Aug. 25, 1953 J. M. ANDREWS 2,650,075

ATMOSPHERIC CONDENSER FOR REFRIGERATING SYSTEMS

Filed Sept. 6, 1951

Fig. 1

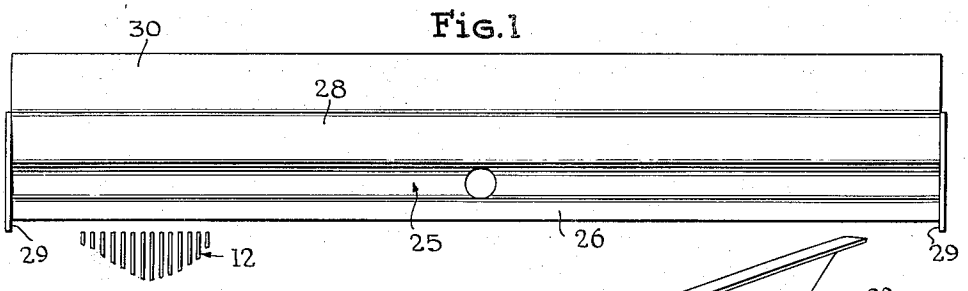


Fig. 2

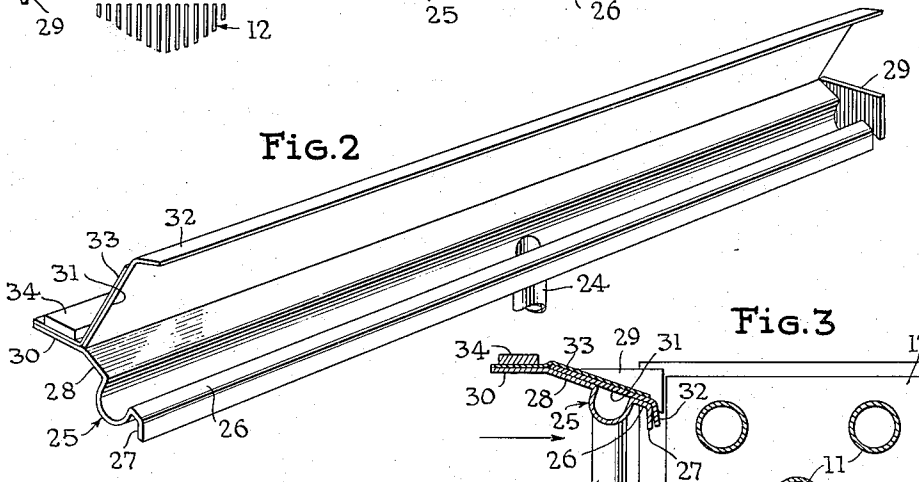


Fig. 3

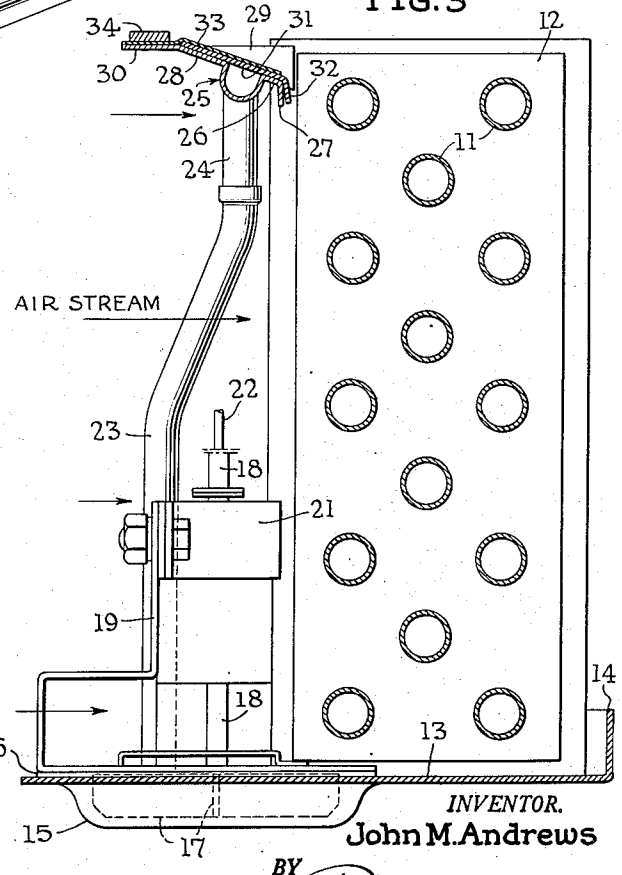
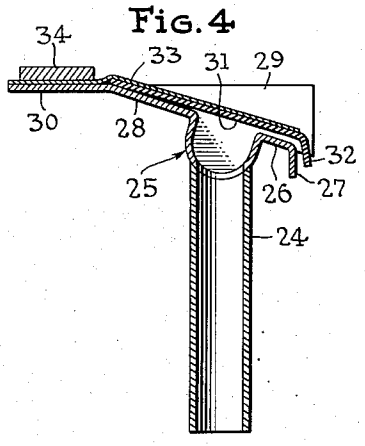


Fig. 4



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ATMOSPHERIC CONDENSER FOR REFRIGERATING SYSTEMS

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3 Claims. (Cl. 257—37)

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The invention relates to air-cooled heat exchangers, specifically condensers such as are used in refrigerating systems. The novelty resides in the means used to deliver water to the fins of small finned air-cooled condensers over which air is rapidly circulated by a fan.

The water may be supplied from any source, but commonly is drip water condensed from the air on the refrigerative evaporator commonly present in air conditioners.

Inexpensive construction, silent operation and uniform distribution of water to all fins are the advantages offered by the invention. Observation of the device in operation shows that the fins are nearly uniformly wetted over the entire extent of the condenser, and yet water droplets are not blown out in the air discharge stream.

An embodiment which has been built and has demonstrated excellent operating characteristics will be described as an example, reference being made to the accompanying drawing, in which:

Figure 1 is a plan view of the distributing trough with the lid removed. A few condenser fins are shown to disclose the spacing.

Figure 2 is a perspective view of the trough with one end plate removed and the lid swung up to an extreme position which it never reaches in operation;

Figure 3 is a vertical section through the condenser and related parts on a plane parallel with the fins. The lid is shown closed.

Figure 4 is a fragmentary section similar to a portion of Figure 3 but on a larger scale, showing the lid open to about the maximum extent occurring in service.

All statements of direction will be made with reference to Figure 3.

The condenser comprises substantially horizontal parallel tubes 11 which pass through parallel, vertical plate fins 12. Tubes and fins for usual refrigerants are of copper. The fins are closely spaced, as indicated in Figure 1, and as indicated by legend on Figure 3, air is blown by a fan or other means continuously in a generally horizontal direction from left to right, and through the intervals between fins.

The construction of the condenser is conventional and hence its inlet and discharge connections, and the connections between the tube passes are not shown.

The condenser is mounted above a drip pan including a bottom 13 and marginal rim 14. A depression 15, snail-shell in form, is pressed in the bottom 13 and with the cover plate 16 serves as the housing for a centrifugal pump whose

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runner comprises radial vanes 17 carried by a vertical shaft 18. The vanes may be of metal and rigid, or of somewhat flexible rubber-like material, both types being known.

Plate 16 has inlet ports through which water from the pan flows into the pump, and carries a bracket 19 supporting the shell 21 which supports bearings for shaft 18 and may house accessory apparatus, not here material. The shaft 18 is continuously driven through flexible shaft 22 by any suitable means such as a small electric motor (not shown). An upright pipe 23 fixed in an opening in plate 16 serves as the discharge connection for the pump. Pipe 23 is offset and connected to nipple 24 through which water from the pump enters a trough generally indicated by the numeral 25.

The form and arrangement of trough 25 are the most significant features of the invention. The trough is approximately semi-circular in cross-section and extends horizontally the full width of the air entrance face of the condenser. It is located close to fins 12 and only slightly below the upper ends of said fins. On that side of the trough which is toward the fins, the trough has a downwardly inclined margin 26, conveniently plane, with a depending lip 27. Along the other side of the trough is an upwardly inclined margin 28 which conveniently is coplanar with margin 26, but not necessarily so. The ends of the trough are closed by plates 29.

Along the edge of margin 28 is a continuous seat 30. The reason for making margins 26 and 28 coplanar is to permit the lid 31 to be constructed as a flat strip with a down-turned rim 32 which coacts with lip 27 to form a downwardly directed nozzle adjustable in width and extending the full length of trough 25 and hence the full width of the condenser.

The lid 31 is hinged by means of a strip of sheet material 33, which may be any durable rubber substitute or flexible synthetic plastic. This strip is cemented or vulcanized to the top face of lid 31 and is clamped between seat 30 and an overlying binder strip 34.

If the rate at which water is supplied to the drip pan varies, and it usually does vary, particularly when it is drip water from the evaporator, the rate of pump delivery will vary similarly and so will the pressure head acting upward on lid 31. This pressure head is low, and in any event is limited by escape of water between rim 32 and the lip 27 (see Figure 4). Hence lid 31 moves to accommodate itself automatically to the water discharge rate and as-

sures delivery of the discharged water to the fins.

The discharged water is carried by the air stream into the inter-fin spaces. A most remarkably even distribution of water results, with consequent low condenser head pressure. The extensive and active water-evaporation on the fins and tubes reduces condenser temperature and pressure increasing the efficiency of the condenser and of the entire refrigerative circuit.

Because the water distribution is so even, high evaporative rates are possible without risk of discharging water droplets at the air exit face of the condenser. Discharge of liquid water entrained in the cooling air stream is wasteful and the wasted water may create a nuisance. This device allows water to escape with the cooling air only in the vapor phase and does so without eliminators, screens or other recovery expedients.

The downwardly inclined margin **26** and depending lip **27** are important in conjunction with the lid **31** and its rim **32**. The forms of these nozzle-forming parts must be suitably coordinated but they can depart from the illustrated embodiment and still perform the function of affording a long pressure-adjusted slot nozzle. The illustrated forms were chosen because they simplify manufacture and are economical of material.

What is claimed is:

1. The combination of a condenser having a plurality of vertical, closely spaced plate-like fins; means for causing a horizontal stream of air to flow through the inter-fin intervals; a trough closed at its ends and having lateral margins at least one of which is inclined downwardly, the trough extending along the upper edge of the entrance face of the condenser with said downwardly inclined margin close to the edges of the fins; a lid adapted to seat against said margins and close the top of said trough, said lid being hinged remotely from the downwardly inclined margin and shaped to conform to the latter; means biasing said lid in the closing direction; and means for continuously delivering water under low pressure to said trough.

2. The combination defined in claim 1 in which the lid and the downwardly inclined margin have flanges which coact to form a downwardly directed nozzle-slot whose width increases as the lid rises.

3. The combination defined in claim 1 in which the trough margins are in the form of flat coplanar flanges, the downwardly inclined one of which has a pendant lip, the lid is coextensive with the trough and flanges whereby its area exposed to the pressure of the delivered water is materially augmented and the lid is biased closed by its own weight.

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