

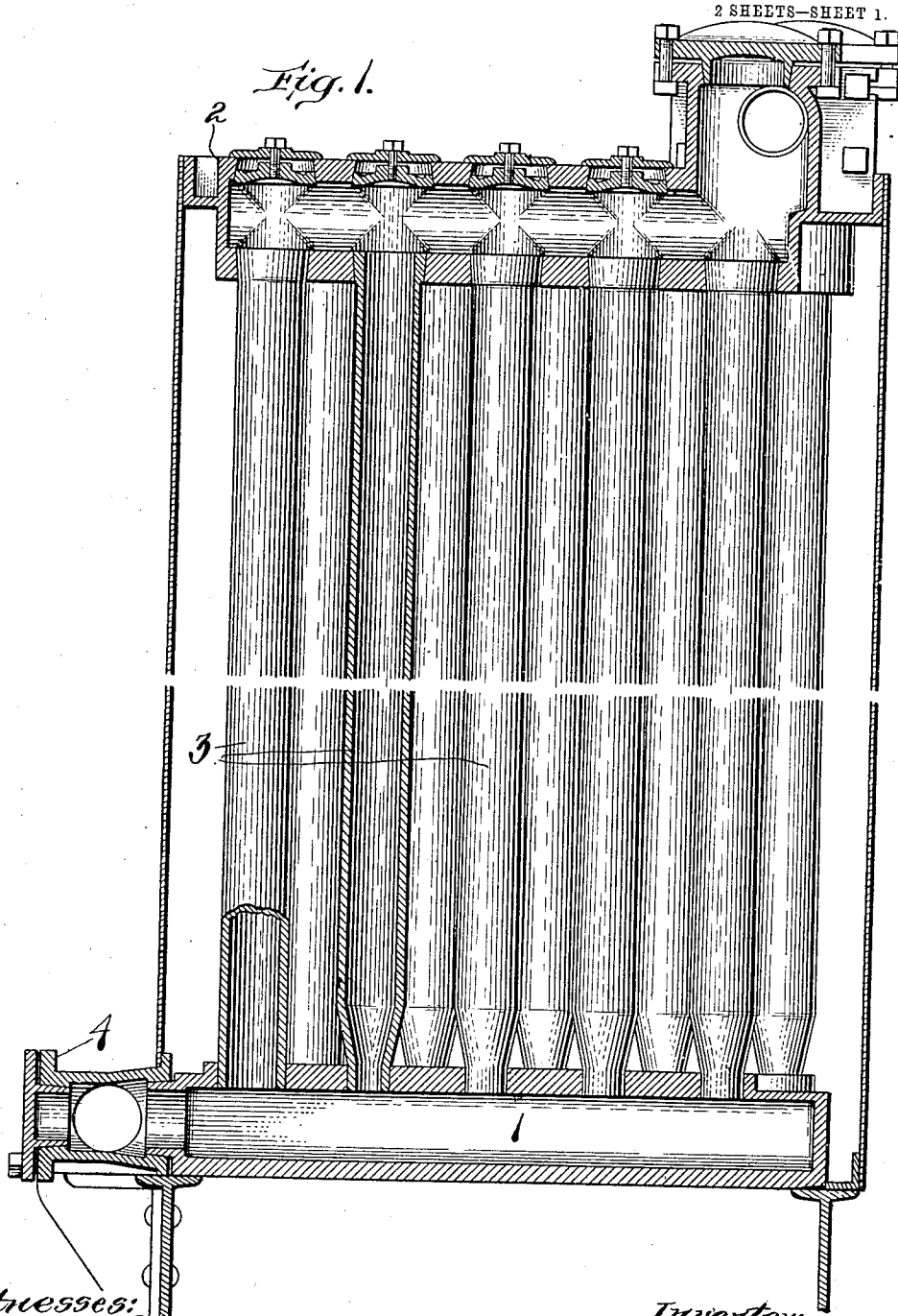
No. 869,701.

PATENTED OCT. 29, 1907.

E. B. FREEMAN.
FUEL ECONOMIZER.

APPLICATION FILED MAR. 8, 1905.

2 SHEETS—SHEET 1.



Witnesses;

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James H. Whelan.

Inventor:

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Attorneys.

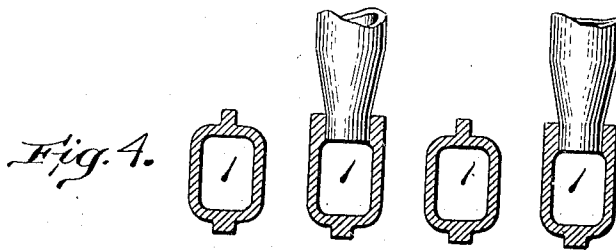
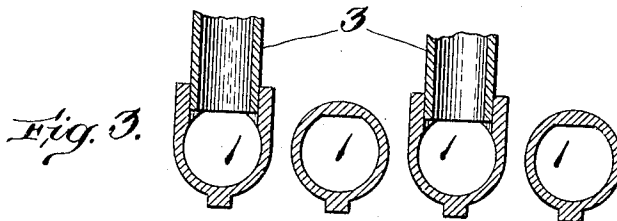
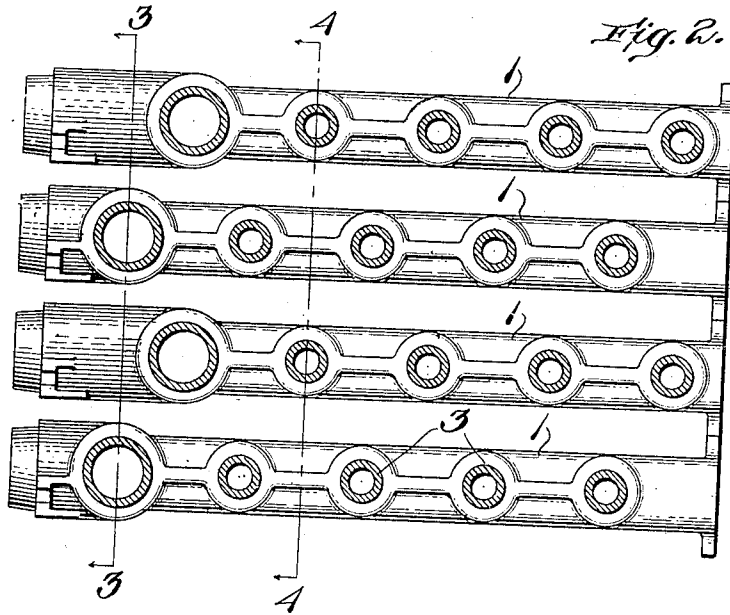
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UNITED STATES PATENT OFFICE.

ERNEST B. FREEMAN, OF DEDHAM, MASSACHUSETTS, ASSIGNOR TO B. F. STURTEVANT COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

FUEL-ECONOMIZER.

No. 869,701.

Specification of Letters Patent.

Patented Oct. 29, 1907.

Application filed March 8, 1905. Serial No. 248,991.

To all whom it may concern:

Be it known that I, ERNEST B. FREEMAN, a citizen of the United States, residing at Dedham, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Fuel-Economizers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to fuel economizers or feed water heaters which utilize the heat of the gases of combustion in heating the water.

More particularly the present invention relates to fuel economizers which comprise upper and lower headers and a series of vertical circulating tubes connecting each lower header with the corresponding upper header, the objects of the invention being to improve the mechanical construction of this type of fuel economizer and to insure a more thorough and complete circulation of the water through all portions of the economizer.

In the type of economizer above referred to it is desirable that the vertical tubes be arranged as closely together as the proper operation of the tube scrapers, by which the soot deposited on the tubes is removed, will permit. This results in the lower headers being placed closely together, and as the lower headers must have a sufficient lateral diameter to enable the vertical tubes to be connected thereto, the spaces beneath the bottom headers are comparatively narrow so that the soot removed from the tubes by the scrapers is not allowed to fall freely through these spaces into the pit below the headers. Also the spaces between the headers are not wide enough to readily admit the hand of a workman so that the tube scrapers or their supporting and guiding plates cannot be replaced or adjusted from beneath the headers but any repairs to these parts can only be made with considerable difficulty and frequently only by removing a portion of the inclosing casing.

A feature of the present invention contemplates the provision of a construction of vertical tubes and bottom headers whereby comparatively wide spaces are provided between the bottom headers to allow the soot removed from the tubes to fall freely into the pit beneath the headers and to enable the tube scrapers and their supporting and guiding plates to be readily replaced and adjusted from beneath the headers without substantially reducing the capacity of the tubes and headers or the surface of the tubes with which the heated gases come in contact.

In fuel economizers of the type referred to there is liability of the water admitted to the economizer passing to the outlet pipe without circulating properly through the vertical tubes, and a feature of the present

invention contemplates the provision of a construction of vertical tubes connecting the upper and lower headers by which this result is prevented.

Fuel economizers of the type referred to are fed with either hot or cold water, the water being admitted at the bottom of the economizer when hot water is used and being admitted at the top of the economizer when cold water is used. In either case, and particularly when the economizer is fed with cold water, moisture in the form of a corrosive acid is condensed upon the tubes from the gases of combustion, and collects at the lower ends of the tubes. The corroding of the tubes at their lower ends by this acid gives considerable trouble in actual practice, as the tubes are weakened and frequently break at this point. The present invention in addition to securing a proper circulation of the water admitted to the economizer also substantially prevents the condensation of moisture from the gases upon the tubes or the "sweating" of the tubes.

The various features of the present invention will be clearly understood from an inspection of the accompanying drawings, in which is illustrated a fuel economizer embodying the same in their preferred form.

Referring to the drawings, Figure 1 is a vertical sectional view of the economizer, the central portion of the vertical tubes and the casing being omitted and the upper and lower portions of the economizer being brought close together for convenience of illustration. Fig. 2 is a plan view of a number of the lower headers in the position which they occupy in the economizer, the lower ends of the vertical tubes connected therewith being shown in section. Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2 looking towards the left and Fig. 4 is a similar view taken on the line 4—4 of Fig. 2.

The economizer illustrated in the drawings is similar to the economizer illustrated and described in the patent to George H. Burpee, No. 729,272, dated May 26, 1903, the various parts, except as modified in accordance with the present invention, being constructed and arranged as disclosed in said patent. The economizer comprises a series of lower headers 1, a corresponding series of upper headers 2, and a series of vertical pipes 3 connecting each lower header with its corresponding upper header. The lower headers are connected at their forward ends by a manifold or wall box 4 by means of which the lower headers are placed in communication with each other. The upper headers are provided at their rear ends with upwardly extending coupling chambers by means of which the upper headers are placed in communication with each other. The upper and lower headers are provided with sockets upon their under and upper sides respectively, in which sockets the upper and lower ends of the vertical tubes 3 are fitted, the construction and

arrangement of the vertical tubes and headers, except as modified in accordance with the present invention, and all other parts illustrated on the drawings, being the same as in the economizer illustrated and described in the patent to Burpee above referred to, to which reference is made for a full disclosure thereof.

In accordance with the present invention a plurality of the vertical tubes are substantially reduced in diameter at their lower ends, the tubes being preferably, however, of the same diameter for the greater portion of their length, so that the reduction in the diameter of the lower ends of the tubes does not substantially diminish their capacity or the surface presented to the heated gases. The upper ends of the vertical tubes are preferably of the same or somewhat greater diameter than the main portions of the tubes in order to facilitate assembling the tubes and headers as described in the patent to Burpee No. 441,392, dated November 25, 1890. It is also believed that this construction improves the circulation of water through the vertical tubes. Also in accordance with the present invention the bottom headers are correspondingly reduced in their lateral diameter at the points of connection therewith of the reduced lower ends of the vertical tubes, as is clearly shown in Figs. 2 and 4. The reduction in the lateral diameter of the bottom headers at these points permits a reduction in the lateral diameter of the lower headers throughout the portions with which the vertical tubes are connected so that comparatively wide spaces are left between the bottom headers through which the soot removed from the tubes by the scrapers can fall freely, and through which a workman can insert his hand or arm and readily re-adjust or replace a broken or displaced scraper or scraper guiding or supporting plate. The lower headers are preferably circular in cross section at their forward ends and in order that the capacity of the lower headers may not be substantially diminished the portions to which the reduced lower ends of the vertical tubes are connected are preferably substantially rectangular in cross section, as indicated in Fig. 4.

The present invention contemplates reducing the lower ends of any number of the vertical tubes connecting a lower and an upper header. In the preferred embodiment of the invention, however, the front tube of each series of tubes which connect an upper and a lower header is of substantially the same diameter throughout and the remaining tubes are substantially reduced in diameter at their lower ends, as thereby the circulation of water through the economizer is improved, as will be hereinafter explained.

The economizer illustrated in the drawings as embodying the present invention can be fed with either hot or cold water, the water being fed into the bottom of the economizer when hot water is used and being fed into the top of the economizer when cold water is used, in accordance with the usual practice. When cold water is fed into the economizer it enters at the rear ends of a number of upper headers and on account of the constricted openings at the lower ends of the vertical tubes tends to pass forward into the headers and enter a number of the vertical tubes instead of passing directly down the vertical tubes at the rear of the economizer. The cold water slowly settles in the tubes and before it reaches the bottom headers is

heated to a sufficient degree to prevent "sweating" of the tubes. The reduction in the diameter of the tubes at their lower ends thus improves the circulation of the water when cold water is fed to the economizer and also prevents the sweating of the tubes and the consequent corroding of the tubes at their lower ends.

The reduction in the diameter of the vertical tubes at their lower ends also improves the circulation when hot water is fed to the economizer. The precise manner in which the water circulates has not as yet been accurately determined but it is believed that the circulation is substantially as follows:—When hot water is fed to the economizer in large quantities it enters from the wall box 4 into a number of lower headers. The greater portion of the water entering a header passes up the front tube of the series connecting the header with its corresponding upper header. The water then passes rearwardly along the upper header and passes down one or more of the vertical tubes which are reduced in diameter at their lower ends, thus agitating the water in the vertical tubes to a considerable extent, and tending to bring every particle of the water in contact with the sides of the tubes. When hot water is fed to the economizer in small quantities a portion of the water goes up the front tubes as before but as the circulation is slow some of the water passes along the lower headers and goes up the tubes which are reduced in diameter at their lower ends.

The present invention has been illustrated and described as applied to the fuel economizer disclosed in the patent to Burpee, No. 729,273. It is to be understood, however, the invention is not limited to such application but may be embodied in any fuel economizer comprising upper and lower headers and vertical circulating tubes.

The invention having been thus described, what is claimed is:—

1. A fuel economizer, having, in combination, a series of lower headers, a series of upper headers, and a series of vertical circulating tubes connecting each lower header with an upper header, a plurality of said vertical tubes being substantially reduced in diameter at their lower ends and said lower headers being correspondingly reduced in their lateral diameter at the points of connection therewith of said vertical tubes, substantially as described.

2. A fuel economizer, having, in combination, a series of lower headers, a series of upper headers, and a series of vertical circulating tubes connecting each lower header with an upper header, a plurality of said tubes being of the same diameter for the greater portion of their length and being substantially reduced in diameter at their lower ends and said lower headers being correspondingly reduced in their lateral diameter at the points of connection therewith of the vertical tubes, substantially as described.

3. A fuel economizer, having, in combination, a series of lower headers provided with sockets on their upper sides, a corresponding series of upper headers provided with sockets upon their under sides, and a series of vertical circulating tubes connecting each lower header with an upper header and fitted at their upper and lower ends in said sockets, a plurality of said tubes being substantially reduced in diameter at their lower ends and said lower headers being correspondingly reduced in their lateral diameter at the points of connection therewith of the vertical tubes, substantially as described.

4. A fuel economizer, having, in combination, a series of lower headers in communication with each other at their forward ends, a corresponding series of upper headers in communication with each other at their rear ends, and a series of vertical circulating tubes connecting each lower header with an upper header, the front tube of said series

being of substantially the same diameter throughout and the remaining tubes of said series being substantially reduced in diameter at their lower ends, substantially as described.

5 5. A fuel economizer, having, in combination, a series of lower headers in communication with each other at their forward ends, a corresponding series of upper headers in communication with each other at their rear ends, and a series of vertical circulating tubes connecting each lower header with an upper header, the front tube of said series of vertical tubes being of substantially the same diameter throughout, the remainder of said tubes being substantially reduced in diameter at their lower ends and said lower headers being correspondingly reduced in their lateral diameter at the points of connection therewith of the reduced lower ends of said vertical tubes, substantially as described.

10 6. A fuel economizer, having, in combination, a series of lower headers provided with sockets on their upper sides, a corresponding series of upper headers provided with sockets upon their under sides, and a series of vertical circulating tubes connecting each lower header with an upper header and fitted at their upper and lower ends in said sockets, a plurality of said tubes being of the same

diameter for the greater portion of their length and being substantially reduced in diameter at their lower ends, substantially as described. 25

7. A fuel economizer, having, in combination, a series of upper headers, a series of lower headers and a series of vertical circulating tubes connecting each upper header with a lower header, a plurality of said tubes being of substantially less diameter at their lower than at their upper ends, and one or more of said tubes being of substantially the same diameter throughout, substantially as described. 30 35

8. A fuel economizer, having, in combination, a series of upper headers, a series of lower headers, and a series of vertical circulating tubes connecting each upper header with a lower header, a plurality of said tubes being of the same diameter for the greater portion of their length and being substantially reduced in diameter at their lower ends, substantially as described. 40

In testimony whereof I affix my signature, in presence of two witnesses.

ERNEST B. FREEMAN.

Witnesses:

FRED O. FISH.

HORACE VAN EVEREN.