No. 869,747. PATENTED OCT. 29, 1907.

J. E. STARR.

AIR COOLER OR SURFACER.

APPLICATION FILED JUNE 28, 1906.

Fig. 1.

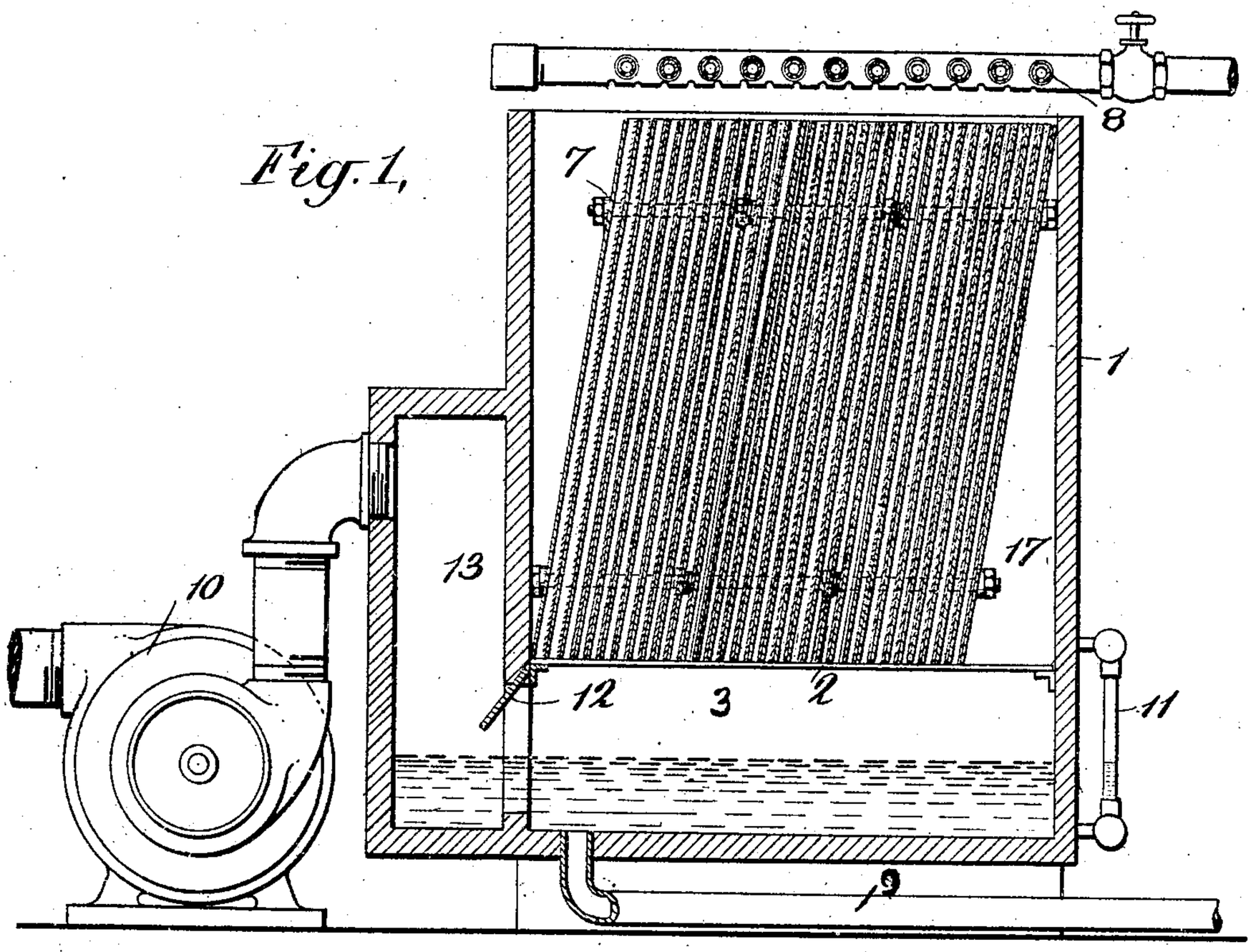


Fig. 2.

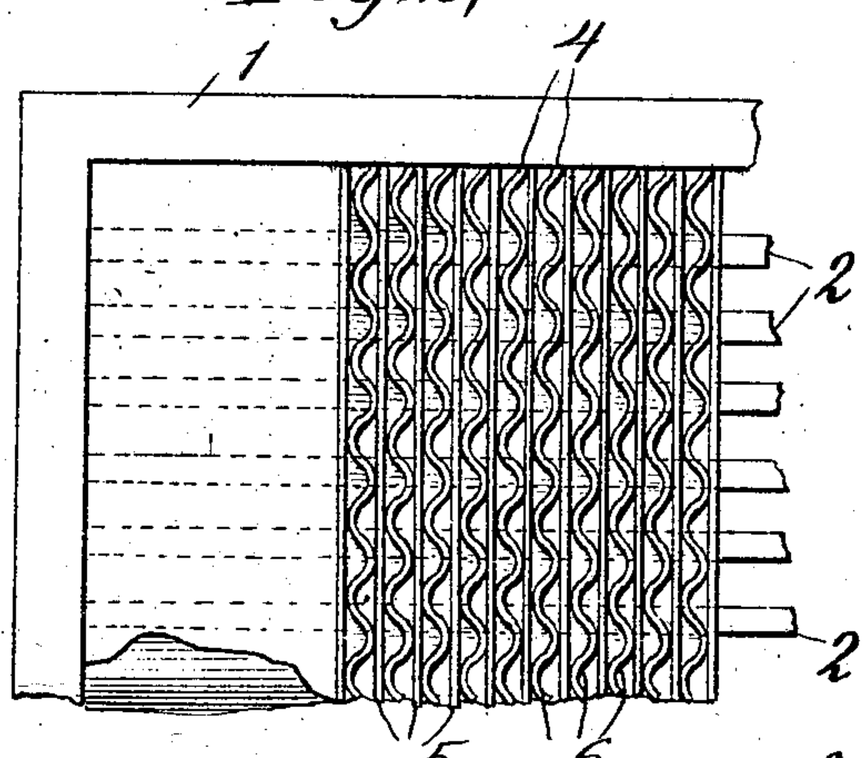


Fig. 3.

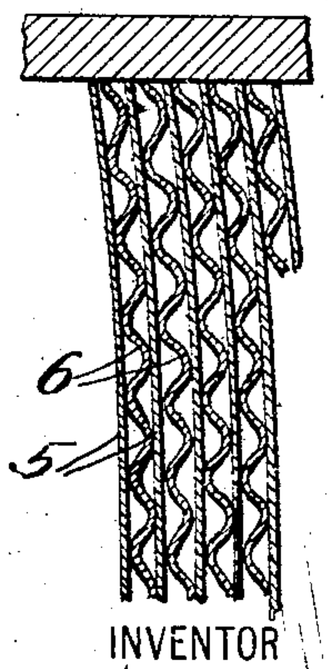
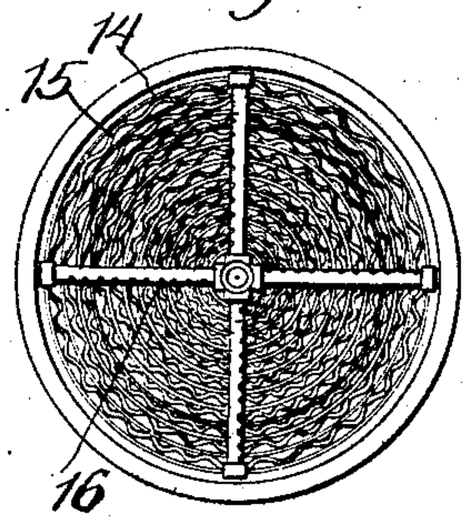


Fig. 4



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AIR-COOLER OR SURFACER.

No. 869,747. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed June 28, 1906. Serial No. 323,872.

To all whom it may concern:

Be it known that I, JOHN E. STARR, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Air-Cooler or Surfacer; and I do hereby declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in apparatus for cooling air or other gas, and belongs to that class of such apparatus wherein a cooling liquid, such as cold brine, is caused to pass in thin films, in contact with currents of air or gas to be cooled. In such apparatus it is customary to provide a large number of plates or surfaces, suitably spaced apart, over which the cooling liquid is caused to flow in thin films or sheets, the air or gas being drawn between such plates or sheets and therefore being caused to pass in close proximity to the flowing films of cooling liquid. Since the problem in such apparatus is to spread the cooling liquid over as great a surface area as possible, within given dimensions, such apparatus are commonly called "surfacers" in the trade.

The objects of my invention are, to improve, simplify and cheapen such air cooling or surfacing apparatus, to obtain a very large area of cooling surface within given dimensions, to provide for the construction of the surfacer from parts which are commonly found in the market, and with a minimum of work on these parts, and generally to make the apparatus simple, compact, efficient and inexpensive.

I will now proceed to describe my invention with reference to the accompanying drawings in which one form of surfacing or air or gas cooling apparatus embodying my invention is illustrated, and will then point out the novel features in claims.

In the said drawings, Figure 1 shows diagrammatically a central vertical section of an air cooler constructed in accordance with my invention; Fig. 2 shows a transverse horizontal section of the surfacer thereof; Fig. 3 is a view similar to Fig. 2, but showing an alternative construction; and Fig. 4 shows a transverse section of a further alternative construction.

In Figs. 1, 2 and 3, 1 designates a tank or chamber inclosing the plates or surfaces over which the cooling liquid flows, such surfaces or plates being supported upon a grating 2 within said tank. 3 designates a space within said chamber into which the cooling liquid falls from the said plates. 4 designates the series of plates over which the cooling liquid flows; the same consisting of corrugated plates 5 and flat plates 6, alternately arranged and set close together, inclined slightly from the vertical. By employing corrugated and flat plates alternately arranged as shown, I avoid altogether the use of special spacing pieces, the corrugated plates in themselves forming spacing pieces while at the same time substantially the entire surface of the upper sides of both the corrugated and flat plates are available for the flow of the liquid. Furthermore, the flat and corrugated sheets may at all times be purchased in the open market in practically any desired size, and require little or no work to be done upon them to fit them for use. In practice, I prefer to bind the series of plates together by bolts 7 passing through the plates, as shown, and the punching of holes for the passage of these bolts is practically the only work to be done upon the plates; but even this is not necessary, as it is quite practicable to place the plates within the chamber 1 without fastening them together.

8 designates a spraying pipe by which cooling liquid may be distributed over the plates, and caused to flow down the same in thin sheets or films; the liquid collecting in the space 3 beneath the grating 2 and being drawn off through pipe 9. When an ample supply of water of sufficiently low temperature is available, I may use ordinary cold water as the cooling liquid; but ordinarily I prefer to use brine or other suitable liquid refrigerating agent, it being understood that in such case pipes 8 and 9 are connected to any suitable refrigerating apparatus.

Air is drawn through the channels between the plates by means of an air circulating apparatus 10, such, for example, as an ordinary fan. Such air, being divided into a large number of relatively small streams, is brought into intimate contact with the cooling liquid flowing over the surfaces of the plates, and thus an efficient exchange of heat between the liquid and air is insured. 11 designates a gage glass for showing the level of the liquid in the space below grating 2. 12 designates a deflecting plate below the grating past which the air must pass and 13 designates an air passage extending from said deflector upward, the whole forming a separator for freeing the air or gas drawn off from the liquid.

I commonly fasten together the plates 5 and 6 so as to form a plurality of groups of plates, each comprising a number of plates convenient for handling.

I commonly use the term "plain plates" herein and in the claims in contradistinction to the term "corrugated plates". Said plain plates are not necessarily flat, as shown in Fig. 2, but may have various forms differing materially from the curved form of corrugated plates 5. In Fig. 3 for example I show said plain plates as slightly curved.

Instead of employing the apparatus shown in Figs. 1–3 inclusive, I may sometimes employ that shown in Fig. 4, which comprises a series of cylinders alternately

plain and corrugated nested one within the other. Numerals 14 designate the plain cylinders and numerals 15 the corrugated cylinders. A convenient device for spraying the liquid in this form of apparatus, is an ordinary Barker's mill 16, the arms of which revolve owing to the reaction of the jets of liquid, and in revolving distribute the liquid thoroughly.

It will be obvious that the apparatus above described is equally suitable for cooling water or other liquid instead of air, when it is liquid and not air which it is desired to cool; the liquid flowing down along the plates as above described, and air being drawn through the channels between the plates as above described, the cooling of the liquid being due to the evaporation induced by the passage in proximity to it of the currents of air. My apparatus is therefore equally suitable for use as an air or gas cooler, and for use as a liquid cooler or "cooling tower" as the latter apparatus is commonly termed.

Heretofore various complicated and expensive constructions have been employed to provide large surface area for the flow in intimate contact of the cooling liquid and air to be cooled, and various expedients have been employed for spacing apart plates, both straight and corrugated. Also metal cylinders have been nested one with another. But I believe I am the first to use in combination, flat or plain and corrugated plates arranged alternately as shown, whereby the corrugated plates space apart the plain plates and are themselves spaced apart by said plain plates, and whereby practically the entire surface of both the plain and corrugated plates is available for the flow of cooling liquid.

The various forms of apparatus above described are likewise suitable for use as humidifiers, that is, apparatus for increasing humidity of air or other gas to any desired extent. I intend my apparatus as so used, to be included in the following claims

What I claim is:—

1. In cooling apparatus such as described, the combination of a series of surfaces, alternately plain and corrugated, means for flowing liquid over said surfaces and through the channels between the adjacent surfaces, and means for passing gas through said channels.

2. In cooling apparatus such as described, the combination of a series of surfaces, alternately flat and corrugated, means for flowing liquid over said surfaces and through the channels between the adjacent surfaces, and means for passing gas through said channels.

3. In cooling apparatus such as described, the combination with a tank having within it a perforate support, and means below such support for collecting liquid, of a series of surfaces, alternately plain and corrugated, within said tank and resting on said support, means for flowing liquid over such surfaces and through the channels between the adjacent surfaces, and gas circulating apparatus arranged to pass gas through the said channels.

4. In cooling apparatus such as described, the combination with a tank having within it a perforate support, and means below such support for collecting liquid, of a series of surfaces, alternately plain and corrugated, within said tank and resting on said support, means for flowing liquid over such surfaces and through the channels between the adjacent plates, and a fan connected with said tank below the said support and arranged to draw gas through the said channels.

5. In cooling apparatus such as described, the combination of a tank having within it a series of surfaces with small channels therebetween for the flow of liquid and gas, and a chamber below such surfaces for collecting the liquid, said chamber having an extension to one side of said series of surfaces, and provided with means for drawing off the gas from such extension, and a deflecting plate between the main portion of said chamber and said extension adapted to effect separation of moisture from the gas by inertia action.

In testimony whereof I affix my signature, in the presence of two witnesses.

JOHN E. STARR.

Witnesses:
H. M. MARBLE,
JOHN E. BATTEN.