Jan. 12, 1937. H. J. KERR ET AL 2,067,669

STEAM BOILER

Original Filed May 13, 1929 3 Sheets-Sheet 1

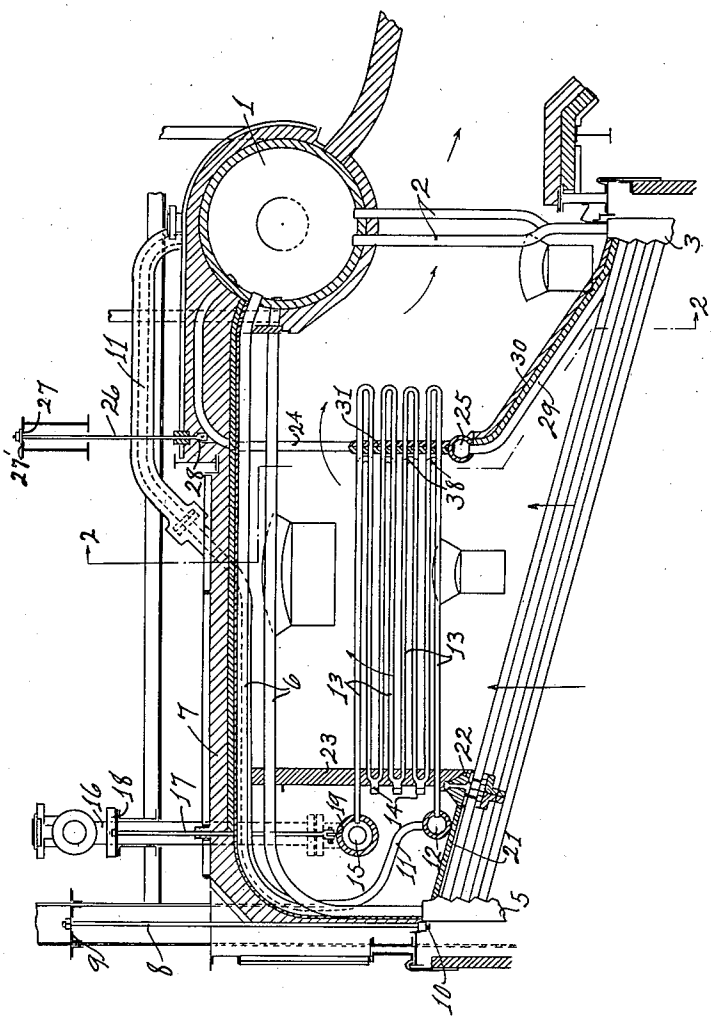


Fig. 1.

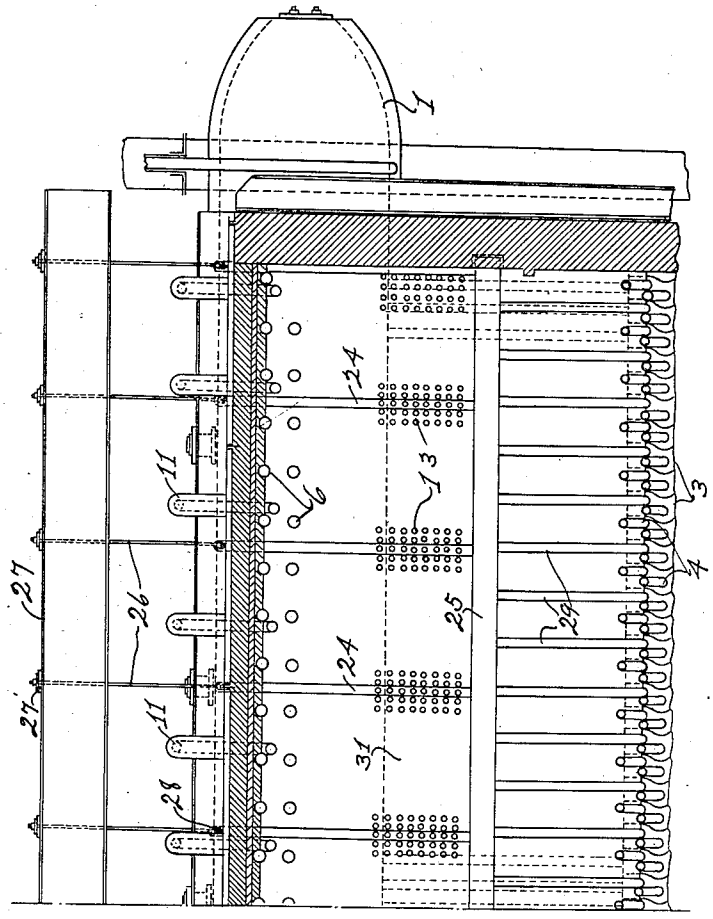
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Fig. 2.



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Fig. 4

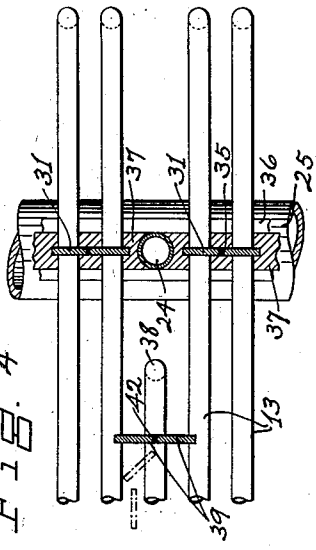


Fig. 3

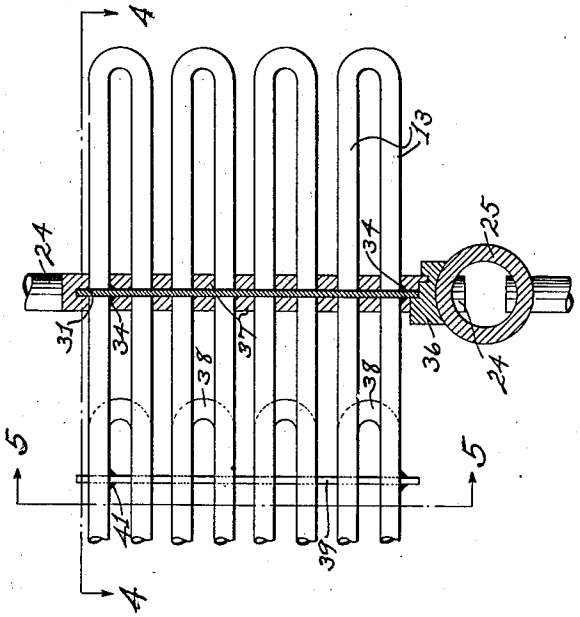
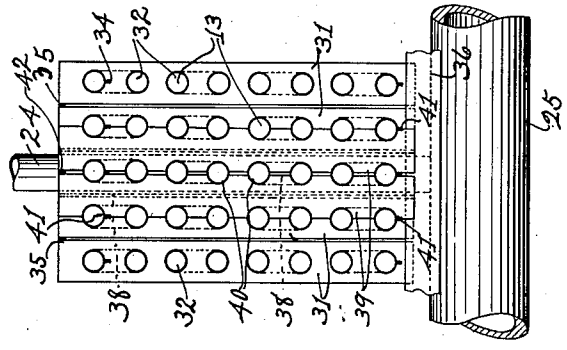


Fig. 5



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STEAM BOILER

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Application May 13, 1929, Serial No. 362,516
Renewed October 21, 1933

16 Claims. (Cl. 122—478)

This invention relates to the construction of water tube steam boilers, and more particularly to an improved supporting arrangement for auxiliary heating surface, such as a steam superheater, located above the main bank of steam generating tubes.

The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through an illustrative embodiment of the invention; Fig. 2 is a section taken along the line 2—2 of Fig. 1; Fig. 3 is a side view on an enlarged scale showing some of the details; Fig. 4 is a section along the line 4—4 of Fig. 3; and Fig. 5 is a section along the line 5—5 of Fig. 3.

In the drawings, reference character 1 indicates a steam and water drum that is connected by nipples 2 to downtake headers 3 that are connected by a bank of inclined tubes 4 to uptake headers 5, which have their upper ends connected to the steam space of the steam and water drum 1 by means of the circulating tubes 6 that may enter the drum 1 along two rows of holes. A roof 7 is provided along the upper side of the upper row of tubes 6. Rods 8 that are supported by means of supports 9 are connected by means of the lugs 10 to uptake headers 5 for supporting the same.

A plurality of tubes 11 preferably equally spaced extend from the steam space of the steam and water drum 1 to the inlet header 12 of the superheater. These tubes pass through the roof 7 and extend for some distance along the inside surface of the roof. A row of U-shaped superheater tubes 13, with one branch longer than the other, extends from the header 12 and the short branches are connected by return bends 14 with another row of U-tubes of the superheater. The return bends have removable plugs in the ends thereof for cleaning the tubes. The ends of the U-tubes opposite the bends in the U-tubes are all connected by return bends and a sufficient number of these tubes are provided to give the desired amount of superheating surface. The uppermost row of U-tubes 13 each has one branch longer than the other, the longer branches extending into the outlet header 15 from which a pipe 16 leads to a steam main. Rods 17 supported by means of supports 18 are connected to the outlet header 15 by means of the lugs 19 to support the same.

A baffle 21 extends from the upper ends of the headers 5 along the upper row of tubes 4 for a short distance beyond the header 12 to a cross support 22 that is supported upon a plurality of the rows of inclined tubes 4. A baffle 23 through which the return bends 14 pass extends from the cross support 22 to the roof 7 and provides a dead gas space above the upper ends of the tubes 4 in which space the superheater headers 12 and 15 are located.

A row of tubes 24 extends from the steam space of the steam and water drum 1 for a short distance along the roof 7 and then downwardly into a cross box or header 25. Rods 26 supported by means of supports 27, with spring washers 27' interposed when desired, are connected to the tubes 24 by means of lugs 28 or otherwise to support the tubes 24 and thereby support the cross box 25. A row of tubes 29 extends from the upper ends of the headers 3 to the lower side of the cross box 25 and a baffle 30 from the headers 3 to the cross box 25 is supported upon the tubes 29. A baffle or superheater tube support 31 extends upwardly from the upper side of the cross box 25 and supports one end of the superheater tubes 13.

The support 31 is shown more in detail and on a larger scale in Figs. 3, 4 and 5. It is shown as comprising vertical plates with holes 32 through which the tubes 13 pass. The tubes may be spot welded in the holes, as indicated at 34, and the edges of the plates at the upper ends may be attached by spot welding, as indicated at 35. The lower ends of the plates 31 rest upon a thick plate 36 lying along the upper side of the header 25. Tile 37 may be applied to both sides of the plates 31 and the tubes 24. Some of the U-tubes 13 are shorter than the others, having the loops 38 thereof terminating on the left hand side of the support 31 to leave spaces at intervals between vertical rows of the tubes 13 through which spaces the tubes 24 pass. The bent ends of the U-tubes which terminate short of the support 31 may be supported from other tubes by means of vertical plates 39 having semi-circular notches 40 along the edges thereof to accommodate the tubes. The plates 39 may be spot welded to the U-tubes that extend through the support 31, as indicated at 41, and the upper ends of the plates 39 may be attached to each other by spot welding, as shown at 42.

The gases pass from the furnace across the inclined tubes 4, thence across the superheater tubes 13 between the baffles 23 and 31, thence over the upper end of the baffle 31 and out between the nipples 2 to a stack, as indicated by the arrows. The superheater headers are shielded from direct contact with the hot gases and the right hand end of the superheater, as shown in Fig. 1, is supported by tubes extending from

the steam and water drum 1 to a header below the superheater, these tubes being supported outside of the boiler setting.

We claim:

1. In a boiler, a superheater, a cross header supporting one end of said superheater, tubes supporting said header, and supports outside of the boiler setting for said tubes.

2. In combination, a bank of steam generating tubes extending across a gas pass, a bank of superheater tubes adjacent the generating tubes, a superheater tube support exposed to furnace gases, a cooling tube in good conductive heat transfer relationship with the support, and means interposing the cooling tube in the circulation of the generating tubes whereby some of the latter maintain the cooling tube filled with a cooling fluid.

3. A steam boiler comprising a bank of steam generating tubes, a steam and water drum positioned above said tube bank, a fluid heater above said tube bank and at a level lower than said drum, a plurality of fluid conduit elements extending upwardly above said tube bank and connected to said drum, means for supporting the end of said fluid heater adjacent said conduit elements from said conduit elements and independently of support from the subjacent portion of said tube bank, and suspension means external to said drum for supporting said conduit elements.

4. A steam boiler comprising an inclined bank of steam generating tubes, a steam and water drum above said tube bank, a row of circulator tubes at each end of said tube bank arranged to connect opposite ends of said steam generating tubes to said drum, a fluid heater above said tube bank and at a level lower than said drum, a row of fluid conduit elements connected to and extending inwardly and upwardly from one end of said steam generating tubes and above said tube bank and having their upper ends connected to said drum, means carried by said conduit elements for supporting one end of said fluid heater, and suspension means external to said drum for supporting said conduit elements.

5. A steam boiler comprising a horizontally inclined bank of steam generating tubes, uptake and downtake headers at the corresponding ends of said tube bank, a steam and water drum above said tube bank, a row of vertical circulator tubes at each end of said tube bank arranged to connect said uptake and downtake headers to said drum, a row of fluid conduit elements extending inwardly and upwardly from said downtake headers above said tube bank and having their upper ends connected to said drum, a baffle mounted on said conduit elements and dividing the space between said rows of circulator tubes into a plurality of gas passes, a fluid heater above said tube bank and comprising vertical rows of tubes extending across one of said gas passes, means for supporting one end of said fluid heater tubes from said conduit elements, and suspension means external to said drum for supporting said conduit elements.

6. A steam boiler comprising an inclined bank of steam generating tubes, a steam and water drum above said tube bank, a row of circulator tubes at each end of said tube bank arranged to connect opposite ends of said steam generating tubes to said drum, a row of fluid conduit elements connected to and extending inwardly and upwardly from one end of said steam generating tubes and above said tube bank and having their upper ends connected to said drum, a baffle mounted on said conduit elements and dividing the space between said rows of circulator tubes into a plurality of gas passes, and suspension means external to said drum for supporting said conduit elements.

7. A steam boiler comprising a horizontally inclined bank of steam generating tubes, uptake and downtake headers at the corresponding ends of said tube bank, a steam and water drum above said tube bank, a row of vertical circulator tubes at each end of said tube bank arranged to connect said uptake and downtake headers to said drum, a row of fluid conduit elements extending inwardly and upwardly from said downtake headers above said tube bank and having their upper ends connected to said drum, a baffle mounted on said conduit elements and dividing the space between said rows of circulator tubes into a plurality of gas passes, and suspension means external to said drum for supporting said conduit elements.

8. A steam generator comprising a setting, a bank of inclined steam generating tubes located in said setting, a steam and water drum directly above and extending transversely of one end of said tube bank, water chambers connected to the ends of said tube bank, a plurality of water tubes connected to one end of said tube bank and extending upwardly in an inclined direction for a portion of their length and having their upper ends connected to said steam and water drum, suspension means external to said steam and water drum for supporting said water tubes, means including said water tubes defining a plurality of serially connected passes for the flow of combustion gases leaving said tube bank, said passes being confined to the space in said setting above said tube bank, and a group of steam heating tubes in the first of said passes to be traversed by the combustion gases.

9. A steam generator comprising a setting, a bank of inclined steam generating tubes within said setting, a steam and water drum extending transversely of and directly above the lower end of said tube bank and connected to the upper end of said tube bank, a row of water tubes extending upwardly intermediate the ends of said tube bank and connected to said drum, suspension means external to said drum for supporting said row of tubes, and a vertically extending baffle supported on said row of tubes and arranged to separate a plurality of gas passes above said tube bank.

10. In a steam boiler, a circulation system including a steam and water drum and a bank of inclined steam generating tubes connected thereto, a bank of return bend fluid heating tubes above said generating bank, and means for supporting said fluid heating tube bank comprising vertically extending tubes arranged adjacent said fluid heating tube bank, suspension means external to said drum for supporting said vertically extending tubes, a header extending transversely of said fluid heating tube bank and connected to and supported by said vertically extending tubes, and means for connecting said vertically extending tubes and header into the boiler circulation system.

11. A steam boiler comprising a bank of inclined steam generating tubes, a steam and water drum above said tube bank, supporting conduits connecting one end of said tube bank to said drum, a group of return bend superheater tubes above said tube bank and at a level below and re-

ceiving steam from said drum, and means for supporting the end of said superheater tubes adjacent said supporting conduits from said supporting conduits and independently of support from the subjacent portion of said tube bank.

12. A steam generator comprising a setting, a bank of inclined steam generating tubes within said setting, uptake and downtake headers at the corresponding ends of said tube bank, a steam and water drum extending transversely of said tube bank and directly above the downtake end thereof, a row of tubes extending upwardly intermediate the ends of and above said tube bank, suspension means external to said drum for supporting said row of tubes, a vertical baffle supported on said row of tubes and arranged to separate a plurality of gas passes above said tube bank, an auxiliary fluid heater extending across one of said gas passes above said tube bank, and means for supporting said auxiliary fluid heater from said row of tubes.

13. A steam boiler comprising an inclined bank of steam generating tubes, a steam and water drum positioned above said tube bank, a baffle extending vertically from said tube bank and defining one side of a heating gas pass above said tube bank, a steam superheater above said tube bank and including a bank of return bend tubes in said gas pass having opposite ends extending through said baffle, and means for supporting the other end of said superheater tube bank independently of support from the subjacent portion of said steam generating tube bank comprising a row of vertically extending tubes connecting one end of said steam generating tube bank to said drum and supporting said other end of said superheater tube bank.

14. A steam boiler comprising a bank of steam generating tubes, a steam and water drum above said tube bank, fluid conduit elements connecting one end of said tube bank to said drum, and a fluid heater above said tube bank comprising a group of return bend fluid heating tubes having their end portions adjacent said fluid conduit elements supported by said fluid conduit elements independently of the subjacent portion of said tube bank.

15. A steam boiler comprising a bank of steam generating tubes, a steam and water drum arranged above said tube bank, groups of circulator tubes arranged to connect the opposite ends of said tube bank to said drum, a group of supporting tubes extending upwardly above said tube bank and intermediate said groups of circulator tubes and having their upper ends connected to said drum, and a fluid heater arranged above said tube bank and supported by said supporting tubes.

16. A steam boiler comprising a bank of steam generating tubes, a steam and water drum arranged above said tube bank, groups of circulator tubes arranged to connect the opposite ends of said tube bank to said drum, a group of supporting tubes extending upwardly above an intermediate portion of said tube bank and having their upper ends connected to said drum, and a fluid heater arranged above said tube bank and having one end thereof supported by said supporting tubes independently of the subjacent portion of said tube bank.

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