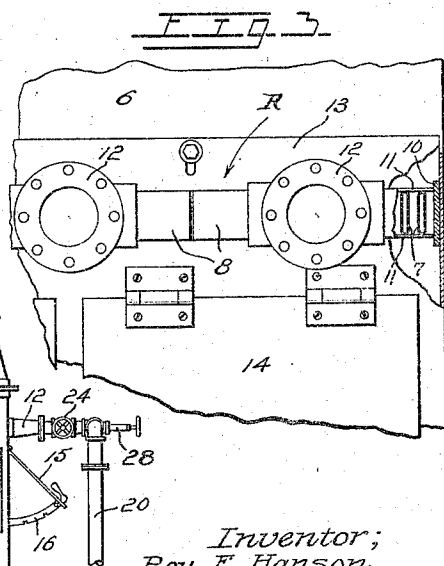
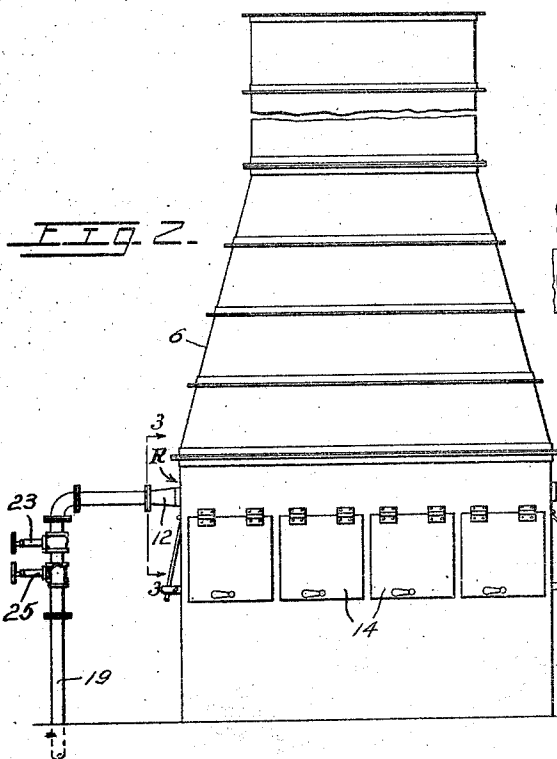
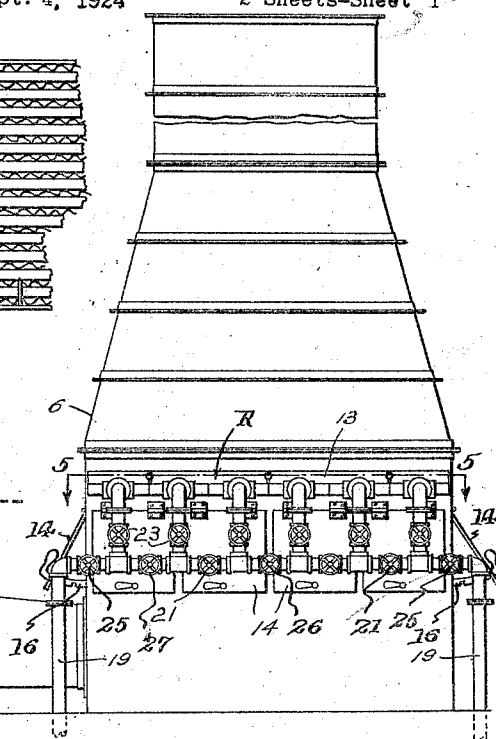
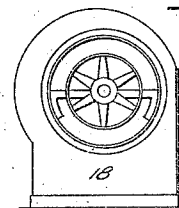
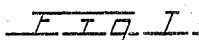


1,551,029

HEAT EXCHANGER

Filed Sept. 4, 1924

2 Sheets-Sheet 1



Inventor;
Roy E. Hanson,
per Arthur J. Farnsworth.
Attorney.

Aug. 25, 1925.

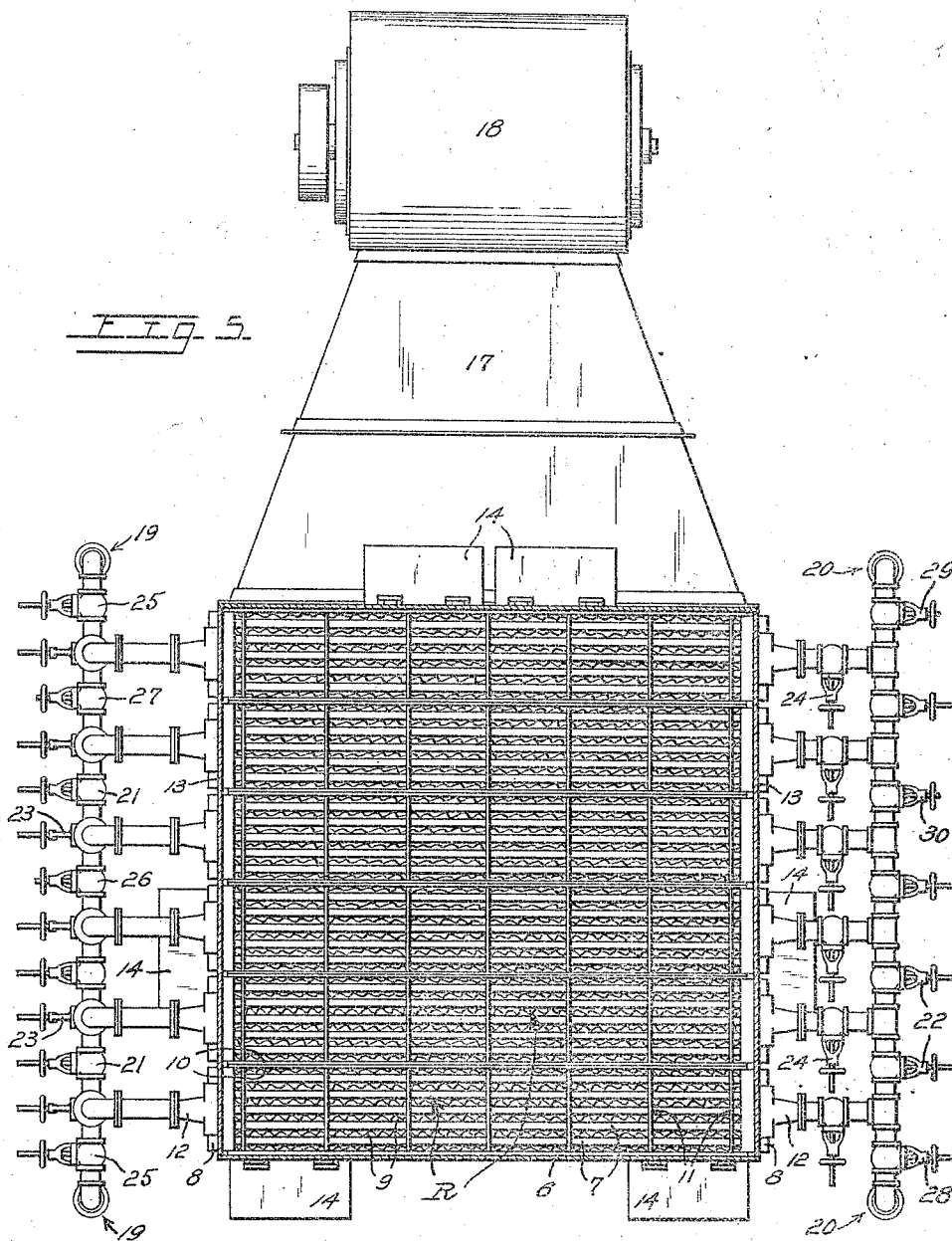
R. E. HANSON

1,551,029

HEAT EXCHANGER

Filed Sept. 4, 1924

2 Sheets-Sheet 2



Inventor;
Roy E. Hanson,

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Patented Aug. 25, 1925.

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UNITED STATES PATENT OFFICE.

ROY E. HANSON, OF HUNTINGTON PARK, CALIFORNIA.

HEAT EXCHANGER.

Application filed September 4, 1924. Serial No. 735,854.

To all whom it may concern:

Be it known that I, ROY E. HANSON, a citizen of the United States, residing at Huntington Park, in the county of Los Angeles and State of California, have invented a new and useful Heat Exchanger, of which a specification is set forth below.

In this specification, and the accompanying drawing, I shall describe and show a preferred form of my invention, and specifically mention certain of its more important objects. I do not limit myself to the forms disclosed, since various changes and adaptations may be made therein without departing from the essence of my invention as hereinafter claimed; and objects and advantages, other than those specifically mentioned, are included within its scope.

My invention relates to heat exchangers adapted for cooling liquids by air connection, and among its principal objects are; first, to provide a multiple-unit type of exchanger in which the units are adapted to co-operate for attaining the desired results, but may be independently cut out of service and removed without appreciably disturbing the functioning of the remaining units; second, to supply means for permitting such an exchanger to operate at relatively high efficiency throughout a wide range of conditions; and, third, to accomplish the above in a construction that is relatively simple, inexpensive, economical in operation, and thoroughly dependable.

My objects are attained in the manner illustrated in the accompanying drawings wherein is shown an exchanger embodying my invention and particularly adapted for such service as cooling transformer oil. In these drawings—

Figure 1 is a side elevation of the complete exchanger, with certain auxiliary equipment in co-operative relation thereto;

Figure 2 is an elevation of the above construction revolved ninety degrees clockwise from the position shown in the previous figure;

Figure 3 is a much enlarged fragmentary elevation taken on the line 3—3 of Fig. 2 with certain parts shown broken to disclose the interior construction;

Figure 4 is a fragmentary plan view of one of the radiating units by itself, on the same scale as Fig. 3; and

Figure 5 is a plan view of the exchanger, shown partly in section on the line 5—5 of

Fig. 1, and drawn on somewhat larger scale than Figs. 1 and 2.

Similar reference numerals refer to similar parts throughout the several views.

The exchanger illustrated comprises a plurality of surface radiation sections R, arranged side by side in a horizontal plane near the lower end of a suitable rectangular stack structure 6, and co-extensive with the cross-sectional area of the stack in that plane. These radiation sections, in the form shown, comprise a number of flattened parallel tubes 7 connected into headers 8 at each end. The tubes are spaced by cross-corrugated longitudinal strips 9, permitting air currents to flow upward between the tubes. Buck straps 10, at the sides of the sections, are cross-connected by the rods 11, and prevent the radiators from expanding laterally due to internal pressure in the flattened tubes. A flanged nozzle 12 is provided at each end of the radiator sections for connecting them into the cooling system piping.

The stack structure is preferably rectangular in section throughout and is always so at the base. Suitable supporting members are provided for the radiator sections which are slid into the stack structure from one side, and repose therein with both nozzles 12 projecting as shown in Fig. 2. A vertically slidable closure plate 13 permits a small vertical movement of the radiators during placement, and makes a tight joint between these and the stack thereafter.

Beneath the radiators, on all four sides of the stack, are a series of top-hinged doors 14 which may be swung outwardly to the position shown at 15, and be retained in that position by means of the attached notched arc-bars 16. These doors provide ingress for the natural draft tending to flow upward through the radiators and out the top of the stack and, by their location all around the stack, permit of taking advantage of prevailing winds to assist the natural flow tendency. At the bottom of the stack base is also a forced draft duct 17 connected to a blower 18. Operation of the blower may be made effective by closing doors 14, and is made use of at times of peak loads.

The transformer oil, or other fluid to be cooled, is piped to and from the exchanger, and a system of valves is employed whereby the radiator sections can be selectively operated in multiple, series, or multiple-series

arrangement. Such a system is illustrated in Figs. 1, 2, and 5 where the hot transformer oil comes to the exchanger through either one or both of the pipes 19, and returns through either one of a similar pair of pipes 20. The cross header connecting supply pipes 19, and a similar header connecting return pipes 20, are sectionalized by means of valves 21 and 22 respectively, between each of the radiator branch connections. Valves 23 and 24 in the respective branches leading to the radiator sections permit of cutting out the latter when desired.

As suggested above, my invention will be found to be especially useful in such service as cooling transformer oil in places where there is a scarcity of water available for this purpose, or where the natural temperature of the cooling water is relatively high. Under these conditions it has hitherto usually been necessary to alternately cool and re-circulate the cooling water. The cooling has been accomplished by spray ponds or cooling towers, depending largely upon evaporation for their cooling effect, and the addition of only make-up water in these cases gradually increases the mineral content of the cooling water and results in the formation of scale in the water coils of the transformers. Water softening plants often are resorted to under these conditions and the investment and maintenance burdens of such systems may easily become very excessive.

In the use of my invention the cost and maintenance expense is relatively much less than that of such systems as those just described and, as the oil is cooled directly without the use of water, there is no tendency to form scale. My system also has the further advantage that it can be employed where no water whatever is available for cooling.

The construction and operation of my device will readily be understood from the foregoing description. I wish to point out particularly, however, that any of the radiator sections may readily be removed by closing the valves in the branches leading to and from it, and then breaking the flange joints at the radiator nozzles. A board may be inserted in the stack in place of a removed section, and the operation of the remaining sections will continue as before. Boards laid upon the radiator sections in the stack may also be employed for directing the draft through the other sections, when it is desired to cut certain sections out of service without removing them from the stack.

As previously mentioned, the piping system shown and described permits of operatively connecting the radiator units in a variety of ways including series, multiple, and multiple-series arrangements. Thus,

referring to Figs. 1 and 5 and particularly to the latter, the two valves 25 connecting the respective ends of the supply header are shown open. The central valve 26, and one other sectionalizing valve 27 in the supply header, are shown closed. In the return header one end valve 28 is shown open and valve 29, at the other end, is closed. One intermediate valve 30 in this header is also closed. The other valves in the system are all open.

Under the above conditions the three top radiator sections are seen to be connected in series; the three lower radiator sections are connected in multiple; and the series connected sections as a whole are in multiple with the three multiple-connected sections below them.

The average time required for passing a stated quantity of fluid through the exchanger may be controlled in this manner, and it may thus readily be adapted for meeting changed duty conditions that arise in regular operation.

I claim as my invention:

1. A heat exchanger comprising; a stack having a portion of rectangular cross-section; a plurality of independently removable radiators disposed in a horizontal plane in said portion; a piping system having branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators; and means for creating a draft in said stack through the radiators.

2. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening draft doors therein; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; and a piping system having branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators.

3. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening draft doors on all four sides thereof; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; and a piping system having branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators.

4. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening top-hinged draft doors on all four sides thereof; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; and a piping system having inlet and outlet branches removably connected to the radiators through inter-

posed valves, whereby fluid may be circulated through the radiators.

5. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening top-hinged draft doors on all four sides thereof; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; means for withdrawing the radiators through normally closed lateral openings in the stack; and a piping system having inlet and outlet headers with branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators.

6. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening draft doors therein; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; a piping system having inlet and outlet headers with branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators; and valves in the headers between said branches.

7. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening draft doors therein; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; a piping system having inlet and outlet headers with branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators; and valves in the headers between said branches; said headers being connected, through valves at each end, to the main supply and main return leads of the system respectively.

8. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening top-hinged draft doors on all four sides thereof; a plu-

50 rality of independently removable radiators disposed in a horizontal plane in said portion above said doors; means for withdrawing the radiators through normally closed lateral openings in the stack; blower means for creating a draft in the stack when said doors are closed; a piping system having inlet and outlet headers, each of which has branches removably connected to each of the radiators through interposed valves; and valves in said headers between each of said branches; said headers being connected, through valves at each end, to the main supply and main return leads of the system respectively.

9. A heat exchanger comprising; a stack having a portion of rectangular cross-section; a plurality of independently removable radiators disposed in a horizontal plane in said portion; a piping system having branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators; and means for creating a draft in the stack through the radiators; said radiators consisting of a plurality of flattened tubes on edge, spaced laterally by vertically corrugated strips, and held against deformation due to internal pressure by means of cross-tied buck straps.

10. A heat exchanger comprising; a stack having a portion of rectangular cross-section with adjustable opening draft doors therein; a plurality of independently removable radiators disposed in a horizontal plane in said portion above said doors; a piping system having inlet and outlet headers with branches removably connected to the radiators through interposed valves, whereby fluid may be circulated through the radiators; and valves in the headers between said branches; said radiators consisting of a plurality of flattened tubes on edge, spaced laterally by vertically corrugated strips, and held against deformation due to internal pressure by means of cross-tied buck straps.

ROY E. HANSON.