an angle to the axis thereof and having its outlet at an angle to the axis of its pivot, a central nozzle shaft arranged in the hollow main shaft and capable of rotary and longitudinal movement, gearing connecting said nozzle and nozzle shaft, a driven gear wheel secured to the outer end of the main shaft, a driven gear wheel splined on the nozzle shaft and two driving gear wheels meshing with the driven gear wheels of the main and nozzle shafts said gear wheels being constructed to rotate said shafts at different rates while the driving gear wheels rotate in unison, substantially as set forth.

16. A boiler tube cleaner comprising a tubular body composed of a rear fixed section and a front section capable of longitudinal and rotary movement relatively to the fixed section, a hollow main shaft journaled in the outer end of the fixed section but held against axial movement, a coupling connecting the front section of the body and the hollow shaft and constructed to compel the front section to turn with the hollow shaft but permit the same to move lengthwise independent thereof, a nozzle pivoted on the front body section at an angle to the axis thereof and having its outlet at an angle to the axis of its pivot, a central nozzle shaft arranged in the hollow main shaft and capable of rotary and longitudinal movement, gearing connecting said nozzle and nozzle shaft, a driven gear wheel secured to the outer end of the main shaft, a driven gear wheel splined on the nozzle shaft, and two connected driving gear wheels pivoted on the fixed body section paralled with said shafts and meshing respectively, with the driven gear wheels of the hollow and central shafts, the two pairs of gear wheels being constructed to product a differential rotation of said shaft during a uniform rotation of said driving gear wheels, substantially as set forth.

17. A boiler tube cleaner comprising a tubular body composed of a rear fixed section and a front section capable of longitudi-

nal and rotary movement relatively to the fixed section, a hollow main shaft journaled in the outer end of the fixed section but held against axial movement, a coupling connecting the front section of the body and the hollow shaft and constructed to compel the front section to turn with the hollow shaft but permit the same to move lengthwise independent thereof, a nozzle pivoted on the front body section at an angle to the axis thereof and having its outlet at an angle to the axis of its pivot, a central nozzle shaft arranged in the hollow main shaft and capable of rotary and longitudinal movement, an open head secured by a screw joint to the front end of said central shaft, gearing operatively connecting said open head and nozzle, a driven gear wheel secured to the main shaft, a driven gear wheel splined to the central shaft, two connected driving gear wheels meshing with said driven gear wheels, respectively, the gear wheels of both pairs being constructed to produce a differential rotary movement of said shafts, and a crank having its hub and one of said driving gear wheels connected by a coöperating tooth on one part engaging with a recess in the other part, the front sides of said tooth and recess being abrupt and while the rear sides thereof are inclined, substantially as set forth.

18. A boiler tube cleaner comprising a rotatable body or carrier having a steam inlet at its outer or rear part, a steam delivery nozzle mounted on the inner or front part of the body and adapted to be rotated with said body and also movable laterally relatively to the axis thereof, and means for adjusting said nozzle extending from the interior to the exterior of said body, substantially as set forth.

19. A boiler tube cleaner comprising a tubular body composed of a fixed rear or outer section and a movable front or inner section, a spring operating to hold said front section yieldingly in its retracted rearward position, and a connection between said front section and said spring extending from the interior to the exterior of said rear body section, substantially as set forth.

20. A boiler tube cleaner comprising a tubular body composed of a fixed rear or outer section having a steam inlet at its rear end and a front or inner section which is movable lengthwise of the rear section and provided with a steam outlet at its front end, a rod arranged centrally in the body sections and slidable through the rear end of said rear section while its front end is operatively connected with said front section so that the same are compelled to move together lengthwise, and a spring surrounding said rod outside of the body and bearing against a shoulder thereon at the outer end thereof, substantially as set forth.

Witness my hand this 29th day of May, 1906.

ROBERT O. HODGE.

Witnesses:
C. F. GEYER,
E. M. GRAHAM.