March 26, 1935. H. P. FESENMAIER 1,995,768

TUBULAR HEAT EXCHANGE STRUCTURE AND A SURROUNDING SHELL THEREFOR

Filed March 23, 1934

Fig. 1

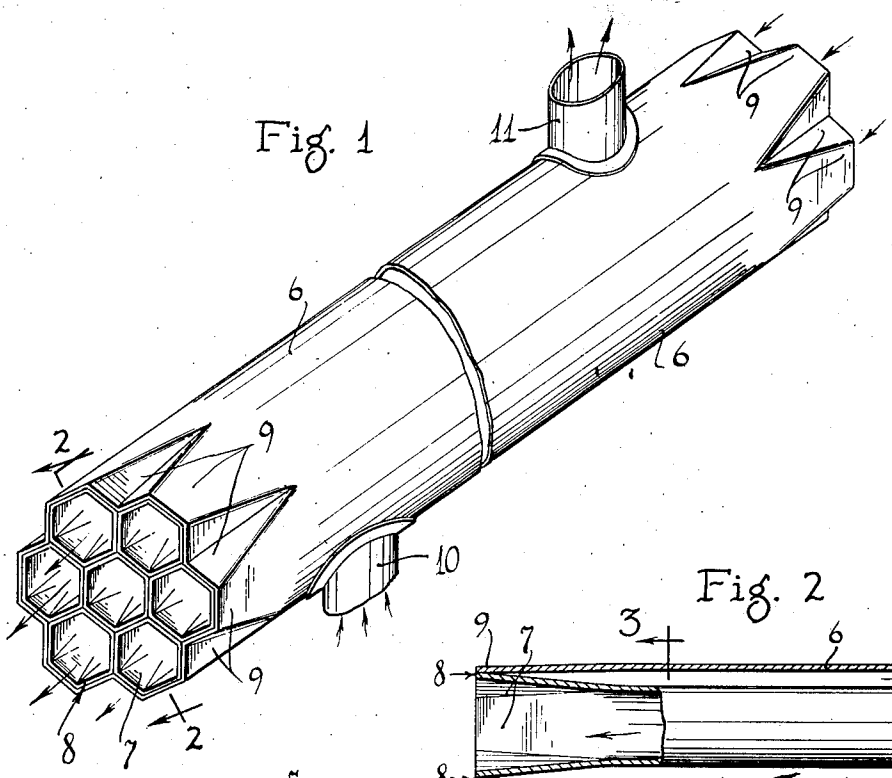


Fig. 2

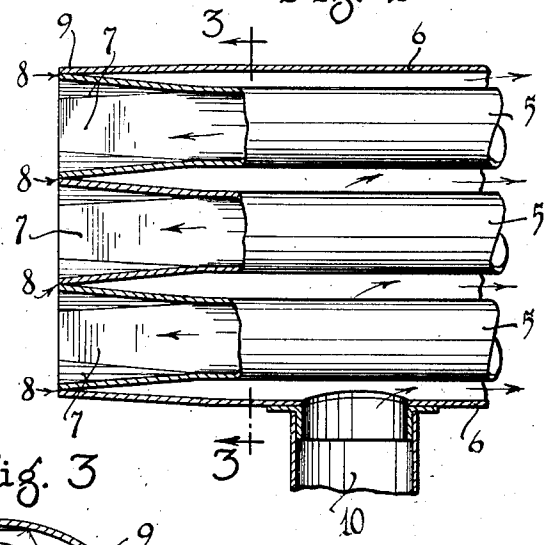


Fig. 4

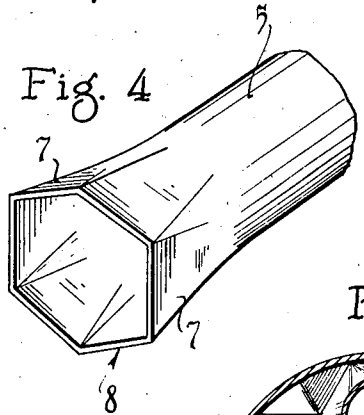
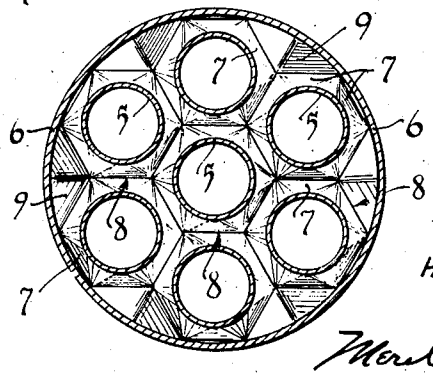


Fig. 3



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TUBULAR HEAT EXCHANGE STRUCTURE AND A SURROUNDING SHELL THEREFOR

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1 Claim. (Cl. 257—124)

My invention has for its object the provision of an extremely simple and highly efficient tubular heat exchange structure and a surrounding shell therefor.

The invention, as illustrated, is embodied in a heat exchange device but is capable of a large range of usage.

To the above end, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claim.

In the accompanying drawing, which illustrates the invention, like characters indicate like parts throughout the several views.

Referring to the drawing:

Fig. 1 is a perspective view of a heat exchange device constructed in accordance with the invention;

Fig. 2 is a fragmentary view partly in side elevation and partly in section taken on the line 2—2 of Fig. 1, on an enlarged scale;

Fig. 3 is a view in transverse section taken on the line 3—3 of Fig. 2; and

Fig. 4 is a fragmentary perspective view of one of the tubes removed from the device.

The heat exchange device, as shown, is well adapted to be interposed in the smoke pipe of a boiler or furnace and form a section thereof and which device comprises a plurality of round tubes 5 in a cylindrical shell or drum 6. The axes of the tubes 5 are parallel, the one with the other, and with the axis of the shell 6.

Each end portion of each tube 5 is expanded, by a bulldozer or other suitable tool, so that the same outwardly flares, as indicated by the numeral 7, and the perimeter of each end of each tube 5 is hexagonal as indicated by the numeral 8. The axis of one of the tubes 5 is coincident with the axis of the shell 6 and the other of said tubes are radially and circumferentially spaced around this central tube 5. The flaring ends of the tubes 5, at each end of the shell 6, are nested and the perimeter 7 of said ends directly engage each other and form close joints therebetween. Obviously, the flaring ends 7 of the tubes 5 hold said tubes radially and circumferentially spaced apart, see Fig. 2.

The end portions of the shell 6 are contracted and pressed onto the perimeter of the outer nested tube ends 8, as indicated by the numeral 9, to close the ends of said shell and form tight joints with the outer tubes 5. The flaring ends 7 of the outer tubes 5 hold the shell 6 spaced from said outer tubes. After the tubes 5 are assembled in the shell 6 and said shell contracted thereon the joints between the ends of the tubes 5 and between the ends of the outer tubes 5 and the shell 6 are closed by welding or other suitable means to form liquid or fluid tight joints therebetween. The flaring ends 7 of the tubes 5 hold said tubes radially and circumferentially spaced from each other and from the shell 6 for the free circulation of liquid or fluid thereabout.

The shell 6 is provided near one of its ends with an intake pipe 10 and near its other end with an outlet pipe 11 that leads to an auxiliary heater and air conditioning device or the like.

It may be assumed that products of combustion are travelling through the tubes 5 from a furnace to a chimney in the direction of the arrows marked on Fig. 1 and that air or water to be heated by the products of combustion in the tubes 5 is travelling through the shell 6 from the pipe 10 to the pipe 11, as indicated by arrows on Fig. 1. As shown, air or water entering the shell 6 through the pipe 10 travels from the coolest to the hottest end of the device or, in other words, the products of combustion in the tubes 5 are travelling in an opposite direction from the air or water travelling in the shell 6. This reverse travel gradually heats the air or water as the same travels along the exterior of the tubes 5 toward the intake ends of the tubes 5. In some instances it might be desirable to reverse the flow of air or water through the shell 6 so that the same travels in the same direction with the products of combustion in the tubes 5.

The above described invention obviates the use of end plates or other parts to close the ends of the shell 6.

What I claim is:

In a device of the class described, a cylindrical shell, and a plurality of tubes in the shell, said tubes at one of their ends being enlarged and having poly-sided perimeters in nested relation, whereby the tubes are held transversely spaced, the one from the other, and from the shell, certain sides of the enlarged tube ends forming V-shaped notches in the perimeter of the nested tubes, the shell between said notches being flattened for direct contact with the outermost sides of the tubes forming the perimeter of the nested tubes, said shell between its flattened surfaces being pressed into the notches for direct contact with the sides of the tubes forming said notches, whereby the respective end of the shell is completely closed by the nested tubes.

HUGO P. FESENMAIER.