

Dec. 16, 1930.

H. G. ULLMAN

1,785,159

HEAT INTERCHANGE DEVICE

Filed Sept. 14, 1927

2 Sheets-Sheet 1

Fig. 1

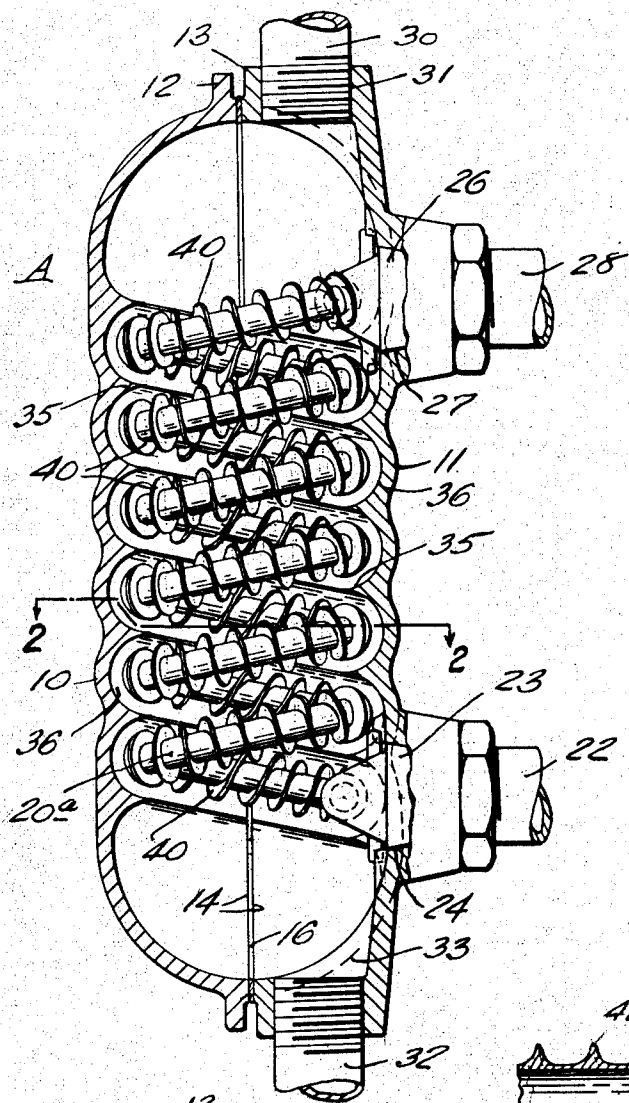


Fig. 3

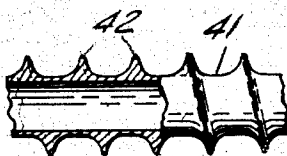
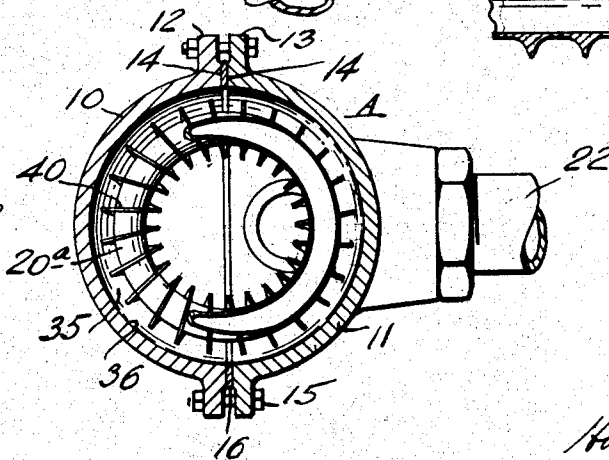


Fig. 2



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Fig. 4.

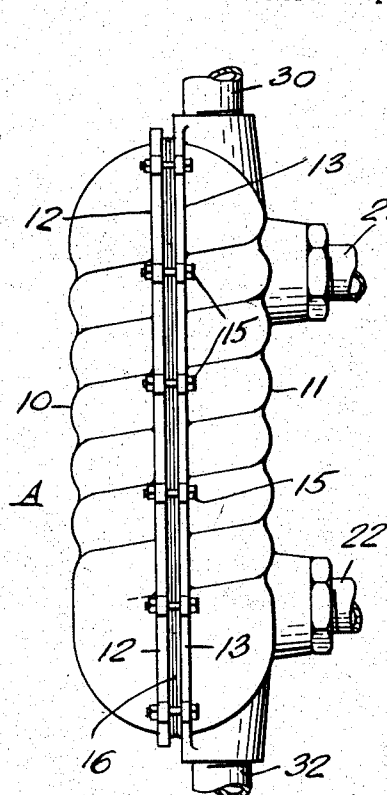


Fig. 5.

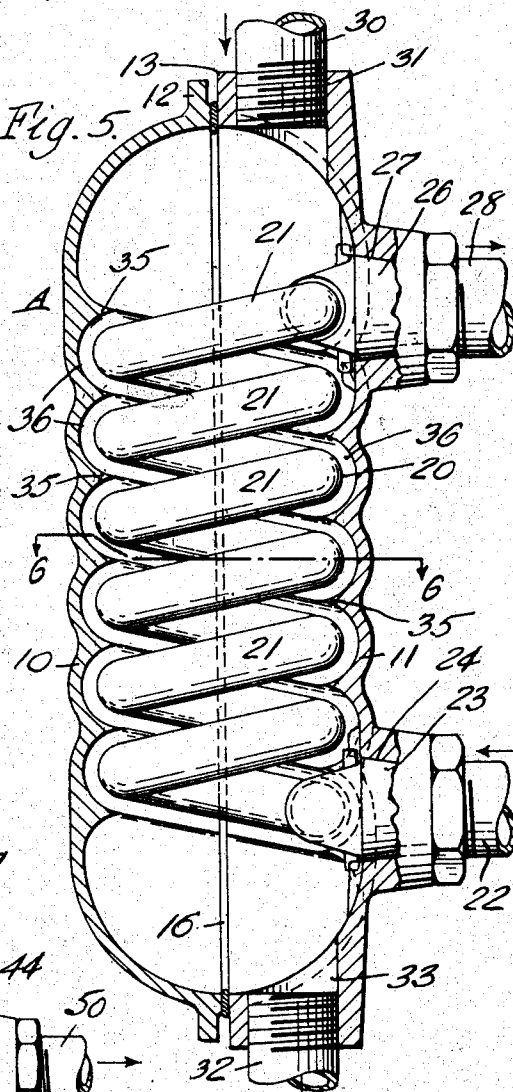


Fig. 7.

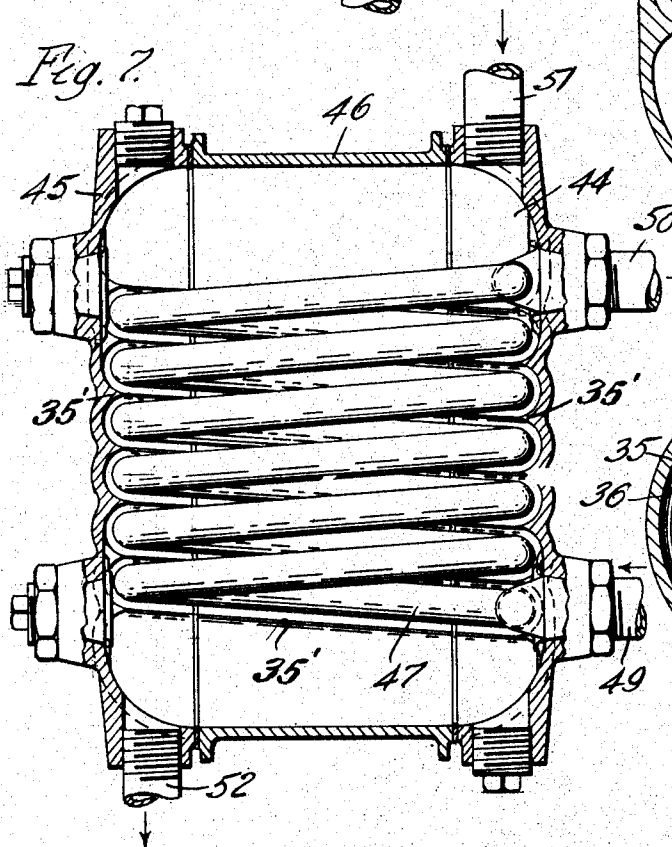
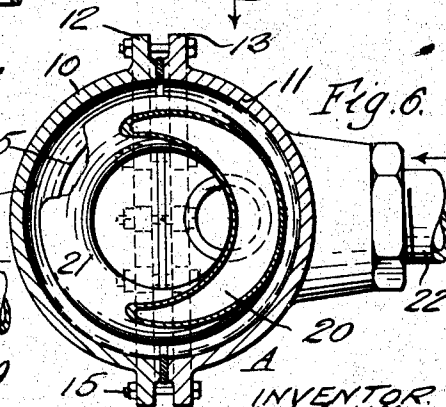


Fig. 6.



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HEAT-INTERCHANGE DEVICE

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This invention relates to improvements in heat interchange devices of the kind having a coil through which one medium is passed and which is arranged within a casing into which the other medium enters and surrounds or passes over said coil. The invention is particularly adapted for use in connection with that class of such devices known as water heaters.

The principal object of the invention is to improve and simplify the construction of heat interchange devices of the character stated so as to increase the efficiency and render the operation thereof more economical than has been possible with constructions heretofore known.

Other objects are to provide an improved heat interchange device having a casing constructed to direct the medium therein away from the walls of said casing and towards and about the coils so as to have intimate contact therewith, whereby the interchange of heat is quickly effected; also to construct the coil of the interchanger so that the medium surrounding said coil will be caused to follow a substantially spiral path around the turns of the coil from one end of the coil to the other; also to arrange the coil in such relation to the aforesaid casing that the spiral movement of the medium about the coil will act in conjunction with the movement of said medium as caused by the construction of said casing, to cause a turbulent action or thorough agitation of the medium in the casing about said coil for the purpose of affording quick and efficient operation.

Other objects are to improve the construction and operation of heat interchange devices in the other respects hereinafter set forth and claimed.

In the accompanying drawings:

Fig. 1 is a vertical section of the improved heat interchange device embodying my invention.

Fig. 2 is a horizontal section thereof, on line 2—2, Fig. 1.

Fig. 3 is a fragmentary view of a modified form of pipe of which the coil of the device may be constructed.

Fig. 4 is a side elevation, on a reduced scale, of the heat interchange device.

Fig. 5 is a vertical section of the device provided with a coil of modified form.

Fig. 6 is a horizontal section thereof, on line 6—6, Fig. 5.

Fig. 7 is a vertical section, on a reduced scale, showing a modified form of the device illustrated in Figs. 5 and 6, wherein said device is provided with an intermediate casing member for affording increased capacity.

The heat interchange device in which the improvements of the present invention are embodied, comprises in general, as usual, a coiled pipe disposed within a hollow closed casing or shell, with its ends suitably connected with supply and discharge pipes or other means outside the casing, for the passage of one of the fluids therethrough, while the casing has suitable inlet or outlet openings for the introduction of the other fluid, whereby the latter enters one end of the casing and surrounds and passes over the coil to effect the desired exchange of heat with the medium passing through said coil, and is then discharged from the casing.

In the construction shown in Figs. 1, 2, and 4-6, the casing or shell A is composed of two half shells 10 and 11 provided respectively with securing flanges 12 and 13 which have abutting faces 14. The two half shells are secured together by suitable bolts or other fastenings 15. A gasket 16 is preferably interposed between the faces of said flanges 12 and 13.

Within the shell or casing A, see particularly Figs. 5 and 6, is arranged a helical coil 20 formed of a number of turns 21 of metallic pipe. The lower end of the coil is secured to an inlet pipe 22 by a suitable connection 23 arranged to fit in and extend through an opening or seat 24 in the half shell 11, while the upper end of the coil is similarly secured by a connection 26 arranged in an opening 27, to a discharge pipe 28. In this manner the medium passing through the coil enters the coil at the lower end of the casing, and after passing through the coil, is discharged at the upper end of said casing by way of the pipe 28. The medium which is to surround the

coil 20 is introduced into the casing in any suitable way, as by means of an inlet pipe 30 secured in a threaded opening 31 in the top of the casing. This medium, after passing downwardly through said casing, is discharged through the lower end thereof through a discharge pipe 32 secured in an opening 33. The inlet and outlet pipes 30 and 32 are preferably also connected to the half shell 11, thus leaving the other half shell 10 entirely free of pipe connections, so that the same can be easily removed to permit inspection of the coil.

In accordance with the invention, the casing is provided with means for deflecting or directing the flow of fluid or liquid medium passing therethrough from the walls of said casing towards and about the coil, to cause an intimate contact of the medium therewith for effecting a rapid and thorough interchange of heat between the medium in the casing and that in the coil. For this purpose, the inner wall or surface of the casing, instead of being straight from one end to the other, as is usual, is formed or provided with ribs or corrugations 35 which extend towards or into the spaces between the successive turns of the coil. A single, continuous, helical rib is preferably used, and the groove or recess 36 between the turns of the ribs 35 is preferably formed substantially concentrically with and in spaced relation to the surface of the coil, or is substantially complementary in contour thereto, as shown clearly in Figs. 1 and 5. In addition, therefore, to directing the fluid at the sides of the casing inwardly about the coil, the rib 35 causes said fluid medium to travel or whirl along a helical path coincident with the coil.

The aforesaid construction acts to cause a turbulent condition and thorough agitation of the medium passing over the coil, resulting in a quick interchange of temperature between the two media, as the fluid in the casing is caused to flow over all exposed portions of the coil 20.

In Figs. 1 and 2, additional means of novel construction are illustrated for effecting a still further turbulent action of the medium passing through the casing 10, whereby a still more intimate and thorough whirling contact of the latter with the coil may be effected. For this purpose, the coil 20a is provided with substantially transverse fins or corrugations, preferably arranged in a helical or spiral path extending crosswise of the tube or pipe of which the coil is formed, being preferably continuous from one end of the coil to the other so as to cause a whirling or rotary movement of the medium about the individual turns of the coil. In said figures, this is effected by winding and securing a thin ribbon or strip 40 of metal of high conductivity, such as copper or brass, to the coil in any well known manner, or as shown in

Fig. 3, the wall of the coil itself may be formed with corrugations 41, thus providing integral ribs or fins 42 thereon, whereby a substantially similar result may be obtained.

By providing the coil with the spirally arranged fins or ribs as just described, the pipe of which the coil is made may be of smaller diameter and with relatively thin walls, thus increasing the radiation and affording increased and quicker exchange of heat between the media.

In the construction shown in Figs. 5 and 6, the casing is formed substantially like that in Figs. 1 and 2, but the coil 20a shown in said Figures 5 and 6 is of the well known plain type, without fins or corrugations. However, it will be seen that the ribs 35 on the casing will act to cause the medium in said casing to have intimate contact with said coil, as in the first construction.

The two forms of heat interchange devices described are particularly adapted for that type known as water heaters or auxiliary water heaters, which are arranged in or connected to systems wherein water is heated or steam generated in a boiler or sectional heater of any other suitable type, the coil of the interchanger or water heater being suitably connected by the pipes 22 and 28 to the supply of water to be heated, the casing of the device being connected by means of the pipes 30 and 32 to the heating system or apparatus so as to permit the introduction of hot water, steam or vapor to the casing of the device.

The improved construction described is such that very little additional fuel is required to heat the water in the coil, while nevertheless a relatively large volume of water may be heated, due to the rapid and thorough contact of the heating medium with the coil.

In Fig. 7 there is shown a modification, wherein two half shells 44 and 45, similar to the half shell 11 before described, are arranged in spaced relation to each other and which are connected to an intermediate casing section 46.

In this case the coil 47 is substantially of oblong form, and the half shells 44 and 45, and also preferably the intermediate section 46 are provided with corrugations or fins 35' arranged coincident with the turns of the coil 47, as in the previous constructions. The coil 47 is preferably carried by one of the half sections, as the one 44, for connection to inlet and outlet supply pipes 49 and 50, while the inlet and outlet pipes 51 and 52 for the entrance and exit of the medium into and out of the casing are preferably connected respectively to the upper end of the half section 44 and the lower end of the half section 45, thereby permitting proper circulation of this medium about the coil 47.

By this arrangement of the heat interchange device, an increased capacity can be provided for without necessitating any ap-

preciable change in the connections between the device and the system or apparatus to which it is to be attached.

I claim as my invention:

1. In a heat interchange device, a hollow coil composed of a plurality of spaced turns through which a fluid medium is passed, a casing extending about said coil and into which a second fluid medium enters and passes over said coil, said casing having an inner surface disposed in spaced relation to the outer side of said coil, said surface being formed with ribs extending inwardly between the turns of said coil at the outer side thereof so as to leave the inner side of said coil unobstructed and said ribs being spaced from said coil for directing fluid in said casing away from said surface between and over said turns of said coil towards the inner unobstructed side thereof, for the purpose set forth.

2. In a heat interchange device, a hollow coil composed of a plurality of spaced turns through which a fluid medium is passed, a casing extending about said coil and into which a second fluid medium enters and passes over said coil, said casing having an inner surface disposed adjacent the outer side of said coil and which is formed of alternate ribs and grooves, said ribs being disposed so as to extend between and in spaced relation to the turns of said coil at the outer side thereof so as to leave the inner side of said coil unobstructed, and said grooves having their surfaces disposed in spaced relation to the turns of said coil and of such a contour as to be substantially complementary to the turns of the latter, whereby fluid passing from the inner side of said coil over the same to the walls of said casing is deflected by said ribs between said turns of said coil and returned to the inner side of the latter.

3. In a heat interchange device, a hollow, substantially helical coil through which a fluid medium is passed and having its turns in spaced relation, a casing extending about said coil and into which a second fluid medium enters and passes over said coil, said casing having an inner surface disposed at the outer side of said coil and formed with a substantially continuous helical rib spaced from said coil and corresponding to the pitch of and extending between the turns thereof towards and leaving the inner side of said coil unobstructed, and said casing having a helical groove alternating with said rib and which is complementary to the turns of said coil, and into which said turns extend for the purpose set forth.

4. In a heat interchange device, a hollow coil composed of a plurality of spaced turns through which a fluid medium is passed, a casing extending about said coil and into which a second fluid medium enters and

passes over said coil, said casing having an inner surface disposed in spaced relation to and of a contour substantially complementary to that of the outer side of said coil and leaving the inner side of said coils unobstructed, and said coil having a transverse external rib arranged in substantially helical form to cause the fluid surrounding the coil to whirl transversely about the turns thereof in its passage through said casing.

5. In a heat interchange device, a hollow coil composed of a plurality of spaced turns through which a fluid medium is passed, a casing extending about said coil and into which a second fluid medium enters and passes over said coil, said casing having an inner surface disposed at the outer side of said coil and which is formed of alternate ribs and grooves, said ribs being disposed so as to extend towards the inner side of said coil between and in spaced relation to the turns of said coil, said grooves having their surfaces disposed in spaced relation to the turns of said coil and which are of a contour substantially complementary to the turns of the latter, and said coil having a substantially helical rib thereon, the portions thereof at the outer side of said coil being disposed within said grooves and in spaced relation to said ribs, for the purpose set forth.

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