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F. R. PERRY

CONDENSER FOR AUTOMOBILE ENGINE RADIATORS

Filed Aug. 2, 1926

Fig 1.

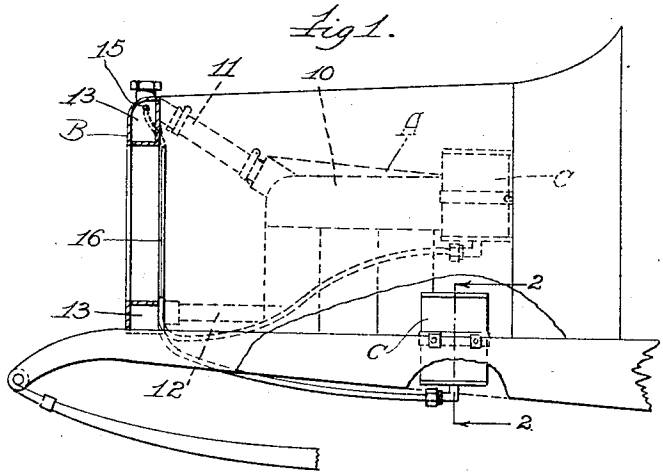


Fig 2.

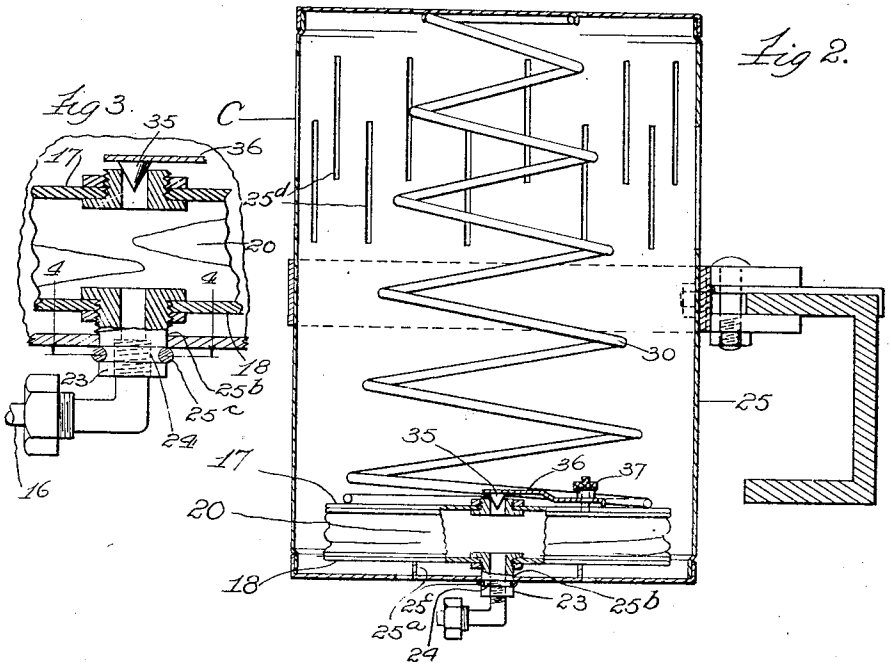
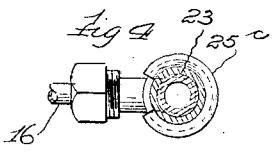


Fig 3.



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UNITED STATES PATENT OFFICE.

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CONDENSER FOR AUTOMOBILE ENGINE RADIATORS.

Application filed August 2, 1926. Serial No. 126,391.

The purpose of this invention is to provide improved means for condensing and returning in liquid form to the water circulation cavity of a radiator of an internal combustion engine the vapor which may be developed by overheating in the circulatory cooling system of which the radiator is a part. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:

Figure 1 is a diagrammatic view showing a construction embodying this invention mounted in operative relation and connection with the radiator of an automobile engine.

Figure 2 is a vertical section of the element of the construction or assemblage shown in Figure 1 which constitutes the characteristic of this invention, being an expansible and reducible receptacle or chamber in fluid communication at its lower part with the upper part of the radiator cavity.

Figure 3 is a detail section of parts shown in section in Figure 2 upon a larger scale than Figure 2.

Figure 4 is a section at the line 4—4 on Figure 3.

In the construction and assemblage shown in the drawings the automobile engine indicated at A has the customary circulatory cooling system comprising the engine jacket indicated at 10 connected with the cavity, 13, of the radiator, B, by inflow pipe, 11, and return flow pipe, 12. The radiator cavity is closed except as to the inflow and outflow connections mentioned, and an overflow port seen at 15. From the overflow port the usual overflow pipe, 16, leads down to a level which may be lower than the bottom of the radiator cavity; but instead of being open for discharge at this low level as in the customary construction of a radiator overflow, it is extended rearward alongside of, or below the engine to any convenient point for locating and supporting on the chassis, or on the body of the automobile, the condenser indicated in totality by C.

This condenser comprises as its principal element an expansible and reducible chamber which as shown, and preferably, is an inflatable and collapsible bag, 20; that is, it is made as to its sides of flexible material adapted, when not inflated or filled in some manner by fluid, to collapse in folds so as to have very small capacity or bulk; but upon discharge into it of fluid under sufficient pressure to overcome the weight of the material of which it is made, which weight causes it normally to lie in collapsed position as shown in full line in Figure 2, it may be expanded, straightening out the folds into smooth cylindrical form, and constituting a chamber of very substantial capacity. The collapsible wall is furnished with rigid top plate, 17, and bottom plate, 18, made of sheet metal to which the cylindrical wall of flexible fabric, impervious to air and moisture, is secured fluid-tight.

In view of the requirement of imperviousness to air and moisture the cylindrical wall is preferably made of rubber-treated fabric, and it may be made of rubber reinforced by textile fiber covering.

This expansible and collapsible chamber is desirably enclosed for protection from exterior injury and for affording enclosure and restraint for the collapsing spring, hereinafter mentioned, in a sheet metal casing, 25, which serves also for mounting the entire unit in any convenient fixed position on the vehicle, as for example, at a low position on the chassis frame, as shown in dotted line on Figure 1, or at a higher position on the dash under the hood, as indicated in full line in said figure, the flexibility of the connecting overflow pipe, 16, indicated by difference in its form in the two positions, permitting shifting the unit from one position to the other.

The radiator overflow pipe, 16, extended as stated for the purpose of locating the radiator in either of the positions indicated rearwardly from the radiator, is connected with the expansible and collapsible chamber, 20, through the bottom plate, 18, thereof, which has at the center a suitable nipple, 23, for said pipe connection. This nipple may serve also for positioning the chamber, 20, centrally in the casing, 25, from whose bottom, lugs 25^a are shown struck up inwardly to afford rests for the bottom plate, 18, of the chamber, 20. The nipple, 23, protrudes from within the casing downwardly through an aperture, 25^b, in the bottom plate of the casing, and is interiorly threaded for the pipe connection, and has exteriorly an encompassing groove, 24, for receiving a snap ring, 25^c, to lock the nipple in the aperture in the bottom plate, 18, of the expansible and collapsi-

ble chamber fast to the bottom plate of the casing, 25.

Upon the top plate, 17, of the collapsible and expansible chamber, 20, there is lodged a helically and spirally shaped spring, 30, whose coils from the bottom up are reduced in diameter at such rate that each coil above the bottom can be accommodated within the coil below it, thus adapting the spring to become pressed in axial direction to within a vertical dimension no greater than the diameter of the wire of which the spring is made. And the pitch of the spiral is such as to make the spring at its full extent react up against the under side of the top of the casing, 25, when the chamber, 20, is fully collapsed, as seen in Figure 2.

Any convenient means may be provided for mounting the casing at desired position on the vehicle, said position being for intended functioning of the structure constructed as described at such level that the entire vertical extent and range of expansion and collapse of the chamber, 20, is a substantial distance below the overflow level of the radiator.

The operation of the device may be readily understood to be as follows:

When the radiator is initially supplied with circulatory liquid for cooling the engine by circulating through the engine jacket, it will be desirably filled to a point causing overflow of the initially cold liquid through the overflow pipe into the condenser chamber, in which the air trapped will be compressed to a degree corresponding to the pressure of the liquid column in the overflow connecting pipe extending above the level of the communication of said pipe with said condenser chamber. When the engine becomes heated causing the circulatory liquid to be heated, the expansion of the liquid throughout the entire circulatory system, including the radiator cavity, will first cause a further overflow or discharge from the upper part of the radiator cavity into the overflow, condenser-connecting, pipe, with the effect of increasing the degree of compression of the air trapped in the condenser chamber. If the heating of the circulatory liquid continues to the point of developing steam or vapor, eventually the liquid in the overflow pipe may be forced down and onward through that pipe and up into the condenser chamber, 20, and further development of vapor, with the resulting increase of pressure, will cause the vapor to bubble up through the water thus accumulated in the condenser chamber. This water being originally cold, and only slightly heated by the water forced over from the radiator cavity by the expansion upon initial heating, will cause the vapor thus discharging through it to be condensed until, if the overheating and development of vapor continues, the water in the condenser chamber may itself become too much heated to cause immediate condensation of the vapor bubbling through it; and vapor may thus accumulate above the water in the condenser chamber to some extent.

Before this condition will have been reached, the condenser chamber may be fully expanded exposing a large area for radiation of the heat, which will eventually result in condensation of vapor which may have accumulated above the liquid in said chamber. The capacity of the chamber will be suited to the engine in respect to the area for radiation of heat and consequent capacity for condensation of the vapor, so that the condenser chamber will not become completely occupied by vapor to the exclusion of the liquid during the time which may elapse after the overheating of the engine is observed by the driver, and before usual measures for correcting the condition of overheating will be taken. And it will be seen that upon the cessation of the overheating, and upon the circulatory system, including the engine jacket and radiator, becoming cooled down to normal temperature,—below that at which vapor will be generated against the pressure obtaining in the radiator cavity,—the pressure in that cavity will fall and thereby become less than the pressure in the condenser chamber. For it will be understood that the expansion of the chamber, 20, being effected by the pressure developed in the radiator cavity against the accumulating tension of the spring, 30, is equal to the pressure in the radiator cavity plus the liquid head, and is the measure of the tensional reaction of the spring, which reacts therefore against that pressure to the maximum degree attained by pressure at its highest point; and exceeds the pressure in the radiator cavity when that has become reduced by the subsequent cooling; and the result therefore is that all the liquid which has been forced over into the condenser chamber, including the liquid resulting from condensation of the vapor which has thus passed over into that chamber, will be forced back without waste into the radiator cavity, and become again a part of the circulatory cooling liquid.

To insure the safety of the device against rupture by reason of over-expansion which might result from continued overheating of the engine through inattention of the driver, a safety valve, 35, is provided in the top plate, 17, of the collapsible and expansible chamber, 20, whose spring, 36, may be tensioned by an adjusting screw, 37, to adapt the valve to yield and open for relief of the pressure at the estimated limit of safety.

For promoting radiation for cooling of the vapor which may be forced over into the condenser chamber, the jacket, 25, is desir-

ably reticulated, as indicated, by the longitudinal slots, 25^d, distributed throughout the upper half of said casing.

I claim:—

1. In combination with the radiator of a circulatory cooling system of an internal combustion engine an expansible and reducible chamber mounted for fluid communication with the radiator cavity at the upper part of the latter, said chamber being yieldingly expansible by the pressure communicated from the radiator cavity upon heating and vaporizing of the circulatory fluid, said chamber having a port for liquid communication with the radiator at the lower part of said chamber and below the liquid level of the radiator, and being exposed to atmospheric cooling for condensing vapor which may pass thereinto from the radiator, and pressure means for contracting the chamber corresponding to the pressure by which it is expanded; whereby upon such contraction liquid remaining in the chamber may be forced back into the radiator against the pressure of the head of liquid and the reduced pressure in said chamber.

2. In combination with a radiator of the circulatory cooling system of an internal combustion engine a chamber mounted with a substantial portion of the extent of its cavity below the normal liquid level of the radiator, and connection for fluid communication leading from the upper part of the radiator cavity to the lower part of said chamber, said chamber being expansible and reducible, and being normally reduced; means for yieldingly resisting its expansion and tending to reduce it; said chamber being exposed to atmospheric cooling for condensing vapor which may pass into it from the radiator, the means for yieldingly reducing the capacity of said chamber being adapted to produce pressure toward the radiator; whereby upon cooling after expansion by vapor under pressure from the radiator, the liquid condensed in said chamber will be forced back into the radiator.

3. In combination with the radiator of the circulatory cooling system of an internal combustion engine a condenser chamber and a fluid flow passage leading from the upper part of the radiator cavity to the condenser chamber, said chamber mounted lower than the radiator end of said passage, said chamber being expansible and reducible, and a spring operating upon said chamber for yieldingly reducing it to a minimum capacity, said spring at the stage of reduction of said chamber to said minimum capacity being tensioned for resisting the pressure of a liquid column whose height is the difference between the level of the fluid flow passage connection with the radiator and its connection with said chamber.

4. In combination with the radiator of the circulatory cooling system of an internal combustion engine an expansible and reducible chamber, and a casing within which it is mounted and exposed to atmospheric cooling at a position at which a substantial part of its vertical extent is below the normal liquid level of the radiator; a pipe connecting the upper part of the radiator cavity with the lower part of said chamber, said chamber being of flexible material, whereby it is collapsible and expansible; a spring reacting upon said chamber for collapsing it and holding it yieldingly collapsed, said spring being tensioned at the collapsed stage of the chamber for upholding a liquid column extending to the height of the pipe connection with the radiator, whereby upon condensation of vapor which may pass from the radiator to said chamber said spring operates for collapsing the chamber to force the liquid of condensation back into the radiator.

5. In combination with a radiator of the circulatory cooling system of an internal combustion engine an expansible and reducible chamber mounted for fluid connection with the upper part of the radiator cavity, the radiator cavity being closed except as to its connections with the remainder of the circulatory cooling system and its said connection with said chamber, and said chamber being closed except as to its connection with the radiator cavity, whereby expansion of the circulatory fluid by the heat of the engine develops pressure in the cavity of the radiator and in the connected cavity of said chamber; said chamber having a substantial vertical extent at maximum expansion below the level of the port of communication of the radiator with said chamber; yielding means tending to hold the expansible and reducible chamber at predetermined low capacity, and to yieldingly resist its expansion under said pressure, said chamber being exposed to atmospheric cooling for condensing vapor which may pass thereinto from the radiator, whereby it is adapted to contract the chamber for forcing back into the radiator the liquid driven therefrom and the liquid resulting from the condensation of the vapor driven therefrom, upon reduction of pressure in the radiator cavity.

6. In combination with the radiator of a circulatory cooling system of an internal combustion engine an expansible and reducible chamber mounted for fluid communication with the radiator cavity at the upper part of the latter, said chamber being yieldingly expansible by the pressure communicated from the radiator cavity upon heating and vaporizing of the circulatory fluid, the conduit for such communication being intermediate its connections with the radia-

tor and with the condenser chamber, and communicating with the latter at the lower part thereof, said condenser chamber being exposed to atmospheric cooling for condensing vapor which passes it from the radiator, and pressure means for contracting the chamber corresponding to the pressure by which it is expanded.

7. In the construction defined in claim 6, the expansible and reducible condenser chamber having a substantial portion of its vertical extent at most expanded stage extended below the level of the communication of the connecting conduit with the radiator cavity, whereby liquid may overflow from the radiator and occupy such substantial portion of the condenser chamber for assisting in the condensation of vapor subsequently forced into the condenser chamber by pressure developed in the radiator.

8. In combination with the radiator of a circulatory cooling system of an internal combustion engine an expansible and reducible chamber mounted for fluid communication with the radiator cavity at the upper part of the latter, said chamber being yieldingly expansible by the pressure communicated from the radiator cavity upon heating and vaporizing of the circulatory fluid, said chamber having a port for communication with the radiator at the lower part of said chamber, and pressure means for contracting the chamber; whereby upon such contraction liquid in the chamber will be forced back into the radiator.

9. In combination with a radiator of the circulatory cooling system of an internal combustion engine, a chamber mounted so that the lower part is below the normal liquid level of the radiator, and connection for fluid communication leading from a point above the normal liquid level of the radiator to the lower part of said chamber, said chamber being expansible and reducible, and being normally reduced; means for yieldingly resisting its expansion and tending to reduce it; said chamber condensing vapor passing into it from the radiator, the means for yieldingly reducing the capacity of said chamber being adapted to produce pressure whereby upon cooling after expansion under pressure from the radiator, the liquid in said chamber will be forced back into the radiator.

10. In combination with a radiator of the circulatory cooling system of an internal combustion engine an expansible and reducible chamber mounted for fluid connection with the upper part of the radiator cavity, the radiator cavity being closed except as to its connections with the remainder of the circulatory cooling system and its said connection with said chamber, and said chamber being closed except as to its connection with the radiator cavity, whereby expansion of the circulatory fluid by the heat of the engine develops pressure in the cavity of the radiator and in the connected cavity of said chamber; said chamber having a substantial vertical extent at maximum expansion below the level of the port of communication of the radiator with said chamber; yielding means tending to hold the expansible and reducible chamber at predetermined low capacity, and to yieldingly resist its expansion under said pressure, said chamber being exposed to atmospheric cooling for condensing vapor which may pass thereinto from the radiator, said yielding means being adapted to be increased in the resistance which it offers to expansion by said expansion, whereby it is adapted to contract the chamber correspondingly to the pressure by which it is expanded for forcing back into the radiator the liquid driven therefrom, and the liquid resulting from the condensation of the vapor driven therefrom, upon reduction of pressure in the radiator cavity.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 26 day of July, 1926.

FRANK R. PERRY.