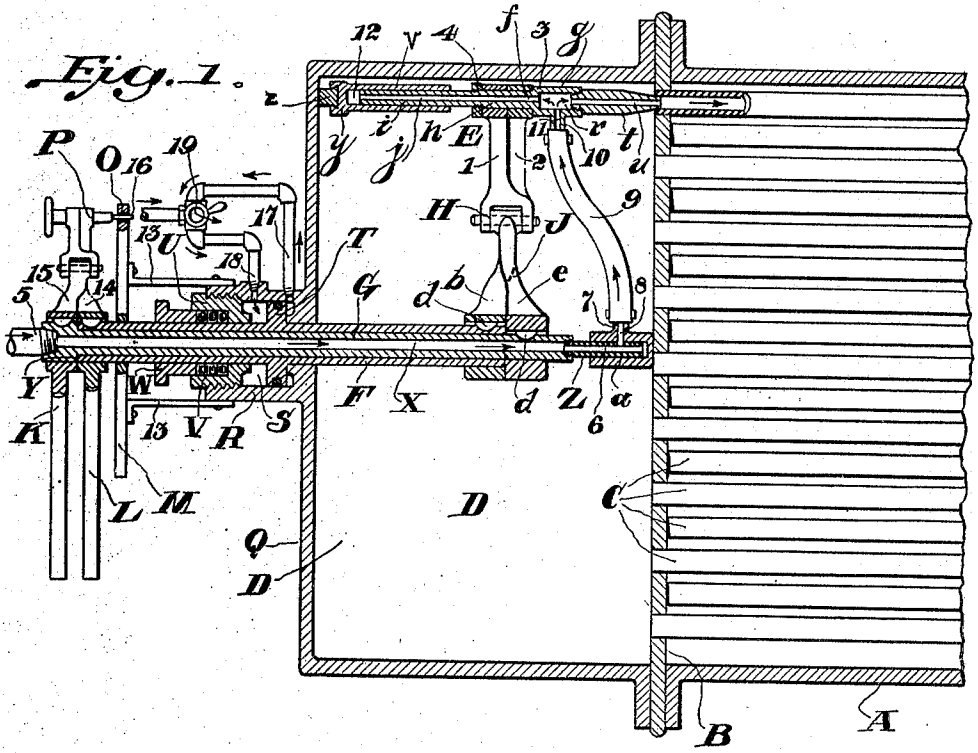
Jan. 9, 1923. 1,441,431.

J. F. KIRGAN.

TUBE CLEANER.

FILED JULY 28, 1921.

Fig. 1.



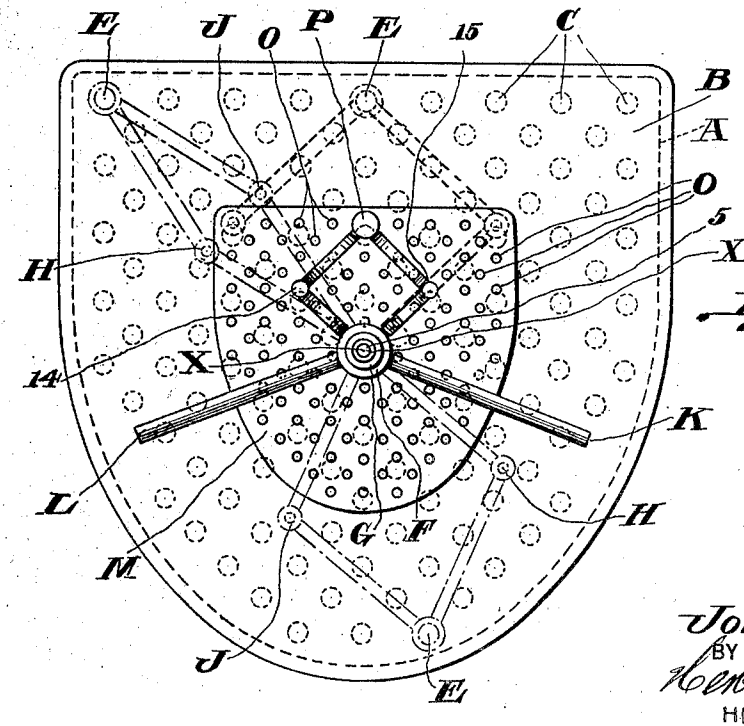


Fig. 2.

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Patented Jan. 9, 1923. 1,441,431

UNITED STATES PATENT OFFICE.

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TUBE CLEANER.

Application filed July 28, 1921. Serial No. 488,190.

To all whom it may concern:

Be it known that I, JOHN F. KIRGAN, a citizen of the United States, and a resident of Phillipsburg, county of Warren, State of New Jersey, have invented a certain Tube Cleaner, of which the following is a specification, accompanied by drawings.

This invention relates to tube cleaning devices and more particularly to a device of this kind applicable to condensers, boilers, or other apparatus having a plurality of tubes through which water or any other medium is adapted to flow for cooling or other purposes.

The tubes of a surface condenser or similar vessel in which water or any other medium circulates require frequent cleaning, due to deposits of entrained foreign matter left in the tubes, and the ordinary practice of cleaning consists in removing the water box or other enclosing part of the apparatus and exposing the ends of the tubes so that they may be attacked individually.

The objects of the present invention are to efficiently and expeditiously clean the tubes of a condenser, boiler or other tubed structure without removing any of the parts of the apparatus, enabling the cleaning device to be formed as a compact, easily assembled integral part of the condenser or other apparatus to which it may be applied, the device being permanently installed within an enclosed portion of the apparatus, such, for instance, as within the water box of a surface condenser.

A further object is to effect the adjustment and operation of a cleaning device installed as set forth by selective means located at the exterior of the apparatus.

Still further objects will hereinafter appear and to the ends set forth the invention consists in the features of construction and combinations of parts described and claimed in the following specification and shown on the accompanying drawing, forming a part hereof.

One preferred practical embodiment of the invention is shown in the annexed drawings, in which

Figure 1 is a vertical longitudinal sectional view of a portion of a surface condenser showing the several parts of the cleaning device in operative position; and

Figure 2 is an end view showing the tube cleaning device in various adjusted positions and also the selective means for effecting the adjustment and operation of the cleaning device.

I have illustrated in the drawings one end of a vessel, specifically shown as a surface condenser, the cylindrical shell A of which is closed at the ends by tube sheets B, only one of the tube sheets being shown herein. Between the tube sheets B extend a plurality of rows, or a nest, of tubes C, which may be arranged in any desired order or relationship. A water box or chamber D forming a part of the water circulating system of the condenser is bolted or otherwise secured to the shell A so that it surrounds the ends of the tubes, the above representing a conventional showing of a device of this kind.

In its essential characteristics the invention includes, in the preferred form herein shown and described, a tube cleaning device E within the water box D and adjustably mounted on a pair of tubular concentric rotatable shafts F and G by means of a plurality of toggle levers H and J, forming, in effect, an arrangement of rotatable lazy tongs or crossed levers. The shafts F and G are rotated by means of handles or levers K and L, respectively, secured to the ends of the shafts, and the entire tube cleaning device E is separately movable in any radial plane or circular plane, or movable simultaneously in said planes or in any direction by rotation of the shafts F and G as a unit or relatively to each other, or both, so that the device may reach all the tubes C one at a time. Exteriorly located and operated selective means in the form of a master index or guide plate M having indicia O corresponding to each of the tubes C and an indicator P movable with and operated by the same means and in the same manner as the tube cleaning device are provided to effect exact alignment of the tube cleaning device with the tube which corresponds to the particular indicia on the guide plate in registry with the indicator.

The head Q of the water box is provided with an outwardly projecting central cylinder R which may be mounted or cast therein and having a comparatively shallow bore or chamber S. The shafts F and G are mounted to reciprocate in the cylinder R their ends

passing through the wall or head Q of the water box or chamber D. A piston T on the outer tubular shaft F is adapted to reciprocate in the bore S in order to move the cleaning device forward and back in the water box and clamp the cleaning device firmly against the tube sheet. The end of the cylinder is closed by a threaded bushing U screwed into the outer end of the cylinder R, packing V and a gland W maintaining a fluid tight connection around the outer shaft F. The inner end of the bushing U and the water box head Q thus form the ends of the cylinder R.

The inner shaft G is hollow, forming a conduit X and it is of slightly greater length than the outer shaft F. At one end the inner shaft G is increased in diameter somewhat, forming an annular shoulder Y against which the end of the outer shaft F abuts. At the opposite end the inner shaft G projects slightly beyond the end of the outer shaft F and into this end is screwed a tube Z which is fixedly secured in a cap *a* adapted to abut against the tube sheet when fluid pressure is supplied to the cylinder R for moving the shafts and tube cleaning device forwardly.

On the end of the outer shaft F within the water chamber D I secure one arm *b* of the toggle lever H by means of a key *d* or otherwise and a similar arm *e* forming part of the toggle J is secured to the portion of the inner shaft G projecting beyond the end of the outer shaft F so that the base of the toggle lever J engages the end of the outer shaft F. The outer concentric shaft F is thus held on the inner shaft G by means of the annular shoulder Y and the toggle lever J and relative longitudinal movement between the shafts is thereby prevented.

The nozzle portion of the tube cleaning device consists of a longitudinal tube *f* having portions *g*, *h* and *i* of graduated diameters provided with a central longitudinal bore *j*, the larger diametered body portion *g* having a fluid chamber *r*. A nozzle *t* is screwed into the end of the body portion *f* at one end of the chamber *r*, this nozzle having a central bore *u* communicating with the chamber *r* and aligned with the bore *j* of the body portion *f*. The opposite smaller diametered end *i* of the body portion *f* telescopes into a cylindrical cap *v*, the end *y* of this cap *v* being provided with a cushion or buffer *z* of rubber or other resilient material adapted to abut against the inner wall of the head Q.

A pair of oppositely swinging toggle arms 1 and 2 are pivoted on the central body portion *h*, the forward arm 2 abutting against an annular shoulder 3 at the end of the portion *g*, and are secured by means of a nut 4 threaded on the end of the central portion *h*. The arms 1 and 2 are freely rotatable on the portion H and their free ends are pivoted to the toggle arm portions *b* and *e* respectively, thus forming a reversely acting double toggle joint construction adapted to act in the manner or lazy tongs.

The concentric arrangement of the shafts F and G enables the tube cleaning device proper to be adjustable radially of the tube sheet B, this being accomplished by rotative movement of the shafts F and G relatively to each other, and the device is adjustable in a circular plane by rotative movement of the shafts F and G as a unit, movement of the shafts being effected by proper manipulation of the handles K and L.

Water is the medium usually employed for cleaning the tubes and this is supplied to the cleaning device from any suitable source, indicated in the present instance as a pipe 5 connected to the end of the inner shaft G, the pipe 5 leading to the conduit X extending through the inner shaft G, this conduit X communicating with the bore 6 of the tube *z* in the cap *a*. The cap *a* is provided with a connection 7 at right angles to the tube Z, the connection having a bore 8 communicating with the bore 6 in the tube Z. A flexible connection is required between the cap *a* and cleaning device E on account of the relative movement between these parts, and this is provided in the form of a flexible pipe or hose 9 extending from the connection 7 in the cap *a* to a connection 10 provided on the large diameter portion *q* of the cleaning device proper, this connection 10 having a bore 11 communicating with the chamber *r* within the large diameter portion *g*.

From the chamber *r* the fluid under pressure is distributed to the bore *j* in the body portion *f* from whence it passes to the bore 12 in the cap and acts hydraulically to extend the telescopic cap *v*, causing the cap to tightly engage the wall Q of the chamber D and the nozzle *t* to enter the tube, the nozzle thus being held in the tube under the pressure of the fluid so that a fluid tight connection is formed between the nozzle and tube and at the same time the tube cleaning device is rigidly supported in exact aligned position. The fluid then flows from the nozzle in a jet under the full pressure for scavenging and cleaning the tube.

The master keyboard index or guide plate M is mounted on the cylinder R by suitable brackets 13. This guide plate may be of the same general conformation as the end of the condenser or other apparatus. It is provided with suitable indicia, in the form of perforations or holes O corresponding to the tubes terminating at the tube sheet B, the holes O being laid out in exact ratio to the tubes C in the present instance a ratio of about 1 to 2 being observed. Each tube C thus has a hole O corresponding to it.

The indicator P operating in conjunction

with the guide plate M is mounted on the shafts F and G by means of toggle levers 14 and 15 in the same manner as the tube cleaning device, the lever 15 being keyed or otherwise secured to the enlarged portion of the inner shaft G and the lever 14 being similarly secured on the end of the outer shaft F abutting against the enlarged portion Y of the shaft G. These toggles 14 and 15 are arranged to bear the same ratio to the toggles of the tube cleaning device as the indicia on the guide plate bears to the tubes, the toggles of the indicator and cleaning device constituting a pantograph.

From the above it will be seen that rotation of the shafts F and G by means of the handles L and M will simultaneously correspondingly actuate the tube cleaning device and indicator, effecting alignment of the indicator with any desired aperture or indicia on the guide plate and alignment of the cleaning device with the individual tube corresponding to said aperture.

When the indicator has been brought into alignment with the proper indicia on the guide plate, pressure fluid is admitted to the cylinder R behind the piston T, moving the shafts F and G, and hence the tube cleaning device and indicator forwardly, so that the pointer 16 of the indicator enters the aperture O, the cap *a* engages the tube sheet B, and the nozzle *t* penetrates into the tube C, all these parts thus being simultaneously locked in operative position. Cleaning fluid under pressure is then admitted to the tube cleaning device in the manner already described to actuate the telescopic support for the tube cleaning device and clean the tube.

In the actuation of the piston T as just set forth fluid pressure, for instance compressed air, is admitted to and exhausted from the ends of the chamber S of the cylinder R through forward and rearward conduits 17 and 18, respectively, passage of the fluid through these conduits being controlled by a three way valve 19 of any desired form. In the position shown the valve is adjusted to admit fluid to the rearward conduit 18 and to the chamber S behind the piston T, the fluid in the forward portion of the chamber S in front of the piston being exhausted through the forward conduit 17 and passing to atmosphere through the centre of the valve 19, the course of the fluid being indicated by the arrows on Figure 1 of the drawings.

When the shafts F and G are to be moved away from the tube sheet B the valve 19 is adjusted to reverse the flow, the fluid entering through the forward conduit 17 and exhausting through the rearward conduit 18 in the same manner. The details of the valve 19 form no part of the present invention as any desired form of valve performing this function may be employed.

In Figure 2 I have indicated various adjusted positions of the toggles showing the broad range of travel for the cleaning device which my arrangement affords.

I claim:

1. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a cleaning device adjustably mounted in said chamber and selective means including separate indicia corresponding to individual tubes for effecting alignment of said cleaning device with individual tubes to be cleaned.

2. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a tube cleaning device adjustably mounted in said chamber, and means comprising a guide plate having separate indicia corresponding to individual tubes to be cleaned, an indicator, and means for setting said indicator for effecting alignment of the cleaning device with desired individual tubes.

3. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a tube cleaning device adjustably mounted in said chamber, means for conducting fluid to said cleaning device and selective means for effecting alignment of the cleaning device with individual tubes to be cleaned, said selective means comprising a guide plate having indicia corresponding to the tubes and an indicator operating conjointly with said cleaning device, and means for setting said indicator.

4. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a tube cleaning device adjustably mounted in said water box and exteriorly operated selective means having separate indicia corresponding to individual tubes, for effecting alignment of said cleaning device with individual tubes to be cleaned.

5. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a tube cleaning device having a nozzle adjustably mounted in said water box, means for conducting fluid to said cleaning nozzle and exteriorly operated selective means comprising a guide plate having separate indicia corresponding to individual tubes and an indicator for effecting alignment of said cleaning nozzle with individual tubes to be cleaned, and means for locking the cleaning nozzle in position.

6. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a cleaning device adjustably mounted in said water

box and exteriorly operated selective means having separate indicia corresponding to individual tubes for effecting alignment of said cleaning nozzle with individual tubes to be cleaned and means for locking the cleaning device in aligned position.

7. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a tube cleaning device adjustably mounted in said water box, means for conducting fluid to said cleaning device and exteriorly operated selective means for aligning said cleaning device with individual tubes to be cleaned, and fluid actuated means for locking the cleaning device in aligned position.

8. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a pair of concentric rotatable shafts passing through said water box, toggle levers on the portion of the shaft within the water box, a tube cleaning device mounted on said levers and selective means for effecting alignment of the cleaning nozzle with individual tubes to be cleaned.

9. In combination with a condenser or the like having a plurality of water tubes in the condensing chamber and a water box in communication with said tubes, a pair of concentric rotatable shafts passing through said water box, toggle levers on the portion of the shaft within the water box, a tube cleaning device mounted on said levers and selective means acting conjointly with said cleaning device for effecting alignment of the cleaning nozzle with a tube indicated by said selective means.

10. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shafts, a tube cleaning device mounted on said levers contiguous to the tubes, a guide plate having indicia corresponding to the tubes, and an indicator operating conjointly with said cleaning device to effect alignment of the cleaning device with a tube corresponding to the indicia in register with said indicator.

11. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shafts, a tube cleaning device mounted on said levers contiguous to the tubes, a guide plate having indicia corresponding to the tubes, and an indicator also mounted on said shafts and operating conjointly with said cleaning device for effecting alignment of the cleaning device with a tube corresponding to the indicia in register with said indicator, and means for locking the cleaning device in operative position.

12. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a guide plate having indicia corresponding to said tubes, a cleaning device adjustably mounted in said chamber, an indicator pointer operating in conjunction with said guide plate and adjustable in correspondence with said cleaning device to effect alignment of said cleaning device with individual tubes to be cleaned.

13. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a tube cleaning device adjustably mounted in said chamber, means for conducting fluid to said cleaning device, a guide plate having apertures corresponding to the tubes and an indicator adjustable in correspondence with said cleaning device and means for setting said indicator to simultaneously effect alignment of the indicator with an aperture in the guide plate and alignment of the cleaning device with the individual tube corresponding to said aperture.

14. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shafts, a tube clearing device mounted on said levers contiguous to the tubes, a guide plate having an aperture corresponding to each tube and an indicator operating conjointly with said cleaning device and adapted to register with an aperture in the guide plate to effect alignment of the cleaning device with a tube corresponding to the aperture in register with said indicator.

15. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shafts, a tube cleaning device mounted on said levers contiguous to the tubes, a guide plate having an aperture corresponding to each tube, an indicator also mounted on said shafts, said indicator operating conjointly with said cleaning device and being adapted to register with an aperture in the guide plate to effect alignment of the cleaning device with a tube corresponding to the aperture in register with said indicator and means for locking the cleaning device in operative position.

16. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shaft, a cleaning device mounted on said

levers, said cleaning device having a fluid discharge nozzle, a guide plate having indicia corresponding to the tubes, an indicator also mounted on said shafts and operating conjointly with said cleaning device to effect alignment of the cleaning device with a tube corresponding to the indicia in register with said indicator, means for moving said shafts longitudinally to lock the cleaning device in adjusted position, and means for conducting cleansing fluid under pressure to the cleaning device, said cleaning device being longitudinally extensible to provide a fluid tight connection between the nozzle and tube.

17. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, a pair of concentric rotatable shafts passing through the wall of said chamber, toggle levers on said shaft, a longitudinally extensible cleaning device mounted on said levers, said cleaning device having a fluid discharge nozzle, a guide plate having apertures corresponding to the tubes, an indicator operating conjointly with said cleaning device to effect alignment of the cleaning device with a tube corresponding to the aperture in register with said indicator, fluid actuated means for moving said shafts longitudinally to lock the cleaning device in adjusted position, and means for conducting cleansing fluid under pressure to the cleaning device to effect longitudinal extension of the cleaning device and provide a fluid tight connection between the nozzle and tube during discharge of cleansing fluid from the nozzle.

18. In combination with a casing having a plurality of tubes, a cleaning device adjustable across the ends of said tubes, a guide plate having separate indicia corresponding to individual tubes and an indicator movable with said cleaning device and adapted to register with said indicia for selectively aligning said cleaning device with individual tubes to be cleaned.

19. In combination with a casing having a plurality of tubes and a chamber surrounding the ends of said tubes, shafts passing through the wall of said chamber, toggle levers on said shafts, a tube cleaning device mounted on said levers contiguous to the tubes and means operating conjointly with said cleaning device to effect alignment of the cleaning device with any individual tube desired to be cleaned.

In testimony whereof I have signed this specification.

JOHN F. KIRGAN.