Sept. 15, 1931. H. H. DOW ET AL 1,823,033

METHOD OF AND APPARATUS FOR HEAT INTERCHANGE

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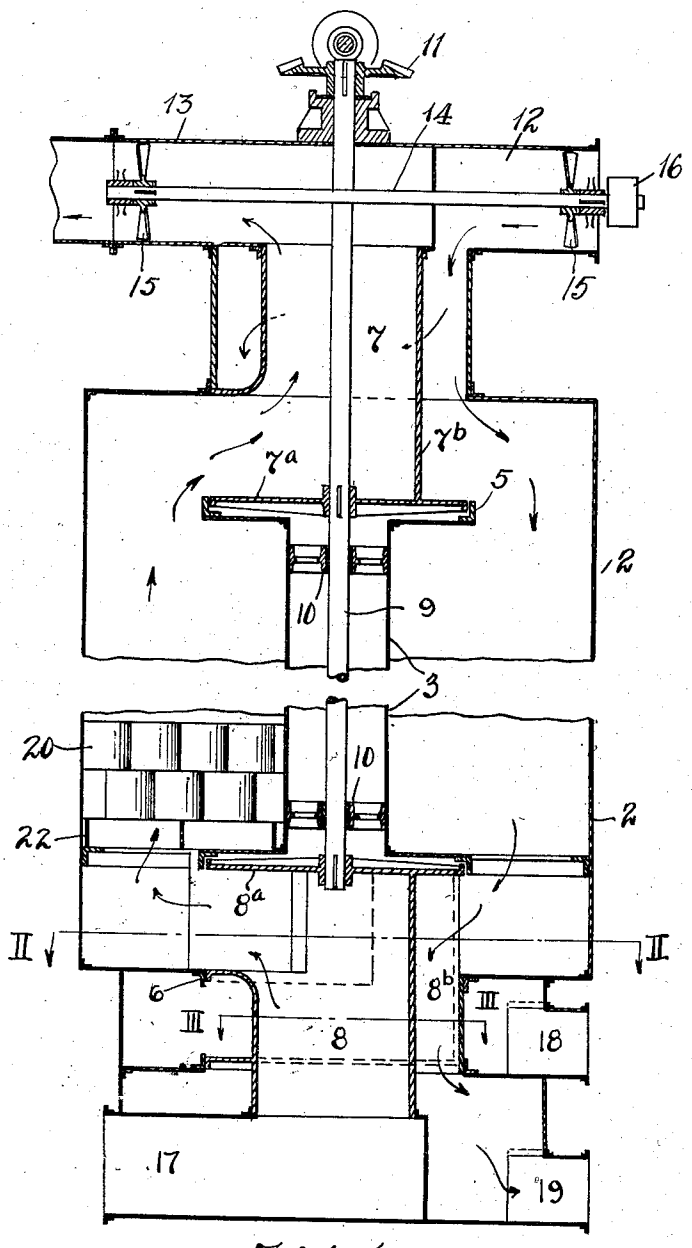


Fig. 1

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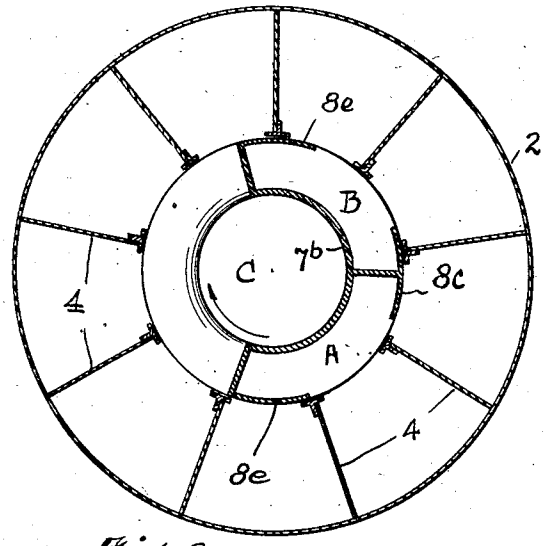


Fig. 2

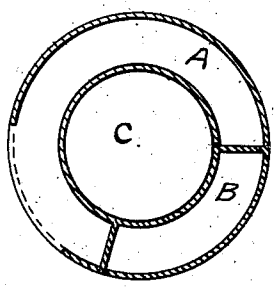


Fig. 3

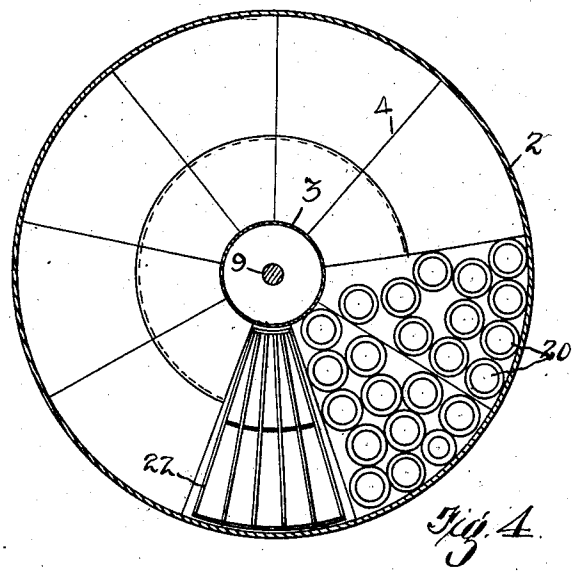


Fig. 4

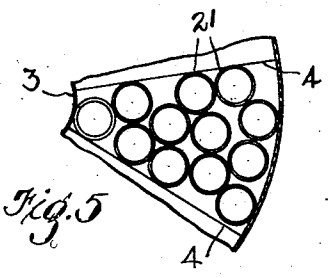


Fig. 5

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Fig. 6.

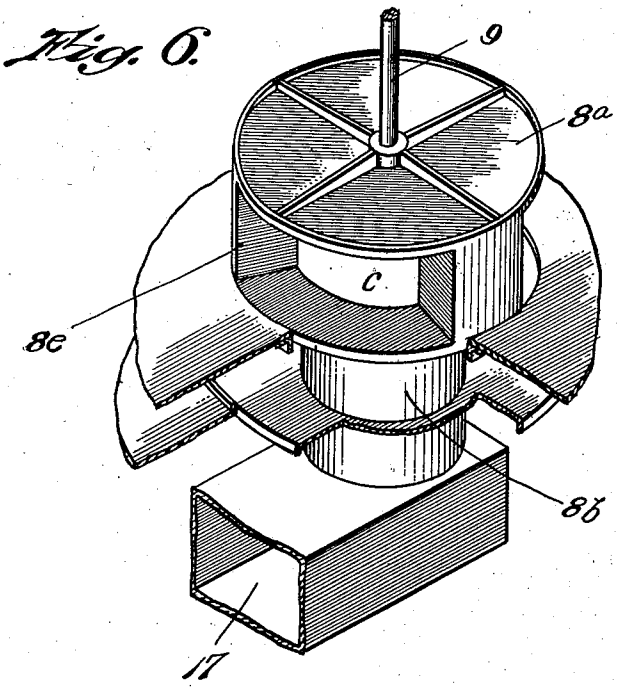
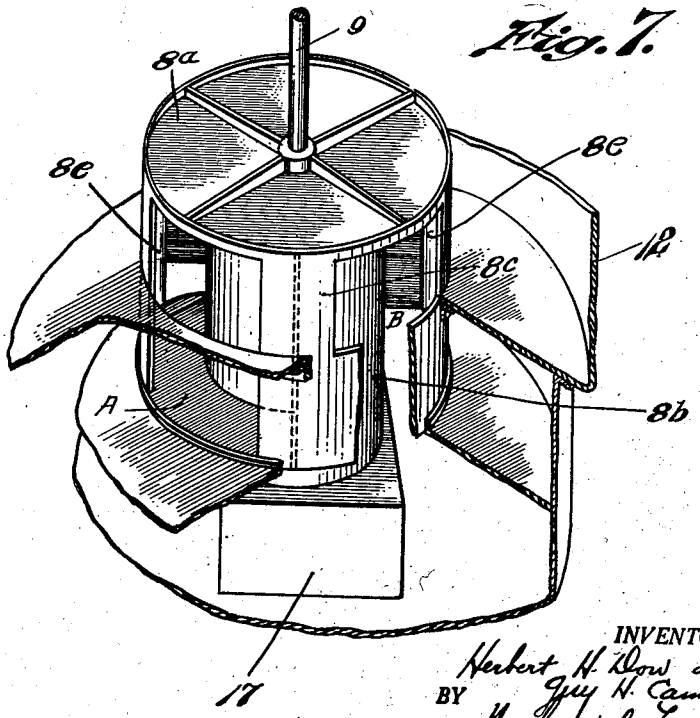



Fig. 7.

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Patented Sept. 15, 1931 1,823,033

# UNITED STATES PATENT OFFICE

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## METHOD OF AND APPARATUS FOR HEAT INTERCHANGE

Application filed February 20, 1926. Serial No. 89,616.

This invention relating, as indicated, to heat interchange, has more particular reference to interchange between media which may in part carry suspended matter, or which may be of more or less corrosive character. Heretofore it has been a matter of considerable difficulty to keep passages clear where a medium leaving deposited matter was employed, also more or less contamination of one medium with the other has been usual.

An arrangement by which clogging and contamination may be prevented is accordingly highly desirable. To the accomplishment of the foregoing and related ends, the invention, then, consists of the means and procedure hereinafter fully described, and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain features embodying the invention, such disclosed features constituting, however, but one of various forms in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a central vertical section through a construction embodying the present improvements; Fig. 2 is a section taken on the plane indicated by the line II—II, Fig. 1; Fig. 3 is a section taken on the plane indicated by the line III—III, Fig. 1; Fig. 4 is a transverse sectional view taken in part through the filling near the base of the tower and in part at lower planes above and below the grating; Fig. 5 is a sectional detail of the filling near the top of the tower, and Figs. 6, 7 are perspective views of the lower valve showing the flow channels.

The reference numeral 2 in the drawings designates an outer shell, and centrally therewithin is an inner shell 3. The precise form and detail of these may vary somewhat but the arrangement as shown is generally most satisfactory. Radial partitions 4 between these shells divide the space into compartments, preferably an odd number. At the upper and lower ends of the inner shell are valve cages 5 and 6 which have openings laterally. Mounted in the valve cages are rotary valves 7 and 8 which comprise respective base plates 7*a* and 8*a* with a wall 7*b* or 8*b* of more or less cylindrical shape and providing port openings at one side. A segmental wall 7*c* or 8*c*, as the case may be, is supported in spaced out relation to the inner wall 7*b* or 8*b* and is proportioned to just close a port leading to the compartments, while extensions 7*e* or 8*e*, as the case may be for the respective valves, are provided which again are proportioned to just close a port which they may be placed squarely over. It is thus seen that the valves establish channels leading to the ports, the channels being such that in the particular form illustrated in Fig. 2, two compartments will be in communication with the valve opening A and two compartments with the valve opening B while the remaining compartments will be in communication with the general valve channel C. It is desirable that a larger number of compartments be opened to the channel C than to the combined passages A and B. The valves are both mounted on a common shaft 9 which in turn is carried by aligned bearings 10 in the inner shell 3. One end of the shaft, the upper in the form shown, although this is a matter of convenience merely, is extended beyond the apparatus and carries suitable gearing 11 by which the shaft may be driven at the desired speed. Coacting with the valve ports are ducts for the inlet and outlet of the media which are to effect the heat interchange, the duct 12 for instance being an inlet for cold medium, for example air, and the duct 13, an outlet for exhaust gases, for example stack gases. A shaft 14 carrying fans 15 and driven by suitable means, for instance, a pulley 16, provides forced draft where necessary. At the opposite end of the apparatus, an inlet duct 17 allows of communication with a source of hot gases and ducts 18 and 19 are arranged for the discharge of heated air or whatever other medium has been used for taking up heat from the hotter gas.

In order to increase the conducting surface and provide tortuous channels through the compartments, a packing or filling, preferably of iron rings or cylindrical sections

is arranged with the units in staggered order. The units 20 as placed in the lower portions of the compartments are of different form or at least thicker wall than the units 21 which are used for the upper portions of the compartments. The units are supported below by a grating or grid 22 and in this manner free access through the filling is possible for the gases to be introduced.

In operation, the shaft 9 is put in rotation and a hot gas, for instance, combustion gases from a furnace is admitted by duct 17 and is diverted through the compartments in succession. At the same time a cool gas whose temperature is to be raised, for instance, air, is admitted by duct 12 at the opposite end of the apparatus and is passed through the compartments successively after the flow of hot gas. The velocity of the air is such by virtue of the relative sizes of cross sectional area provided for flow or by the driving means for forcing it that the flow of air downward is much more energetic than the flow of the combustion gases upwardly. It thus results that the blast of air through any given compartment is such as to dislodge and blow out settled matter such as soot, ashes or the like and the passages are thus kept measurably clear. The valves being in continuous rotation, the air in passing down is diverted successively in two streams through the channels A and B. The blast through channel A sweeps out residual gas which may have been left from the combustion gas preceding in flow through the compartment and this contaminated air finds outlet ultimately through conduit 18 from whence it may be disposed of as desired. The successive sweep of air through channel B after passing through the compartments proceeds thence ultimately through conduit 19 and since the compartments have been swept clear of residual hot gas by reason of the first blast of air, the second blast is uncontaminated and may be used for any purpose requiring an uncontaminated supply. It will be noticed that the valve element 7*c* or 8*c* as the case may be being intermediate between the channels A and B serves to cut off in its revolution one compartment intermediate the two streams of air and intermingling is thus prevented. By reason of the greater thickness of the units 20 as employed at the base of the tower, any corrosion which may result from acid in the heating medium is provided for, since such corrosion as might occur would be more intensive nearest the point of inlet of the hot gases and the strength of the units of the filling will still be sufficient to support the superincumbent mass even after allowing for corrosion to quite a considerable extent. A thinner wall type of unit is sufficient above since the amount of corrosion is much less in this region.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. In a method of heat exchange, the steps of communicating regenerative material with heating fluid, cutting off said communication, communicating said regenerative material with scavenging fluid, cutting off said scavenging fluid, communicating said regenerative material with fluid to be heated, and cutting off said fluid to be heated.

2. In a method of heat exchange, the steps of successively communicating regenerative material with supplies of heating fluid, scavening fluid, and fluid to be heated, and cutting off communication of the regenerative material with the scavenging fluid prior to communication with the fluid to be heated.

3. In a heat exchanger, a plurality of compartments, heat absorbing material disposed therein, means for supplying a fluid medium of one temperature, and a second fluid medium of another temperature to said compartments, and for discharging the same from said compartments, means for dividing the flow of the second medium through each compartment in two separate successive stages, valves for controlling the flow of said media through said compartments, and means for operating said valves to successively open and close each compartment to the flow of said first medium and to the flow of each stage of the second medium.

4. In a heat exchanger, a chamber containing regenerative material, means for supplying heating fluid to said chamber, means for supplying scavenging fluid to said chamber, means for supplying fluid to be heated to said chamber, valve means for controlling the supply of said fluids to said chamber, and means for operating said valve means to successively supply said fluids to said chamber and to cut off the supply of scavenging fluid prior to the supply of fluid to be heated thereto.

5. In a heat exchanger, a chamber containing regenerative material, inlet means for supplying heating fluid, scavenging fluid, and fluid to be heated to said chamber, said means including valves for independently controlling the flow of each of said fluids into said chamber, means for operating said valves to permit successive inlet of said fluids to said chamber, and outlet means for conducting said fluids from said chamber.

Signed by us this 4th day of February, 1926.

HERBERT H. DOW.
GUY H. CANNON.