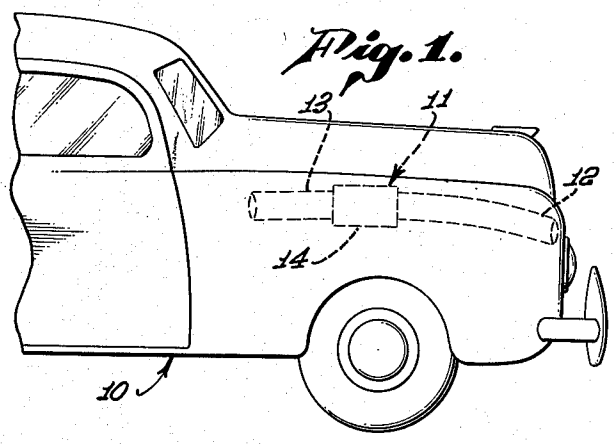
April 7, 1953 F. E. SNOW 2,634,112

EVAPORATIVE COOLER WITH AUTOMATIC FEED

Filed Aug. 13, 1949

Fig. 1.



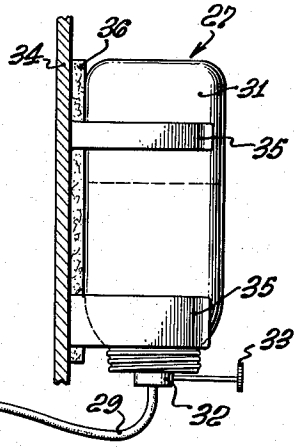


Fig. 2.

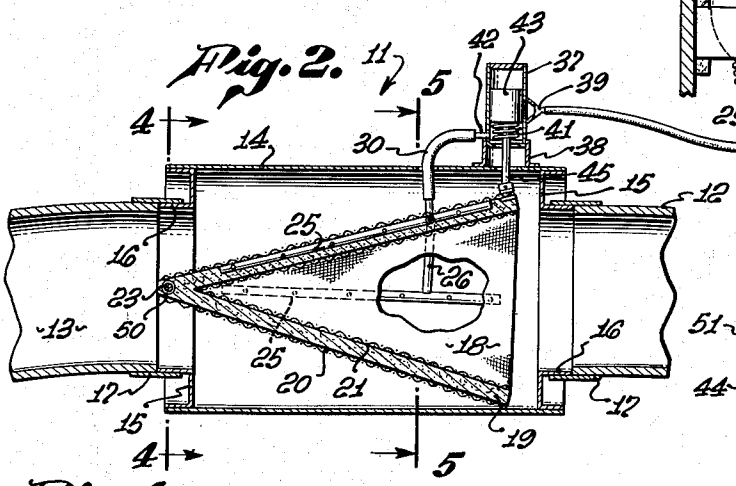


Fig. 3.

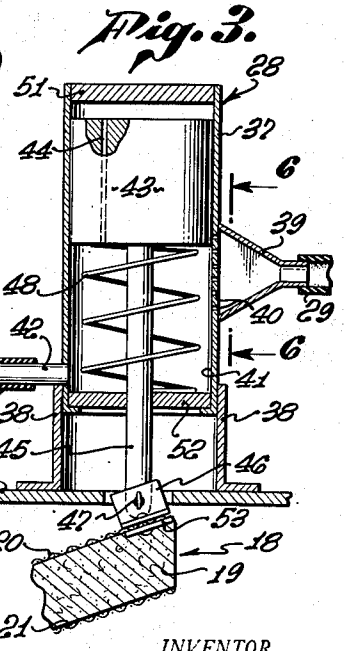


Fig. 4.

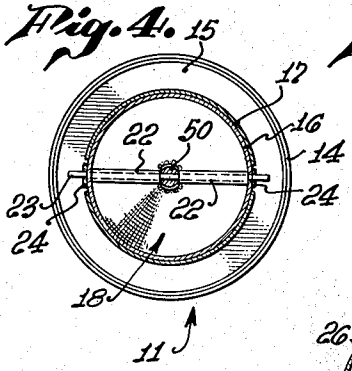


Fig. 6.

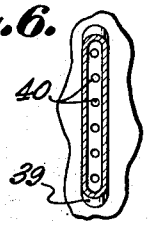
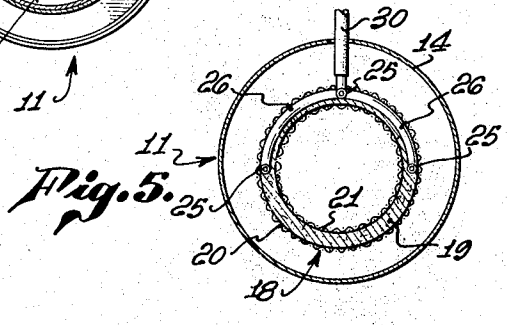


Fig. 5.



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EVAPORATIVE COOLER WITH AUTOMATIC FEED

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2 Claims. (Cl. 261—66)

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This invention relates to air coolers, and particularly to those utilizing the refrigeration effect produced by the evaporation of water produced by the passage of air through moistened absorbent material. This invention is particularly adapted for use in connection with motor vehicles.

In coolers of this character the absorbent material is ordinarily held between wire mesh or the like. Through this absorbent material air is passed, and when the absorbent material is sufficiently dampened, the passage of air evaporates the water, and as is well known, the air is thereby cooled.

Heretofore devices of this character required frequent attention, there being an inconvenience in intermittently saturating the absorbent material. This necessarily required that the evaporator be located where it could easily receive such attention. Furthermore, the operation of such devices was characterized by continuously varying degrees of saturation with corresponding degrees of refrigeration produced.

It is accordingly one object of this invention to provide an evaporative cooler obviating frequent attention. For this purpose, a novel feed device is used whereby liquid is administered to the absorbent material automatically.

It is accordingly another object of this invention to provide a structure whereby the amount of water in the absorbent material is substantially constant in time so that the condition of operation is substantially invariant, remaining at its optimum level, and thereby providing an efficient cooler which continuously provides the maximum refrigeration effect.

The above objects are accomplished by providing a novel valve structure and operating mechanism therefor which opens the valve in response to a reduction below a limit of the actual fluid content of the system.

It is another object of this invention to provide a valve and operating mechanism which permits the passage of water to the evaporator at a rate proportional to the reduction below a limit of the actual fluid content of the system. In this manner it is further provided that only the correct amount of water is admitted to the system, insuring against overcompensation of the conditions therein.

It is still another object of this invention to provide an evaporative cooler particularly adapted for use in passenger automobiles, and which is automatically supplied with the correct amount of water such that it may be conveniently located.

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It is a further object of this invention to provide a cooler which may utilize existing ventilator ducts in an automobile.

It is a still further object of this invention to provide an automatically operated cooler that is simple in structure and efficient in operation.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a fragmentary side view showing particularly the adaptation of this device for use in connection with a passenger automobile;

Fig. 2 is an enlarged view mostly in section, showing the structure of a device incorporating this invention;

Fig. 3 is a sectional view showing on a further enlarged scale the valve structure of Fig. 2;

Fig. 4 is a sectional view taken along the plane 4—4 of Fig. 2;

Fig. 5 is a sectional view taken along the plane 5—5 of Fig. 2; and

Fig. 6 is a sectional view taken along the plane 6—6 of Fig. 3.

In Figure 1, the device incorporating this invention is illustrated as mounted for operation in connection with a passenger automobile 10. The air cooler 11 is interposed between an inlet ventilator duct 12 appropriately communicating with a source of air adjacent the radiator portion of the automobile 10, and an outlet ventilator duct 13 communicating with the interior portion of the automobile 10. These ducts 12 and 13 may previously have existed in the automobile 10 as one continuous duct, it being common in modern automobiles to provide them.

The particular manner in which the ventilator ducts may be secured to the air cooler 11 is shown in more detail in Fig. 2.

A cylindrical housing 14 of the cooler 11 is provided with inwardly projecting flanged collars 15 at the extremities of the housing 14. These collars 15 may be appropriately secured to the housing 14 as by welding. These collars 15 are in the form of annular channels, each of the flanged collars 15 having an annular neck

portion 16 which has an outside diametral dimension corresponding to that of the ventilator ducts 12 and 13. A clamp ring 17 secures the ventilator duct 12 or 13 to the housing 14 by overlying both the neck portion 16 and the duct 12 or 13.

As shown in Fig. 2, an evaporator unit 18 is of hollow conical form and comprises absorbent material 19 secured between an outer and an inner screen cone 20 and 21 respectively. The absorbent material may be excelsior, hemp fibres, or the like, capable of holding sufficient quantities of water.

The evaporator unit 18 is mounted within the housing 14 in such a manner that the inner cone portion 21 of the evaporator communicates with the inlet duct 12 at the base thereof. The apex portion of the conical evaporator 18 is correspondingly located adjacent the outlet duct 13.

As shown most clearly in Fig. 4, the evaporator is pivotally mounted within the housing 14 at the apex portion thereof. For this purpose, a bearing standard 50 is joined to the apex of the cone 20, through which passes a pivot pin 23. A pair of symmetrically disposed spacer sleeves 22 are disposed over pin 23, for centrally locating the evaporator 18 within the housing 14. Each of these sleeves 22 abuts the bearing standard 50 at one end and at the other end abuts the neck portion 16. Rod 23 defines an axis of angular adjustment of the evaporator unit 18. C-shaped washers 24 clamp on the rod 23 to restrict axial movement of the rod.

The housing 14 is adapted to be mounted in such a manner that the pivotal mounting for the evaporator unit 18 extends in a horizontal direction. As shown most clearly in Fig. 2, the diameter of the base of the outer cone 20 is substantially less than that of the interior of the housing 14. Thus the evaporator unit 18 is capable of angular adjustment within the housing 14 in a manner to be hereinafter described.

As shown most clearly in Figs. 2 and 5, a plurality of spaced perforated tubes 25 are provided between the inner and outer cones 21 and 20 of the evaporator 18 surrounded by the absorbent material 19 for uniformly saturating the absorbent material 19 with water. In this instance, three such tubes are shown, one adjacent the upper portion of the evaporator unit 18, and one on each side thereof. The water fills the absorbent material 19 by virtue of the forces of gravity and capillarity.

These tubes 25 are interconnected by connecting tubes 26. Water is adapted to be supplied from a reservoir 27, through a spring loaded valve structure 28, and cooperating tubes 29 and 30 which may be of flexible material such as rubber. The tube 30 is connected to the upper perforated tube 25 adjacent the connecting tubes 26. The reservoir 27 is mounted above the housing 14 so that upon the opening of valve 28, water flows to the evaporator 18 by gravity.

As the automobile 10 moves to the right in Fig. 1, or as air is forced in any other appropriate manner through the housing 14, the air will be cooled by the refrigeration effect produced by the passage of air through the water-laden material 19. The base portion of the evaporator communicating with the inlet duct 12, the major portion of the incoming air will pass through the screens 20 and 21 of the evaporator 18, and traverse the moistened absorbent material 19.

The water reservoir 27 may comprise a container 31 of suitable capacity which may be intermittently filled. A valve structure 32 may be manually controlled, as by the aid of a thumb screw 33 to initiate the operation of the system.

The container 31 may be detachably secured to the frame 34 of the automobile 10 as by the aid of spring clips 35. In order to insure against damaging the container 31, a felt pad 36 may be inserted between the container 31 and the metal frame 34.

The spring loaded valve 28, as shown most clearly in Fig. 3, is adapted to control the flow of water to the evaporator unit according to the moisture conditions of the unit 18.

This valve 28 comprises a cylindrical valve body 37 appropriately secured on the top of the housing 14, as by the aid of angle brackets 38, welded or brazed thereto.

A flattened, flared tube 39 communicates with the rubber hose 29 leading to the water reservoir 27, and at its flared portion (Fig. 6) communicates with a plurality of spaced inlet ports 40. This flared tube 39 may be welded to the valve body 37. These inlet ports 40 communicate with the interior chamber 41 of the valve body 37.

An outlet conduit 42 out of alignment with the inlet ports 40 communicates with the bottom portion of the chamber 41. To this outlet conduit may be connected the rubber hose 30 leading to the evaporator unit 18. Excepting the inlet and outlet ports, the chamber 41 is, of course, fluid tight. Thus, its upper and lower ends may be formed of brass discs 51 and 52 having a force fit in the casing 37.

A piston type closure member 43 is adapted to be moved within the chamber 41 and open one or more of the inlet ports 40. This closure member 43 fits closely against the inner walls of the valve body 37 in order that a good seal may be achieved in closing the ports 40. In Fig. 2, this closure member 43 is illustrated in closed position, and in Fig. 3 it is shown in a position in which all but one of the ports 40 are open. The rate of flow of water is controlled according to the position of the closure member 43.

In order to permit movement of the closure member 43 within the valve body, but yet to provide stability, a through aperture 44 of small diameter is provided therein. A dashpot effect is thereby obtained, stabilizing the movement of the closure member 43 and the evaporator unit 18 to which the closure member 43 is attached.

The closure member 43 is connected to the angularly adjustable evaporator unit 18, and is moved according to the angular position thereof in a manner to be hereinafter described.

A valve stem 45 is secured to the closure member 43 and extends through the valve body 37 at the lower portion thereof. The lower end of the valve stem 45 extends through the housing 14 and is secured to the outer cone 20 of the evaporator unit 18. For this purpose, a clevis 46 may be provided on the outer cone 20, and secured to the cone 20 as by the aid of rivets. A reinforcing plate 53 is placed within the outer screen 20 beneath clevis 46. A cotter pin 47 secures the valve stem 45 to the bracket 46.

A compression coil spring 48 surrounds the valve stem 45 and abuts the disk 52 and the closure member 43. This spring 48 thus urges the closure member 43 toward open position and also urges the evaporator 18 to move counterclockwise from the position of Fig. 2 about the axis defined by the rod 23 of the pivotal sup-

porting structure. This spring 48 therefore biases the system to valve opening position.

The unit 18 may be angularly adjustable between the limits defined by the housing 14. The distance at the base portion of the evaporator 18 through which it is adjustable corresponds to that of the distance travelled by the closure member 43 between fully opened and fully closed valve position.

In the position of the evaporator unit 18 as shown in Fig. 2, the absorbent material 19 is filled with water. In this condition, the combined weight of the unit 18 and the water therein causes the evaporator unit 18 to assume its clockwise-most position, overcoming the bias of the coil spring 48. In this position, therefore, the closure member 43 prevents the further flow of water through the valve structure by sealing the inlet ports 40 from the chamber 41.

As the water evaporates from the absorbent material 19, the combined weight of the evaporator unit 18 decreases, and thus the coil spring 48 will expand due to the decreased load. The expansion of spring 48 causes the closure member 43 to move upwardly, opening one or more of the ports 40 so that water may be supplied to the evaporator unit 18.

In this manner, the proper amount of water is supplied to the system according to the actual conditions of operation of the evaporator unit 18.

The valve closing position in which spring 48 is compressed, as in Fig. 2, corresponds to that position in which there is the proper amount of water in the absorbent material 19 in order that the maximum refrigerating effect is produced, and the evaporator 18 operates at its most efficient point. The spring constant of the spring 48 must of course be such with respects to the unit 18 as to permit this relationship to exist.

Upon the initiation of the operation of the system by opening the valve 32, the evaporator unit will be in its most counter-clockwise position, all of the ports 40 being open to permit the greatest rate of flow. As the water saturates the absorbent material 19, increasing the combined weight of the unit 18, the ports will be closed in succession, gradually reducing the rate of flow until a stable condition of operation is reached. As the rate of evaporation changes, the rate of supplying water must be accordingly changed. This is automatically accomplished by the novel cooperation of the valve 28 with the evaporator unit 18, together with the particular arrangement of the ports 40.

The inventor claims:

1. In an evaporative cooler mechanism: a housing having an air inlet and an air outlet aligned with the inlet; an evaporator unit having a liquid absorbert material; conduit means opening at said material for supplying liquid to said material; a pivotal mounting for said unit within said housing; resilient means biasing said unit toward one position; said unit being angularly movable within said housing according to the quantity of liquid therein; opposite ends of the unit being exposed respectively at the inlet and outlet, and a valve for controlling the flow of liquid to said material according to the position of said unit; said valve having an inlet comprising a plurality of spaced ports and a closure member cooperating therewith and adapted to open or close one or more of said ports, and connected to the unit.

2. In an evaporator unit: a liquid absorbent material; a frame for holding the material; said frame having openings therethrough; conduit means opening within the material for passing liquid to the material; a pivotal support for the frame adjacent one end thereof; a valve structure controlling the passage of liquid through said conduit means; said valve comprising wall means forming a piston chamber, said wall means having longitudinally spaced ports opening in said chamber, an outlet in communication with said conduit means, and a piston closure member closely accommodated in said chamber, and adapted to establish communication between said ports and said outlet in sequence, said piston having a restricted port between opposite sides thereof; a connection between said member and the frame adjacent the other end of the frame; and resilient means urging said member toward one position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
97,748	Springer	Dec. 7, 1869
470,424	Frazar et al.	Mar. 8, 1892
818,397	Tresenreuter	Apr. 17, 1906
1,378,055	Pusey	May 17, 1921
1,898,785	Murdoch et al.	Feb. 21, 1933
1,907,121	Robbins	May 2, 1933
2,237,497	Munford	Apr. 8, 1941
2,322,110	Bock	June 15, 1943