

Jan. 12, 1937.

L. KOOISTRA

2,067,671

FLUID HEATER

Filed April 23, 1931

Fig. 1

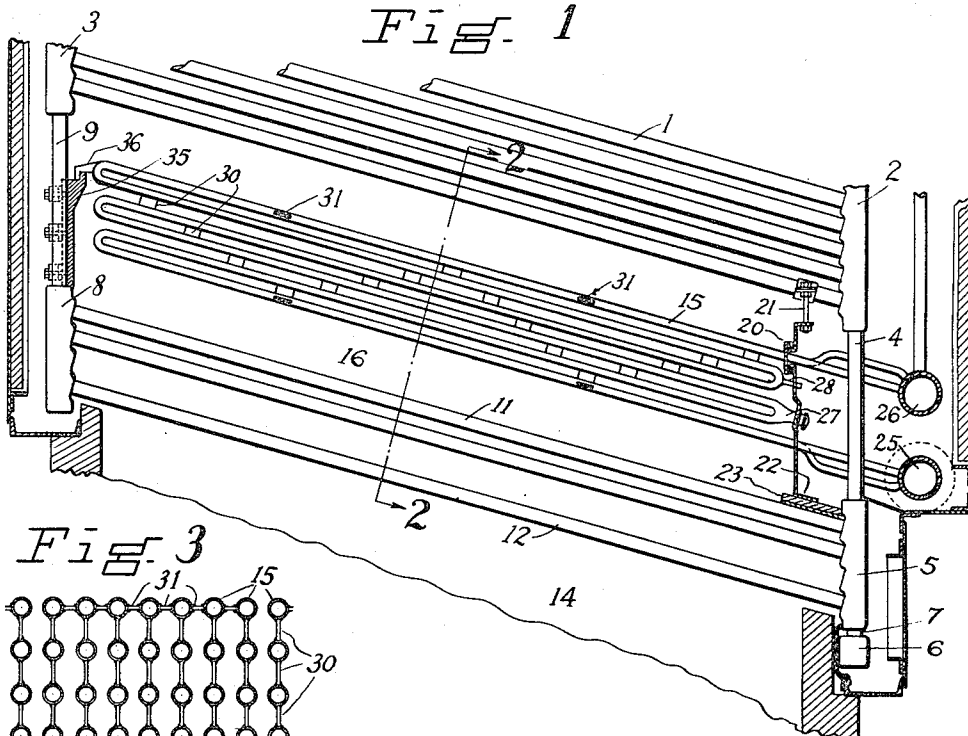


Fig. 3

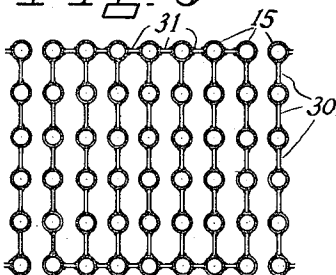
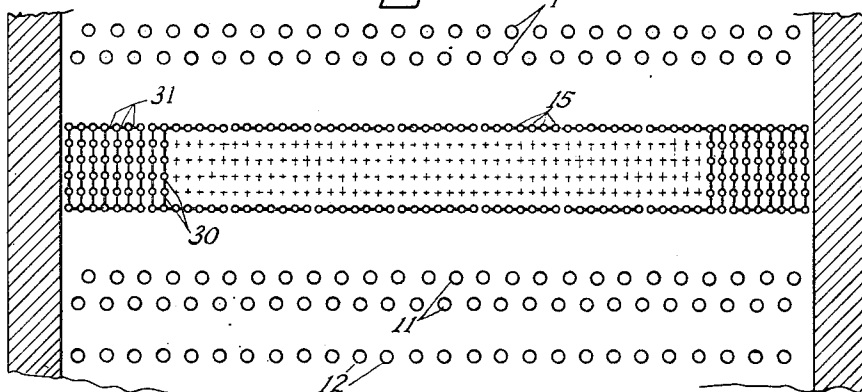


Fig. 2



INVENTOR
Lambert Kooistra
BY *Benj. R. Newcomb*
ATTORNEY

UNITED STATES PATENT OFFICE

2,067,671

FLUID HEATER

Lambert Kooistra, Bayonne, N. J., assignor to
The Babcock & Wilcox Company, Bayonne,
N. J., a corporation of New Jersey

Application April 23, 1931, Serial No. 532,193

15 Claims. (Cl. 122—476)

This invention relates to heat transfer devices, and more particularly, to a support for a bank of tubes extending across a gas flue in such a device.

An object of the invention is to provide an
5 intertube support and bracing members for a bank of tubes disposed across a flue in a heat transfer device.

Another object of the invention is to provide in a bank of tubes of considerable length, inter-
10 tube supports which coact with the tubes in the bank to form a truss support therefor.

A specific object of the invention is to provide for a tube bank, characterized by a plurality of tubes extending across a gas flue in a plurality of
15 return bends arranged in vertical rows, intertube supports between certain of the tubes to prevent buckling and sagging of the bank, while permitting expansion and contraction of the tubes, and supporting members at the ends of the bank to
20 support the bank in its entirety.

Other objects will be apparent to those skilled in this particular art from the claims and the description in the specification in connection with the drawing, in which—

25 Fig. 1 is a side view, in section, of a portion of a boiler;

Fig. 2 is a sectional end view taken along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a structural detail of the invention.

In the embodiment of the invention chosen for purposes of illustration, in Fig. 1 is shown a boiler associated with a boiler setting, with the upper steam generating parts and steam and
35 water drum, and a portion of the combustion chamber broken away. In this figure is shown a bank of steam generating tubes 1 connected at one end to downtake headers 2, and at the other end to a row of uptake headers 3.

40 A row of nipples 4 connects the downtake headers 2 with a second row of downtake headers 5 disposed therebelow. A mud drum 6 is connected by nipples 7 to the second row of downtake headers 5. A similar row of uptake headers 8 is connected by nipples 9 to the lower end of the row
45 of uptake headers 3.

A bank of steam generating tubes 11 is connected at its ends to the headers 5 and 8, and a lower row of tubes 12, similarly connected to those headers, is disposed directly above a combustion chamber 14 and acts as a slag screen for the rest of the tubes. A superheater 15 is disposed in the space between the two banks of
50 steam generating tubes 1 and 11, and comprises a plurality of tubes arranged in vertical rows

which extend across the gas flue 16 in a plurality of return bends.

A supporting member 20 is secured at its upper end by a clamp 21 to the lowermost row of the steam generating tube bank 1, and at its lower
5 end a bent portion 22 rests upon a baffle member 23 which is supported by the upper row of tubes of the bank 11. The inlet and outlet ends of the superheater extend through the supporting
10 member 20 and are connected respectively in an inlet header 25 and an outlet header 26 of the superheater. Members 27 and 28 are secured to the bent portions of the tubes at one end of the bank and extend through the support 20,
15 where, in conjunction with the inlet and outlet ends they serve to support the superheater bank at that end.

Secured between adjacent tubes in the same vertical row is a plurality of metallic structural
20 connectors 30 arranged between the tubes along a diagonal line through the bank to form, with the metal of adjacent tubes, a truss support for the bank, which prevents bending in a vertical plane. Secured between the tubes of the upper
25 and lower rows of the superheater bank laterally, are members 31. These members act as cross ties and prevent buckling sideways.

The members 30 and 31 divide the tubes comprising the superheater bank into blocks, and by their bracing effect hold the tubes in each block
30 in place with respect to each other and prevent substantial sagging or buckling distortion of the bank, while at the same time permitting expansion and contraction of the tubes.

The members 30 and 31 are exposed to the
35 sweep of combustion gases at high temperature, but they are secured in good thermal contact to the tubes of the superheater 15 through which a heat absorbing medium is circulated so that they will not be heated to a destructively high tem-
40 perature. At the same time these members do not present sufficient cross sectional area to the gases to materially effect their flow.

Secured to the uptake nipples 9 in any desired
45 manner, such as by bolting, are members 35 which engage hook members 36, which are secured to the bent portions of the uppermost row of tubes of the superheater 15. The members
50 35 and 36 engage each other, and by their co-operation serve as a support for one end of the superheater bank. These members 35 and 36 may slide relative to each other so that contraction and expansion of the tubes is permitted. The other end of the bank is supported by the
55 member 21 as previously described.

A specific supporting structure has been described in some detail which is especially adapted to brace and support a long bank of tubes made up of a plurality of tubes arranged in vertical rows and extending across a gas flue in a plurality of return bends, but it is to be understood that such a combination of supporting and bracing members may have other uses, and although specific members have been described, it is to be understood that changes, omissions, substitutions and additions may be made within the spirit of the invention as defined by the appended claims.

What I claim is:

1. In a heat transfer device, a bank of horizontal tubes with a support at one end thereof, a plurality of members secured between intermediate portions of adjacent tubes of said bank and coacting therewith to form a truss support therefor and prevent lateral distortion of the bank, while permitting longitudinal expansion and contraction of said tubes.

2. In a heat transfer device, a bank of tubes each having a plurality of return bends of considerable length and supported in suspension from its ends, a plurality of members secured between the tube legs of said bank and coacting therewith to form a truss support therefor and prevent lateral distortion of the bank while permitting expansion and contraction of said tubes.

3. Heat transfer apparatus comprising means forming a high temperature heating gas flue, a bank of tubular fluid conduit elements, each arranged in a plurality of superposed tube legs of substantial length extending across said gas flue and having their ends connected for a serial flow of fluid therethrough, means for supporting said tube bank at longitudinally spaced points, and means for minimizing sagging of the tubes of said bank between said points of support consisting of members connecting adjacent tube legs of each tube, with the connecting members for each tube arranged and uniting with the connected tube portions to form a truss extending substantially between the points of support.

4. Heat transfer apparatus comprising means forming a high temperature heating gas flue, a bank of tubular fluid conduit elements, each arranged in a plurality of superposed tube legs of substantial length extending substantially horizontally in said gas flue and having their ends connected by return bends for a serial flow of fluid therethrough, means for supporting said tube bank at its ends, and means for minimizing sagging of the tubes of said bank between said points of support consisting of metallic members connecting adjacent tube legs of each tube, with the connecting members for each tube arranged and uniting with the connected tube portions to form a truss extending substantially between the points of support.

5. Heat transfer apparatus comprising means forming a high temperature heating gas flue, a bank of tubular fluid conduit elements, each arranged in a plurality of superposed tube legs of substantial length extending substantially horizontally in said gas flue and having their ends connected by return bends for a serial flow of fluid therethrough, means for supporting said tube bank at its ends, means for minimizing sagging of the tubes of said bank between said points of support consisting of metallic members connecting adjacent tube legs of each tube, with the connecting members for each tube arranged

and uniting with the connected tube portions to form a truss extending substantially between the points of support, and rigid metallic members connecting laterally adjacent tubes to minimize lateral distortion of the tube bank.

6. Heat transfer apparatus comprising means forming a heating gas flue, spaced headers, a bank of multiple-looped return bend tubes of substantial depth having their opposite ends connected to said headers and intermediate portions arranged in a plurality of superposed tube legs of substantial length extending across said gas flue and connected by return bends, means for supporting said tube bank at spaced points adjacent the sides of said gas flue, and means for minimizing sagging of said bank between said points of support consisting of members connecting adjacent superposed tube legs and arranged and uniting with the connected tube legs to form a truss between the points of support.

7. A steam generator comprising a furnace chamber and a steam boiler above the furnace chamber, said boiler comprising opposite rows of vertical headers, a bank of horizontally inclined water tubes connecting said rows of headers, means providing an up-pass for the flow of products of combustion adjacent one of said rows of headers, a bank of tubular fluid conduit elements of substantial depth above said water tube bank and arranged in vertical rows with a plurality of tubular elements of substantial length in each row extending across said up-pass, means for supporting said bank of tubular elements at spaced points adjacent the sides of said up-pass, and means connecting adjacent superposed tubular elements in each row and uniting with the connected element portions to form a truss for minimizing sagging of said bank of tubular elements between said points of support.

8. A steam generator comprising a furnace chamber and a steam boiler above the furnace chamber, said boiler comprising opposite rows of vertical headers, a bank of horizontally inclined water tubes connecting said rows of headers, means providing an up-pass for the flow of products of combustion adjacent one of said rows of headers, a bank of tubular fluid conduit elements of substantial depth above said tube bank and arranged in vertical rows with a plurality of tubular elements of substantial length in each row extending across said up-pass, means for supporting said bank of tubular elements at spaced points adjacent the sides of said up-pass, and means for minimizing sagging of said bank of tubular elements between said points of support consisting of lugs welded to adjacent superposed tubular elements in each row and uniting with the connected element portions to form a truss.

9. A steam generator comprising a furnace chamber and a steam boiler above the furnace chamber, said boiler comprising upper opposite rows of vertical headers, lower opposite rows of vertical headers below the upper headers and spaced therefrom, opposite rows of nipples connecting vertically aligned headers, a lower bank of horizontally inclined water tubes connecting the lower headers, an upper bank of horizontally inclined water tubes connecting the upper headers, means providing an up-pass for the flow of products of combustion adjacent one of the rows of nipples and the headers connected thereto, a bank of tubular fluid conduit elements of substantial depth between said tube banks and ar-

5 ranged in vertical rows with a plurality of tubular elements of substantial length in each row extending across said up-pass, means for supporting said bank of tubular elements at spaced points adjacent the sides of said up-pass, and means connecting adjacent superposed element portions in each row and uniting with the connected element portions to form a truss for minimizing sagging of said bank of tubular elements between said points of support.

10 10. The combination in a superheater of a pair of spaced parallel headers and units connected between said headers, said units comprising a plurality of vertically spaced horizontally extending pipe runs serially connected by return bends, stiffening means fixed between the upper pipe runs of each unit to form a girder thereof; means for supporting the weight of the pipe runs below said girder therefrom, and means for supporting said girder.

15 11. A steam boiler comprising a steam and water drum, a fluid heater positioned below said drum and comprising a bank of return bend fluid heating tubes having superposed tube legs of substantial length, vertically extending supporting tubes having their upper ends connected to said drum, means for supporting one end of said fluid heater from said supporting tubes, means for supporting said fluid heater adjacent its opposite end, and means for minimizing sagging of said fluid heater tube legs between said points of support consisting of members rigidly connecting adjacent superposed tube legs and arranged in a truss-defining formation between said points of support.

20 12. Fluid heating apparatus comprising a heating gas pass, a group of fluid heating tubes each having a series of superposed tube legs extending across said gas pass and serially connected at opposite sides of said gas pass by return bend portions arranged in vertical planes, means for supporting said fluid heating tubes at opposite sides of said gas pass, and means connecting adjacent superposed tube legs of each fluid heating tube in a truss formation between said points of support.

25 13. A steam boiler comprising a bank of steam generating tubes, a steam and water drum, conduits extending upwardly from one end of said tube bank to said drum, a fluid heater positioned above said tube bank and comprising a bank of

return bend fluid heating tubes each having superposed tube legs of substantial length, means for supporting one end of said fluid heater from said conduits, means for supporting said fluid heater adjacent its opposite end, and means independent of said steam generating tube bank for minimizing sagging of said fluid heater tube legs between said points of support consisting of members rigidly connecting adjacent superposed tube legs and arranged in a truss-defining formation between said points of support.

30 14. A steam boiler comprising a bank of steam generating tubes, a steam and water drum, upcomer and downcomer conduits extending upwardly from the upper and lower ends of said tube bank respectively to said drum, a fluid heater positioned above said tube bank and comprising a bank of return bend fluid heating tubes each having superposed tube legs of substantial length, means for supporting one end of said fluid heater from said upcomer conduits, means for supporting said fluid heater adjacent its opposite end, and means independent of said steam generating tube bank for minimizing sagging of said fluid heater tube legs between said points of support consisting of members rigidly connecting adjacent superposed tube legs and arranged in a truss-defining formation between said points of support.

35 15. A steam boiler comprising a steam and water drum, a bank of inclined steam generating tubes below said drum, upcomer and downcomer conduits extending upwardly from the upper and lower ends of said tube bank respectively to said drum, a steam superheater positioned above said tube bank and below said drum and comprising a bank of horizontally extending return bend tubes having superposed tube legs, means connecting adjacent superposed tube legs of said superheater tubes in a truss formation extending between opposite ends of said superheater, and means for supporting said superheater at its opposite ends comprising cooperating members mounted on said upcomer conduits and adjacent portions of said superheater tubes respectively and arranged to provide a supporting connection for said superheater tubes permitting expansion thereof relative to said upcomer conduits.

LAMBERT KOOISTRA. 50