April 6, 1926. 1,579,453

G. S. NEELEY

METHOD OF PREVENTING SCALING AND PITTING OF STEAM BOILERS

Filed Nov. 22, 1924 2 Sheets-Sheet 1

Fig. 1

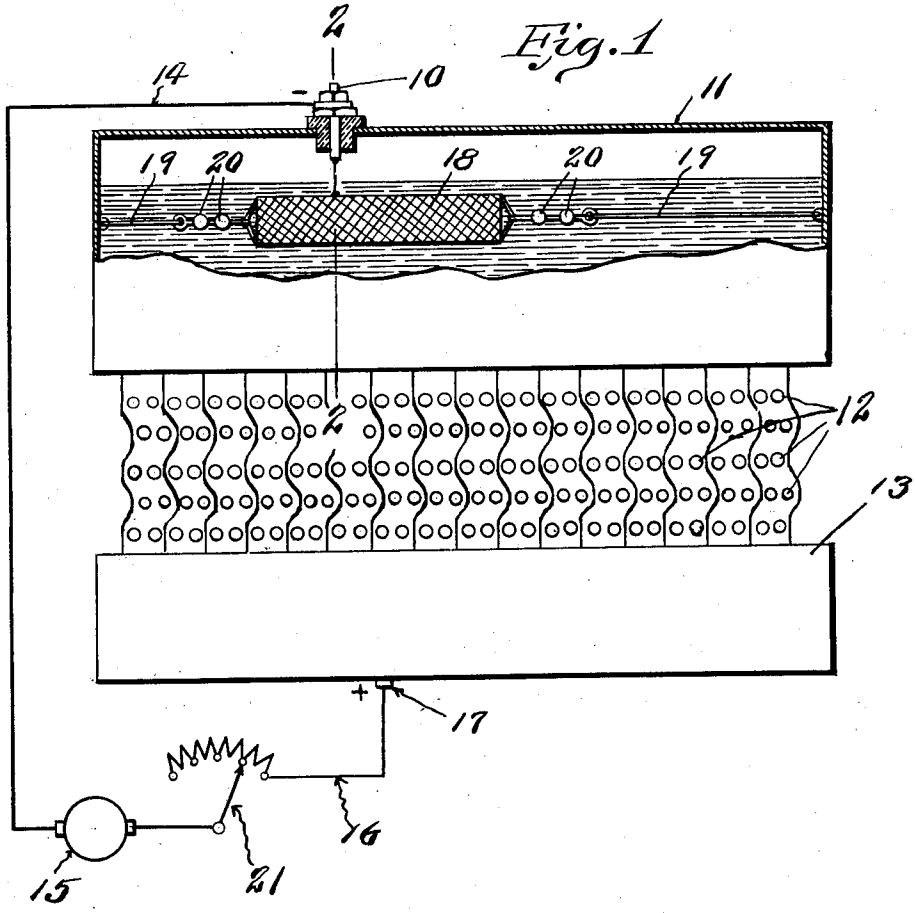
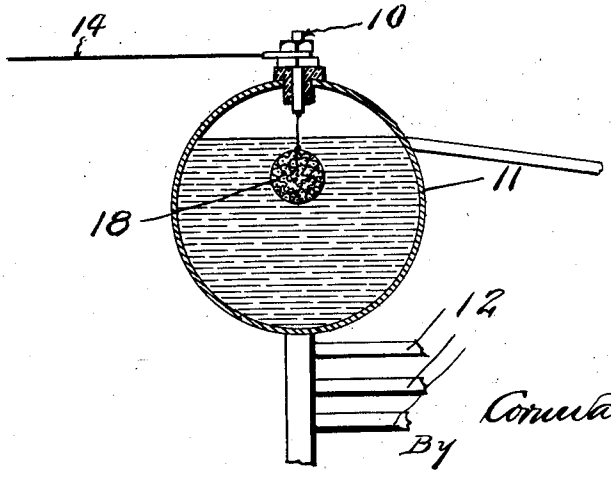


Fig. 2



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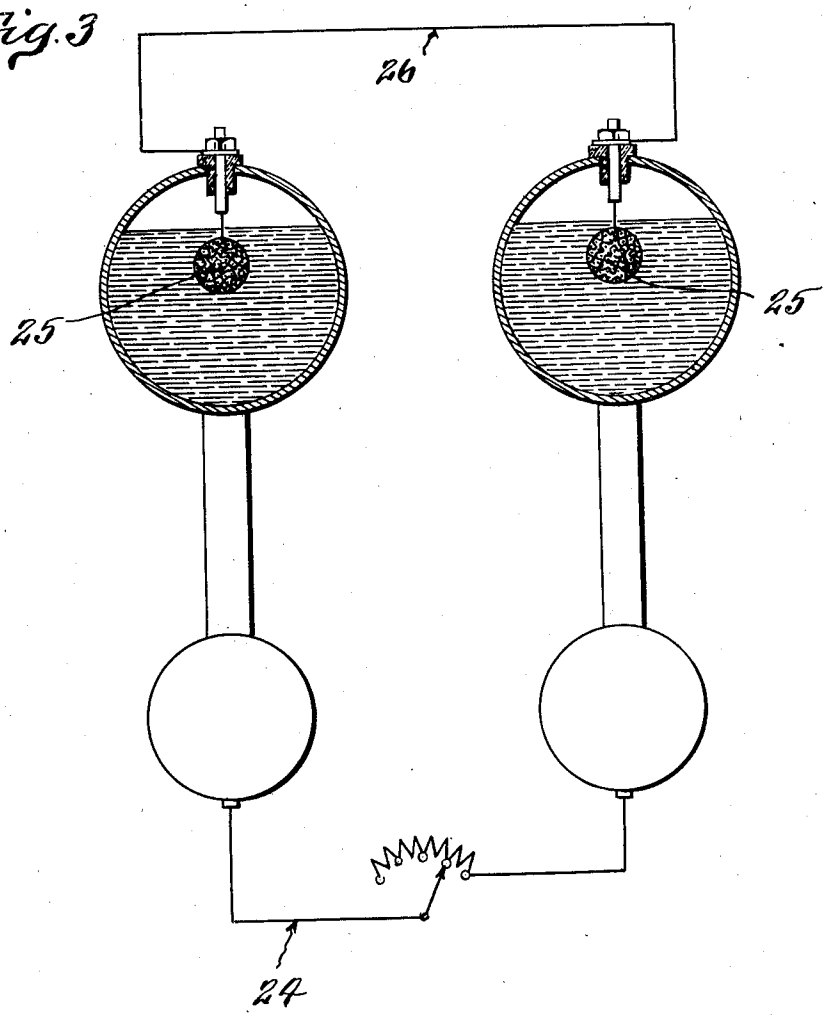
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METHOD OF PREVENTING SCALING AND PITTING OF STEAM BOILERS

Filed Nov. 22, 1924 2 Sheets-Sheet 2

Fig. 3



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Patented Apr. 6, 1926. 1,579,453

UNITED STATES PATENT OFFICE.

GEORGE S. NEELEY, OF WOOD RIVER, ILLINOIS, ASSIGNOR OF ONE-HALF TO GRIFFIN WATKINS, OF ALTON, ILLINOIS.

METHOD OF PREVENTING SCALING AND PITTING OF STEAM BOILERS.

Application filed November 22, 1924. Serial No. 751,543.

To all whom it may concern:

Be it known that I, GEORGE S. NEELEY, a citizen of the United States, residing at Wood River, Illinois, have invented a certain new and useful Improvement in Methods of Preventing Scaling and Pitting of Steam Boilers, of which the following is a specification, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a new and useful method of preventing the formation of scale and pitting of the metal plates of steam boilers.

The objects of the invention are to provide a novel method of preventing the formation of scale on the internal surfaces of steam boilers and tubes and of removing the scale from the internal surfaces of the boilers and steam pipes and maintaining the same free of scale thereafter.

Further objects of the invention are to provide a method for preventing the pitting of the internal surfaces of the steam boilers.

Still further objects of the invention are to provide a simple method of preventing scaling and pitting of the internal surfaces of steam boilers, which method can be easily practiced, is inexpensive and highly efficient.

With these and other objects in view, my invention consists in certain novel features of construction and arrangement of parts, hereinafter more fully described and claimed, and illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view showing the drum of the steam boiler partly in cross section and showing the electrical circuit utilized in practicing my method.

Figure 2 is a vertical cross section taken on lines 2—2 of Figure 1.

Figure 3 is a diagrammatic view showing two boilers connected together at the respective points for neutralizing the electrochemical action of each other.

The formation of scale and the pitting of the internal surfaces of boiler plates is due to the fact that all steam boilers when in operation become generators of an intense electrochemical action in accordance with the well-known principle of thermo couple and the steam plates of the boiler act as one element of the couple, the water contained in the boiler forming the second element and the heat of the furnace completing the third element. Thus a thermo couple action is set up, the capacity of which is determined by the size and number of boilers in service at any given time.

It has been proven by tests that the boiler plates under normal operating conditions act as the positive pole of the couple while the water in the boiler forms the negative pole. The electrochemical action thus produced is responsible for the scaling and pitting of the plates.

In practicing my method, I neutralize this electrochemical action induced by the operation of the boiler by producing a counter electrochemical action in the boiler and the water contained therein. This counter electrochemical action is produced by providing a suitable source of electrical energy and connecting it to the boiler and the water contained therein, whereby the current flowing through the circuit thus established travels in a direction opposite to the flow of current induced by the operation of the boiler.

In order to carry my method into practice, I provide a suitable electrode or connector 10 which is seated in and insulated from a drum 11. This electrode projects into the drum and occupies a position as far away from the heating surfaces of the boiler, that is, tubes 12 and header 13, as circumstances will permit. Electrode 10 is connected by a connection 14 to one pole of a suitable source of electrical energy 15 which may be a small generator or a rectifier. A wire connection 16 connects the other pole of source 15 with the external metal surface of the boiler or drum as indicated at 17. Electrode 10 is connected to a conductor 18 which is supported in a drum 11 by connections 19 and is insulated therefrom and from the drum by insulators 20. The conductor 18 is preferably disposed in the upper half of the drum and near the surface of the water contained therein.

Thus an electrical circuit is established between the source of electrical energy and the boiler, the water in the drum being in contact with one electrode and the drum being connected to the other electrode whereby the electrical current supplied by connections 14 and 16 is caused to travel from the drum to the water, or vice versa, depending upon the polarity of the elec-

trodes. Generally, the metal plates of the boiler are connected to the positive pole and the conductor 18 submerged in water in the drum is connected to the negative pole. However, if desired or necessary, alternating current may be used in the circuit with very good results. A rheostat 21 is interposed in the circuit for regulating the strength of the current applied to the steam boiler, the purpose being to apply to the steam boiler an electrical current which is equal in strength to the electrical current generated or induced by the operation of the steam boiler.

When the boiler is in operation, an electric current is set up in the steam boiler and the strength thereof can be ascertained by connecting the terminals of connections 14 and 16 to an appropriate electrical measuring instrument. Upon ascertaining the strength and the intensity of the current thus generated or induced, the terminals of connections 14 and 16 are connected to a suitable source or supply of electrical energy 15 so that the electric current supplied from the external source 15 travels in an opposed direction generated by the boiler while the latter is in operation. The rheostat 21 is regulated so as to maintain the externally supplied electrical current equivalent in strength and intensity to the induced current generated by the operation of the boiler.

As is well known, one electric current can be used to counteract the effects of another electric current and the effects of one electric current can be thereby nullified or assisted by the other current as desired by the operator. Therefore, the current supplied from an external source such as 15, neutralizes the generated current and the electrochemical action produced in the boiler by the generated current is thereby stopped and the scaling and pitting of the internal surfaces of the boiler caused by said electrochemical action is thus prevented.

When two steam boilers are used, the corresponding metal portions of the boilers may be connected together as shown in Figure 3 by a connection 24 and conductors 25 placed in each boiler and insulated therefrom may be connected together by a connection 26. Thus the electric current generated by one boiler reacts on the electric current generated by the other boiler, thereby neutralizing or nullifying the electrochemical action of each boiler and thus preventing formation of scale and pitting of both boilers.

My method of electrical energization of the steam boiler and its water contents by outside means for the purpose of preventing the formation of scale and the pitting of internal surfaces of the steam boiler is simple, can be easily practiced, and can be readily installed and operated at low cost.

While I have shown the preferred method of my invention, it is obvious that various changes and arrangements of parts can be made in practicing my method without departing from the spirit of my invention.

I claim:

1. The hereindescribed method of preventing the formation of scale and pitting of the steam boilers, consisting in connecting one terminal of an electric circuit to the metal portion of the steam boiler, at a point which is located at or near the lowermost portion thereof, connecting the other terminal of said circuit to a single conductor located in and near the top line of the water contained in said boiler, and insulated from the latter, whereby said boiler and said water are electrically energized by an external source of electrical energy.

2. The hereindescribed method of preventing the formation of scale and the pitting of steam boilers consisting in electrically connecting together the corresponding metal portions of two boilers, and electrically connecting together conductors arranged in the water of the respective boilers whereby the electric current generated by one operating boiler is opposed and neutralized by the electric current generated by the other boiler.

3. The hereindescribed method of preventing the formation of scale consisting in electrically connecting the corresponding metal portions of two boilers, and electrically connecting together the water contained in said boilers whereby the electric force generated by the operation of one boiler reacts on and neutralizes the electric force generated by the other boiler, thereby nullifying the electrochemical action of both of said boilers.

4. The hereindescribed method of preventing the formation of scale consisting in electrically connecting together the corresponding metal portions of two boilers and connecting together and insulating from said boilers the water contained therein, whereby the electric force generated by the operation of one boiler reacts on and neutralizes the electric force generated by the other boiler, thereby nullifying the electrochemical action of both of said boilers.

5. The method of preventing incrustation and scale in steam boilers and their connections consisting in establishing an external electrical circuit between the substantially coolest metal portion of a boiler and the hottest portion of the water contained therein.

6. The method of preventing incrustation and scale in steam boilers and their connections consisting in establishing an external electrical circuit, and connecting the terminals thereof to the metal portion of a boiler and to the water contained therein at points of greatest temperature differences.

7. The method of preventing scaling and pitting of the internal surfaces of steam

boilers and their accessories, consisting in electrically connecting together the metal portions of two boilers at their substantially coolest points and electrically connecting together conductors arranged in the water contained in the respective boilers near the steam lines of the water.

8. The method of removing and preventing scale in the steam boilers and their accessories consisting in electrically connecting together, respectively, the metal portions of two boilers and the water elements contained in said boilers at points of greatest temperature differences.

9. The method of removing and preventing scale in the steam boilers and their accessories consisting in electrically connecting together, respectively, the metal portions of two boilers and the water elements contained in said boilers at points of greatest electrical potential.

In testimony whereof I hereunto affix my signature this 20th day of November, 1924.

GEORGE S. NEELEY.