May 9, 1933. A. B. MODINE 1,907,433

HEAT EXCHANGE APPARATUS

Filed Aug. 9, 1929 2 Sheets-Sheet 1

Fig. 1.

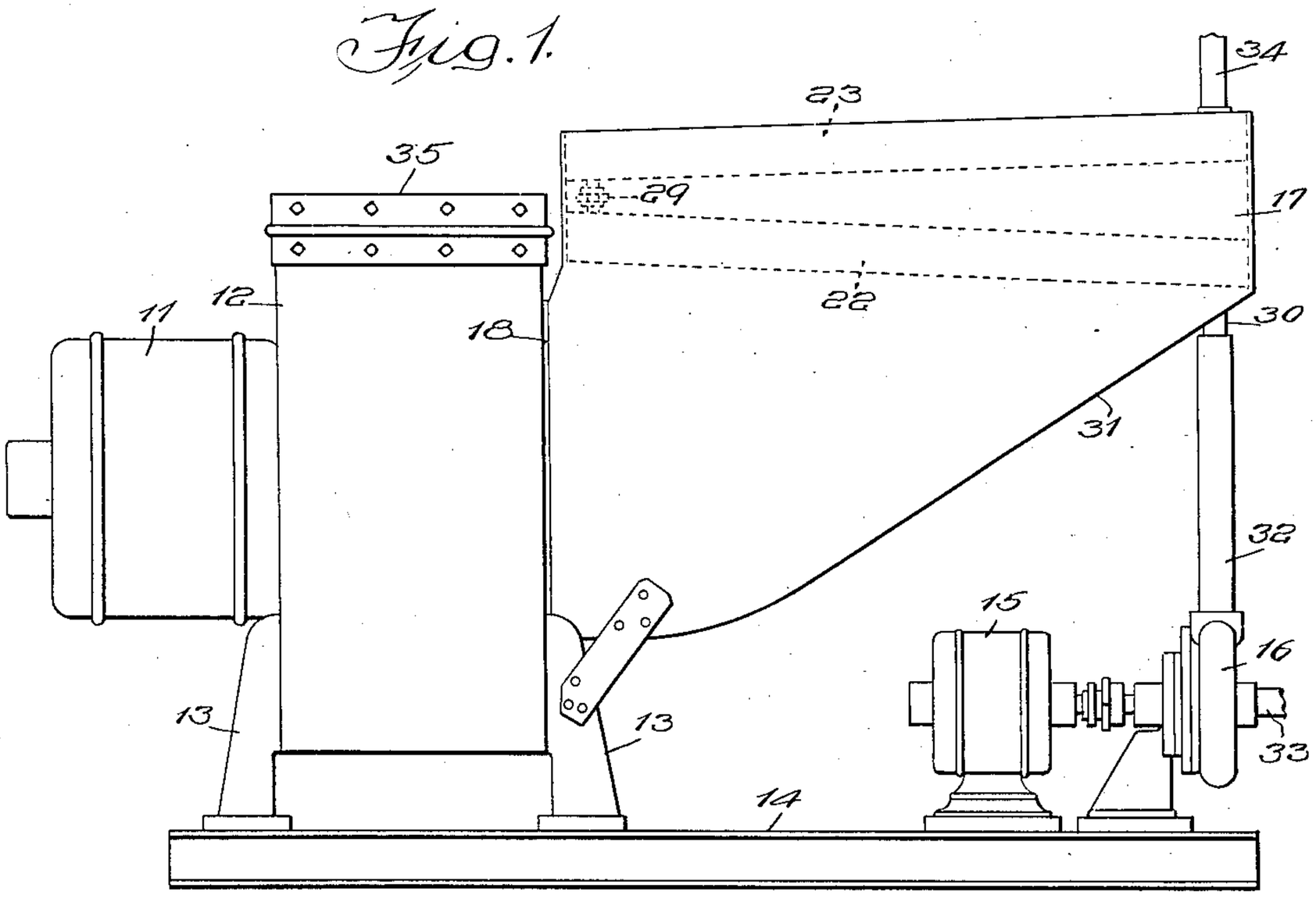

Fig. 2.

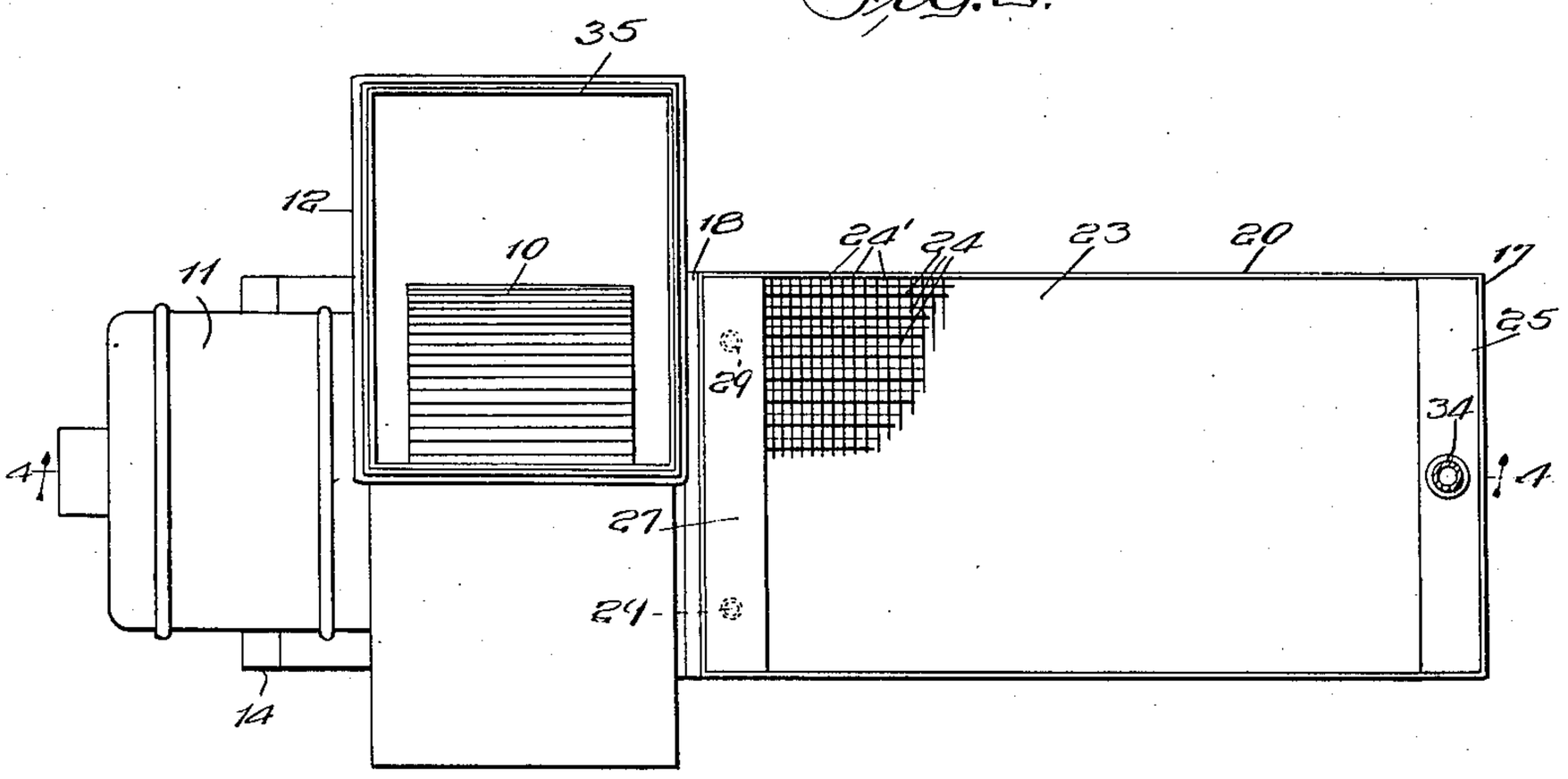

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Fig. 3.

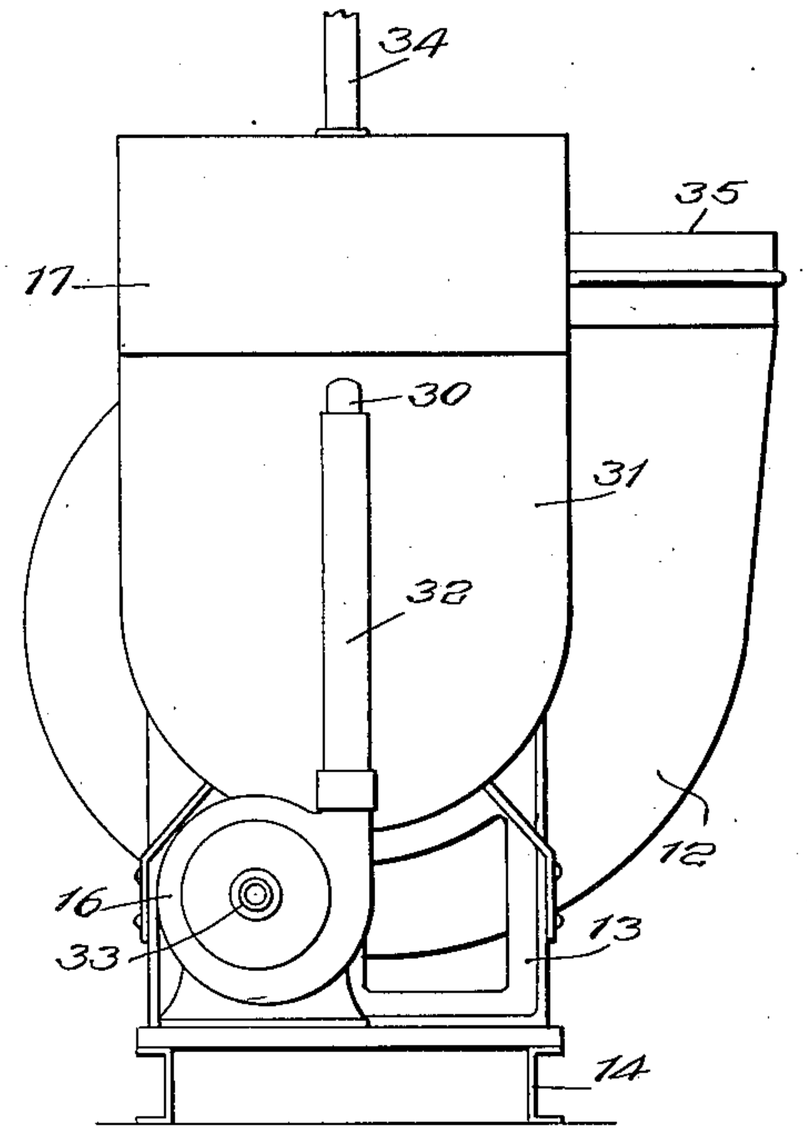


Fig. 4.

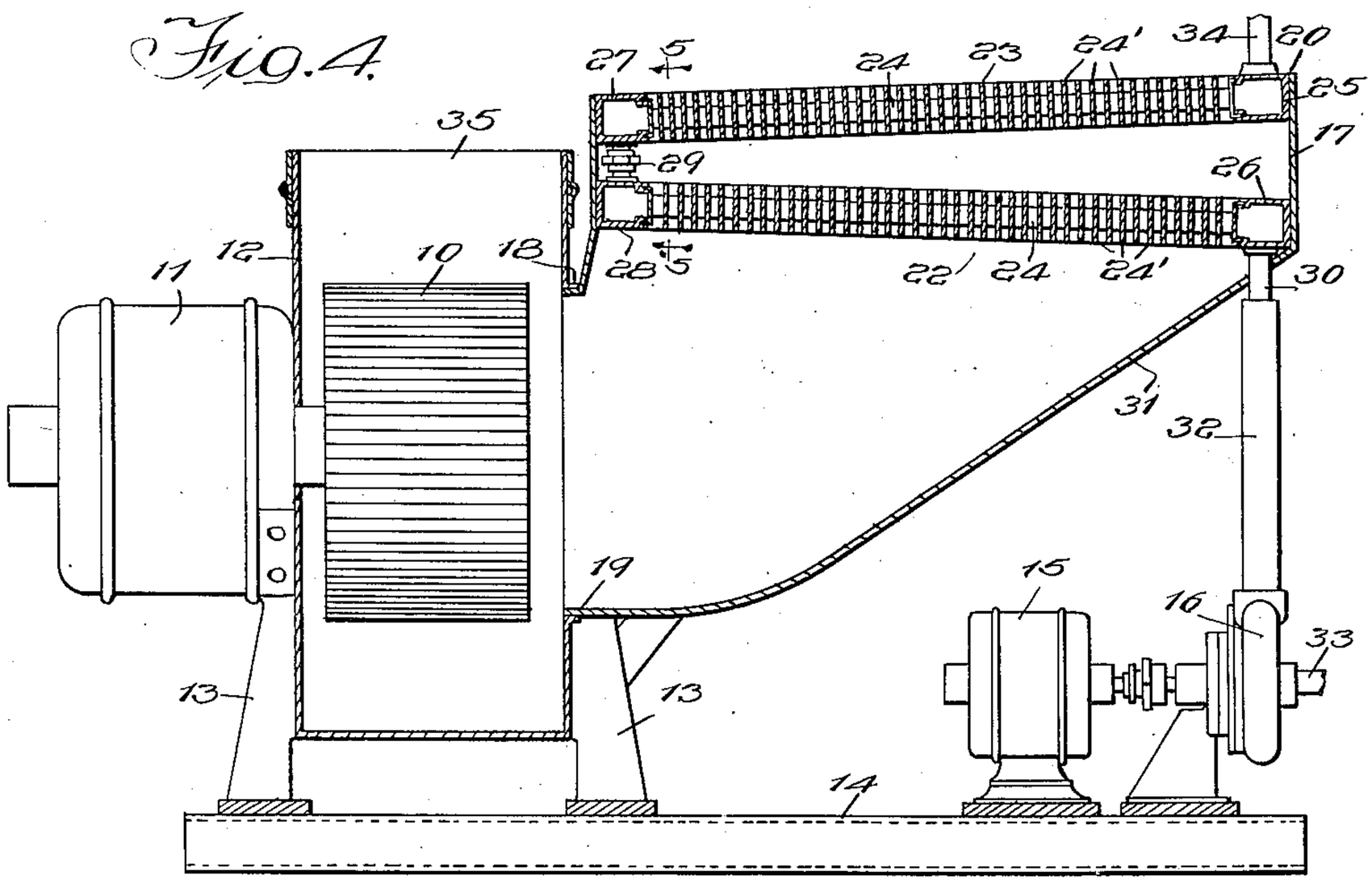
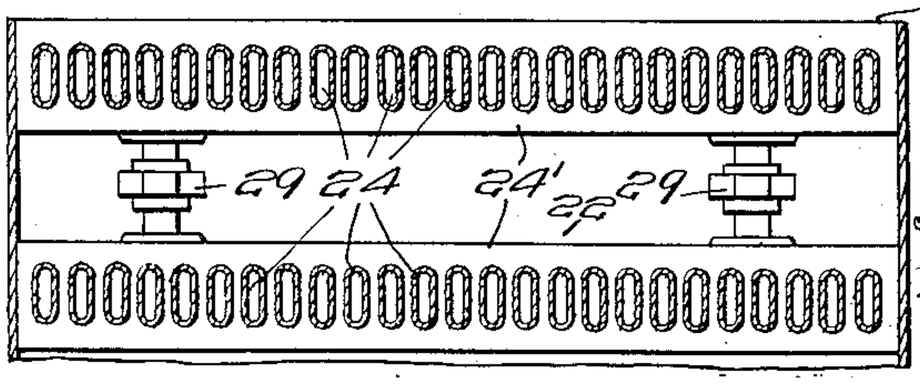


Fig. 5.



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UNITED STATES PATENT OFFICE

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HEAT EXCHANGE APPARATUS

Application filed August 9, 1929. Serial No. 384,732.

The invention relates to heat exchange devices and has among its various objects the provision of a unitary structure whereby a large quantity of one fluid substance is forced into the path of a relatively large moving body of another fluid substance to thereby quickly and economically cause the heat of one substance to be transferred to the other to thereby change the temperature of the former.

A further object of the invention is the provision of means whereby a liquid is pumped or otherwise forced into the path of a stream of fluid to thereby vary the temperature of said liquid or fluid and to provide means for forcibly causing movement of said fluid relatively to the liquid to thereby facilitate a temperature change of either the liquid or fluid.

Another object of the invention is the provision of a unitary structure which includes a fan, a liquid pump, a radiator through which the liquid is pumped and from which said liquid is delivered to the system and to arrange said radiator with respect to an air duct in which the fan is located so that air is caused to travel through the radiator to thereby reduce the temperature of the liquid as it passes through the radiator.

The invention has these and other objects, all of which will be more readily understood when read in conjunction with the accompanying drawings which illustrate one embodiment of which the invention is susceptible, it being evident that changes and modifications may be resorted to without departing from the spirit of the appended claims forming a part hereof.

In the drawings, Fig. 1 is a side elevation of a unitary structure whereby the above and other objects may be accomplished;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is an end view of the structure shown in Fig. 1;

Fig. 4 is a section taken on line 4—4 of Fig. 2; and

Fig. 5 is a section taken on line 5—5 of Fig. 4.

The embodiment of the invention illustrated in the drawings contemplates the use of a fan 10 which is mounted upon an end of the shaft of an electric motor 11. This fan is rotatably arranged in a fan housing 12 which is supported by means of the legs 13—13 connected with the frame or base 14 which also provides a means upon which a motor 15 and water pump 16 are mounted. A member 17 providing an air duct is connected with and projects laterally from the fan housing 12. The fan housing has an opening 18 into which one end, such as 19, of the duct 17 is inserted to complete an air passage with the fan housing. The opposite end 20 of the duct 17 is provided with a heat exchange device or radiator generally designated 21 which includes a plurality of radiator units respectively designated 22 and 23 including tubes 24 having fins 24′ to facilitate the dissipation of heat contained in the commodity forced through the heat exchange units 22 and 23. The opposite ends of the units 22 and 23 are respectively connected with headers 25, 26, 27 and 28 which are soldered or otherwise fastened in the opening 20 of the duct 17. The headers 27 and 28 communicate with each other through the medium of the fittings generally designated 29 which may include a union to facilitate connection and separation of the radiator units 22 and 23 from each other should this, at any time, be found necessary or desirable. A pipe connection 30 extends from the lowermost header 26 and extends through the wall 31 of the duct 17 and has a pipe connection 32 connected therewith which completes a connection between the header 26 and the water pump 16. It is understood that the water pump 16 has an inlet 33 whereby water or any other liquid which it is desired to cool or vary the temperature of is forced into the header 26, through the heat exchange unit such as 22 and thence into the header 28, through the fittings 29 into the header 27, through the pipe 23, header 25 and out through the outlet pipe 34, this pipe being adapted to be connected to any structure containing a fluid the temperature of which it is desired to change. These units 22 and 23 are inclined relatively to each other as clearly shown in Fig. 4 to facilitate draining thereof. The tubes of the radiator units

22 and 23 are preferably elongated in cross section as shown in Fig. 5 and the fins 24′ are, as also shown in said figure, of a relatively long and narrow character and are of relatively thin gauged material so as to more readily conduct heat from the commodity forced through the tubes of these units. It is manifest that when the fan 10 is rotated in one direction that air is drawn through the radiator units 22 and 23 into the interior of the duct 17 from which it is dispelled through the opening 34 provided in the fan housing. From the foregoing description, it is evident that a relatively simple structure of unitary character is provided whereby a fluid is forced through heat exchange units and caused to travel through a path of moving air created by the fan 10 which will quickly vary the temperature of the liquid flowing in said units or the air passing through said units and thereby cause the temperature thereof to be brought to the degree desired for the particular use for which it is to be employed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A device of the kind described comprising in combination, a housing having openings providing air passages and having a tubular member secured at one of the openings and projecting from said housing, said tubular member increasing in dimension from said opening to the termination of said member, air advancing means provided in said housing and arranged axially of said opening, and a horizontally disposed heat exchange device located in said termination of said tubular member.

2. A device of the kind described comprising in combination, a housing having openings providing air passages and having a tubular member secured at one of the openings and projecting from said housing and increasing in dimension from said housing, air advancing means provided in said housing and arranged axially of said opening, and a plurality of connected horizontally disposed heat exchange devices located in the larger portion of said tubular member.

3. A device of the kind described comprising in combination, a housing having openings providing air passages, a tubular member connected with and projecting from said housing at one of said openings, a heat exchange device projecting in the same direction as said tubular element, said heat exchange device being extended across said tubular member, and air advancing means arranged in said housing.

4. A device of the kind described comprising in combination, a member providing a housing, air advancing means located in said housing, said housing having openings providing air passages, one of said openings being arranged axially of the air advancing means, a tubular element connected with said housing at said last mentioned opening, said tubular element having a laterally extending opening, and a heat exchange device located in said opening.

5. A device of the kind described comprising in combination, a member providing a housing, air advancing means located in said housing, said housing having openings providing air passages, a tubular element connected at one end with said housing and extending from one of the openings, the opposite end of said tubular member opening in a lateral direction and being of a substantially larger dimension than said opening in said housing, and a heat exchange device located in said enlargement.

6. A device of the kind described comprising in combination, a member providing a housing, air advancing means located in said housing, said housing having openings providing air passages, a tubular element connected at one end with said housing and extending from one of the openings, the opposite end of said tubular member opening in a lateral direction and being of a substantially larger dimension than said opening in said housing, a heat exchange device arranged substantially parallel with the axis of the air advancing means located in said enlargement.

7. In a device of the kind described, the combination of an open ended member providing an air duct, the opening at one end of said member being of a substantially larger dimension than the opening at the opposite end thereof, a housing connected with the smaller end of said member, said housing having openings therein providing air passages, air advancing means located in said housing, and a heat exchange unit adapted to be inserted in said enlargement with one edge thereof located adjacent said housing.

8. In a device of the kind described, the combination of an open ended member providing an air duct, the opening at one end of said member facing in an upward direction and being of a substantially larger dimension than the opening at the opposite end thereof, a housing connected with the smaller end of said member, said housing having openings therein providing air passages, air advancing means located in said housing, a heat exchange device located in said enlargement.

9. A device of the kind described comprising in combination, a housing, air advancing means located in said housing, openings provided in said housing providing air passages, a tubular member connected with said housing at one of said openings, said member having an end which projects in a lateral direction relatively to said portion thereof connected with said opening in said housing,

and a heat exchange unit adapted to be inserted into said laterally projecting portion of the tubular member and be supported by said tubular member against displacement inwardly relatively to said tubular member.

10. A device of the kind described comprising in combination, a housing, air advancing means located in said housing, openings provided in said housing providing air passages, a tubular member connected at one of said openings, said tubular member varying in dimension from said opening to the opposite end thereof, and a heat exchange unit adapted to be inserted in the larger portion of said tubular member and be supported by said tubular member against displacement inwardly relatively to said tubular member.

11. A device of the kind described comprising in combination, a housing, air advancing means located in said housing, openings provided in said housing providing air passages, a tubular member connected at one of said openings, said tubular member varying in dimension from said opening to the opposite end thereof, said last mentioned end opening in a direction transverse to said opening in said housing at which said tubular member is connected, and a heat exchange device located in the larger portion of said tubular member.

12. A device of the kind described comprising in combination, a housing, air advancing means located in said housing, openings provided in said housing providing air passages, a tubular member connected at one of said openings, said tubular member varying in dimension from said opening to the opposite end thereof, said last mentioned end opening in a direction transverse to said opening in said housing at which said tubular member is connected, and oppositely inclined heat exchange units located in the larger portion of said tubular member.

In witness whereof, I hereunto subscribe my name this 18th day of July A. D., 1929.

ARTHUR B. MODINE.