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SUPERHEATER

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Fig. 1.

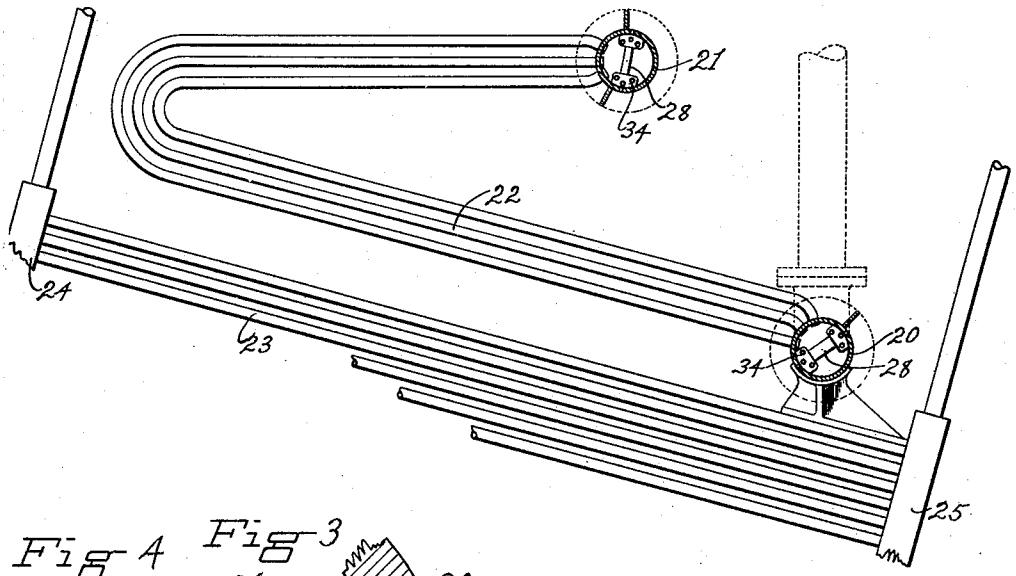


Fig. 4

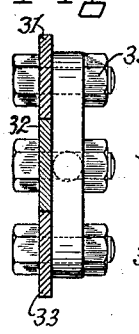


Fig. 3

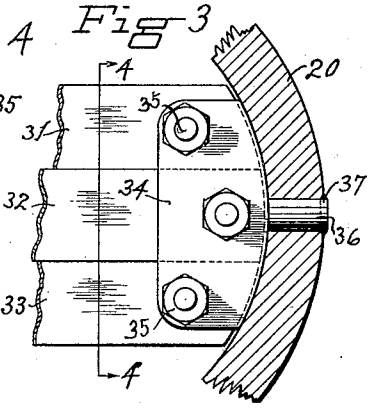


Fig. 6

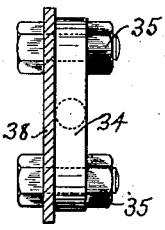


Fig. 5

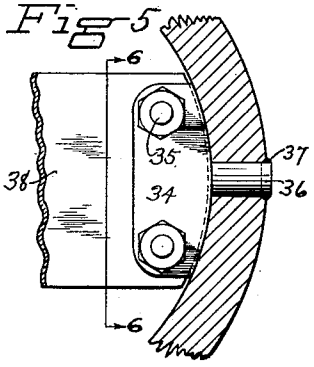


Fig. 7

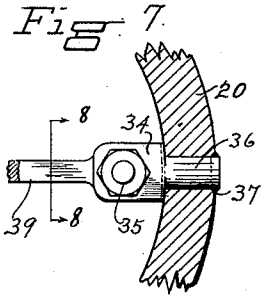


Fig. 8

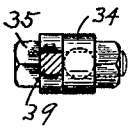


Fig. 10.

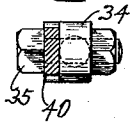
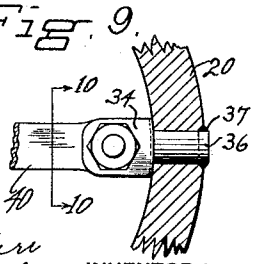


Fig. 9.



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Fig. 2.

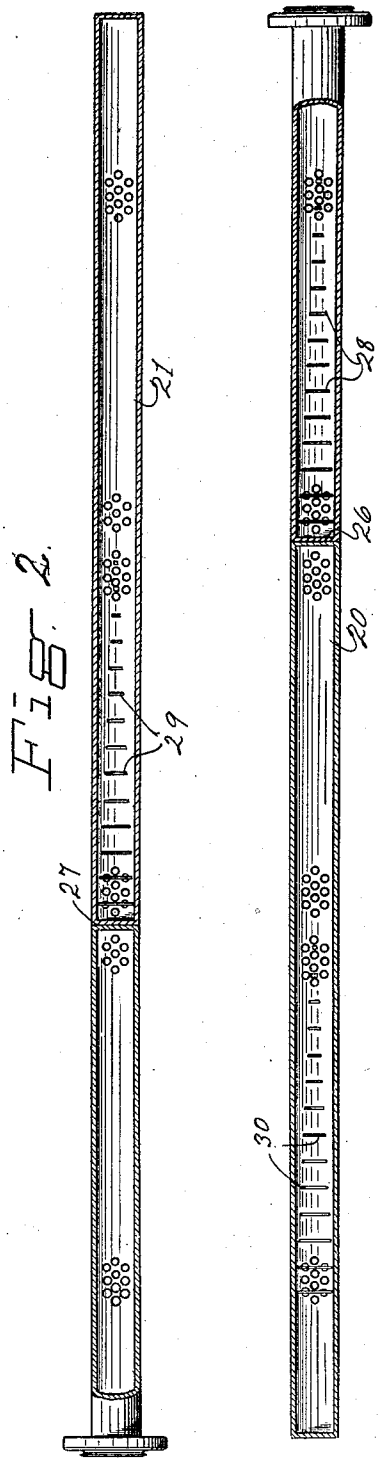


Fig. 12.

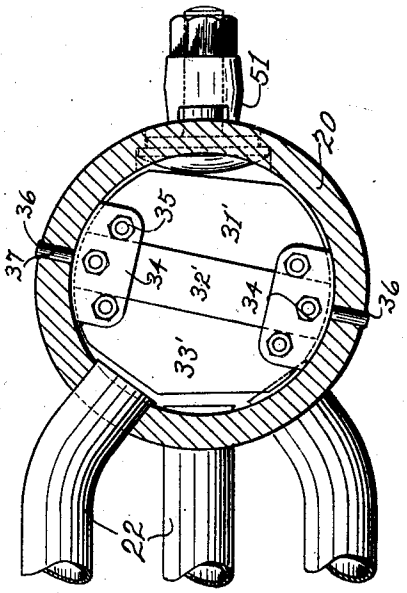
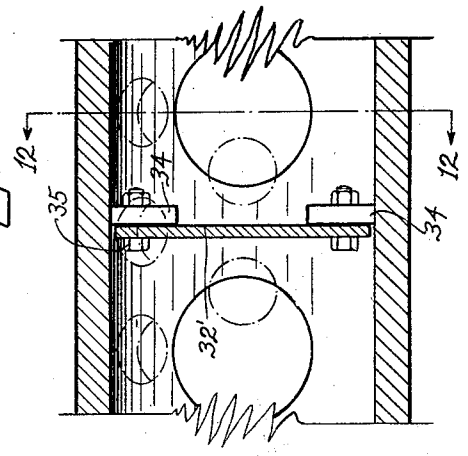


Fig. 11.



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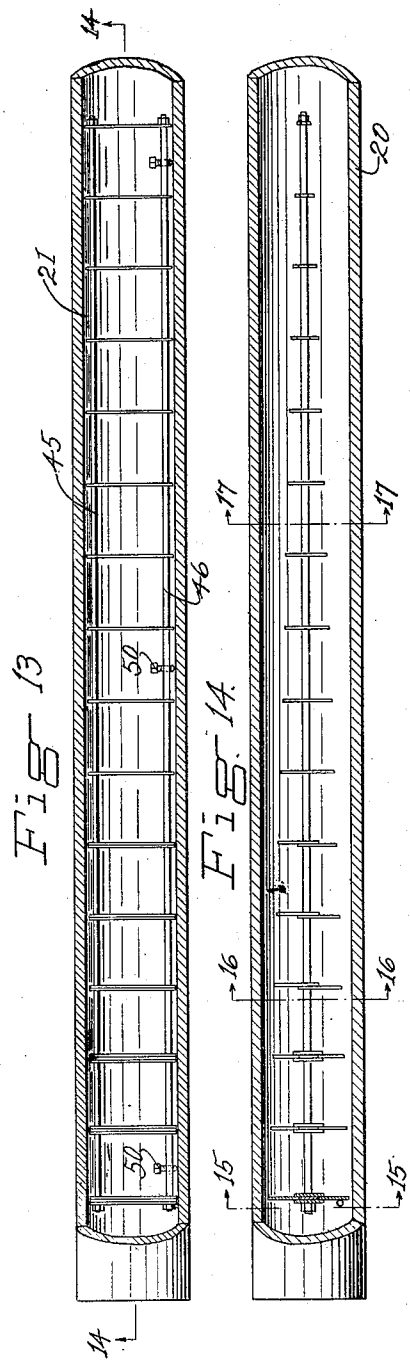


Fig. 13

Fig. 14

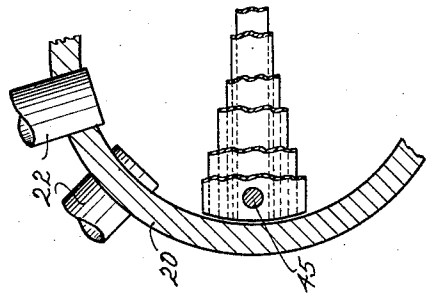


Fig. 17

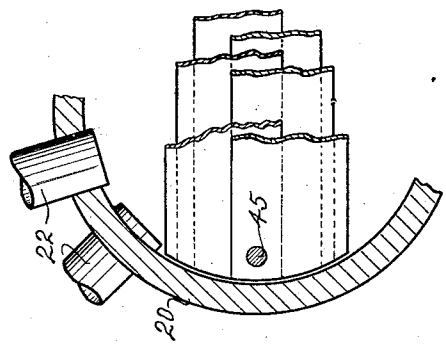


Fig. 16

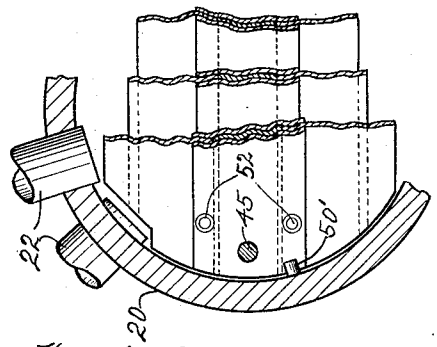


Fig. 15

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Fig. 19

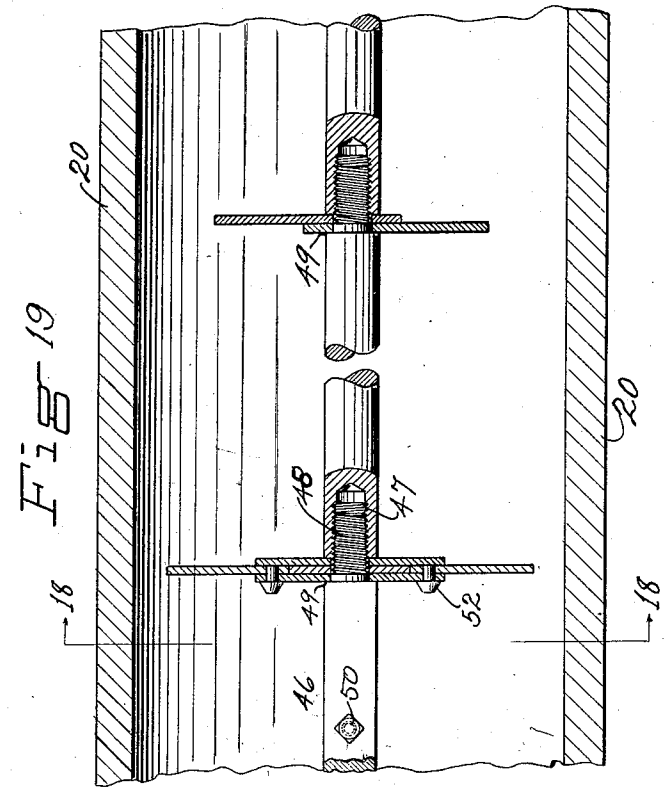
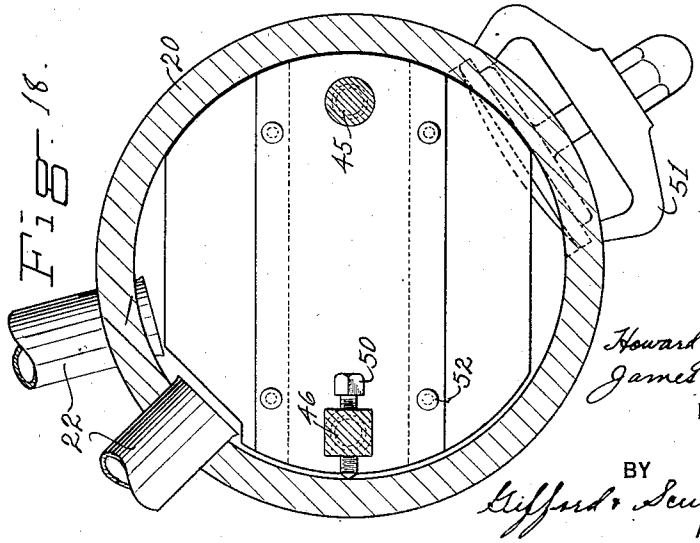


Fig. 18.



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Patented July 14, 1931 1,814,707

UNITED STATES PATENT OFFICE

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SUPERHEATER

Application filed June 24, 1926. Serial No. 118,210.

This invention relates to superheaters in which the distribution of steam or other fluid in the tubes connecting the superheater headers can be improved so as to obtain a more even distribution of the same, and will be understood from the description in connection with the accompanying drawings, in which Fig. 1 shows a U-tube superheater embodying our invention and positioned in relation to a steam boiler, with the superheater headers broken away; Fig. 2 is a view of the superheater headers of Fig. 1, looking from the right of that figure and with the headers broken away to show the construction; Fig. 3 is a section through the header, partly broken away, showing one of the header diaphragms; Fig. 4 is a section along the line 4—4 of Fig. 3; Fig. 5 is a view similar to Fig. 3 showing another header diaphragm; Fig. 6 is a section along the line 6—6 of Fig. 5; Figs. 7 and 9 are views similar to Fig. 3 showing other header diaphragms; Figs. 8 and 10 are sections along the line 8—8 of Fig. 7 and 10—10 of Fig. 9, respectively; Fig. 11 is a large-scale longitudinal section through the header; Fig. 12 is a section along the line 12—12 of Fig. 11; Fig. 13 is a longitudinal section of one of the headers showing a modification of the invention; Fig. 14 is a section along the line 14—14 of Fig. 13; Figs. 15, 16 and 17 are sectional views, partly broken away, showing some of the details of one of the modifications, these figures being taken along the line 15—15, 16—16 and 17—17, respectively, of Fig. 14; Fig. 18 is a section along the line 18—18 of Fig. 19 and Fig. 19 is a longitudinal section, partly broken away, showing some of the details of one of the modifications.

It has been found that, in devices having headers connected by tubes, in which the fluid is introduced into one end of the inlet header and passes from this header through the tubes to the other header, and thence out of the opposite end of the outlet header, the variations in differences in static pressures at the opposite ends of the several tubes cause more of the fluid to pass through some of said tubes than through others. This has been found to be especially true, for example, in steam superheaters where the steam passes from one header to the other, and thence longitudinally along the other, and thence back to the first header, and so on, making a plurality of passes between the headers. By the present invention, a more even distribution of the fluid through the tubes connecting the headers is obtained. This result is accomplished by interposing diaphragms or obstructions in the headers, which diaphragms or obstructions increase in size away from the inlet end of the header or section from which the fluid enters the tubes, thus increasing the velocity of the fluid above that which it would have if the diaphragms or obstructions were not present, thereby more nearly equalizing the differences in pressures between the ends of all the tubes connecting the headers. The arrangement described above results in the provision of a core extending lengthwise of a header and varying in cross sectional area, so as to vary the area of the header through which the steam passes and maintain the velocity of the steam substantially constant.

The invention will be specifically described in connection with a steam superheater for boilers, but it is to be understood that it is not restricted to this particular use.

In the drawings, reference character 20 indicates the inlet header of a superheater, and 21 the outlet header of the same, which headers are connected by U-shaped tubes 22 having one branch longer than the other. This superheater may, for example, be located above the inclined tubes 23 of a water tube boiler, having headers 24 and 25 to which the tubes 23 are connected, as indicated in Fig. 1. The header 20 may be divided by means of the partition 26 (Fig. 2) into two sections, one of which, the inlet section, is about half as long as the other, and the header 21 may be similarly divided by means of the partition 27, with the outlet section about half as long as the other, these partitions being so spaced that steam will enter the end of the inlet header and pass through the first third of the tubes to the outlet header, thence longitudinally in this header to the second third of tubes, back to the inlet header, thence longitudinally in this

header to the third group of tubes, and back into the outlet header and through the outlet to the mains, thus causing the steam to undergo three passes across the hot gases from the inlet to the outlet. It is obvious that in an ordinary superheater, the velocity of the entering steam would be gradually decreased as a portion of the steam passes out through the tubes connecting the headers, as the volume of steam longitudinally of the inlet header becomes less and less toward the partition 26 and similar in the other sections of the headers from which the steam leaves. In order to prevent this decrease in the velocity of the steam in the headers, sets of obstructions 28, 29 and 30 are placed in the headers, as indicated in Fig. 2.

The obstructions are shown as gradually increasing in size in the direction of steam flow, and this is the usual arrangement, particularly when used in connection with a header of uniform cross-section such as shown, and from which extend tubes which are all of substantially equal diameter. By the use of these obstructions, it is possible to obtain substantially uniform velocity of the steam passing through the header, without restricting the flow area of the tubes connected to the header.

These obstructions may be made in a variety of forms, some of which are illustrated in the other views. In Figs. 3 and 4 the widest obstructions are shown as being made up of three plates or diaphragms 31, 32 and 33 placed edge to edge and extending across the header. The ends of these plates are rounded to fit the inside of the header and are bolted to the braces 34 by means of the bolts 35. The braces 34 have pins 36 extending through holes in the header, and are welded in place, as indicated at 37, so as to prevent the diaphragms from being forced longitudinally of the headers by the steam. The diaphragms are made in sections, so that they may be inserted through the handhole openings of the header.

In the form shown in Figs. 5 and 6, the diaphragm 38 is made in one piece, and is held in place by means of the brace 34 and pin 36. In the form shown in Figs. 7 to 10, the diaphragms 39 and 40 are similarly held in place, but are made of decreasing sizes, the diaphragm 40 being intermediate in size between the diaphragms 38 and 39. Figs. 11 and 12 indicate how a form of diaphragm slightly different from that shown in Figs. 3 and 4, made up of plates 31′, 32′ and 33′ is located in the header 20 and held in place by means of the braces 34 and pins 36.

Figs. 13 to 19 inclusive, being views of a modification, show the assembly of the diaphragms of progressively increasing size, the smallest size being near the inlet end of the header and the largest size near the other end of the same. The diaphragms may be assembled by passing rods 45 and 46 through holes in opposite ends of the same. The rods 45 may be made round in cross section, and the rods 46 square in cross section. These rods are made up of sections, each having a screw-threaded recess 47 at one end and a screw-threaded end 48 at the other end, with shoulders 49 at the end of the screw-threaded section. The sections of the rods are screwed together with the screw-threaded portions extending through the holes in the diaphragms, and clamp the respective diaphragms between the end of one section and the shoulder 49 of the adjacent section, as most clearly shown in Fig. 19. The square rods 46 may have set screws 50 extending therethrough, which set screws can be screwed in so as to hold the rods and assembled diaphragms in place inside the headers by friction. Stop lugs 50′ (Fig. 15) may be used to keep the diaphragms in place. The handhole fitting of the usual type for the headers is shown at 51.

In Figs. 15, 16 and 17 are shown the side views of the diaphragms which gradually decrease in size toward the inlet end of the header. The diaphragms may be made up of a plurality of plates assembled to form a single diaphragm (as shown in Figs. 15 and 16), thus enabling the individual plates to be inserted through the handholes, or the smaller baffles may be made up of individual plates (as shown in Fig. 17). In this modification the diaphragms may be assembled complete if the end of the header is open. If not, the diaphragms may be assembled piece by piece through the handholes.

In the operation of the device, steam enters the inlet end of the header 20 and as portions of the steam are withdrawn through the tubes nearest the inlet, the remaining steam passes around the edges of the successive diaphragms that are larger in area, thus increasing the velocity of the steam and causing the same to distribute more evenly over the entire set of tubes between the headers. This effect can be obtained where the headers are divided up into sections by means of the partitions, or where the partitions are omitted.

The device described above results in a core disposed in a header and tapered from one end toward the other, being formed of varying cross sectional area, so as to vary the effective area of the header in which it is disposed, and thereby, vary the velocity of the fluid passing through the header. It will also be noted that the core is made in sections, so that it may be easily removed. Viewed from another angle, the construction provides a core in the form of a plurality of compartments which are connected together by openings forming free communication between the compartments.

We claim:

1. In a device of the character described, headers connected by tubes, means for introducing a fluid under pressure into one of said headers and into the tubes connected thereto and withdrawing it from the other ends of said tubes and from the other header, and a series of diaphragms located in the header to which the fluid is introduced and opposite the tubes into which the fluid enters, said diaphragms extending transversely of the header and increasing in size in the direction of the flow of fluid and the flow of fluid being unobstructed along the portion of the header wall in which said tubes are located.

2. In a device of the character described, a header of substantially uniform cross section and having an inlet for a fluid under pressure, a plurality of tubes extending transversely from said header and adapted to receive said fluid therefrom, and a core disposed in said header and increasing in size in the direction of flow of said fluid, the flow of fluid being unobstructed along the portion of the header wall in which said tubes are located.

3. In combination, a header adapted for the passage of fluid under pressure, a plurality of tubes extending transversely from said header, a plurality of compartments formed in said header and having free communication therebetween through openings of varying area, and means for introducing said fluid under pressure in one end of said header, the communicating openings between said chambers decreasing in size as their distance from the inlet increases and the flow of fluid being unobstructed along the portion of the header wall in which said tubes are located.

4. In a device of the character described, headers connected by tubes, means for introducing fluid at one end of said tubes into one of said headers at one end of the tubes and withdrawing it at the other end of said tubes from the other header, and a series of diaphragms located in a header in the space opposite the ends of the tubes into which the fluid enters, said diaphragms extending transversely of the header and increasing in size in the direction of steam flow, hand holes in said header, each of said diaphragms being made of parts small enough to pass through said holes.

5. In a device of the character described, a header provided with a hand hole opening and with tube openings extending longitudinally thereof, a second header, tubes secured in said openings and connected to said second header, means for introducing fluid to one end of said header and withdrawing it from the opposite ends of said tubes, and a series of diaphragms extending transversely of the header to which the fluid is introduced and removably secured to said header, each of said diaphragms being formed of parts sufficiently small to pass through said hand hole, and said diaphragms increasing in size in the direction of flow of fluid.

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