

Feb. 8, 1944.

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2,340,853

HEAT EXCHANGER FOR SUPERCHARGERS

Filed June 27, 1941

2 Sheets-Sheet 1

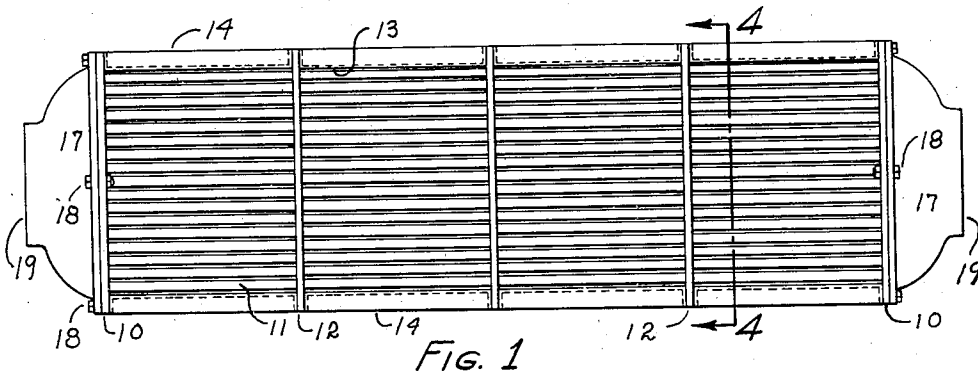
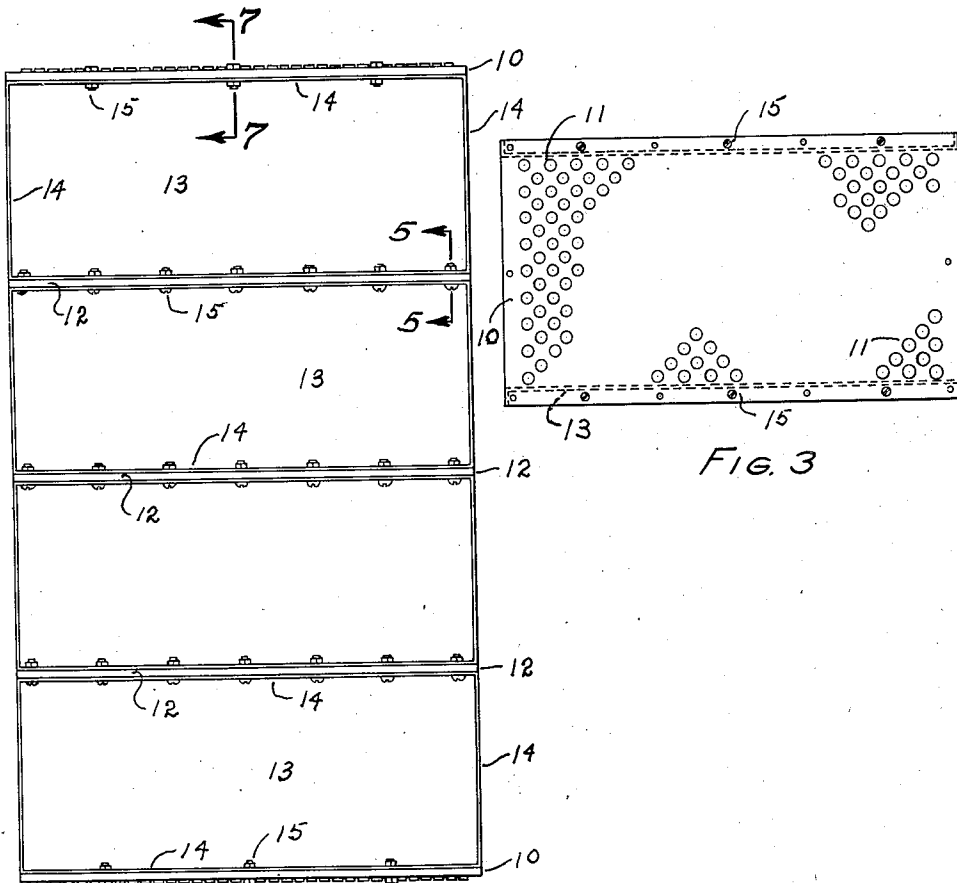


FIG. 3

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2 Sheets-Sheet 2

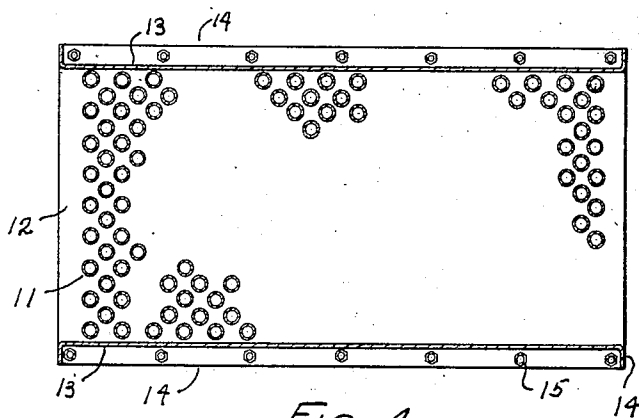


FIG. 4

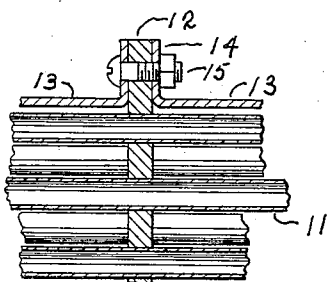


FIG. 5

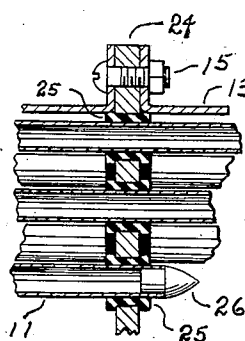


FIG. 6

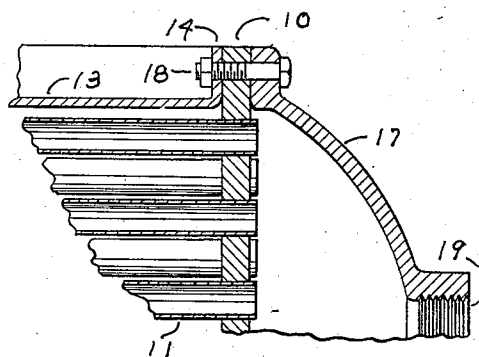


FIG. 7

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## UNITED STATES PATENT OFFICE

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## HEAT EXCHANGER FOR SUPERCHARGERS

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Application June 27, 1941, Serial No. 399,969

1 Claim. (Cl. 257—248)

The present invention relates to air coolers particularly adapted for use on airplanes equipped with a supercharger.

Objects of the present invention are to provide a device which is strong, efficient, durable and extremely light in weight.

Further objects of my invention are to provide a device which is simple, easily manufactured and assembled and easily installed.

Still further objects of the present invention are to provide a device from which some of the parts can be used on various sized units and wherein all or the larger part of the device may be made from aluminum sheets and commercial aluminum tubes.

To these and other useful ends, my invention consists of parts, combinations of parts, or their equivalents, and mode of operation, as hereinafter set forth and claimed and shown in the accompanying drawings in which:

Fig. 1 is a front elevational view of the preferred embodiment of my invention.

Fig. 2 is a top view of the design shown in Figure 1 less the header covers.

Fig. 3 is an end view of the device as shown in Figure 2.

Fig. 4 is a transverse sectional view taken on line 4—4 of Figure 1.

Fig. 5 is a fractional section taken on line 5—5 of Figure 2.

Fig. 6 is a section similar to Figure 5 but illustrating a modification.

Fig. 7 is a fractional longitudinal section taken on line 7—7 of Figure 2 but including a fraction of the header cover.

As thus illustrated, the end tube plates 10—10 are made from thick aluminum sheets. Intermediate plates 12 are provided, which may be somewhat thinner than plates 10. Plates 10 and 12 are provided with closely spaced registering apertures through which tubes 11 extend, as illustrated.

I provide top and bottom plates 13 having end and side flanges 14. Plates 10 and 12 on their top and bottom edges and the adjacent flanges 14 are provided with spaced apertures for the reception of bolts 15.

Temporary bolts 15 are used for securing plates 10 to their flanges less the header caps. After bolts 15 are made taut, the tubes are expanded into their openings in the tube plates, so as to firmly anchor the tubes in the plates. The preferred method for this operation is by the ball system which is too well known to require further description.

After the completion of the assembly as described and shown in Figure 2, the temporary bolts holding plates 10 to their flanges are removed and header covers 17—17 are placed into position and made fast by means of bolts 18, the front and rear edges of plates 10 and the front and rear edges of header covers 17 are also provided with apertures for the reception of bolts 18 (see Figure 1).

It will be seen that the header covers will be securely fastened to plates 10 and that plates 10 and 12 will be securely fastened together by means of members 13 and 14 and the tubes.

Header covers 17 are preferably shaped as illustrated and provided with suitable inlet and outlet openings 19—19. These openings may be operatively connected to the supercharger and inlets leading to the engine (not shown) so the heated air, after it leaves the supercharger passes through tubes 11 and will be cooled by the blast of air forced around the tubes, as will hereinafter appear.

An inlet scoop and an air outlet duct may be provided (not shown) and suitably secured to flanges 14 or suitable ducts may be secured to the front and rear flanges, one leading to a suitable air supply means thus other than frontal pressure may be provided for forcing an air blast through the device.

It will be noted that the plates are relatively closely spaced and that they cooperate with members 13 to form a number of air ducts through which tubes 11 extend.

In devices of this type, it is desired that the air be forced through these air ducts at high velocity so as to increase the heat exchange capacity of the device. It has been found that if the exposed part of the tube is very long, the action of the air will cause serious vibration and in time destroy the tubes. An object of this invention is to extend the tubes through narrow ducts so the length exposed to the blast of air will not be great enough to permit vibration.

It will be seen by scrutinizing the various figures that members 13 are positioned in close proximity to the top and bottom rows of tubes, the space being such as will permit about the same volume of air to pass between plates 13 and the adjacent tubes as will be caused to pass between the tubes. Thus the device will be efficient without the necessity of providing air locks, etc.

In Figure 6, I illustrate a modification wherein intermediate plates 24 are provided with tube apertures which are somewhat larger than the

apertures shown in the other figures. They are made suitable for the reception of finaged rubber or synthetic rubber sleeves 25. The sleeves are designed so the tubes will fit tightly in the sleeves and in turn the sleeves will be held tightly in their apertures.

I provide a temporary tapered plug 26 in the ends of the tubes and the tubes are then forced into the assembly longitudinally, member 26 acting to permit the tube to enter the sleeve by expanding the opening in the sleeve so members 25 will be tightly held in their openings and the tubes tightly held in the sleeves. After completion of the assembly, the ends of the tubes may be expanded in the apertures in end tube plates 10 in any well known manner.

An object of sleeves 25 is to form a suitable anchorage for the medial portion of the tubes and avoid the necessity of expanding the entire length of the tubes as already described.

Clearly members 13 may be used on two different width assemblies and these members may also be used on various length assemblies, and assemblies with various numbers of air ducts.

Members 13 and their flanges, the header covers and the tubes all being securely fastened together will provide a very rigid assembly even though the parts are all made from aluminum.

5 Having thus shown and described my invention, I claim:

A device of the class described, comprising a bundle of tubes which is rectangular in cross-section, end tube plates having openings therein through which the ends of said tubes extend, at least one relatively thick continuous intermediate tube plate having openings therein through which said tubes extend with the tubes anchored against movements relative to the tube plates, flanged plates positioned between opposite edges of said end and intermediate plates and co-operating therewith to form separate air ducts through which the tubes extend, flanges of said flanged plates flatly engaging sides of the end and intermediate plates at their edges outwardly of said tubes, and bolts extending through said flanges and plates whereby said tubes and flanged plates are intimately secured together.

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