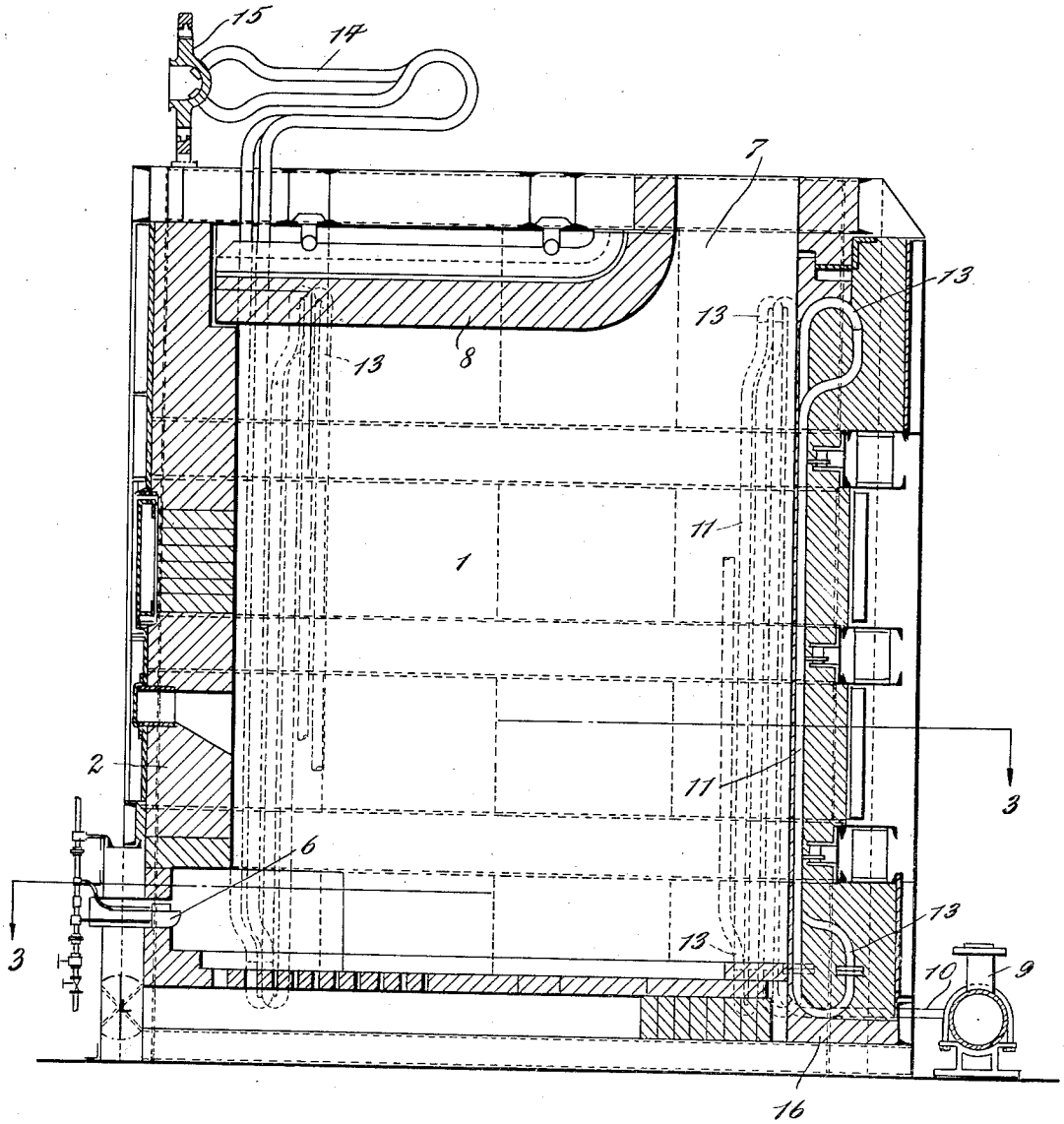
Aug. 22, 1933. H. J. KERR ET AL 1,923,097

RADIANT HEAT SUPERHEATER

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Fig. 1.



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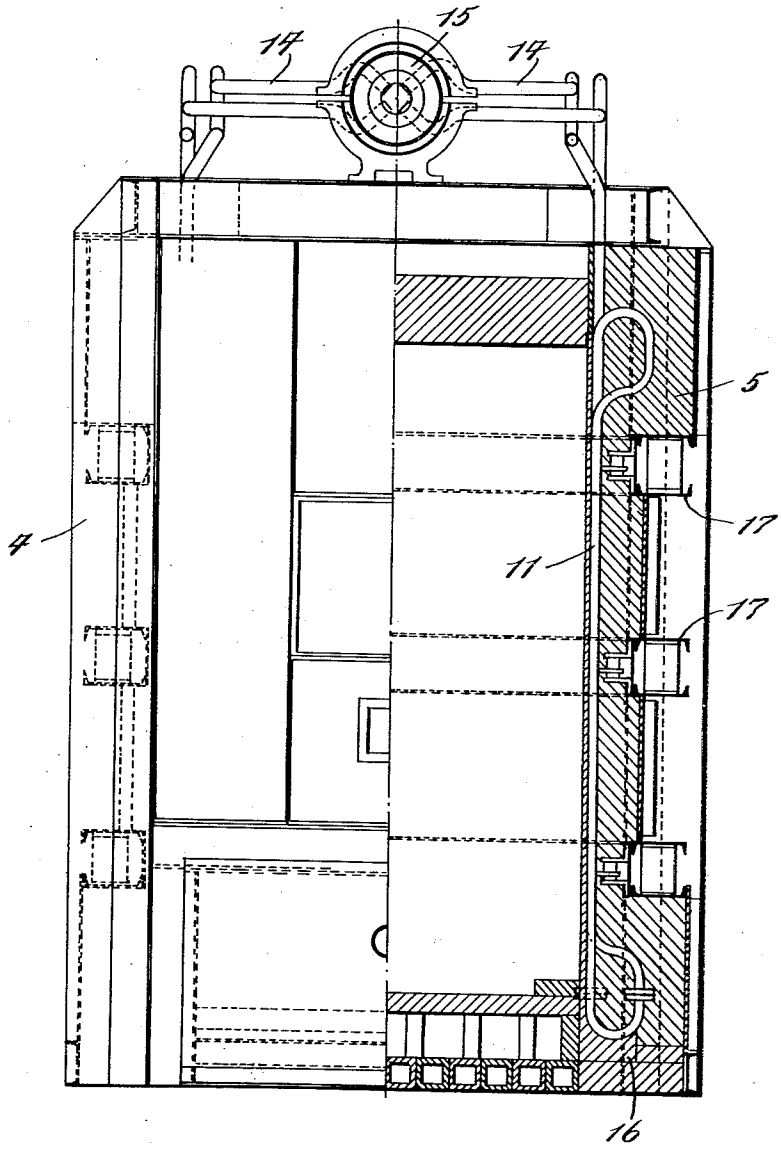
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RADIANT HEAT SUPERHEATER

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Fig. 2.



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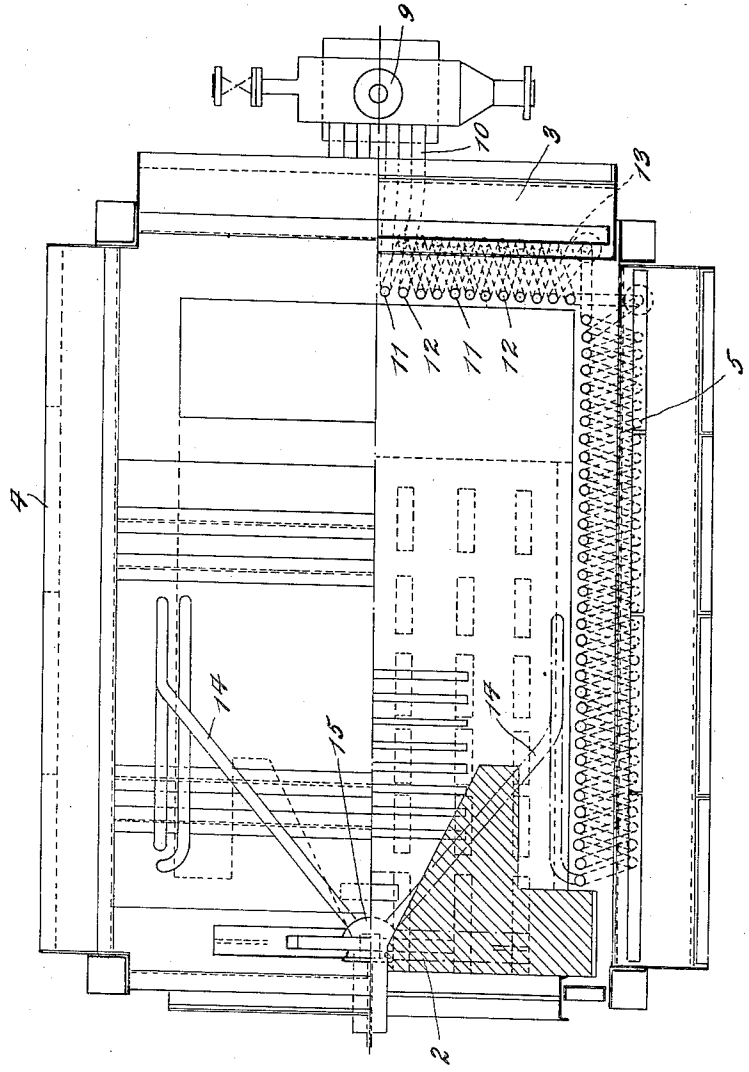
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Fig. 3.



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Fig. 11.

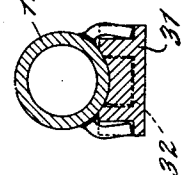


Fig. 10.

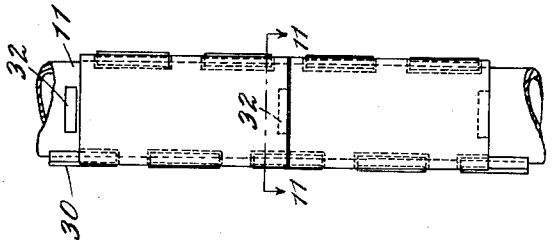


Fig. 8.

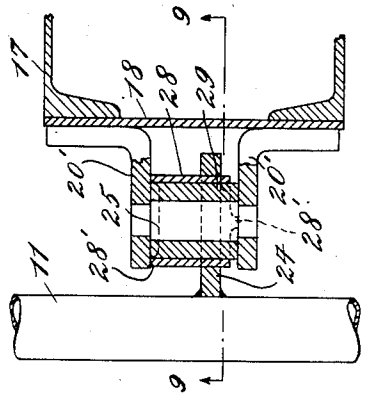


Fig. 9.

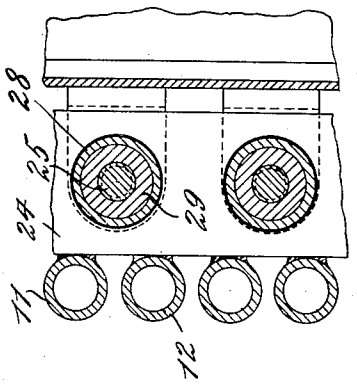


Fig. 6.

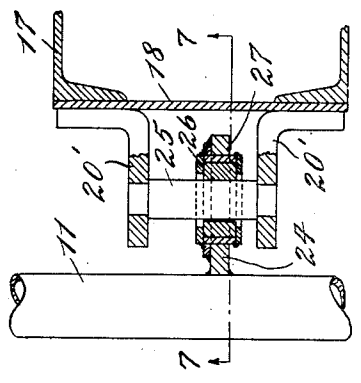


Fig. 7.

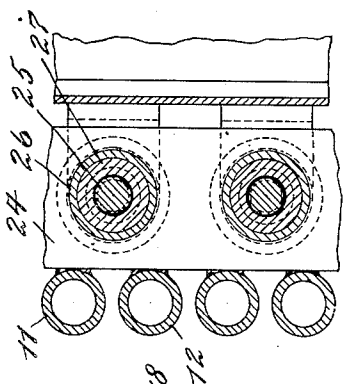


Fig. 4.

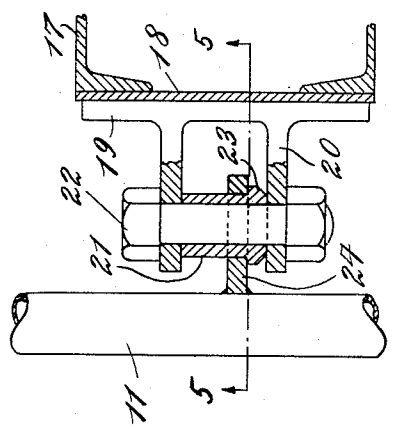
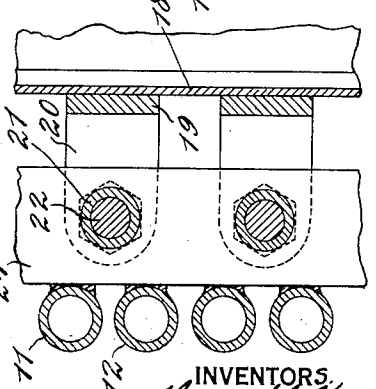


Fig. 5.



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UNITED STATES PATENT OFFICE

1,923,097

RADIANT HEAT SUPERHEATER

Howard J. Kerr, Westfield, and John E. Black, Rumson, N. J., assignors to The Babcock & Wilcox Company, Bayonne, N. J., a Corporation of New Jersey

Application July 19, 1929. Serial No. 379,397

15 Claims. (Cl. 122—485)

This invention relates to a novel and improved form of radiant heat superheater, more particularly of the separately fired type, and the novel features will be best understood from the following description and the annexed drawings, in which we have shown selected embodiments of the invention and in which;

Fig. 1 is a vertical longitudinal section through a superheater constructed according to the invention.

Fig. 2 is a view taken from the left of Fig. 1, half of this view being an end elevation and half a vertical section through Fig. 1.

Fig. 3 is a view, half of which is a top plan view of Fig. 1, and the other half of which is a section on the line 3—3 of Fig. 1.

Fig. 4 is a vertical section showing one form of connecting tubes to supporting members.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Figs. 6, 7, 8 and 9 are views corresponding respectively to Figs. 4 and 5, but showing different forms which the connecting means may take.

Fig. 10 is a fragmentary vertical elevation of the front of a tube having tile secured thereto, and Fig. 11 is a section on the line 11—11 of Fig. 10.

Referring now to the drawings in detail, the invention is shown as embodied in a separately fired superheater which comprises a combustion chamber 1 having a front wall 2, a rear wall 3, and side walls 4 and 5. Means is provided for burning fuel in the chamber, this means being exemplified by oil burners 6 disposed in the front wall and adapted to project burning fuel towards the rear wall. Air for combustion purposes may be introduced through holes in the floor. The products of combustion pass upwardly through the throat 7, the top of the chamber being formed by an arch 8.

Disposed adjacent the wall 3 at the end opposite the burners, is a steam inlet 9 from which lead a plurality of connections 10, here shown as four in number. These connections are connected to groups of wall tubes 11 and 12, each connection joining one group to the inlet. These wall tubes are shown arranged in a single row along the respective walls and extend vertically for substantially the entire height of the rear wall 3 and the side walls 4 and 5, each group being formed of alternate tubes in a row. One of the connections from the inlet is joined to one of the tubes 11, and another is joined to one of the tubes 12. Each tube 11 is joined to the next tube 11 by means of outwardly extending loops 13 disposed at the top and bottom of the tubes, the groups extending both ways from the inlet 9 along the face of the wall 3 and thence along the walls 4 and 5 respectively. There are thus provided four groups of tubes, and each group terminates adjacent the front wall 2, where it is joined by suitable connections 14 to a steam outlet 15. The tubes for walls 4 and 5 and the supporting means associated therewith, particularly toward the steam outlet, are preferably made of a material more highly resistant to heat than are the tubes and supports in the end wall 3. The lower loops 13 of the tubes are supported on tile 16 which thus form a support for the entire tube. The tubes 11 in the row in any one wall are preferably all joined together at their upper and lower looped portions as by welding, so as to form, in effect, one continuous tube from the inlet to the outlet and, similarly, the tubes 12 in a row are all joined together. Flanged connections are provided for joining the tubes in adjacent walls.

Disposed in the walls 3, 4 and 5 are horizontally extending supports here shown as channels 17, to the inner flanges of which are secured plates 18 as best shown in Figs. 4 to 9 inclusive. On the inner face of these plates are secured brackets to secure the tubes to the supports. Referring first to Figs. 4 and 5, the bracket 19 is provided with inwardly extending ears 20, between which is disposed a porcelain thimble 21 held in place by a bolt 22 passing through the thimble. The thimble is provided with a horizontal shoulder 23 between which, and the upper ear 20 may slide a bar 24 to which is welded a plurality of tubes 11 and 12, this bar having holes to receive the thimbles. The porcelain thimble forms a support or bearing and guide for the bar, and also serves to decrease heat losses from the tubes to the supporting means. The above arrangement serves to restrict lateral movement of the tubes while permitting expansion and contraction longitudinally thereof. In the form shown, there are three vertically spaced tube supports, and preferably in the middle one, the bar 24 is provided with slots permitting movement of the tubes towards the furnace when heated.

In Figs. 6 and 7, there is shown a modification, in which there are provided two ears 20' between which is secured a pin 25. In this form the bar 24 is provided with larger openings than in the form shown in Figs. 4 and 5, and in each opening is secured a metallic cage 26 within which is a porcelain collar 27.

In the form shown in Figs. 8 and 9, which is now considered the preferred form, the cage is

in the form of a metallic sleeve 28 enclosing a porcelain collar 29, this collar extending substantially the entire length of the pin 25 between the ears 20' and the sleeve 28 forming a bearing extending through the hole in the bar 24. This sleeve has at its ends circumferentially spaced projections 28' which serve to space the body of the sleeve from the ears.

In Figs. 10 and 11 is shown a tube 11 having lugs 30 welded thereto and adapted to engage in recesses in tile 31 to hold the tile in position on the face of the tube. Transversely extending lugs 32 are welded to the face of the tube to aid in supporting the tile. The tile may also be cemented to the tubes and lugs.

We claim:—

1. A radiant heat superheater comprising an inlet and an outlet, and a plurality of parallel tubes disposed in a row between said inlet and outlet, with alternate tubes in the row connected together and adjacent tubes connected to the inlet and outlet by separate connections, whereby two paths are formed between the inlet and the outlet.

2. A separately fired superheater comprising a combustion chamber having end and side walls, means for projecting a burning fuel from one of said end walls towards the other, a steam inlet disposed adjacent said other end of the chamber, steam tubes lining said other end wall and said side walls and arranged in groups extending from said inlet, a connection from said inlet to one end of each of said groups, and a steam outlet connected to the other end of each of said groups.

3. In combination, a combustion chamber having a wall, a row of tubes disposed in said wall and adapted to receive heat from said chamber, loops joining together the ends of said tubes to form a continuous length of tubing, and an inlet and outlet connected to opposite ends of said tubing, said loops being located rearwardly of the inner face of the wall so that they are protected from excessive heating.

4. A separately fired steam superheater comprising, in combination, a combustion chamber having end walls and side walls, means for projecting a burning fuel across said chamber, a steam inlet disposed adjacent the wall of the chamber remote from said means, steam conducting tubes lining the chamber walls and arranged in groups extending from said inlet, a connection from said inlet to one end of each of said groups and a steam outlet connected to the other end of each of said groups, the tubes of some of the groups being arranged in alternation.

5. A steam superheater comprising, in combination, a furnace providing a combustion chamber having end and side walls, means in one of the said walls for projecting a burning fuel toward the opposite wall, a steam inlet disposed externally of and adjacent said opposite wall, rows of steam conducting tubes lining said walls and arranged in groups of alternate tubes beginning at said inlet, a separate connection from said inlet to one end of each of said groups, wall-enclosed loops connecting successive tubes of said groups, and a steam outlet connected to the other end of each of said groups.

6. A fluid heat exchange device comprising, in combination, a heating chamber, a row of fluid conducting tubes lining one wall of said chamber, and intersecting loops connecting alternate tubes so as to form the row of tubes into a plurality of fluid conducting conduits.

7. A fluid heat exchange device comprising, in combination, a heating chamber, a row of fluid conducting tubes lining one wall of said chamber, and overlapping loops connecting alternate tubes so as to form the row of tubes into a plurality of fluid conducting conduits.

8. In a radiantly heated steam superheater, a furnace, means for burning fuel in the furnace, a wall confronting the burning fuel, a steam inlet adjacent the wall, a steam outlet, a plurality of conduits conducting steam from the inlet to the oulet, each conduit having sections arranged along the wall and subjected to heat radiantly transmitted from the burning fuel, tying means positioned along the wall and connected to said sections, lost motion connections in the tying means for maintaining the sections in their operative positions while permitting the sections to have expansion and contraction movements relative to the wall, and mechanically stressed thermal insulators in said lost motion connections and constituting parts of the bearing surfaces of said connections.

9. In a radiantly heated steam superheater, a furnace including a structural member, means for burning fuel in the furnace, a wall confronting the burning fuel, a steam inlet adjacent the wall, a steam outlet, and a plurality of conduits conducting steam in the same number of separated streams from the inlet to the outlet, each conduit having sections arranged along the wall and subjected to heat radiantly transmitted from the burning fuel, a guide member back of the sections and extending longitudinally thereof, a cooperating member having an opening receiving the guide member, and a mechanically stressed thermal insulator interposed relative to said members, said members and the insulator constituting tying means maintaining the sections in their operative positions during longitudinal expansion and contraction movements of the sections.

10. In fluid heat exchange apparatus, a furnace, a row of fluid conducting tubes arranged along a wall of the furnace to receive heat radiantly transmitted from burning fuel in the furnace to heat a contained fluid to temperatures above 1000° F., heat insulating material and structural members disposed rearwardly of the tubes, and metallic tying means connecting the structural members and the tubes through the insulating material to maintain the tubes in their operative positions while permitting them to have longitudinal expansion and contraction movements relative to the structural members, the insulating material being in the form of metal encased heat insulating devices interposed in the tying means to interrupt the transmission of the high temperature heat to the structural members, said devices constituting parts of the bearing surfaces which have relative movements during movements of the tubes.

11. In a fluid heat exchange device, a tubular member subjected to furnace gases at high temperatures and containing a fluid the temperature of which is raised by heat from the gases, a heat conductive support not exposed to the furnace gases, and means connecting the member and the support and having bearing surfaces permitting relative movement therebetween while maintaining the member in its operative position, said means including a thermal insulator forming one of the bearing surfaces and adapted to withstand the high mechanical stresses imposed by the forces causing such relative movement without losing its integrity or its heat insulating property.

12. In a fluid heat exchange device, a tubular member subjected to furnace gases at high temperatures and containing a fluid the temperature of which is raised by heat from the gases, a heat conductive support not exposed to the furnace gases, and means connecting the member and the support and having bearing surfaces permitting relative movement therebetween while maintaining the member in its operative position, said means including a metal jacketed thermal insulator forming one of the bearing surfaces and adapted to withstand the high mechanical stresses imposed by the forces causing such relative movement without losing its integrity or its heat insulating property.

13. A wall tube superheater comprising, in combination, a furnace, a plurality of tube sections arranged along a wall of the furnace and conducting a fluid past the furnace gases, end connectors joining the adjacent ends of pairs of tubes to connect them for the series flow of a motive fluid therethrough, and means intermediate the connectors and connected to the sections and a wall of the furnace for maintaining the sections in their operative positions during their expansion and contraction movements, the connectors and said means being arranged to permit different sections to move apart or lengthwise with relation to each other without imposing excessive stresses upon the entire structure.

14. In a superheater, a furnace, a source of motive fluid, a row of tube sections disposed in substantial parallelism along a wall of the furnace, free tubular loops joining the adjacent ends of pairs of the sections so that the motive fluid flows in series through the connected tube sections in series, separate series of the sections and loops forming separate conduits through which the fluid flows in parallelism from an inlet to an outlet with the loops at both ends of the sections, the loops permitting the connected sections to move freely under the influence of the forces of expansion and contraction, and means acting upon the sections to maintain them in their operative relationships during such movements.

15. In a superheater, a furnace, a source of motive fluid, a row of tube sections disposed in substantial parallelism along a wall of the furnace, relatively free tubular loops joining the adjacent ends of pairs of the sections so that the motive fluid flows in series through the connected tube sections in series, separate series of the sections and loops forming separate conduits through which the fluid flows in parallelism from an inlet to an outlet, the loops permitting the connected sections to move freely under the influence of the forces of expansion and contraction, and means acting directly upon the sections and connected to a fixed part of the furnace structure to maintain the sections in their operative relationships while permitting the sections to move relatively longitudinally under the influence of contraction and expansion.

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