A HYDRAULIC METHOD OF CLEANING THE FIRE SIDE OF BOILER TUBES.

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Various methods and many appliances for removing the dirt, scale and other impurities that accumulate on the interior of boiler tubes and drums have been developed. As a result the watersides of water-tube boilers are, generally speaking, well preserved and the life of a boiler now is much longer than it was years ago.

On the other hand, practically the only device that has been satisfactorily developed for preventing the accumulation of soot on the tubes is the soot blower. However, this does not always keep the tubes and the spaces between them perfectly clean, and in time a certain amount of material, rich in sulphur and acids, may accumulate locally between the tubes. In most plants, afloat or ashore, the operating personnel remove this accumulation by routine cleaning after the boiler has steamed a specified number of hours, using special saws, lances, picks, etc.—a slow, laborious and not overly efficient method at the best. Some marine engineers, realizing the deficiencies of this method, periodically remove the boiler side casings to make the tubes more accessible and permit a thorough cleaning and removal of deposits.

A quick and efficient method of cleaning the firesides of tubes was recently developed by an officer of the United States Navy. It is a hydraulic method and consists of washing the tubes with hot fresh water under pressure. The method is an outgrowth of the keen competition in engineering performance among the ships of the Navy. The engineer officers, realizing the detrimental effect that dirty fire sides have on economy, spend much time and labor removing the soot, scale and other impurities, and the desire to accomplish this work without sacrificing other important items of upkeep work, led to investigating the feasibility of dissolving the deposits in some easily obtainable and inexpensive medium. It developed that hot water would answer, so a practical method of applying it was worked out.

The apparatus in its present state of development is particularly adapted for use on express-type boilers of Yarrow design, but it can readily be adapted for use on other types of boilers, by a slight modification either of the boiler casing or of the apparatus itself. In some types the unobstructed tube lanes run the length of the boiler. Under these conditions of design a cleaning panel would have to be installed in the front end of the boiler and the apparatus worked from that end instead of from the furnace side, as is described later.

In general the apparatus consists of a cleaning nozzle, or lance, connected through a hose, a water heater and a pressure pump to a source of fresh water, and of appliances for preventing the water from striking the brickwork or the casing insulation. Provision is also made for draining the mixture of fresh water and deposits from the interior of the boiler. An outline of the various parts, as well as the assembled apparatus and instructions for use, is given in the following paragraphs.

Figure 1 shows the various types of cleaning nozzles, or lances, which are short lengths of piping, one end of which is connected to a hose leading to a source of fresh water, while the other end is perforated. These perforations are of such size that their combined area is not greater than the cross-sectional area of the lance. This is necessary in order that the streams emitted will be under sufficient pressure to attack the deposits. As only a small amount of water is used in cleaning a boiler, any water heater that will raise the temperature of 250 gallons of water 125 degrees F. in an hour can be used. One that can be readily constructed by the operating force is shown in Figure 2.

The combination drain trough and screen, Figure 3, consists of canvas cut to fit around the fire-side row of tubes and is fitted with side flaps to prevent water running over the edges. It has two drain holes for connections leading to the drain lines.

Figure 4 shows the drain trough connection to the lower drum of the boiler. It is made watertight by means of the packing bar, Figure 5, part 1; the channel bar, part 2; swing bolts, Figure 6, part 1; and tube clamps, part 2.

The packing bar is an ordinary piece of ¾-inch channel bar cut to suit the length of the lower drum of the boiler. The web of this bar is drilled to take 3/16-inch bolts, spaced six inches between centers. Soft rubber packing is placed between the flanges in such a manner that it extends beyond the flanges for a distance of at least a quarter of an inch. The other channel bar is of the same size as the packing bar, and holes are drilled in its web that will fair up with those drilled in the packing bar. The tube clamp is a clamp that has one end of each face curved to fit around the tubes of the boiler and the other end made flat to take the flat part of the swing bolt. The flanges of this clamp are drilled to take two ½-inch bolts, one of which is used to hold the swing bolt in place and the other to act as the pivot point of the swing bolt. The swing bolt is made in two pieces, one part being a bracket and the other a bolt. The flat end of the bracket fits between the flanges of the tube clamp, and the other end is drilled and tapped to take the bolt used for holding the packing bar against the drum.

In making the trough connection to the drum, the trough gasket connection is made first by placing the free end of the canvas between the webs of the channel and packing bars. Next, the bolts are installed in the web and then set up, making a watertight joint with the canvas acting as a gasket. The packing bar is then placed against the drum, the tube clamps and the swing bolts placed in position and the joint between the drum and the packing bar made by setting up on the swing bolts.

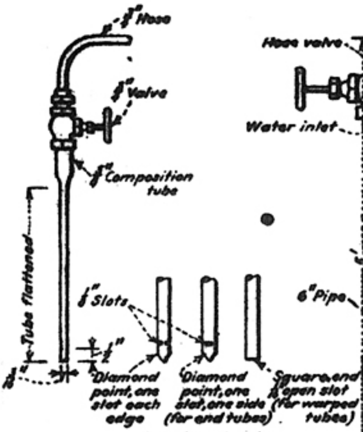
When this method is used, the apparatus is set up as shown in Figure 7. A staging is then rigged in the furnace of the boiler, and the operator stands on this and works over the top of the screen. The lance is placed in one of the tube lanes and the water is then turned on. After the lance has been moved back and forth several times, the water is shut off and the lance is shifted to another tube lane. The process is repeated until the water draining from the tube bank runs clear. The tubes are then blown with compressed air. After this is done, the apparatus is removed from the boiler and a slow fire lighted and maintained for a sufficient length of time to insure that all parts have been thoroughly dried.

PRECAUTIONARY MEASURES.

The following precautions should be observed when this method of boiler cleaning is used.

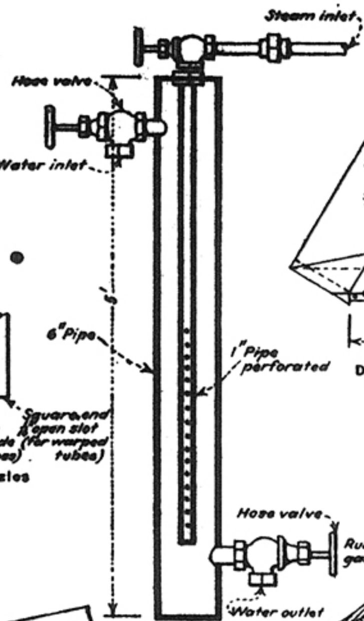
1. The drum surface in the wake of the packing bar must be wire brushed and scraped and every effort made to obtain a watertight joint between the drum and the trough. Several inspections should be made while the cleaning is in progress to determine if any leaks have started. Any that do develop should be stopped immediately.

2. The nozzle valves, or lances, should be so selected that water will not be directed against the brickwork or the casing insulation.



Cleaning Nozzles

FIG. 1



Water Heater

FIG. 2

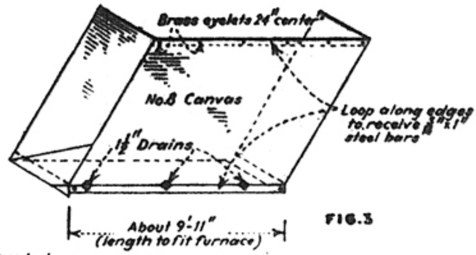
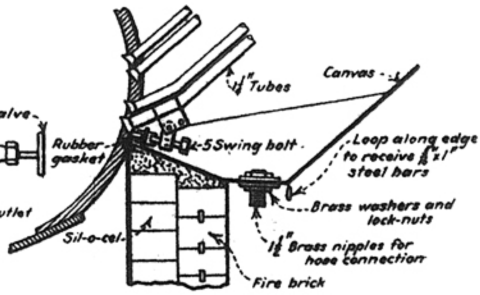


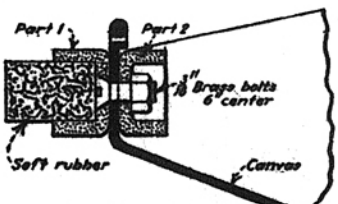
FIG. 3

Detail of Canvas Trough and Screen



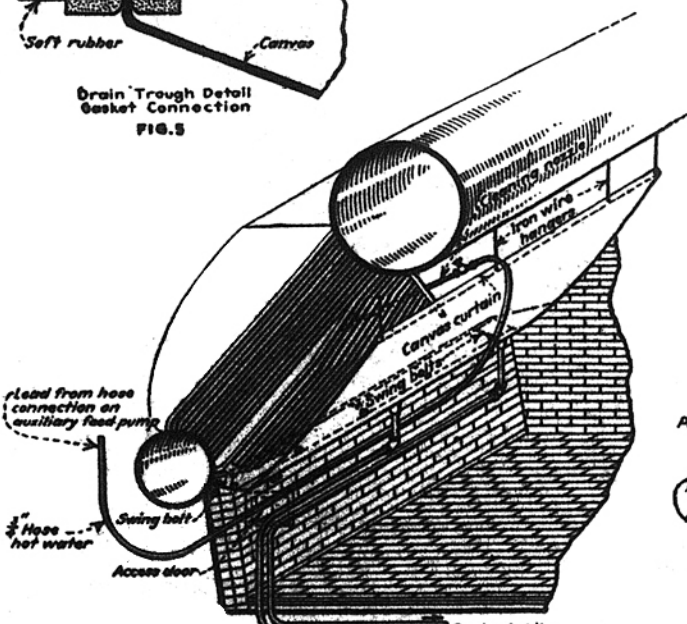
Trough Connection to Drum

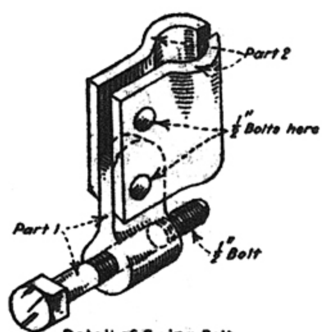
FIG. 4



Drain Trough Detail Gasket Connection

FIG. 5





Detail of Swing-Bolt and Tube Clamp

FIG. 6

Left Side of Boiler

FIG. 7

DETAILS OF TUBE-WASHING APPARATUS.

3. A large piece of canvas should be placed across the row of tubes adjacent to the side casing of the boiler, or a screen similar to the one installed on the furnace side should be fitted.

4. Water must be delivered at a pressure of about 60 pounds, and the temperature of this water must not be allowed to drop below 165 degrees F. This temperature should be checked frequently while the cleaning is in progress.

5. When the cleaning of the tubes has been accomplished, blow out the tubes with compressed air.

6. After the tubes have been blown, dry out the boiler by means of a slow fire.

Originally, it was thought that the amount of water used would militate against the use of this method on board ship. However, it has been found that only 300 to 1000 gallons is required per boiler. The difference in the quantity of water used is accounted for by the condition of the boiler and the care with which the operators work. Furthermore, if the cleanings are so planned that they are accomplished at the same time that the water in the boiler is to be changed, the water that would ordinarily be dumped into the bilges can be used for cleaning the fire sides. Under these conditions the amount of water used is negligible.

This method has been given a thorough service test on many ships of the United States Navy, and it has been definitely demonstrated that three men can thoroughly clean a boiler in one day. Some ships have employed this method for about a year. No damage to the brickwork or the casing insulation has been reported, and the tubes have been kept free from dirt and scale. The increase in economy has been marked. Furthermore, not only are men who were used for cleaning available for other important work, but less fuel is burned and corrosion of fire sides of tubes has been prevented.—"Power," April 17, 1928.

OPERATING EXPERIENCES WITH 1300-POUND STEAM PRESSURE.*

By John Anderson.

CORROSION PERIOD.

The failure of four boiler tubes only 330 hours after being cleaned, and with a very low condenser leakage, upset all previous deductions in regard to the prevention of scale troubles. It seemed impossible that less than 1/10 per cent condenser leakage would furnish enough solids to cause tube failure from scale formation. Continuous operation of the boiler would be impossible, unless some sort of feed water treatment could be used to prevent scale formation entirely. An inspection of the blisters showed them to be of a different nature than those which had occurred previously. The bulge was more pointed, and had a diameter of only ¾-inch. Moreover, the deposit inside the bulge was apparently of a different nature, being black in color and in larger quantities than before. This indicates the conditions observed after only 131 hours (5½ days) operation. Table VI gives analyses of this deposit found opposite the failures.

It will be noted that there is an excess of black iron oxide, obviously the product of electrolytic corrosion. In the first analysis a large percentage of scale-forming elements was present, though in the last 72 per cent was black iron oxide. From the analyses it was apparent that the cause of the

* Extract from a paper read before the Institute of Fuel on November 28, 1927.