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1,491,443

H. M. TOOMBS

AIR COOLING APPARATUS

Filed Nov. 14, 1921

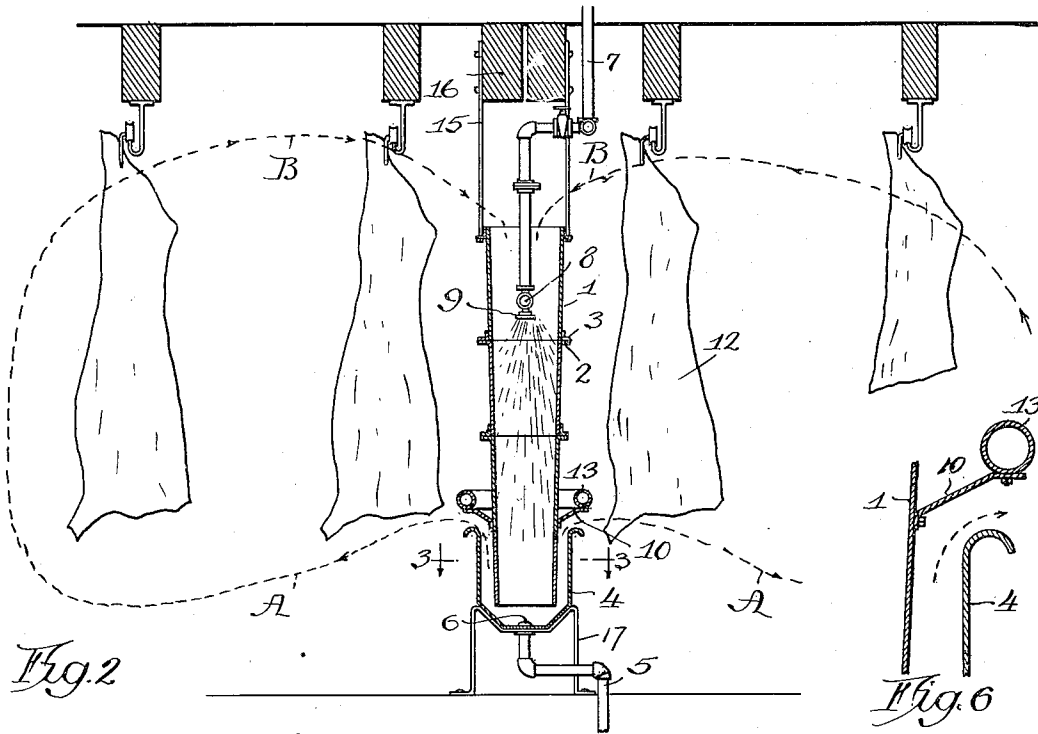


Fig. 2

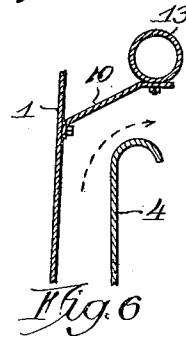


Fig. 6

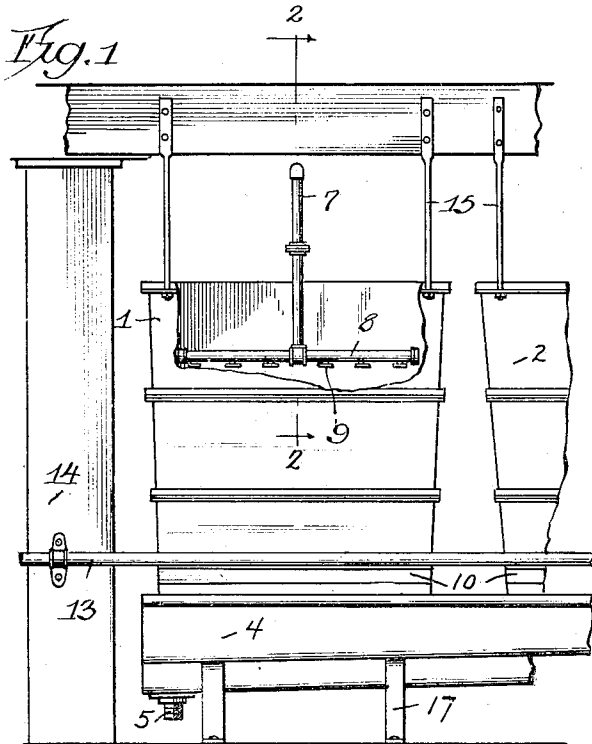


Fig. 1

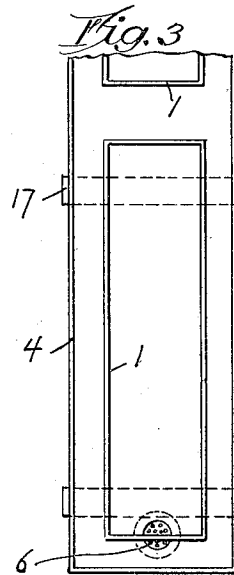


Fig. 3

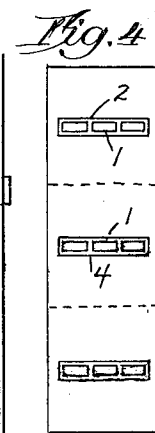


Fig. 4

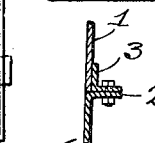


Fig. 5

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UNITED STATES PATENT OFFICE.

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AIR-COOLING APPARATUS.

Application filed November 14, 1921. Serial No. 514,938.

To all whom it may concern:

Be it known that I, HAROLD M. TOOMBS, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in an Air-Cooling Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to means for cooling cold storage rooms or the like, and in some of its general aspects aims to provide means for effectively employing a cooling liquid (such as brine) for cooling air within such a room and for adequately circulating the cooled air through the room. Furthermore, it aims to provide a simple inexpensive and highly efficient arrangement for this purpose which can easily be erected in a cold storage room without requiring any changes in the construction of the building, and one which can readily be installed in units corresponding in grouping and number to the size of the room and the needed amount of cooling.

In securing the required low temperature in chilling rooms such as those of packing houses, it has long been customary to employ sprays of brine (suitably chilled by an ice machine or the like) for cooling the air in a loft above the chilling room, and to have this air circulate downwardly through the chilling room. This plan has the serious objection that it requires a large amount of loft space. It has also been customary to some extent to install a brine spraying equipment in a laterally adjacent room or chamber from which the cooled air is circulated through wall openings into the chilling room. This also requires a corresponding special room construction and has the additional and serious disadvantage that the chilled air will only travel laterally to a limited extent across the chilling room, therefore limiting the effective cooling to rooms of relatively small dimensions.

My present invention aims to overcome all of these objections to the arrangements now in common use by providing an equipment which can readily be installed in an ordinary chilling or cold storage room without making any changes whatever in the construction of the room or of the build-

ing in general, and which also can readily be installed for effective use in rooms of any desired size or shape. Further and more detailed objects will appear from the following specification and from the accompanying drawings, in which—

Fig. 1 is a fragmentary elevation of a series of air cooling units embodying my invention and installed in the type of room commonly used for chilling beef or the like, a wall portion of one part being broken away to show one arrangement of the brine spraying nozzles.

Fig. 2 is a fragmentary section taken transversely of Fig. 1 along the correspondingly numbered line and also showing how the illustrated unit can be installed between two rows of beef sides.

Fig. 3 is an enlarged horizontal section on the line 3—3 of Fig. 2 through the trough and the lower end of the hopper of the unit of Figs. 1 and 2.

Fig. 4 is a reduced plan view of a chilling room similar to that of Figs. 1 and 2, showing a desirable arrangement of my cooling equipment in large rooms.

Fig. 5 is an enlargement of a portion of Fig. 2, showing how the hopper sections are secured to each other.

Fig. 6 is an enlargement of another portion of the same figure, showing the disposition of the guard rail and air deflector with respect to the hopper and the brine trough.

In the immediate commercial application, my invention is particularly suitable for use in the chilling and cold storage rooms of packing houses and I am therefore describing the same in such an application, although I do not wish to be limited to its employment for these particular purposes. In the embodiment of the drawings, the cooling equipment of my invention is constructed in units which can readily be installed in an ordinary room in any desired grouping. Each of these units consists primarily of a vertical hopper having a spray of brine discharged downwardly into the same, a brine discharging trough underhanging the bottom of the hopper, and deflectors extending at each side of the hopper above and beyond the side edges of the brine trough for laterally deflecting the cooled air. In practice, each hopper is desirably composed of a number of vertically superposed

sections, each of the lower sections having at its top an outwardly directed flange 2 which is bolted to angle iron strips 3 fastened to the lower edge of the next higher section after the manner shown on an enlarged scale in Fig. 5. The superposed sections are successively smaller downwardly of the hopper, so that the hopper as a whole gradually decreases in width towards its lower end. This lower end extends for a considerable distance downwardly into a brine trough 4 which empties into a discharge pipe 5 through a strainer 6, the pipe 5 being the return duct for a brine supply system cooled by an ordinary ice machine. Freshly cooled brine is supplied through a pipe 7 to a horizontal spray pipe 8 disposed within the hopper somewhat below the top thereof and carrying a series of spray nozzles 9, these nozzles being desirably designed for affording a downwardly directed flaring or angular spray of the brine.

Above the sides of the brine trough 4 at each side of the hopper are deflectors 10, each of which desirably extends from the adjacent side of the hopper for some distance outward beyond the side of the brine trough, and each of which desirably slopes upward from the brine trough and then continues substantially horizontally, somewhat after the manner shown in Fig. 2.

The sides of the brine trough and the air deflectors are so positioned that the resulting outlet for the air drawn downwardly through the hopper by the cooling action of the spray is disposed at a considerable distance above the floor of the room, thus permitting the emitted air to sink by gravity while traveling laterally of the room substantially as indicated at A in Fig. 2. Likewise, the top of the hopper is desirably at some distance below the ceiling of the room and may even be below the top of the beef sides or the like which are to be cooled, thus permitting the circulated air to be returned along downwardly terminating paths such as shown at B in Fig. 2.

In operation, the downward spraying of the brine into the hopper carries air downwardly with it, thus producing a suction at the top of the hopper which will cause a continuous downward circulation of air through the same. At the same time, the flaring of the spray towards the sides of the hopper restricts the effective air passage through the same and hence increases the velocity of the air after the latter has entered the top of the hopper. This increase in velocity causes the air to intermingle all the more thoroughly with the spray of brine (which spray desirably is quite fine or misty in form) so that the air loses its heat to the brine and becomes chilled while warming the brine. Then, as the continued forcing of the air downwardly

through the hopper forces the air upward between the lower end of the hopper and the sides of the brine trough, the air issuing at each side of the lower end of the hopper is deflected by the deflector 10 so as to cause it to travel laterally of the room with sufficient velocity to carry it for a considerable distance. In doing so, it is gradually warmed, and in practice divides in a large number of portions circulating upward and gradually uniting to form the fresh and downwardly directed supply of air through the hopper, as partly indicated by the arrows on the dotted lines of Fig. 2.

To reduce the cost of manufacture, the hoppers are desirably built in convenient lengths and grouped lengthwise of one another in rows, with the hoppers in each row depending into a single brine trough after the manner indicated in Fig. 1. By installing a number of such rows of cooling units in a room, I can readily secure the chilling effect required for a room of any size regardless of the dimensions thereof. That is to say, I merely need to space the rows of cooling units so that the lateral air circulation from each row will be ample for the section of the room of which this row forms substantially the central line, as for example the sections into which the room of Fig. 4 is divided by the dotted lines of that figure.

Moreover, such an installation can readily be made right in the ordinary chilling room as now employed in packing houses or the like. For example, Fig. 2 shows a part of such an installation as made in a beef chilling room where the cooling units can readily be installed in the space ordinarily provided between the rails or tracks from which the rows of beef sides are suspended. In such a case, it is desirable that the beef should not be swung directly against any part of the cooling unit, as this might damage the same. I therefore preferably guard against such a damaging by providing guard rails 13 at opposite sides of the hopper, these guard rails being suitably fastened to walls, columns or other rigid portions of the building, such as the column 14 of Fig. 1. I also desirably support each hopper independently of the brine trough so as to leave the entire space between the lower portion of the hopper and the sides of the brine trough clear for the unhampered emission of the cooled air. For example, the drawings show each hopper as suspended by straps 15 from the ceiling joists 16, and show the brine trough as supported by steel straps 17 bent to afford legs.

Of course, the relative proportions of the various parts can be varied considerably, but I desirably terminate the substantially vertical hoppers or spray confining casings sufficiently below the ceiling of the room to

permit the ready sucking of the warmed air into the same and also desirably dispose the air exits sufficiently above the floor to permit gravity to cooperate with the pressure under which the air is emitted in effecting the distribution of the chilled air across the room. To secure this exit pressure or velocity, I preferably space the trough sides from the hopper or tube sides so that the total outlet area adjacent to each spray confining tube is less than the area of the lower end of the tube, thus causing the reduction in the effective size of the exit passages to accelerate the velocity of the emitted air.

However, I do not wish to be limited to these or other details of the construction and arrangement here disclosed, it being obvious that the same might be modified in many ways without departing from the spirit of my invention or from the appended claims. For example, the cross-section of the spray tubes and the construction and arrangement of the spray outlets may be widely varied, though I preferably provide a wide and finely divided distribution of the spray. By so doing, I am able to secure an intimate intermingling of the spray with the air and a correspondingly efficient exchange of heat between the brine and the air, so that my apparatus requires less brine than is required for the same amount of cooling with the old style brine lofts. So also, my cooling apparatus can readily be adapted to rooms of any height, thereby doing away with the irregular floor levels formerly introduced into packing house constructions by the added height of the brine lofts.

Furthermore, it will be noted that the deflectors not only provide a wide air circulation across the room but also prevent such direct upward air currents alongside the hoppers as would reduce the efficiency of the cooling system. Likewise, the return air currents in passing below the ceiling timbers prevent the condensation of moisture on the ceiling which has been so common and objectionable with the brine loft systems as heretofore in use.

I claim as my invention:

1. A room cooling apparatus comprising a substantially vertical tube disposed at a considerable distance from the walls of the room and having open ends disposed at considerable distances respectively from the floor and from the ceiling, means for direct-

ing a diverging spray downwardly into the tube, drip catching means disposed below the tube and freely housing the extreme lower end of the tube at opposite sides thereof, and air deflectors respectively overhanging the drip catching means at opposite sides of the tube and each extending obliquely upward from the adjacent side of the tube and decreasing in inclination away from the tube.

2. A room cooling unit comprising an upwardly open trough, a substantially vertical tube depending at its lower end into the trough and having its lower end freely spaced from the sides of the trough, means for producing downward suction of air through the tube and cooling the air while passing through the tube, air deflectors extending laterally from the trough and overhanging the said trough sides and freely spaced from the latter, and guards extending parallel to the trough sides laterally outward of the air deflectors.

3. A room cooling unit comprising an upwardly open trough, a substantially vertical tube depending at its lower end into the trough and having its lower end freely spaced from the sides of the trough, means for producing downward suction of air through the tube and cooling the air while passing through the tube, air deflectors extending laterally from the trough and overhanging the said trough sides and freely spaced from the latter, and guards extending parallel to the trough sides laterally outward from the tube beyond both the air deflectors and the trough sides.

4. A room cooling unit comprising an upwardly open trough, a substantially vertical tube depending at its lower end into the trough and having its lower end freely spaced from the sides of the trough, means for producing downward suction of air through the tube and cooling the air while passing through the tube, air deflectors extending laterally from the trough and overhanging the said trough sides and freely spaced from the latter, and guards extending parallel to the trough sides, the tube, deflectors and guards all being supported independently of the trough to leave unobstructed openings between the tube and the trough.

Signed at Chicago, Illinois, November 10th, 1921.

HAROLD M. TOOMBS.