

E. R. MORRISON.

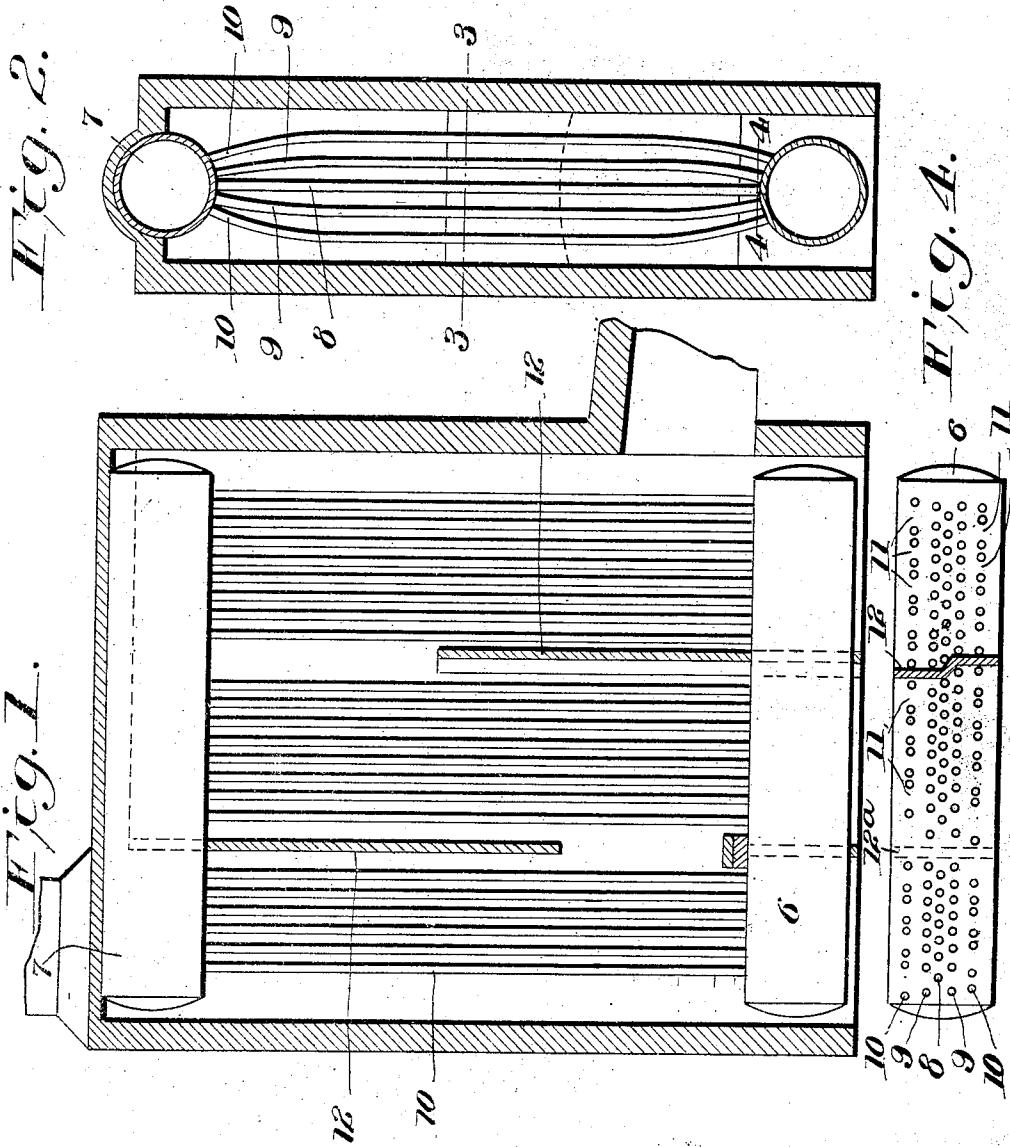
STEAM BOILER.

APPLICATION FILED MAR. 1, 1912.

1,061,312.

Patented May 13, 1913.

2 SHEETS—SHEET 1.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

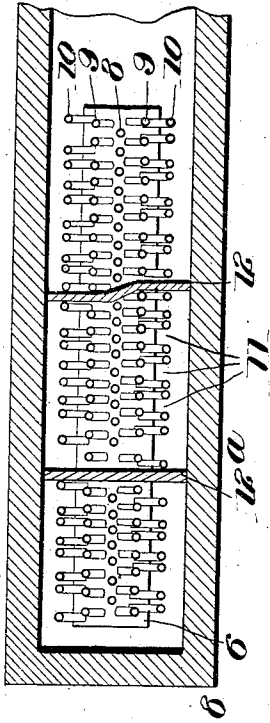


Fig. 6.

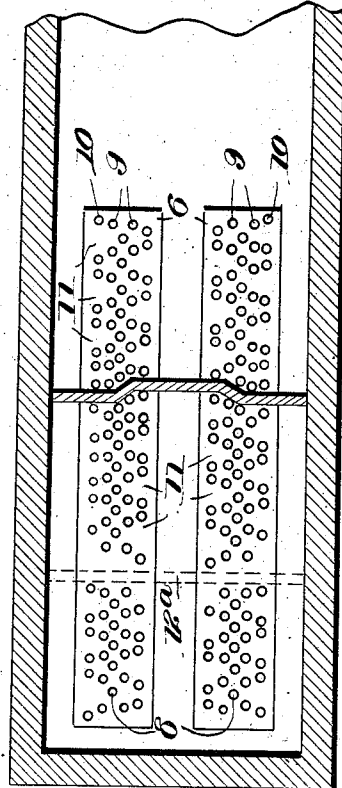
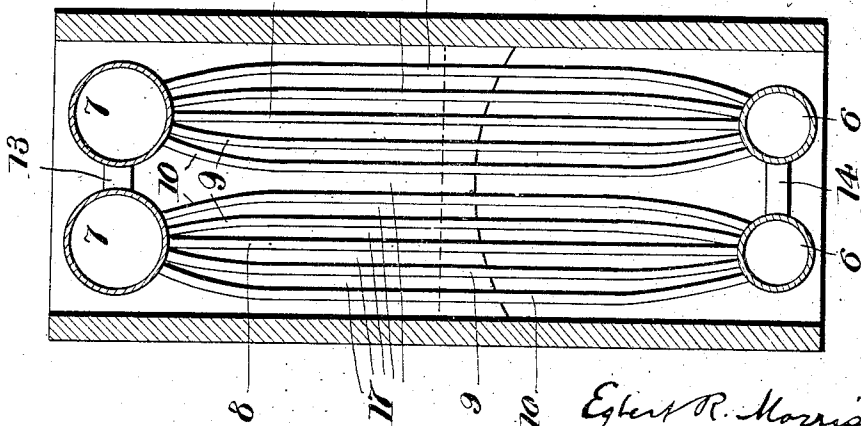


Fig. 5.



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UNITED STATES PATENT OFFICE.

EGBERT R. MORRISON, OF SHARON, PENNSYLVANIA.

STEAM-BOILER.

1,061,312

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, EGBERT R. MORRISON, a citizen of the United States, residing at Sharon, in the county of Mercer and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to water tube boilers, and embodies a new arrangement of the tubes in such boilers having a plurality of rows of vertical tubes connected at top and bottom to upper and lower headers.

Five rows of tubes are used, and the tubes in the two outer rows are grouped in pairs, the pairs in one outer row alternating or being staggered with respect to the pairs in the other outer row, and the tubes of the rows between the middle row and each outer row being located opposite to the spaces between the tubes of the middle row, the whole arrangement being such as to allow a free passage or space for the removal of any of the tubes in the inner rows, whereby any tube in the boiler may be removed without necessitating the removal of other tubes.

A further feature of the invention is the location of tubes, in multiple section boilers, in such manner that all the tubes are substantially equidistant, so there is no large alley for the heat to follow.

The invention is illustrated in the accompanying drawings in which—

Figure 1 is a vertical longitudinal section of a single section boiler with the tubes arranged as stated. Fig. 2 is a vertical cross section. Fig. 3 is a section on the line 3—3 of Fig. 2. Fig. 4 is a section on the line 4—4 of Fig. 2. Fig. 5 is a vertical section, and Fig. 6 is a horizontal section, of a double section boiler embodying the invention.

Referring specifically to the drawings, the lower headers are indicated at 6 and the upper headers at 7 and these headers are connected by vertical water tubes in banks, the tubes being arranged in five rows. The middle row of tubes is indicated at 8, and the next two side rows at 9. Each tube 9 is located opposite to the space between the tubes of the row 8, with a sufficient distance apart to allow each tube 8 to pass between the tubes 9, and the said tubes 9 are opposite each other on the respective sides. The tubes 10 of the outer rows are arranged in pairs, with a comparatively wide space, indicated at 11, between each pair, this space being preferably in exact line with the space

between the tubes 9, and the pairs of tubes 10 are staggered or alternate with each other in the opposite rows, so as to produce in the outer row an alternating series of long and short spaces, the long spaces in one row being opposite the short spaces in the other. In consequence of this arrangement it will be seen that any tube of the row 9 may be taken out or replaced through the wide spaces 11 in the corresponding outer row, and furthermore any one of the tubes 8 may be taken out or put in through said space, one tube 8 being removable through the space at one side and the next tube being removable through the space at the opposite side; all without removal of any other tube.

In the drawings I have shown the invention applied to three pass boilers of the double and single section type, the front or lower baffle walls being indicated at 12 and the rear or upper baffles at 12^a. In the double section type the upper and lower drums are preferably connected by cross pipes 13 and 14 respectively, to permit steam and water circulation.

The described arrangement of the flues permits any flue to be easily removed as stated, and also enables the flues to be set as close together as the strength of the flue sheets will permit.

The invention is applicable to straight or bent tubes and also to vertical or inclined tubes, and in other respects is not limited to the exact type shown. The arrangement enables the rows of tubes to be set close together, so as to accommodate as many rows without an objectionable large drum, the tubes in the rows being far enough apart to avoid weakening the sheet and to permit the removal of any tube. The tubes of the three intermediate rows are maintained at a uniform distance apart, the distance between the rows being preferably less than the distance between any two adjacent tubes in the same row.

The lower or front baffle walls 12 are preferably located between the tubes so as to emerge, or be located, in the outer rows, in what would otherwise be narrow spaces in those rows, which spaces are increased somewhat to allow room for a reasonably heavy baffle wall. This arrangement permits the length of the drums or headers to be reduced to the minimum. This arrangement requires a bend in the baffle wall. In the upper or rear baffles 12^a, this arrange-

ment is not used, as it would necessitate a bend, and as the upper baffle wall is supported by an arch, such a bend would be objectionable.

5 In the double section boiler, as shown in Figs. 5 and 6, or in any other multiple section boiler the tubes in all the rows across all the sections are so bent or located as to be equidistant throughout the greater
10 part of their length, that is throughout their whole length except where they necessarily converge to connect to the headers. This produces spaces 17 between all the rows, which spaces are substantially equal, and
15 hence no large alley is left or produced for the heat to follow without contact with a heating surface.

The location of the bent lower baffle walls as above described does not interfere with
20 the removal of the tubes 9 in a straight diagonal path. The upper baffle walls, 12^a, are however, kept straight and thus would interfere partially with the removal of an adjacent tube 9 and therefore the tube di-
25 rectly in front of the inner tube is omitted, so that in the entire boiler any tube may be removed without the removal of another.

What I claim is:

1. A tubular boiler having five rows of
30 tubes, located beside each other, the tubes of the two outer rows being located with alternate wide and narrow spaces between the tubes of each of said rows, the wide spaces in each of said rows being opposite the
35 narrow spaces in the other.

2. A tubular boiler having five rows of tubes located beside each other, the distance between the three inner rows being less than the distance between adjacent tubes in any
40 one of said rows, and the tubes of the two outer rows being located in pairs with wide spaces between each pair, the wide spaces being located alternately in the two opposite outer rows.

3. A tubular boiler having five rows of tubes, located beside each other, the middle row being staggered with respect to the two adjacent rows and the tubes of the two outer rows being located with alternate wide
50 and narrow spaces between the tubes of each of said outer rows, the wide spaces in each of said rows being opposite the narrow spaces in the other and in line with the tubes in the middle row and the arrangement of these wide and narrow spaces
55 and the distance apart of the outer and adjacent rows being such as to allow a passage for the removal of any tube 9, in the inner rows as well as a passage for the removal of any tube 8, in the middle row.
60

4. A tubular boiler having five rows of tubes located beside each other, the middle

row being staggered with respect to the two adjacent rows and the distance between the three inner rows being less than the distance between adjacent tubes in any one of
65 said rows, and the tubes of the two outer rows being located in pairs with wide spaces between each pair, the wide spaces being located alternately in the two opposite outer
70 rows and the arrangement of these wide and narrow spaces and the distance apart of the outer and adjacent rows being such as to allow a passage for the removal of any tube 9, in the inner rows, as well as a pas-
75 sage for the removal of any tube 8, in the middle row.

5. A water tube boiler having a heating chamber through which the combustion products flow from front to rear, multiple
80 drums located side by side in said chamber and extending lengthwise from front to rear therein, in the same general direction as that of the flow of products through said chamber, banks of tubes connected to said
85 drums and standing beside each other in said chamber, the banks being arranged in relation to the side walls of the heating chamber and in relation to adjacent banks in such manner that the space between the
90 outside tube of one bank and the wall, or between the outside tube of one bank and the outside tube of another bank, is practically the same as the space between any two
95 tubes of any one bank, the tubes of the banks being bent in such a manner that this spacing will exist throughout the larger part of the tube length, thus resulting in securing a uniformity in size of all the heat
100 alleys between all the rows of tubes regardless as to whether the heat alleys are formed by two tube rows of the same bank, two tube rows of different banks or a tube row on one side and the side wall of the heating
105 chamber on the other side.

6. A tubular boiler having five rows of tubes located beside each other, the tubes of the three inner rows being staggered with respect to each other and the tubes of the two outer rows being located to form
110 alternate wide and narrow spaces, the wide space in each of said rows being opposite the narrow space in the other, and a bent baffle wall extending across the rows and located at each side of the bank in what
115 would otherwise be one of the narrow spaces in the two outer rows.

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

EGBERT R. MORRISON.

Witnesses:

ROY NEVILLE,
ANNA THOMAS.