

(No Model.)

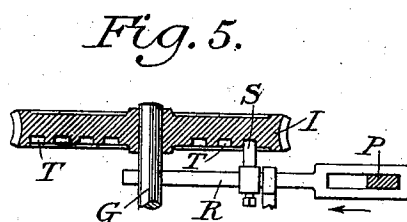
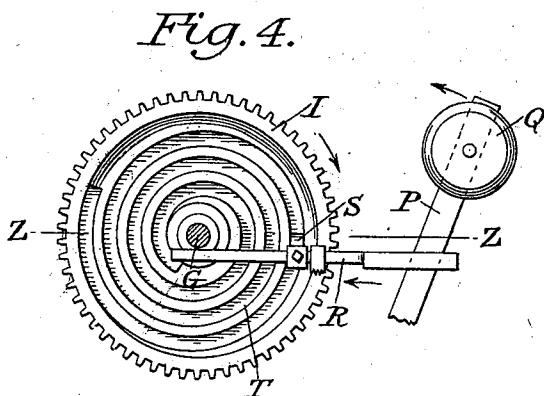
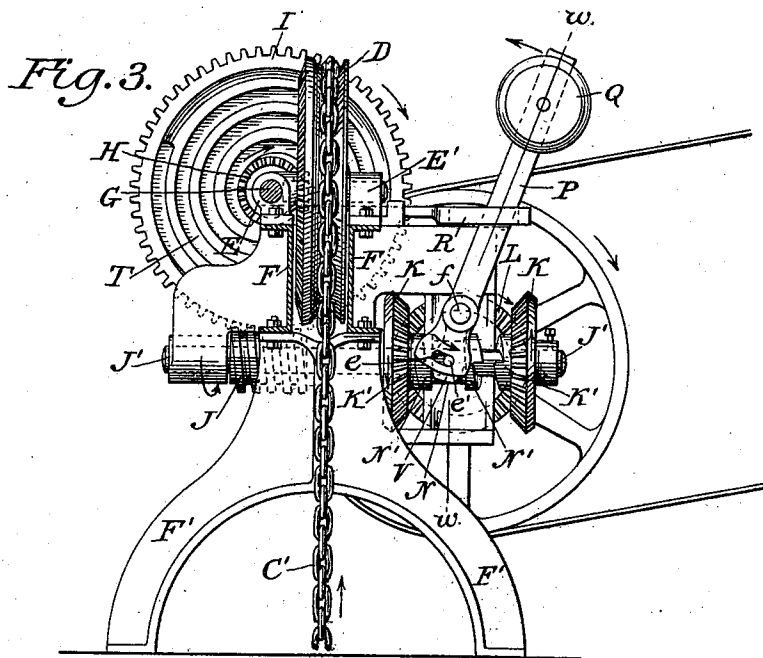
2 Sheets—Sheet 2.

G. H. BURPEE.

TUBE SCRAPER FOR FEED WATER HEATERS.

No. 502,223.

Patented July 25, 1893.



Attest:

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UNITED STATES PATENT OFFICE.

GEORGE H. BURPEE, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN FUEL ECONOMIZER AND ENGINEERING COMPANY, OF SAME PLACE.

TUBE-SCRAPER FOR FEED-WATER HEATERS.

SPECIFICATION forming part of Letters Patent No. 502,223, dated July 25, 1893.

Application filed March 9, 1891. Serial No. 384,258. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. BURPEE, of the city, county, and State of New York, have invented certain new and useful Improvements in Tube-Scrapers for Feed-Water Heaters; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to the automatic, tube-scraping devices in feed-water heaters or "fuel-economizers" for use in connection with large furnaces for steam-boilers, and to the mechanism for operating the scrapers.

It has for its object to so simplify the construction of the scrapers and their operative mechanism as to reduce the cost and increase the efficiency thereof.

It consists in the novel construction and combination of the several parts of said scraping mechanism substantially as hereinafter described and claimed.

In the accompanying drawings:—Figure 1 is an end view of a feed-water heater fitted with my invention, with its end wall removed to disclose the heating tubes, and the clutch device in the mechanism for actuating the scrapers shown in vertical section upon the line *w—w* of Fig. 3. Fig. 2 is a cross-section, in line *y—y* of Fig. 1, illustrating the arrangement of the scrapers for one section of the heating-tubes. Fig. 3 is a cross-section in line *x—x* of Fig. 1, the driving-mechanism by which the scrapers are actuated being shown in elevation. Fig. 4 is an elevation in detail of the spiral cam-face of the wheel by which the clutch-lever is operated and Fig. 5 is a cross-section on the line *z—z* of Fig. 4.

Similar letters indicate like parts in all of the figures.

The first part of my invention relates to the scrapers for the heating-tubes. These scrapers consist of curved plates A, A', each the section of a cylinder, and each adapted to conform to and closely embrace one-third of the circumference of a heating-tube, so that three of the scraping-plates when assembled upon a heating-tube will completely encircle the same, as shown in Figs. 1 and 2. The two curved plates A and A' for each

scraper are connected by a coupling-bar A² and are supported against a heating-tube W to travel longitudinally upon it, by means of a frame composed of a central bar B, (see Fig. 2) adapted to pass between the double row of tubes in each section of the water-heater or "economizer" and having cross arms B' B' projecting therefrom to extend in each direction between the tubes of each row. An exterior central lug *a*, is formed preferably midway the length, of the coupling bar A² of each scraper to project out far enough to rest either upon the bar B, or the end of one of the arms B' B' of the supporting-frame as the case may be, the ends of the arms being severally forked to bring them in position to provide a suitable bearing for the lugs. In order that the lugs projecting from the scrapers located on opposite sides of the central bar B of the frame may rest thereon side by side without interference, so that the lugs may be made long enough to have a secure bearing on the central bar without increasing the space between adjacent rows of tubes, the forked ends of the cross-arms are made of unequal length, so that the lugs on the remaining two scrapers which embrace the tubes on opposite sides of the bar may find proper support upon said arms without requiring any change in the position of the lugs on the respective scrapers. The scrapers are all made to correspond in every particular so as to be duplicates, and, by means of the arms B' B' having forked ends of unequal length in the supporting-frame may all be interchanged upon the tubes. Preferably the frame is made double or in two thicknesses, to be united by bolts *b* as shown in Figs. 1 and 2 so that the lugs *a*, *a*, may be clasped between them. Each scraper frame is fitted with a central rod C to which is attached a chain C', carried over a pulley D, mounted above the tubes upon an axis parallel with the length of the scraper-frame and of such diameter as that the chain carried over it for one section of the heating-tubes shall drop into position for attachment to the central rod C of the scraper-frame for the next section. The scraper-frames for the several sections are thus suspended in pairs, each pair upon a single chain carried over the one pulley, so that, as the pulley revolves in

either direction, one of the frames with its scrapers shall be drawn upward over the one set of tubes while the other frame will be allowed to drop upon its set of tubes. By reversing the movement of the pulley at proper intervals all the scrapers are made to travel continuously back and forth, up and down, over the entire length of the tubes, so as to prevent any accumulation or incrustation of soot or rust thereon. Should any scraper become blocked the pulley actuating the pair to which it belongs will slip under its chain and so permit the other scrapers to continue their reciprocations though with an increased strain upon the motor.

The bearing blocks E, E', for the journals of the several chain-pulleys D, D, are supported upon two channel-irons or beams F, F', extending the length of the heater, and these are mounted at each end upon brackets F', F', (see Fig. 3) resting upon the top of the heater. The bearing-block E at one end of each pulley-axle is so formed, as shown in Fig. 3, as to furnish a bearing for a shaft G, which is made to extend at a right angle with the pulley axles, from end to end of the heater. Beveled pinions H, H, are secured upon this longitudinal shaft G, to engage beveled teeth formed upon the face of each chain-pulley D, so that, by the rotation of the shaft G, all the pulleys will be made to revolve in unison. The shaft G is provided at one end with a large worm-wheel I secured thereto to gear with a worm J upon one end of a counter-shaft J', mounted in suitable bearings under the channel-beams F, F, and upon whose opposite end are fitted two idle bevel-wheels K, K, geared to a bevel-wheel L, upon the driving-shaft M, of the machine so as to be revolved continuously thereby each in an opposite direction. Between the two idle-wheels K, K, a collar N is fitted to slide loosely upon the shaft J', to which it is however keyed by a spline *t*, (see Fig. 1) so as to revolve therewith, although free to move longitudinally thereon. At each end of this sliding-collar N are secured notched disks N' (see Fig. 3) adapted to engage, as a clutch, a counterpart notched disk K', on the hub of the opposite idle-wheel K, so that, by sliding the collar N in the one direction or the other, the shaft J' may be coupled to the one loose or idle driving-wheel K, or the other, and be thereby made to rotate in the direction corresponding with that of the wheel with which it is thus coupled. The clutch is automatically shifted from the one loose driving-wheel to the other at the moment the scrapers have reached the ends of the tubes over which they travel, so as to reverse the direction of rotation of the shaft J', and of the chain-pulleys D, D, geared thereto in manner as described, by the action of a reversing lever P pivoted intermediate the wheels K, K, above the clutch-collar N to oscillate in a vertical plane, its lower end below its pivot being transversely slotted as at *e*, to receive a pin *e'*,

projecting from a forked shifting-yoke V, pivoted to swing on the pin *f* serving as a pivot for the lever P, and to embrace the collar N between its clutch disks N'. The slot *e*, is so extended as to allow a slight play of the lever independently of the pin, which, when the end of the slot is reached thereby, operates, under the continued movement of the lever in that direction, to carry the yoke, collar and clutch with it. The longer, upper end of the lever is fitted with a weight Q to enforce its movement in either direction from a vertical position. The movement of the reversing-lever P beyond the vertical in each direction is produced by means of a horizontal sliding-rod R mounted in suitable ways and slotted at its outer end to embrace the lever as shown in Fig. 5. This sliding-rod is made to extend across in front of the face of the worm-wheel I, parallel therewith, and carries an adjustable finger S adapted to enter and engage a spiral groove or scroll T, formed in the face of the worm-wheel and encircling its axis, (see Fig. 4.) The engagement of the finger S with the scroll or spiral cam-groove T, operates, as the worm-wheel I revolves in one direction, to slide the rod R outward, and in the opposite direction, inward, and the length of the rod and the position of the finger S thereon are so adjusted with reference to the reversing-lever P, as that, when, in the revolution of the wheel I and of the chain-pulleys D, D, secured upon the same shaft, the scrapers have reached the ends of the heating-tubes, the reversing-lever will be carried over so far beyond a perpendicular line as that it will drop in that direction by its gravity and by this movement will throw the clutch out of engagement with the one idle-wheel and into engagement with the other, so as to reverse the movements of the chain-wheels and consequently of the scrapers. The slot *e*, in the lower end of the reversing-lever P, and that in the rod R through which the upper end of the lever extends, permit the lever to be brought back to a vertical position independently of the clutches. Thus, in the operation of the machine, the continuous revolution of the driving-pulley will operate to produce automatically a constant reciprocating movement of the scrapers over and upon each of the vertical tubes in the heater from end to end thereof, their movement being automatically reversed as soon as the ends of the tubes are reached thereby.

I am aware that a feed-water heater has hitherto been described as being provided with a tube-scraper in which a central bar has forked supporting-arms with ends of equal length and each scraper has thereon a supporting-lug, but the scrapers are not symmetrical with respect to a vertical line passing through the lug and the scrapers are so located with reference to each other that the bearing points of the lugs on the supporting arms and on the central bar come directly opposite each other. The consequence is that the scrapers

are not interchangeable throughout and that were the device placed upon tubes set as closely as it is now the practice to set them, the lugs which rest upon the central bar and stand
5 opposite one another would of necessity be so short as to be liable to slip off frequently. In the present case each scraper is symmetrical with respect to the vertical line passing through the lug and at the same time the
10 supporting-arms are constructed as described and the scrapers so arranged thereon as that the bearing points of the lugs on opposite sides of the supporting-arms and of the central bar are offset with respect to each other.
15 The result is that any scraper can be used in any position and in the place of any other, and at the same time the supporting-lugs can be of such length as will effectually prevent all liability of their slipping off the central
20 bar while the device is in operation.

I claim as my invention—

1. The combination in a feed-water heater of a series of vertical tubes arranged in two rows, a central bar extending horizontally between said rows, arms projecting from said
25 bar and each being forked and having diverging ends of unequal length and triple interchangeable scrapers surrounding said tubes and having each a lug on its outer face and
30 each being symmetrical with respect to a vertical line passing through said lug, the opposite lugs of the scrapers on opposite sides of said central bar having bearing points thereon offset with respect to each other and the op-
35 posing lugs of the scrapers on opposite sides of one of said forked arms having bearing points on the long and short ends respectively of said forked arms, substantially in the manner and for the purpose herein set forth.
40 2. The combination with a driving-shaft for

the chain pulleys in a feed-water heater constructed substantially as described, and a worm-wheel on said shaft, of a spiral or scroll cam upon the side face of said worm-wheel, a countershaft geared to said driving-shaft, 45 idle-wheels revolving loosely on said countershaft, a driving-wheel geared to both idle-wheels to produce their revolution in opposite directions, a clutch interposed between the two idle-wheels to engage the one or the
50 other and keyed to the countershaft, a pivoted reversing-lever operating by gravity to throw the clutch out of engagement with the one idle-wheel into engagement with the other, and a sliding-rod coupled to the lever and en- 55 gaging the spiral cam, whereby the reversing-lever is oscillated and the clutch shifted by the movement of the rod as it reaches either end of the cam in the revolution of the cam-wheels, substantially in the manner and for 60 the purpose herein set forth.

3. The combination in the reversing mechanism of a feed-water heater, with a pulley on the main shaft actuating the scrapers, a worm-wheel upon said shaft having a spiral 65 cam upon its lateral face, of a swinging yoke pivoted upon the axis of the lever having a lateral pin projecting from its lower end through a transverse slot in the end of the lever, a clutch actuated by said yoke, and a 70 driving-wheel geared to the worm-wheel by means of the clutch, substantially in the manner and for the purpose herein set forth.

In testimony whereof I have signed my name to this specification in the presence of 75 two subscribing witnesses.

GEORGE H. BURPEE.

Witnesses:

A. N. JESBERA,
E. M. WATSON.