Nov. 15, 1955 E. B. DERR 2,723,540

AIR CONDITIONER CONDENSER INCORPORATING CONDENSATE DISPOSAL MEANS THEREON

Filed April 2, 1953

Fig. 1.

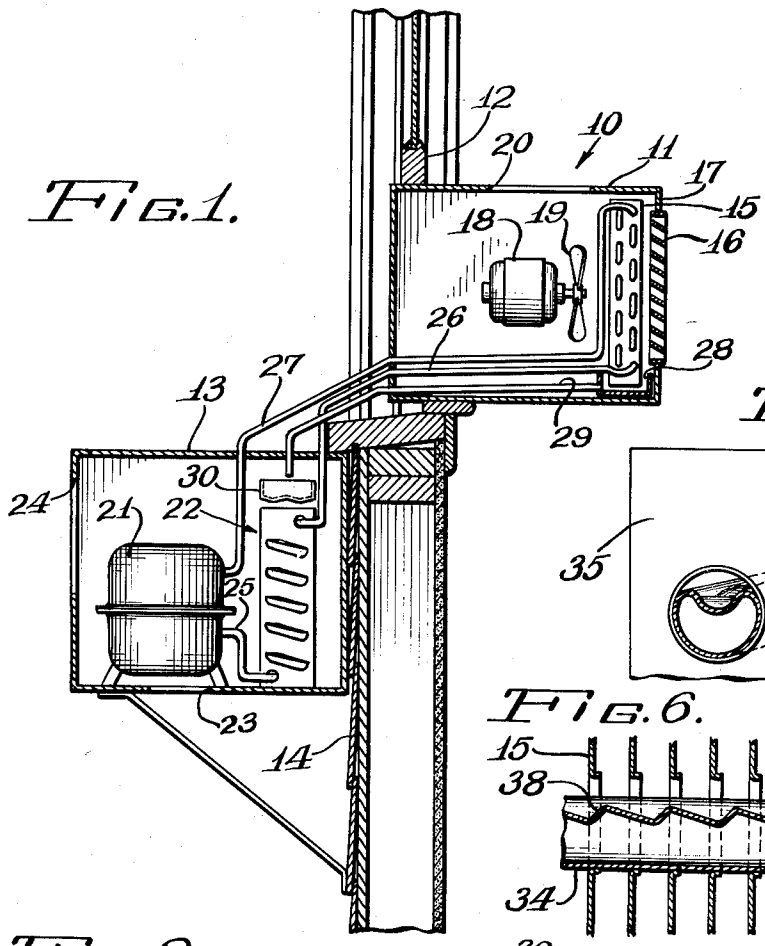


Fig. 5.

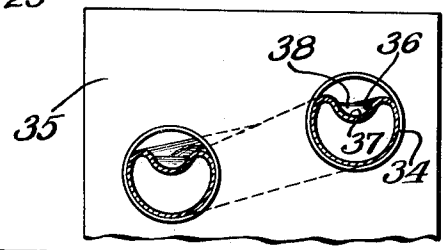


Fig. 6.

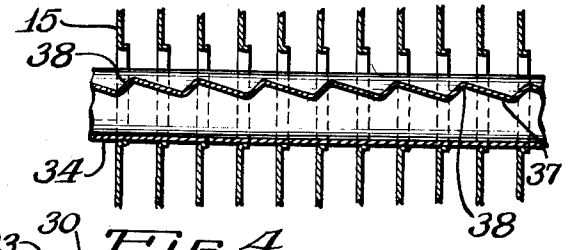


Fig. 2.

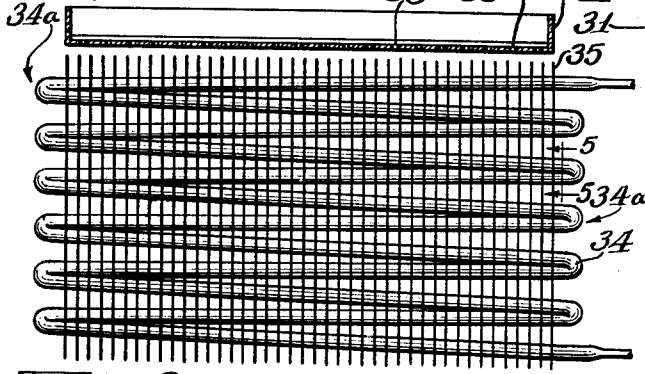


Fig. 4.

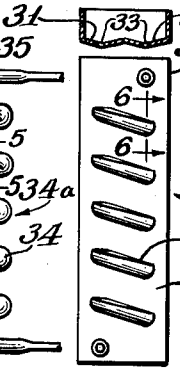


Fig. 7.

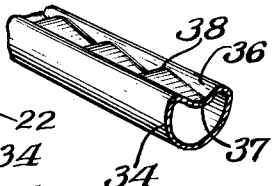
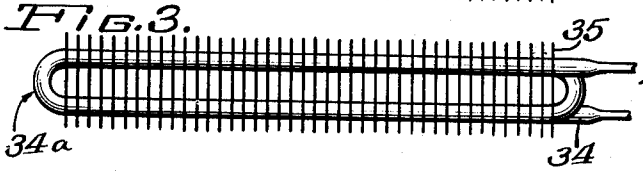


Fig. 3.



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AIR CONDITIONER CONDENSER INCORPORATING CONDENSATE DISPOSAL MEANS THEREON

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10 Claims. (Cl. 62—140)

This invention relates to refrigerating apparatus, but more particularly it is concerned with the disposal or disposition of the condensate that collects in an air conditioning unit during the operation thereof.

One of the most common, and perhaps perplexing, problems encountered in the operation of air conditioning apparatus revolves around the provision of suitable means for disposing of the moisture that condenses out of the atmosphere being cooled. This problem is particularly annoying in the window-mounted, portable-type air conditioning unit because it is a self contained unit and is not generally provided with drainage connections that might readily facilitate drainage of the condensate to a sewer or the like for disposition. Heretofore, of course, many attempts have been made to satisfactorily solve this problem and, as a result, many devices and means have already been proposed for simplifying eventual disposition of such condensate. Up to the present, however, such means as have heretofore been proposed have not been entirely successful and consequently there has been no general acceptance by the public or the trade of the devices presently available for such purposes. It is a primary object of this invention, therefore, to provide simplified means for disposing of the moisture condensed out of the atmosphere being cooled during the operation of an air conditioning unit.

Another object is to provide a simple yet efficient means, incorporated within the condensing unit of an air conditioning apparatus, for disposing of condensate as it accumulates therein during the operation of said apparatus.

A further object is to provide a refrigerant condenser, adapted for use with an air conditioning unit, which has simplified means formed therewithin for effectively disposing of moisture condensed out of the atmosphere being cooled by said air conditioning apparatus.

A still further object is to provide a refrigerant condenser fashioned with a refrigerant-carrying hollow tube or conduit having a longitudinally extending channel-like groove or depression on the exterior surface thereof.

A yet still further object is to provide a finned-type tubular refrigerant condenser having an exterior groove in the tube thereof that extends longitudinally substantially the entire length of said tubing, and which defines a passage through which liquid may flow by gravity from one end of the tube to the other.

A principal object of the invention is to provide a refrigerant condenser having means for containing a liquid in intimate heat exchange relation with the exterior thereof during the evaporation of said liquid by heat from said condenser.

Another principal object is to provide a tubular-type refrigerant condenser wherein the upper surface of the tube is depressed radially inwardly to provide a continuous longitudinal canal exteriorly thereof for conveying liquid from one end of the tube to the other, and which canal includes a plurality of longitudinally spaced and transversely extending dam-like wall members.

An important object is to provide improved means for bringing moisture, condensed out of atmosphere being cooled by air conditioning apparatus, into intimate thermal contact with the condenser of the air conditioning unit when circulation of air across the condenser of said unit depends upon natural draft.

A further principal object is to provide a tubular-type finned refrigerant condenser having a plurality of contiguous reservoirs disposed longitudinally along the exterior of the condenser tube and connected together by a canal the walls of which are fashioned in the exterior surface of the condenser tube.

Another object is to provide improved air conditioning apparatus having means therein for retaining moisture, condensed out of the atmosphere being cooled, in intimate thermal contact with the condenser thereof until the evaporation of said moisture has been effected.

The foregoing and other objects and features of the invention will become apparent as the disclosure is more fully made in the following detailed description of a preferred embodiment of the invention, as illustrated in the accompanying drawings in which:

Fig. 1 is a sectional view through a window-mounted air conditioning unit fashioned in accordance with the present invention.

Fig. 2 is a front elevational view of a finned-type tubular condenser constructed according to the present invention, and having the moisture distributor pan positioned thereabove shown in section.

Fig. 3 is a top plan view of the proposed condenser.

Fig. 4 is a side elevational view of said condenser with the moisture distributor pan shown in section thereabove.

Fig. 5 is an enlarged sectional view taken on line 5—5 of Fig. 2 and shows the peripheral contour of the condenser tube.

Fig. 6 is a sectional view taken on line 6—6 of Fig. 4, and shows in enlarged dimensions a longitudinal section of a portion of the condenser tube of the present invention, together with its radiating fins.

Fig. 7 is a prespective view of a portion of the condenser tube of the present invention.

Referring now to the drawing it will be noted that in a preferred embodiment a portable-type air conditioning unit has been depicted as mounted in a partially opened window with a portion of the unit disposed within an enclosure to be cooled and another portion thereof positioned beyond the enclosure in the outside atmosphere. The air conditioning unit, indicated generally by the reference numeral **10**, includes a conventional inner cabinet **11** that is mounted by suitable conventional means (not shown) in a partially opened window **12**, and an outer cabinet **13** mounted by suitable conventional means (not shown) on an exterior wall **14** of the enclosure being cooled. The inner cabinet **11** encloses a generally conventional refrigerant evaporator **15** positioned proximate a grilled opening **16** in the inner wall **17** of said cabinet, and an electric motor **18** that drives a fan **19** for drawing air through an opening **20** in the top of said cabinet and passing it over said evaporator before discharging it, by way of the grilled opening **16**, back into the enclosure being cooled. The outer cabinet **13** may include a motor-compressor assembly **21**, and a refrigerant condenser **22** positioned therewithin. Said condenser may be cooled by air passing in natural draft fashion through an opening **23** in the bottom of the cabinet **13**, over the condenser **22**, and back into the atmosphere by way of an opening **24** in the outer wall of said cabinet. If desired, of course, a motor-driven fan (not shown) may be provided for blowing air over the condenser in accordance with well understood practices. Refrigerant-carrying conduit **25** connects the motor-compressor **21** to the condenser **22** and conduit **26** connects the opposite end of the condenser to the evaporator **15**, while conduit **27** returns refrigerant from the evaporator to the motor-compressor all in a conventional manner.

Positioned beneath the evaporator **15**, in the inner cabinet **11**, is a moisture collector or drip pan **28** which extends the full length of the evaporator and is dimen-

sioned so that the vertical walls therof extend beyond the vertical surfaces of the evaporator. Connected to this pan is a conduit **29** which serves to drain moisture collected in pan **28** into a second pan-like shallow container **30** disposed above condenser **22** in the outer cabinet **13**. The container **30**, preferably, is fashioned with a floor or bottom that contains two longitudinally extending valleys or depressed portions **31** and **32**, respectively, each of which is provided at the low point thereof with a plurality of spaced openings **33**. Said container is positioned, preferably, so that one of said depressed portions is disposed directly above each vertical row of condenser tubes with the openings **33** therein substantially in vertical alignment with the center line of one row of the tubes.

Now in accordance with the more specific teachings of the present invention, the refrigerant-carrying conduit, of the condenser **32**, may be fashioned as a hollow or tubular member **34** bent back upon itself to provide a serpentine coil, indicated generally by the numeral **34***a*, which is generally rectangular in shape and with successive turns thereof vertically spaced and extending through a plurality of vertically positioned and horizontally spaced radiating fins **35** to which they may be affixed in any suitable conventional fashion. The tubular conduit member **34**, which initially may be generally circular in cross section, is provided with a longitudinally extending outwardly opening canal-like recess **36** in the exterior surface thereof which may be rolled, molded, pressed, debossed or otherwise suitably formed therein. As thus fashioned, there is provided a continuous canal-like passage or trough which, preferably extends from one end of said condenser tube to the other. The floor or bottom **37** of said recess may, additionally, be provided with a succession of longitudinally spaced bumped-up or raised portions which form transversely extending ridges or hump members **38**. The height of each bumped-up portion is, preferably, somewhat less than the height of the adjoining, side walls of the trough for reasons which will presently be apparent. Such ridges may function as small dikes to form a series of connected pools or reservoirs along said trough whereby any liquid passing through the trough will be delayed until such successive reservoir is filled to overflowing capacity before passing onward. Since the condenser will be vertically positioned, it will be appreciated that when the conduit or tube **34** is fashioned to form a rectangularly shaped coil the depressed or outwardly opening recessed portion or trough **36** must face upwardly at all points throughout the full length of said conduit in order to properly confine liquid as it flows along the trough from one end of the tubular conduit to the other. Since the successive turns of the condenser coil are vertically spaced, the trough provides a sloping passageway of gradually decreasing elevation, and, since the path through the trough is continuous, it will be obvious that liquid introduced into the upper turns of the trough will tend to flow by gravity to the lower or bottom turns thereof. The flow of such liquid will, of course, be somewhat impeded by the series of transverse dam-like members **38** but, because the height of the bumped-up ridges **38** is less than that of the side walls of the trough and the volumetric capacity of each pool or reservoir is limited, the restriction is not so great as to cause overflowing of the edges of the trough but instead the liquid will flow to the next successive reservoir before overflowing the side walls of any preceding reservoir.

In operation moisture condensed out of the air passing over the evaporator **15** is collected and accumulated in the drip pan **28** positioned therebeneath and thence conducted by way of conduit **29** to the shallow container or distributor **30**. Since the bottom of container **30** is perforated, and the openings therein are in alignment with the trough **36** in the upper surface of the topmost turn of the condenser coil, any moisture collecting in said container will eventually be discharged into said trough where it will immediately be brought into intimate thermal contact with the heat of the condenser. Because of the gradual slope of said trough the condensate will flow by gravity toward the opposite or lower end of the conduit in the condenser coil but its flow will be retarded by the succession of reservoirs, and hence the fluid will be confined in intimate thermal contact for a greater length of time and evaporation will continue so that sufficient quantities of said liquid will be evaporated before the lower turns are reached. In this manner the condensate is effectively disposed of without any overflowing thereof into the cabinet.

It should now be apparent that a novel air conditioner condensate disposal means has been shown and described, and it is to be understood that changes may be made in the construction without departing from the spirit of the invention or the scope thereof as defined in the appended claims.

What is claimed is:

1. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively connected to said evaporator and having the condenser thereof disposed exteriorly of said enclosure, said condenser including a serpentine-shaped refrigerant-carrying coil having a longitudinally extending outwardly opening recess on the exterior surface of the coil, and means for conveying moisture from beneath said evaporator to the exterior recess in the condenser coil whereby the moisture collected may repose in the recess while being evaporated by the heat of the condenser.

2. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively connected to said evaporator and having the condenser thereof disposed exteriorly of said enclosure, said condenser being fashioned with a refrigerant-carrying conduit having a continuous longitudinally-extending trough formed in the exterior surface of the conduit and further having the conduit disposed with one end elevated above the opposite end thereof, and means for conveying moisture from beneath said evaporator to the upper portion of said trough whereby the moisture collected is evaporated by the heat of the condenser as the moisture flows by gravity from an upper end of the trough longitudinally along the conduit to the lower end thereof.

3. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively connected to said evaporator and having the condenser thereof disposed exteriorly of said enclosure, said condenser including a refrigerant-carrying conduit fashioned as a coil having a plurality of vertically spaced turns therein and having a plurality of closely spaced fins through which the turns thereof extend, said condenser conduit being further fashioned with an outwardly opening trough in the exterior surface of the conduit that extends longitudinally substantially from one end of the conduit to the other so that liquid introduced at the upper end of the trough may flow by gravity longitudinally along the conduit to the lower end thereof, and means for conveying the moisture collected from beneath the evaporator to the upper portion of said trough whereby said moisture is brought into heat exchange relationship with the condenser and retained in such relationship as it flows along the trough and evaporation thereof is effected.

4. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively

connected to said evaporator and having the condenser thereof disposed exteriorly of said enclosure, said condenser including a refrigerant-carrying conduit fashioned as a coil having a plurality of vertically spaced turns therein and having a plurality of closely spaced fins through which the turns thereof extend, said condenser conduit being further fashioned with an outwardly opening trough in the exterior surface thereof that extends longitudinally substantially from one end of the coil to the other so that liquid introduced at the upper end of the trough may flow by gravity to the lower end thereof, means for conveying moisture from beneath the evaporator to the condenser, said means including a shallow container having a perforate bottom with the perforations therein disposed in vertical alignment with the center line of the trough in the condenser conduit and said container being positioned above the topmost turn of the condenser coil whereby the moisture from beneath the evaporator is discharged into a heat exchange relationship with the condenser conduit and is retained in such relationship as it flows by gravity along the trough and until evaporation thereof is effected.

5. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively connected to said evaporator and having a condenser cooled by natural draft circulation of air passing over the surface thereof and disposed exteriorly of said enclosure, means for conveying condensed moisture from beneath the evaporator into contact with the condenser, said condenser including a refrigerant-carrying conduit fashioned as a coil having a plurality of vertically spaced and successively arranged turns therein and having a plurality of closely spaced vertically positioned radiating fins through which the turns of the coil extend, said conduit being provided in the exterior surface thereof with an outwardly opening trough which extends longitudinally substantially from one end of the conduit to the other, said conduit having further fashioned in the exterior surface thereof a plurality of integrally formed longitudinally spaced and transversely extending raised portions, and having said raised portions cooperating with said trough to provide a series of contiguous reservoirs extending longitudinally along the length of the conduit wherein moisture condensed from air after being introduced into the reservoirs in an upper portion of the condenser conduit flows by gravity from one reservoir to another so that the evaporation thereof may be effected by the heat of the condenser.

6. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air passing over the evaporator, a condensing unit operatively connected to said evaporator and having a condenser cooled by natural draft circulation of air passing over the surface thereof disposed exteriorly of said enclosure, means for conveying condensed moisture from beneath the evaporator into contact with the condenser, said condenser including a refrigerant-carrying conduit fashioned as a rectangularly-shaped coil having a plurality of vertically spaced and successively arranged turns and having a plurality of closely spaced vertically positioned radiating fins through which the turns of the coil extend, means formed in the exterior surface of the condenser conduit providing a liquid-carrying passage externally disposed and extending longitudinally substantially from one end of the conduit to the other whereby moisture condensed from air passing over the evaporator is brought into heat exchange relation with the condenser and retained in such relationship as it flows by gravity from one end of the conduit to the other and until evaporation of the moisture is effected.

7. In a portable air conditioner having an evaporator located within an enclosure, means disposed beneath said evaporator for collecting moisture condensed from air

passing over the evaporator, a condensing unit operatively connected to said evaporator and having the condenser thereof disposed exteriorly of said enclosure, means for conveying the condensed moisture from beneath the evaporator into contact with the condenser, said condenser including a refrigerant-carrying conduit fashioned as a coil having a plurality of vertically spaced and successively arranged turns therein and having a plurality of closely spaced vertically positioned radiating fins through which the turns of the coil extend, said conduit being further fashioned with a plurality of contiguous reservoirs disposed longitudinally along the exterior surface of said conduit and connected together by a canal the walls of which are formed from the exterior surface of said conduit, whereby moisture condensed out of atmosphere being cooled is retained in intimate heat exchange relationship with the condenser conduit as the moisture flows along the canal therein and until evaporation of the moisture is effected.

8. In air conditioning apparatus, a refrigerant condenser, comprising: a refrigerant-carrying conduit fashioned as a coil with a plurality of vertically spaced and successively arranged turns therein; a plurality of vertically positioned and horizontally spaced radiating fins through which the turns of said conduit extend; said conduit being provided with a longitudinally extending and outwardly opening recess in the upper exterior surface of the conduit, and which extends substantially the entire length of the conduit, whereby liquid introduced into the recess at an upper end may flow by gravity to a lower end thereof; and means for introducing liquid into an upper end portion of said recess.

9. In air conditioning apparatus, a refrigerant condenser, comprising: a refrigerant-carrying conduit fashioned as a coil with a plurality of vertically spaced and successively arranged turns therein; a plurality of vertically positioned and horizontally spaced radiating fins through which the turns of said conduit extend; said conduit being provided with a longitudinally extending and outwardly opening trough in the upper exterior surface of the conduit; said trough having a plurality of longitudinally spaced and transversely extending ridges which are integrally fashioned with and project upwardly from the lowest portion of said trough, whereby a series of successively arranged reservoirs is provided throughout the length of said trough; and means for introducing liquid into an upper end portion of said trough.

10. In air conditioning apparatus, a refrigerant condenser, comprising: a refrigerant-carrying conduit fashioned into a substantially rectangularly-shaped coil having a plurality of successively arranged turns therein; said coil being disposed so that the successive turns thereof are vertically spaced from one another; a plurality of vertically positioned and horizontally spaced radiating fins through which the turns of said coil extend; said conduit being further fashioned with an outwardly opening and longitudinally extending trough-like recess in the upper exterior surface of the conduit; said trough-like recess having inclined and spaced apart side walls connected at the lowest portion thereof by a floor member; said floor being provided with an undulated surface that is continuous from one end of the recess to the other; said undulated floor being dimensioned so that the high points thereof are less than the elevation of the proximate side walls of said recess, whereby liquid flowing in said recess may flow to the next successive undulated portion before overflowing the side walls of the recess; and means for introducing liquid into the recess at a point proximate the upper end of the coil.

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