April 24, 1945. D. DALIN 2,374,178

MEANS FOR REGULATING THE PASSAGE OF GASES IN HEAT EXCHANGERS

Filed Dec. 12, 1942 2 Sheets-Sheet 1

Fig. 1

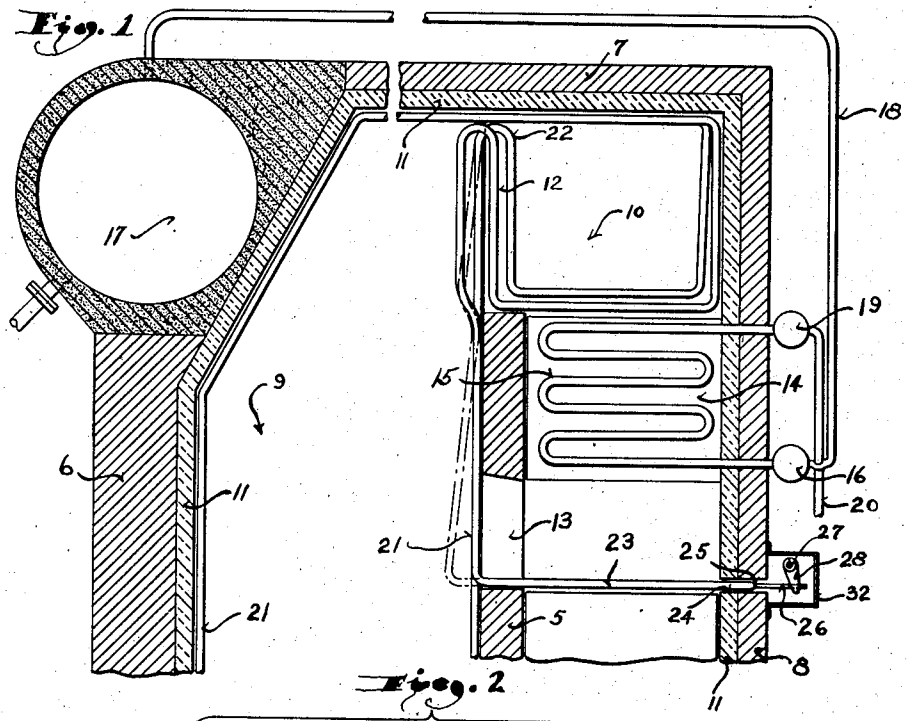
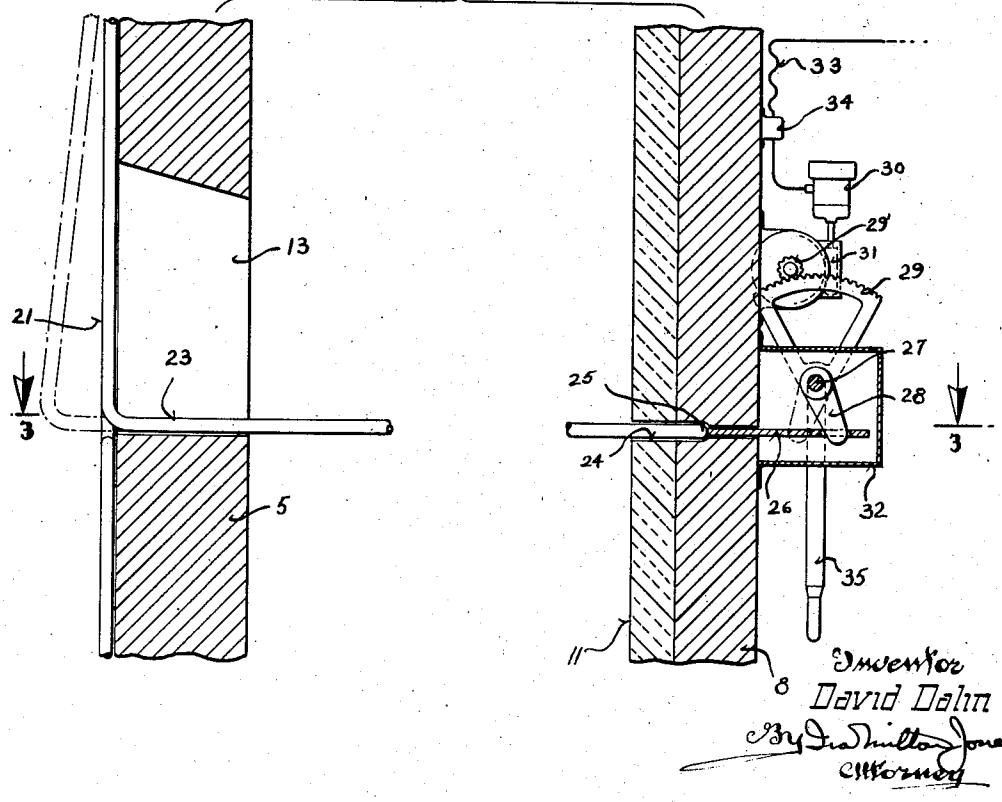


Fig. 2



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Fig. 3

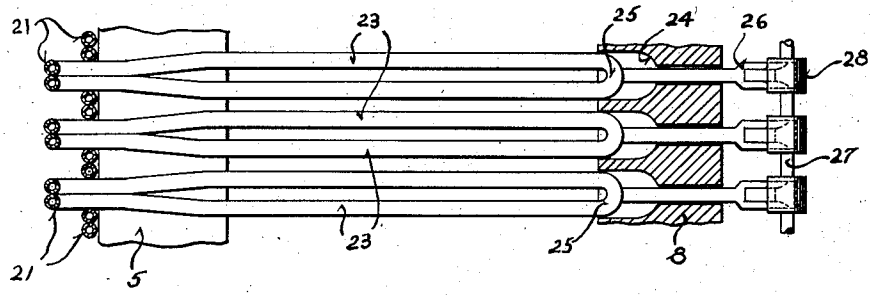


Fig. 4

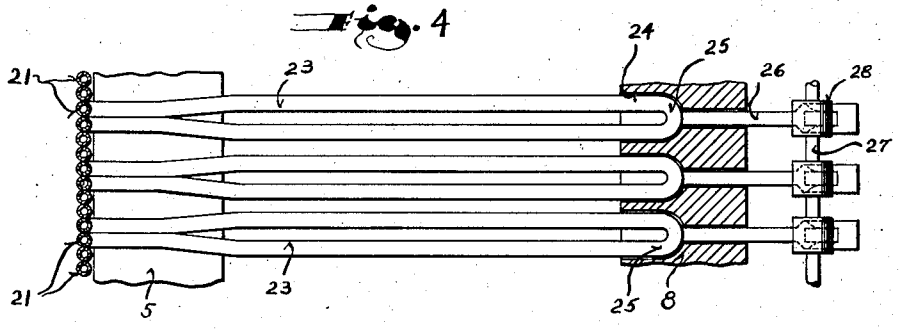
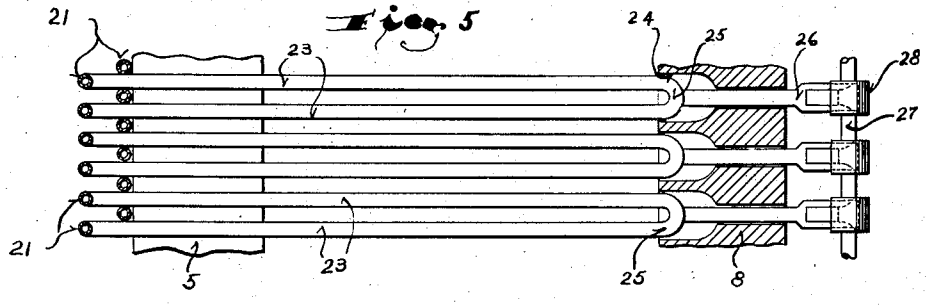


Fig. 5



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2,374,178

MEANS FOR REGULATING THE PASSAGE OF GASES IN HEAT EXCHANGERS

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Application December 12, 1942, Serial No. 468,832
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7 Claims. (Cl. 122—480)

This invention relates to heat exchange apparatus and refers particularly to a shutter or damper construction for controlling the flow of temperature modifying gases through a gas pass in which a heat exchanger may be located.

There are many instances in heat exchange apparatus where it is desirable to regulate the flow of hot gases through a gas pass and thereby control the effect of the hot gases upon a heat exchanger which may be a superheater or the like. One such instance is found in steam generators wherein the furnace has an offtake gas passage in which a superheater is located. Thus, by controlling the amount of the hot gases which pass through that portion of the offtake gas passage in which the superheater is located a predetermined output condition may be maintained for the steam generator.

With this general objective in view, it is an object of the present invention to provide a shutter or damper construction for controlling the passage of gases through an opening and wherein the shutter or damper comprises a bank of fluid cooled tubes certain of which are movable with respect to others to vary the spacing between the tubes and thereby regulate the flow of gases through the opening.

More specifically, it is an object of this invention to provide a heat exchange apparatus equipped with cooperating walls which define primary and secondary gas passages connected by a main inlet and a by-pass opening and wherein a bank of fluid cooled tubes extending across the by-pass opening serves to regulate the flow of hot gases through that portion of the secondary passage lying between the main inlet and the by-pass opening.

Another object of this invention is to provide a damper or shutter of the character described which is composed of a bank of fluid cooled tubes so mounted that certain of the tubes may be flexed to vary their positions with respect to adjacent tubes and thereby determine the effectiveness of the barrier formed by the bank of tubes.

The present invention is particularly advantageous in the control of gas flow through separate passageways of the furnace chamber in a steam generator for the reason that one set of tubes may be used to form the variable shutter or damper and also line the furnace walls to simultaneously insulate the furnace walls and constitute part of the boiler heat exchange surface.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a vertical sectional view through a steam generator illustrating one application of the invention;

Figure 2 is an enlarged view showing a portion of the construction shown in Figure 1;

Figures 3 and 4 are fragmentary sectional views taken through Figure 2 on the plane of the line 3—3 and showing the open and closed positions of the damper; and

Figure 5 is a view similar to Figure 3, but showing a slightly modified arrangement of the tubes.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts, the numeral 5 designates a partition wall which cooperates with fixed furnace walls 6, 7, and 8 to form a primary gas passageway 9 and a secondary gas passageway 10, the furnace walls having a refractory lining 11.

The top of the partition wall 5 is spaced from the top furnace wall 7 to provide a main inlet opening 12 connecting the primary and secondary gas passageways at the top. A by-pass opening 13 in the partition wall and spaced downwardly from the top thereof provides another point of communication between the two passageways.

The area of the secondary passageway 10 lying between the main inlet opening 12 and the by-pass opening 13 constitutes a heating chamber 14 in which a superheater 15 is located.

The inlet ends of the superheater coils are connected with an inlet header 16 which in turn is connected to a steam drum 17 by a supply line 18. The outlet ends of the superheater coils are connected to an outlet header 19 from which a steam line 20 leads to any desired point of steam utilization.

Fluid cooled tubes or coils 21 line the furnace walls, extending along the wall 6 to the ceiling wall 7 which they follow to the wall 8. Here the tubes extend down along the wall 8 to a point substantially in line with the top of the partition wall 5. The tubes or coils then continue across the secondary gas passageway to a point adjacent to the top of the partition wall

where they are directed abruptly upwardly and downwardly to form hairpin bends 22 and continue downwardly across the face of the partition wall defining one side of the primary gas passageway.

Adjacent tubes or coils have their hairpin portions 22 offset so as to permit the flow of combustion gases through the main inlet opening 12, the extent of the offset determining the freedom of gas flow through the main inlet.

At the by-pass opening 13 the tubes or coils are disposed in side by side relation to normally close the by-pass opening so that the gases enter the secondary gas passageway through the main inlet opening 12 to flow down past the superheater coils 15 and out through the lower portion of the secondary gas passageway which may be used for an economizer chamber.

Certain of the coils 21 are bent at right angles adjacent to the lower edge of the by-pass opening 13 to have portions 23 extend across the secondary gas passageway into openings 24 in the wall 8 where they are looped back on themselves as at 25. The loops 25 have links 26 connected thereto and extended out through the wall 8 to provide means for applying endwise motion to the looped portions of the coils.

The mechanism by which such motion may be imparted to the coils comprises a shaft 27 mounted for oscillation and provided with levers 28 which have their free ends connected to the links 26. A gear segment 29 secured to the shaft 27 meshes with a pinion 29' driven from a Selsyn type motor 30 by a worm and worm wheel 31. A cover or housing 32 preferably encloses the projecting ends of the links 26 and their actuating levers to close the openings 24.

The Selsyn type motor is controlled by an impulse organ or regulating mechanism 33 responsive to temperature sensitive control means (not shown) but governed by the temperature of the steam issuing from the superheater, the impulse organ acting through a relay 34.

Upon oscillation of the shaft 27 either by the Selsyn type motor or by a manually actuatable handle 35 all of the levers 28 and all of the coils driven thereby are pushed or pulled to flex the tubes so connected thereto and extending across the by-pass opening to vary their spacing with relation to the other stationary tubes which continue straight across the by-pass opening. Thus, it is possible to adjust the size of the by-pass opening to permit the hot combustion gases to by-pass the superheater coils and thereby maintain a predetermined temperature condition for the steam issuing from the superheater.

It is, of course, obvious that the levers 28 can be mounted on the shaft 27 in different positions of angular relationship so that certain of the coils will be moved farther than others if this is found desirable or necessary to maintain proper control for the flow of hot gases or for like purposes the links may have a lost motion connection with their respective levers 28.

The tubes or coils 21 are adapted to have a suitable coolant, as for instance, a water-steam emulsion, continuously circulated therethrough and as will be readily apparent, the tubes or coils may constitute part of the heat exchange surface of the boiler. Therefore, they not only serve the dual function of increasing the heating surface of the boiler and of providing a controllable damper or shutter for the by-pass opening 13, but, lining the walls of the furnace chamber as they do, they also protect these walls from direct heat application.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a heat exchange apparatus: fixed furnace walls; a partition wall cooperating with said fixed furnace walls to define adjacent primary and secondary passageways for hot combustion gases, said partition wall having a main opening through which said passageways are connected for the flow of hot gases from the primary passageway into the secondary passageway and having a bypass opening spaced from the main opening through which the hot combustion gases may flow to avoid the area in the secondary passageway lying between said openings; a heat exchange device in said area of the secondary passageway; a bank of fluid cooled tubes extending across said bypass opening to form a barrier of variable effectiveness depending upon the spacing of said tubes, said tubes extending along the partition wall to a point spaced a considerable distance from the bypass opening, certain of the tubes having their portions which extend across the bypass opening movable with respect to the other tubes by flexure of their portions remote from the bypass opening; and means connected to said movable tubes for flexing said tubes to vary the effectiveness of the barrier across the bypass opening and consequently the affect of the hot combustion gases on the heat exchange device.

2. In a heat exchange apparatus: fixed furnace walls; a partition wall cooperating with said fixed furnace walls to define adjacent primary and secondary passageways for hot combustion gases, said partition wall having a main opening through which said passageways are connected for the flow of hot gases from the primary passageway into the secondary passageway and having a bypass opening spaced from the main opening through which the hot combustion gases may flow to avoid the area in the secondary passageway lying between said openings; a heat exchange device in said area of the secondary passageway; a bank of fluid cooled tubes extending across said bypass opening to form a barrier of variable effectiveness depending upon the spacing of said tubes, the tubes of said bank extending across the partition wall between its two openings and across the main opening where they have a reverse bend, the spacing of the tube portions extending across the main opening being substantial so as not to interfere too greatly with the flow of gases from the primary passageway into the secondary passageway, the portions of the tubes extending across the bypass opening being normally closely adjacent to each other to form an effective barrier; and means connected to certain of the tubes at the bypass opening for flexing said tubes from their reverse bends to alter the spacing between the tube portions extending across the bypass opening and thus vary the effectiveness of the barrier across the bypass opening and correspondingly alter the affect of the hot combustion gases on the heat exchanger.

3. In a heat exchange apparatus: fixed furnace walls; a partition wall cooperating with said fixed furnace walls to define adjacent primary and secondary passageways for hot combustion gases, said partition wall having a main opening through which said passageways are connected for the flow of hot gases from the primary passageway into the secondary passageway and having a bypass opening spaced from the main opening through which the hot combustion gases may

flow to avoid the area in the secondary passageway lying between said openings; a heat exchange device in said area of the secondary passageway; a bank of fluid cooled tubes extending across said bypass opening to form a barrier of variable effectiveness depending upon the spacing of said tubes, said tubes lining the walls of the primary passageway and extending through the main opening to line part of the walls of the secondary passageway, said tubes also extending across the partition wall space intervening its openings, and certain of the tubes having continuations thereof passing through the bypass opening and extending across the secondary passageway to a point adjacent to one of the fixed furnace walls; and means on the exterior of said fixed furnace wall and connected to said adjacent tube portions for moving said portions toward and from the partition wall so as to flex the tubes connected thereto and thus shift the same relative to the other tubes extending across the bypass opening to vary the effectiveness of the barrier across said bypass opening.

4. In a heat exchange apparatus of the character described: cooperating fixed walls defining a passageway for hot combustion gases, said passageway having an inlet through which hot combustion gases normally enter the same, one of the walls defining said passageway having a bypass opening through which the hot gases may flow into the passageway and thus bypass that part of the passageway lying between the bypass opening and the inlet; a bank of fluid cooled tubes overlying said wall and extending across the by-pass opening, said tubes in their normal positions being closely adjacent to substantially close the bypass opening, certain of the tubes being bent abruptly and extending through the bypass opening across the passageway to the opposite wall thereof at which point said tubes have a return bend to again cross the passageway and extend through said bypass opening; and means exteriorly of said passageway and connected to the reversely bent portions of the tubes for shifting the same toward and from the wall in which the bypass opening is located to thereby flex the tubes connected thereto out of their normal positions to vary the spacing between the tubes forming the barrier across the bypass opening.

5. In a heat exchange apparatus of the character described: fixed furnace walls; an upright partition wall cooperating with the furnace walls to define substantially vertical primary and secondary passageways for hot combustion gases, the top of said partition wall being spaced from the top fixed furnace wall to provide normal communication between said passageways, said partition wall having a bypass opening spaced downwardly of its top, the space in the secondary passageway between the top of the partition wall and its bypass opening serving as a superheater chamber; a superheater in said chamber; a bank of fluid cooled tubes covering the upper portion of the partition wall and extending across the bypass opening to form a barrier of variable effectiveness depending upon the spacing of the tubes, certain of said tubes being movable at least in their portions which extend across the bypass opening to vary the effectiveness of said barrier, said movable tubes having loop portions extending through the bypass opening and across the secondary passageway to a point adjacent to the opposite fixed furnace wall; and means exteriorly of said fixed furnace wall and connected with said looped portions for shifting said looped portions toward and from the partition wall to shift the movable tubes with respect to the fixed tubes and thereby vary the effectiveness of the barrier and correspondingly alter the affect of the hot combustion gases on the superheater.

6. In a heat exchange apparatus of the character described: fixed furnace walls; an upright partition wall cooperating with the furnace walls to define substantially vertical primary and secondary passageways for hot combustion gases, the top of said partition wall being spaced from the top fixed furnace wall to provide normal communication between said passageways, said partition wall having a bypass opening spaced downwardly of its top, the space in the secondary passageway between the top of the partition wall and its bypass opening serving as a superheater chamber; a superheater in said chamber; a bank of fluid cooled tubes covering the upper portion of the partition wall and extending across the bypass opening to form a barrier of variable effectiveness depending upon the spacing of the tubes, certain of said tubes being movable at least in their portions which extend across the bypass opening to vary the effectiveness of said barrier, said movable tubes having loop portions extending through the bypass opening and across the secondary passageway to a point adjacent to the opposite fixed furnace wall; and means exteriorly of said fixed furnace wall and connected with said looped portions for shifting said looped portions toward and from the partition wall to shift the movable tubes with respect to the fixed tubes and thereby vary the effectiveness of the barrier, said bank of tubes extending upwardly beyond the top of the partition wall and each tube having a return bend near the top furnace wall from which point the movable tubes flex during adjustment of the barrier, the tube portions above the partition wall being spaced to permit the flow of hot combustion gases therebetween.

7. In a heat exchange apparatus: fixed furnace walls; an upright partition wall cooperating with the furnace walls to define adjacent primary and secondary passageways; a main opening connecting the primary and secondary passageways; said partition wall having a bypass opening at a distance from said main opening through which hot combustion gases flowing in the primary passageway towards the main opening may enter the secondary passageway before they reach the main opening and thus bypass the space in the secondary passageway beyond the bypass opening; a superheater in said space; a bank of liquid cooled tubes connected to a source of cooling liquid and extending across the bypass opening and by their spacing controlling the amount of hot gases which bypass the superheater in the secondary passageway beyond the bypass opening; and means connected to certain of said tubes in the region of the bypass opening for flexing said tubes to shift their portions which extend across the bypass opening with respect to the remaining tubes and thus vary the spacing between the tubes to control the amount of the hot gases which bypass the superheater.

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