

Sept. 8, 1925.

1,553,093

A. B. MODINE

RADIATOR

Filed May 10, 1920

4 Sheets-Sheet 1

Fig. 1.

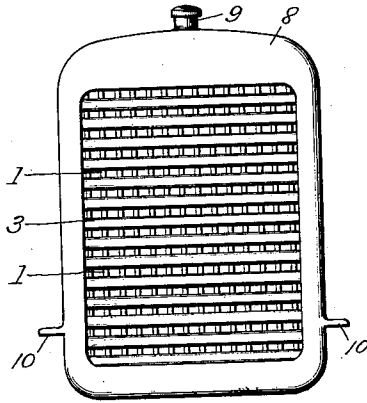


Fig. 2.

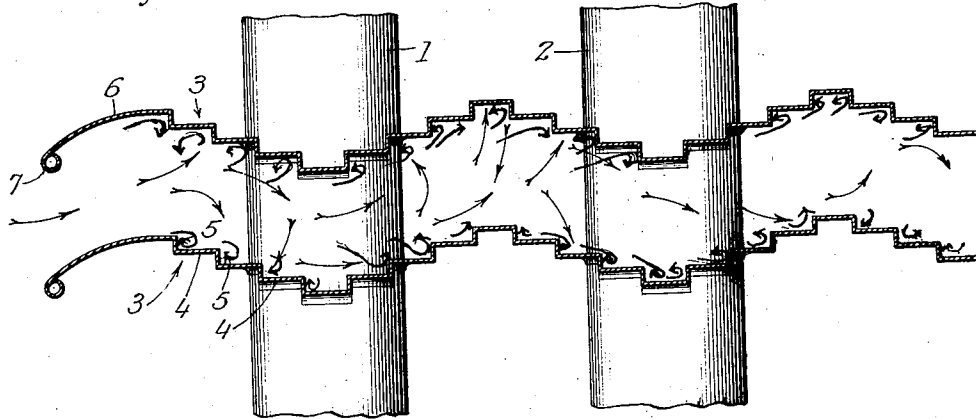


Fig. 3.

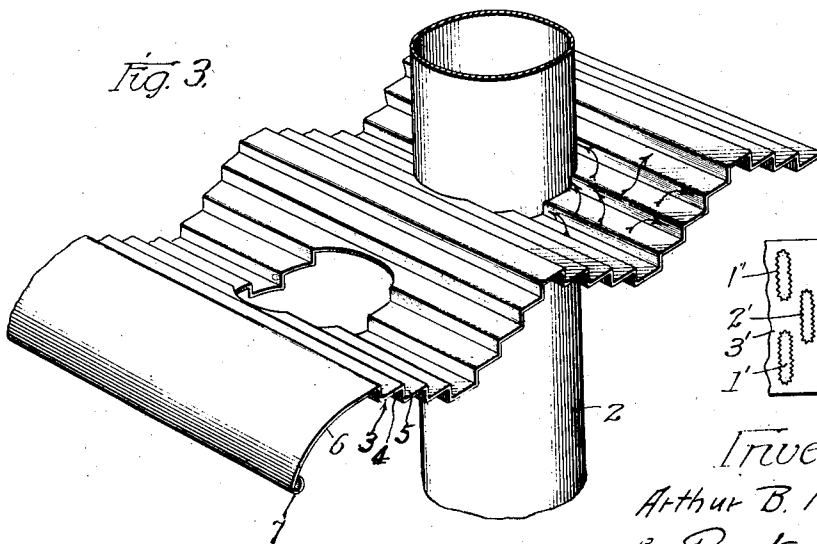
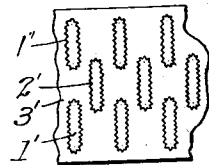


Fig. 4.



Inventor
Arthur B. Modine
By Burton W. Hill
Atty

Sept. 8, 1925.

1,553,093

A. B. MODINE

RADIATOR

Filed May 10, 1920

4 Sheets-Sheet 2

Fig. 5.

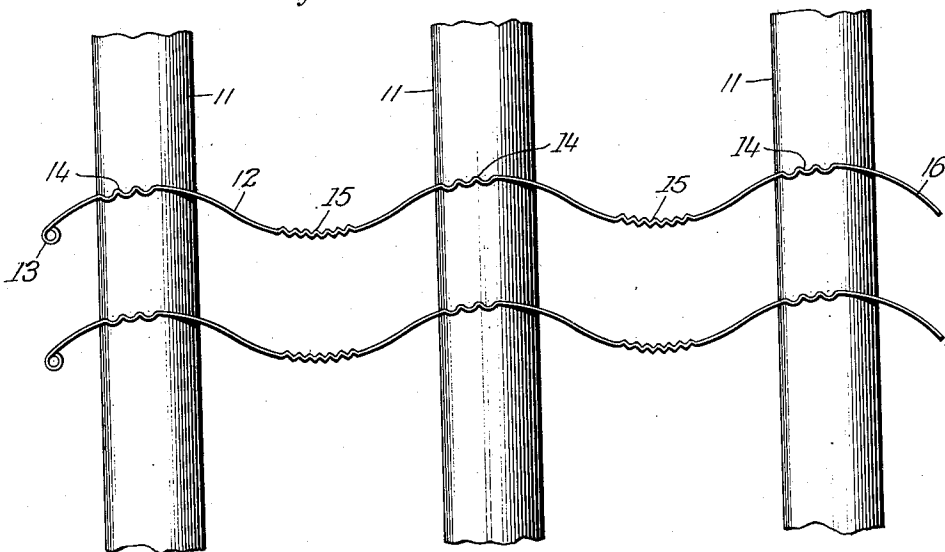
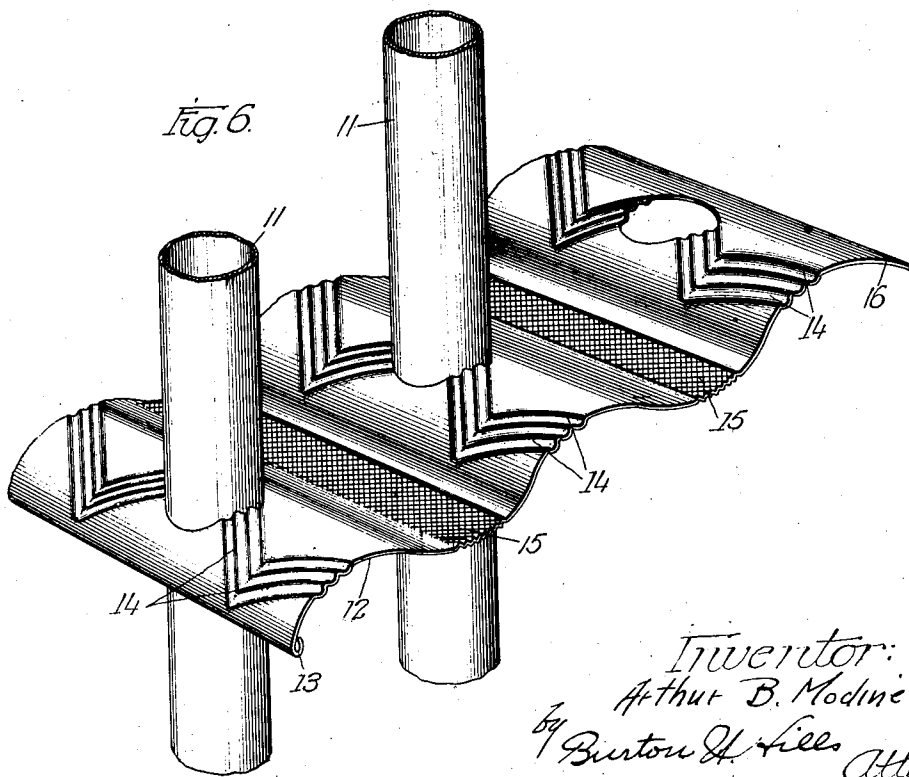


Fig. 6.



Inventor:
Arthur B. Modine.
By Burton H. Lees Atty.

Sept. 8, 1925.

1,553,093

A. B. MODINE

RADIATOR

Filed May 10, 1920

4 Sheets-Sheet 3

Fig. 7.

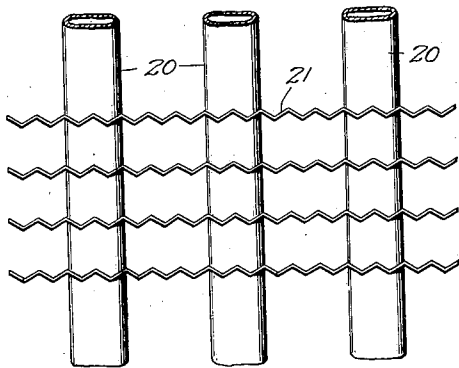


Fig. 8.

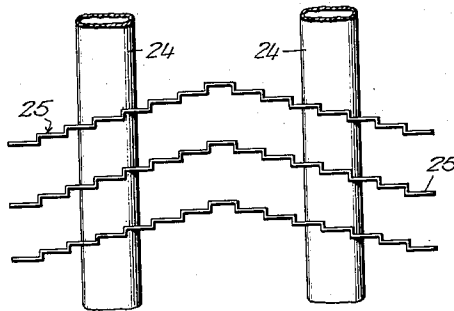


Fig. 9.

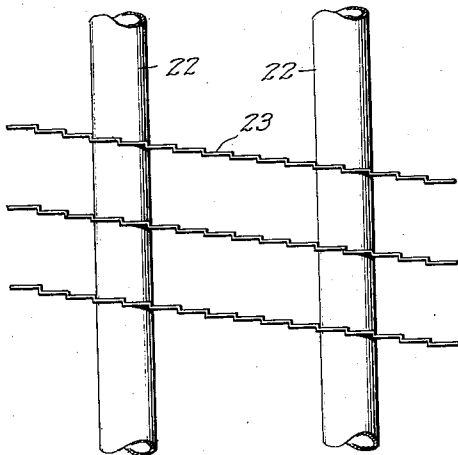
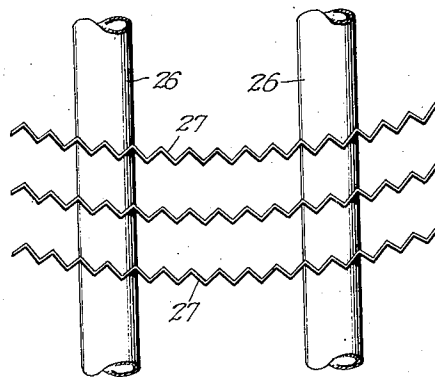


Fig. 10.



Inventor
Arthur B. Modine
By Burton W. Hill, Atty.

Sept. 8, 1925.

1,553,093

A. B. MODINE

RADIATOR

Filed May 10, 1920

4 Sheets-Sheet 4

Fig. 11.

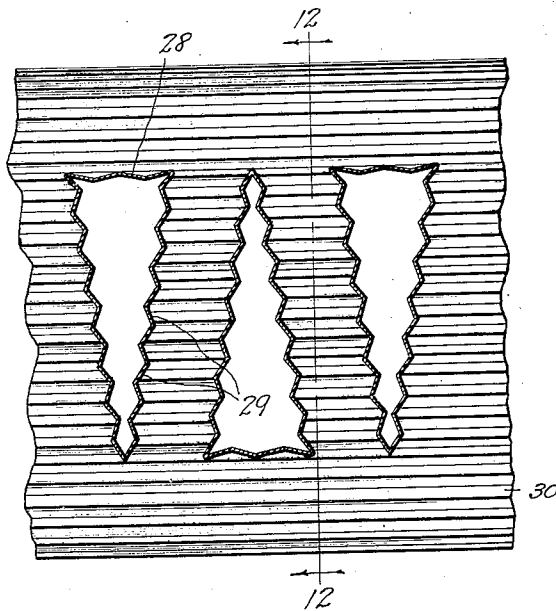


Fig. 12.

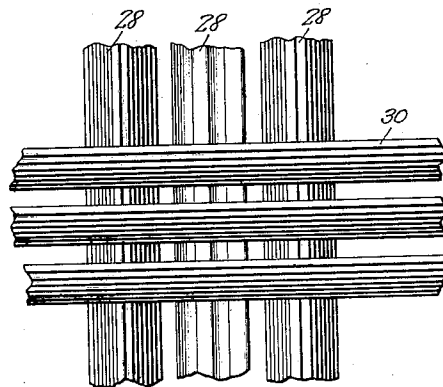
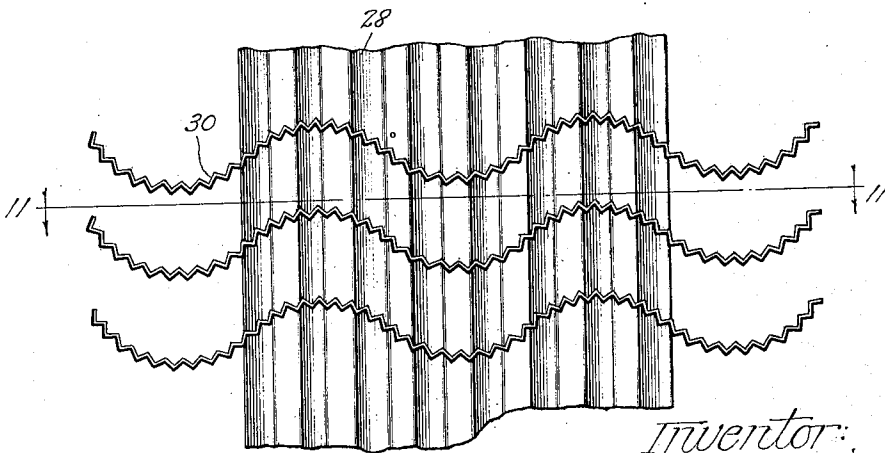


Fig. 13.



Inventor:
Arthur B. Modine
by Burton H. Hill, atty.

Patented Sept. 8, 1925.

1,553,093

UNITED STATES PATENT OFFICE.

ARTHUR B. MODINE, OF RACINE, WISCONSIN.

RADIATOR.

Application filed May 10, 1920. Serial No. 330,215.

To all whom it may concern:

Be it known that I, ARTHUR B. MODINE, a citizen of the United States, residing at Racine, in the county of Racine and State of Wisconsin, have invented certain new and useful Improvements in Radiators, of which the following is a description.

My invention belongs to that general class of devices known as radiators and relates more particularly to a type of radiator to be used in connection with cooling systems for cooling the fluid used in the system or dissipating the heat therefrom. The invention has among its objects the production of a radiator construction of the kind described that is simple, efficient, attractive, durable, convenient and satisfactory for use wherever found applicable. It has particularly as an object the production of a construction of radiator in which a turbulent condition is set up or produced in the passing air so that the same is substantially violently agitated, and a more efficient radiator produced. Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

To this end my invention consists in the novel construction, arrangement and combination of parts herein shown and described, and more particularly pointed out in the claims.

In the drawings, wherein like reference characters indicate like or corresponding parts,

Figure 1 is a front elevation of my construction embodied in an automobile radiator;

Figure 2 is a sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a perspective view of a portion of the same;

Figure 4 illustrates an efficient arrangement of pipes;

Figure 5 is a sectional view similar to Figure 2 of a slightly modified construction;

Figure 6 is a perspective view of the same;

Figure 7 is a sectional view similar to Figure 4 of another construction;

Figure 8 is a sectional view of another form;

Figure 9 is a similar view of another form;

Figure 10 is a similar view of another form;

Figure 11 is a sectional view taken substantially on line 10—10 of Figure 12 illustrating another construction;

Figure 12 is a front elevation of the same; and

Figure 13 is a sectional view taken substantially on line 12—12 of Figure 10.

Referring to the drawings, a substantially complete radiator is shown in Figure 1, the construction illustrated and described being particularly intended for automobile use. This type of radiator is therefore shown, it being understood, however, that, the construction may be employed wherever found applicable in the transfer of heat or control of temperatures. As most clearly shown in Figures 2 and 3, 1 and 2 represent tubes, pipes or conduits of the desired size, shape and material, and 3, 3 etc., plates, discs or deflectors extending transversely of the tubes for increasing the cooling area, agitating and circulating air or the like about the tubes and assisting in dissipating the heat and spacing the tubes. I do not consider it necessary to describe the entire radiator other than to say that 8, (see Figure 1), represents a plate over the tank parts which are not shown in detail, 9 the filler tube, and 10 brackets or extensions on the radiator frame for supporting and securing the radiator in place. The plates 3 are formed with openings through which the tubes pass, the plates closely fit the tubes and are secured thereto by soldering or the like so as to efficiently conduct or radiate the heat therefrom. The plates may connect the several tubes or not as may be desired. Where they do not connect the adjacent tubes they consist substantially of discs of the desired size and shape.

Referring particularly to the Figures 2 and 3 mentioned, the plates are formed with a series of steps consisting of portions 4 and 5, the same being substantially wavy from edge to edge or front to back, as shown, so that they are at an angle to the tubes. I prefer to form the front edge as at 6 and turn the extreme edge over as at 7 so as to give a pleasing appearance and make the same ornamental. I have endeavored to show by the arrows and lines how the air as it passes between the plates is deflected back and forth. It is thoroughly agitated as it

passes between the plates and around and about the tubes. As it strikes the faces of the portions 5 it is deflected back and forth between the plates traveling transversely the tubes and between them and longitudinally thereof. There is no tendency for an air film to form at the plates and the air midway between the plates to pass through at increased velocity without serving its purpose, but on the contrary, owing to the turbulence or agitation in the air, the air is all utilized for cooling or taking up the heat, so that the heat is dissipated from the tubes to a greater extent. The appearance of the completed radiator is pleasing.

In Figure 4, I have illustrated how the shape and arrangement of the tubes may be modified. As shown, 1' and 2' illustrate substantially oval or flat tubes and 3' roughened or corrugated plates, it being understood the tubes may be roughened on the exterior if desired.

In the constructions shown in Figures 5 and 6, 11—11 represents the tubes which may be of the desired size, shape and construction, and 12 the plates. In this case I have shown the plates waved or curved from front to back. The front end is preferably turned over as at 13 to avoid a sharp edge and give a pleasing appearance, and the rear end 16 may be extended if desired. In this case, instead of straight steps or bends shown in Figure 2, I provide substantially V-shaped corrugations 14 which, when constructed as shown, have a tendency to deflect the passing air onto, around and about the tubes. I also prefer to roughen the same as at 15. This may be done by slightly corrugating the same or merely knurling the plates on either or both sides. This construction causes a turbulent condition or state of the air passing over the plates.

In the construction shown in Figure 7, 20 represents the tubes and 21 the plates which are made, in this case, corrugated and are not inclined but cut the line of tubes at substantially right angles. With this type the air is agitated or deflected between the plates and about the tubes, affording an efficient cooling.

The construction in Figure 8 is in some respects similar to that shown in Figure 2. Referring to the figure, 24 represents the tube and 25 the plates. In Figure 9, 22 represents the tube and 23 the plates which, in this case, tend to agitate the air similar to the construction shown in Figures 2 and 8. Figure 10 more clearly resembles the construction shown in Figure 7, except that the plates 27, through which the tubes 26 extend, are slightly curved between the edges.

In Figure 11, 28 represents the tubes and 30 the plates. In this case the plates are shown somewhat similar to the plates il-

lustrated in Figure 5, except that they are corrugated similar to Figures 7 and 10. The tubes, however, are of different shape and corrugated as indicated at 29. It is immaterial as to the shape of the tubes, as they may be round, oval, square, diamond shape or the like, in cross sectional shape and made rough, corrugated, angular, smooth, or as desired. When constructed as shown in Figure 11, however, it will be noted that the area is considerably increased and that the air is swirled or thoroughly deflected or agitated between the plates and the tubes.

The important feature is the thorough agitation or breaking up of the air or intermixing of the cool and warm particles which takes place to a more or less extent in all the constructions shown. The rate of heat transfer is dependent upon the temperature difference between the heated surface and the circulating air. Using smooth radiating surfaces in a radiator, the tendency is for a film of heated air to lag behind and serve to insulate these surfaces from the main body of circulating air and the purpose of the agitation is to destroy this film and allow the surfaces to come into contact with air at a lower temperature. The result is that the air in contact with the plates and tubes is cooler than it would ordinarily be, as every particle of air is used for cooling purposes. It will be obvious that any of the styles of tubes referred to or shown may be combined with any of the styles of plates or discs referred to or shown without requiring illustrations of all the possible combinations. With all the constructions, I prefer to solder or otherwise secure the plates or discs and tubes together so as to increase the efficiency of the radiator and to incline the plates so as to substantially cause all air to contact with the plates. It will be noted that when constructed as shown, there are no pockets found in which dust, chaff, etc., may catch and accumulate.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In a radiator of the kind described and in combination, a plurality of spaced tubes and spaced plates mounted thereon and extending in planes transversely the axes thereof, said plates being substantially curved between the front and back edges and corrugated on the curved portions.

2. In a device of the kind described and in combination, a plurality of tubes pro-

vided with roughened surfaces and a plurality of plates extending transversely thereof, said plates formed with a series of curves between the front and back edges and with a series of corrugations on each of the curves and extending transversely of the tubes.

3. In a device of the kind described and in combination, a plurality of tubes, and a plurality of plates extending transversely thereof, said plates formed with a series of curves between the front and back edges and with a series of corrugations on each of the curves and extending transversely of the tubes.

4. In a radiator of the kind described and in combination, a plurality of spaced tubes and spaced parallel plates mounted thereon and extending transversely thereof from side to side of the radiator, the said plates lying in planes intersecting the axes of the tubes and provided with a series of steps formed thereon between the front and back edges of the plates and arranged to cause a turbulence of the air passing between the plates.

5. In a device of the kind described and in combination, a plurality of tubes and spaced plates extending transversely thereof, said plates provided with horizontal steps thereon, the top faces of adjacent steps lying in varied horizontal planes extending progressively up and down from the front to the back edge of the plate causing a state of turbulence of the air passing between the adjacent plates and around the tubes.

6. In a device of the kind described and in combination, a plurality of tubes, and plates extending transversely thereof, said plates having a series of substantially un-

dulating curves from the front to the rear thereof, and provided with steps formed thereon to cause a state of turbulence of the air passing between the plates, the plane tangent to the tops of the curves across each plate intersecting the tube axes.

7. In a device of the kind described and in combination, a plurality of tubes, and plates extending transversely thereof, said plates having a series of substantially undulating curves from front to rear thereof, and provided with horizontal steps thereon, and top faces of adjacent steps lying in different horizontal planes to cause a state of turbulence of the air passing between the plates.

8. In a device of the kind described and in combination, a plurality of tubes, and plates extending transversely thereof, said plates having a series of substantially undulating curves from front to rear thereof and provided with a series of steps on each of said undulations to cause a state of turbulence of the air passing between the plates.

9. In a device of the kind described and in combination, a plurality of tubes, and plates extending transversely thereof, said plates having a series of substantially undulating curves from front to rear thereof and provided with a series of horizontal steps formed on each of said undulations, the top face of the adjacent steps lying in different horizontal planes to cause a state of turbulence of the air passing between the plates.

In testimony whereof, I have hereunto signed my name.

ARTHUR B. MODINE.