

Dec. 6, 1932.

H. G. CHATAIN

1,890,108

HEAT TRANSFER DEVICE.

Filed July 13, 1931

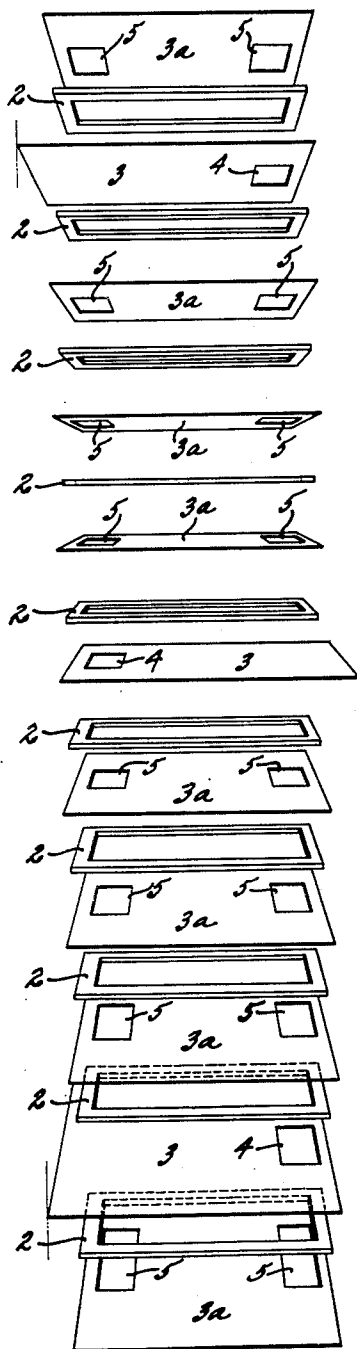


Fig. 3

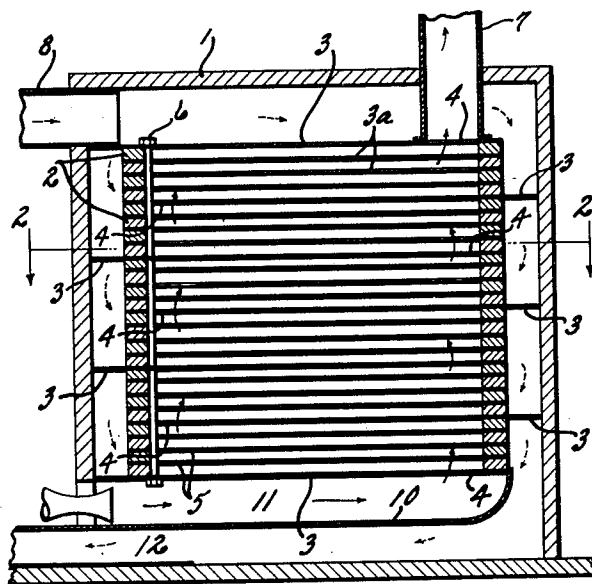


Fig. 1

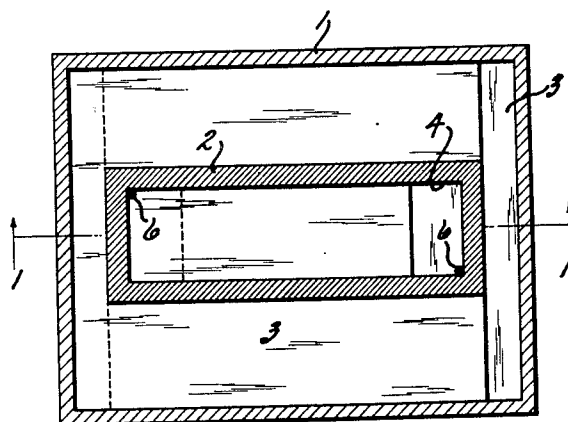


Fig. 2

INVENTOR

Henri G. Chatain

BY

Brockett, Hyde, Haley & Meade
ATTORNEYS

UNITED STATES PATENT OFFICE

HENRI G. CHATAIN, OF ERIE, PENNSYLVANIA, ASSIGNOR TO NORTHERN LABORATORIES, INC., OF CLEVELAND, OHIO, A CORPORATION OF OHIO

HEAT TRANSFER DEVICE

Application filed July 13, 1931. Serial No. 550,362.

This invention relates to heat transfer devices of the type employing plates and spacer elements within an enclosure so arranged as to divide the enclosure into passage ways for the mediums between which the heat is to be transferred.

The objects of the present invention are to provide a novel form and disposition of the elements in such a device which shall give economy in manufacture, a high efficiency in functioning.

Particularly an object of the invention is to provide such a device which shall lend itself in assembly to flexibility to meet the various specific applications of intended use. My invention comprises such a system of plates and spacers that the paths provided thereby within the housing may be of various and varying sectional areas, and comprise passes including different numbers of parallel passages between plates.

The exact nature of this invention together with further objects and advantages thereof will be apparent from the following description taken in connection with the accompanying drawing, in which Figs. 1 and 2 are sectional elevation and typical horizontal section respectively of an embodiment of the invention, Fig. 1 being as in the plane of line 1—1, Fig. 2, and Fig. 2 being as in the plane of line 2—2, Fig. 1; and Fig. 3 is a perspective view of a number of elements arranged in spaced relation but in their order of assembly.

With reference now to the drawing the principal parts of the device are the stack of elements appearing in Fig. 1 and the housing 1 arranged thereabout, these parts being preferably rectangular as indicated, for purposes of economy. The stack is made up of elements which latter are in the form of metal plates, and spacers 2, one of the spacers being arranged between each pair of plates.

There are two forms of plates, partition plates 3 and conductor plates 3a, which former also serve as conductor plates equally with the other plates.

The spacers 2 are all alike. Each is in the form of a frame having side and end portions of less dimensions than those of the

housing 1, defining a large through opening, so that as indicated in Fig. 2 there will be a space between frame and housing extending entirely about the frame, and each frame is of some considerable thickness as compared with that of the plates, as indicated in Figs. 1 and 3.

The partition plates 3 are all alike. Each is of width to extend laterally to the sides of the housing and of length to extend from one end of the housing to the far ends of the adjacent spacers 2, terminating flush with the latter. Each partition plate has an opening 4 immediately within these far spacer ends and thus bracketed on three sides thereby as indicated in Fig. 2. Adjacent partition plates are oppositely disposed longitudinally, that is, alternate partition plates are arranged to extend to opposite ends of the housing so that the openings 4 of the plates will be disposed within the frame ends but at opposite ends of the stack of frames, as indicated in Figs. 1 and 3.

The conductor plates 3a are also all alike each is of width to extend laterally across the housing 1 and of length coextensive with the spacers 2. Each conductor plate has at each end an opening 5 located to be bracketed by the corresponding ends of adjacent spacers 2 when the parts are arranged in stacked relation as in Fig. 1. One or more of these conductor plates 3a is between each adjacent pair of partition plates 3, and always between a pair of spacers 2.

The parts are assembled into the stack, with their openings in registry and in the following characteristic order. First a partition plate 3, then a spacer 2, then one or more conductor plates 3a, with a spacer 2 between each pair, then a spacer 2, and finally another partition plate 3 but turned in the opposite direction from the first partition plate 3, etc. In the drawing three conductor plates 3a are arranged between each pair of partition plates 3 so that four spacers 2 are required between each pair of partition plates. The assembly of the elements in the stack is secured in any convenient manner such as by welding together of the parts or by bolts 6. The sides of the housing 1

bear against the side edges of all of the plates in the stack and the ends of the housing bear against those ends of the partition plates which extend beyond the ends of the spacers.

5 The top and bottom sides of the housing are spaced somewhat from the corresponding ends of the stack so that the conduit 7 may provide a connection with the opening 4 of the end partition plate 3, and a lead through
10 the housing wall; a connection 8 may be provided in the housing for the compartment 9 above the stack; so that a similar arrangement may be made at the bottom of the housing. In the example shown, a canopy 10 is
15 arranged to provide a passage 11 communicating with the opening 4 of the lowermost partition plate and a passage 12 communicating with the end space associated with the immediately adjacent elements, both pas-
20 sages 11 and 12 leading without the housing.

It will be apparent that by the arrangement described two paths of flow are provided within the housing 1, one passing within the confines of the spacers 2, as indicated
25 by the solid arrows, and the other without the spacers 2 as indicated by the broken arrows. Since the spacers 2 are substantially surrounded by one of the paths it will be obvious that in most applications such path is
30 the logical one for the cooler medium, that is, the one to which heat is to be transferred from the other medium. Of course the external parts may be arranged so that flow through either path may be in either direction such as would be indicated by reversing
35 the direction of either of the sets of arrows.

Each plate extends both within and without the column of spacers so that transmission of heat by the conductivity of the plate metal is highly efficient. Particularly it is to be noted that each path of flow includes reverse flow passes in the directions of the plates. Each path includes parallel passages between one or more pairs of plates so that there will be a maximum of heat transfer with a minimum obstruction to flow. The number of parallel passages in a pass, determined by the number of conductor
45 plates 3a between a pair of partition plates 3, may be varied according to the conditions for which the device is intended, and the number may vary in a single device according to such conditions; and of
50 course the total number of elements in the stack will also depend upon the conditions to be met.

Thus, in conclusion, the elements are all of simple form. Only three forms are required.
60 Yet therefrom may be assembled heat transfer devices of widely different capacities and characteristics to meet as wide a field of application.

What I claim is:

65 1. In a heat transfer device of the class de-

scribed, a system of plates and spacers arranged in a stack within a housing, said spacers comprising frames having sides and ends spaced from those of said housing, said plates extending laterally to the sides of said housing, each plate extending on one end to said housing and on the other end terminating with the spacers and having an opening immediately within the spacer end, adjacent of said plates being turned in opposite directions, whereby two paths of flow are provided within said housing, one within said spacers and the other thereabout, each path including reverse flow passes in the directions of said plates and between a pair thereof.

2. In a heat transfer device of the class described, a system of plates and spacers arranged alternately in a stack within a housing, said spacers comprising frames having sides and ends spaced from those of said housing, said plates extending laterally to the sides of said housing and including partition plates and conductor plates, each conductor plate being longitudinally coextensive with said spacers and having a pair of spaced openings one within each spacer end, each partition plate extending on one end to said housing and on the other end terminating with the adjacent spacer and having an opening within the spacer end, adjacent partition plates being turned in opposite directions and having a conductor plate therebetween, whereby two paths of flow are provided within said housing, one within said spacers and the other thereabout, each path including reverse flow passes in the directions of said plates, and each pass including parallel passages between more than a pair of plates.

3. In a heat transfer device of the class described, a housing and a stack of heat transfer means therewithin, said means having sides spaced from those of the housing, and having communicating cavities whereby the arrangement provides two passages generally longitudinal of the housing, one within and the other laterally surrounding said cavities, said means having flange parts extending within the cavities and arranged to provide lateral passes for the inner of said passages, and having flange parts extending laterally to the sides of said housing and arranged to provide lateral passes for the outer of said passages, some of said flange parts being interrupted to provide communication between adjacent of said passages.

In testimony whereof I hereby affix my signature.

HENRI G. CHATAIN.