April 12, 1949. H. W. CASE 2,466,684

RADIATOR CORE

Filed April 18, 1945

Fig 1

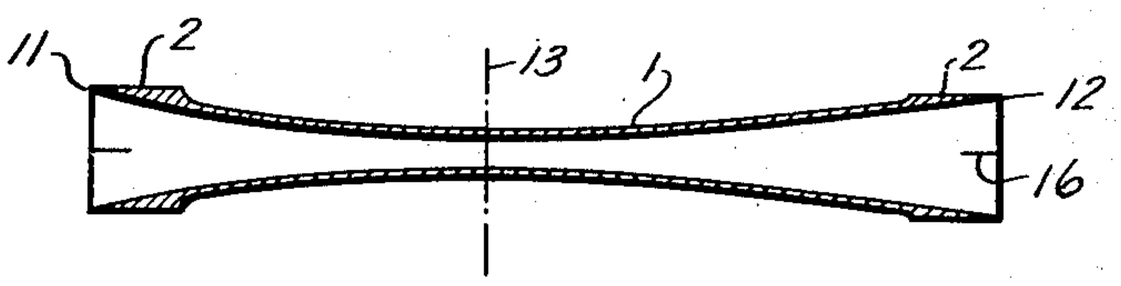


Fig 3

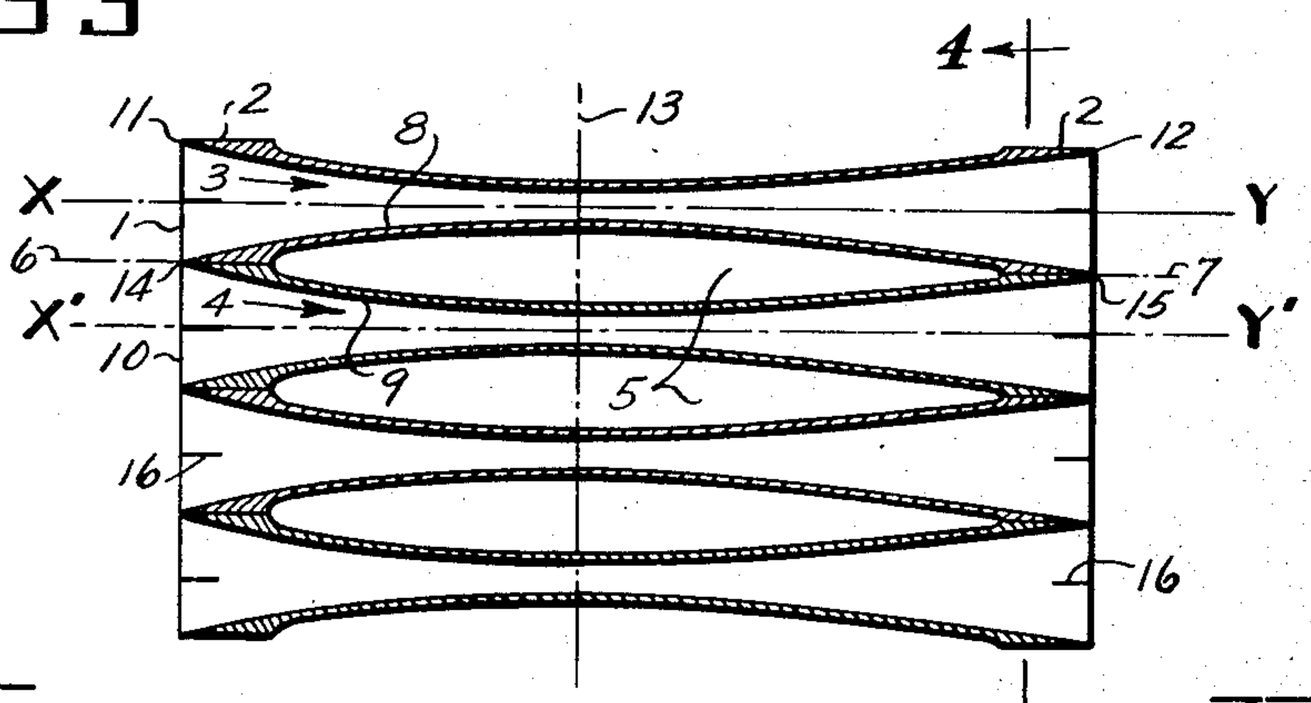


Fig 2

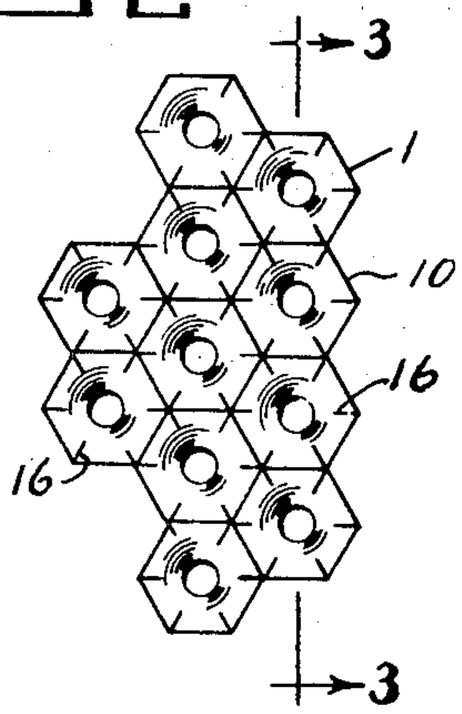
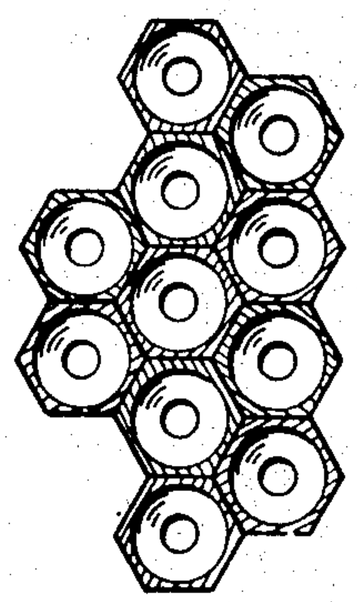


Fig 4



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RADIATOR CORE

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2 Claims. (Cl. 257—128)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to radiator core tubes and particularly to the tubes of radiator cores through which the cooling medium travels at extremely high speed, as it does for instance in the radiators of high speed aircraft, the improvement in subject invention being particularly concerned with the mounting sleeves of such tubes.

In my prior Patent No. 2,325,036, of July 27, 1943, I show and describe a radiator core made up of Venturi-shaped tubes, the Venturi shape being such that if a section is taken through the core on a plane which passes through the axis of two adjacent tubes, the section formed by the lower surface of the upper tube and the upper surface of the lower tube will be substantially that of a symmetrical airfoil. This section varies from a true symmetrical airfoil in that the chord line of the upper contour is separated slightly from the chord line of the lower contour.

The mounting sleeves of the tubes disclosed in the prior patent supra, however, were so made and formed as to leave relatively blunt ends front and back on the airfoil shape above mentioned, thereby retarding the entry and exit of the airflow through the core.

It is therefore an object of this invention to substantially follow the teaching in the prior patent, supra, insofar as the tubes are of such Venturi shape that the section formed by the lower surface of the upper tube and the upper surface of the lower tube follows the form of a true symmetrical airfoil. In the section of the present invention the chord lines of the upper and lower contours are one and the same. It is also the object of this invention to so alter and improve the mounting sleeves that the said true symmetrical airfoil shapes come to substantially a sharp edge both front and back, to the end that there may be both a smoother entry and a smoother exit for the cooling air passing through the radiator whereby the volume of air passing through the core in a given time will be increased.

More generally the object of my invention is to provide a radiator core tube which will offer the smallest possible resistance to the passage of air at a given speed, by so forming the tube that the air moving through the tube will be passing around a true symmetrical airfoil section which has characteristics proportionate to the speed for which the radiator is designed.

Still another object is to so fashion the mounting sleeves on the core tubes that a minimum turbulence will be caused within the tube as the air is passing therethrough. This and other objects and meritorious features I attain in the manner hereinafter described, reference being had to the drawing, wherein:

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Fig. 1 is an axial section through one of my improved radiator core tubes.

Fig. 2 is an end view of a section of a radiator incorporating a plurality of these tubes.

Fig. 3 is a cross-sectional elevation through a row of tubes taken on the line 3—3 of Fig. 2.

Fig. 4 is a transverse section taken at 4—4 of Fig. 3.

Like reference characters refer to like parts throughout the several views.

The axial cross section Fig. 1 shows a single tube 1 of Venturi shape, the throat of which, in the instant case, is at 13, which may be somewhere near the midway point of its length. The cross section of the main portion of the tube shown is circular both outside and inside but of varying dimensions throughout the length, while the end sleeves 2 are hexagonal on the outside and of uniform external dimensions throughout their length, the inside diameter being flared outwardly gradually merging from round to hexagonal as at 16, the internal and external hexagonal contours meeting in a sharp edge at the end of the tube as at 11 and 12 where the inner contour and the outer contour substantially coincide.

Fig. 2 shows the end view of a section of a radiator incorporating a plurality of these tubes. After assembling the tubes together as shown in this figure, they are soldered at the ends in the same manner as conventional radiator core tubes; i. e., by dipping in molten solder while held in a clamp.

In Fig. 3 the cross-sectional elevation through a row of tubes taken on the line 3—3 of Fig. 2, the section formed by the contours 8 and 9 representing the lower and upper "wetted" air surfaces of the walls of two adjacent core tubes, such as 1 and 10, respectively, on said plane, will conform to the shape of a true symmetrical airfoil having extremities both front and back terminating in sharp edges as at 14 and 15. The thickest section of the airfoil is on line 13. The cooling air proceeds through the center of the tubes as shown by the arrows 3 and 4, while the fluid to be cooled is circulated around the core tubes in the spaces 5 between adjacent tubes. The line 6—7 represents the chord of the airfoil section which is described as being the lower and upper "wetted" air surfaces of the walls of core tubes 1 and 10, re-

spectively. If the upper contour 8 of the airfoil having the line 6—7 as its chord is rotated about the axis x—y, which is substantially parallel to the chord but displaced therefrom on the convex side of the contour 8, the surface thus generated will have the form of a Venturi-shaped tube which constitutes the wall of radiator core tube 1 in Fig. 3. If the lower contour 9 of the airfoil having the same line 6—7 as its chord is rotated about the axis x'—y', the surface thus generated will constitute the wall of core tube 10. The "wetted" air contours 8 and 9 representing the lower and upper sections of core tubes 1 and 10, respectively, are symmetrical about their common chord 6—7. Consequently, the air which passes through the two tubes 1 and 10 flows around a true symmetrical airfoil and the wind resistance of the two tubes is equivalent to that of a true symmetrical airfoil section.

In the single embodiment of my invention which I have shown and described, I have suggested the use of round tubing with the ends brought to hexagonal shape, but it will be obvious that the ends could be square or triangular and that the tubing could be hexagonal, square or of other suitable cross section.

Moreover, in the embodiment selected for illustration, I have shown certain curves as at 8 and 9 of Fig. 3 to define the shape of the airfoil, but it will be obvious that the section of the airfoil which will offer minimum resistance in any particular case will depend upon the speed at which the radiator core is to be used.

Having thus described an embodiment of my invention, I claim:

1. A radiator core composed of a plurality of elements, each comprising a Venturi-shaped tube which flares from the throat outwardly toward the ends, mounting portions at the ends of the tubes being externally shaped to uniform prismatic contour throughout their length, the inside contour of the tubes being so shaped and flared that the inside and outside contours come into exact coincidence in a sharp edge at the

end of the tube, so that when the tubes are laid with their mounting sleeves upon each other, the section formed by the lower inside contour of the upper tube and the upper inside contour of the lower tube, when viewed at a section formed by a plane passing through the axis of the two tubes, will have the form of a true airfoil section with symmetrical upper and lower contours meeting their common chord at the ends of the tubes.

2. A radiator core composed of a plurality of elements, each comprising a Venturi-shaped tube which flares from the throat outwardly toward the ends, mounting portions at the ends of the tubes being externally shaped to uniform prismatic contour throughout their length, the inside contour of the tubes being so shaped and flared that the inside and outside contours come into exact coincidence in a sharp edge at the end of the tube, so that when the mounting sleeves are held together at both ends of the tubes, the cooling air which flows through the core tubes will flow around symmetrical airfoil sections which have their upper and lower contours meeting their common chords at the ends of the tubes.

HAROLD W. CASE.

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