July 26, 1955 G. E. RUCKSTELL 2,713,997

ENGINE COOLING FIN ASSEMBLY

Filed Sept. 1, 1950

Fig. 1

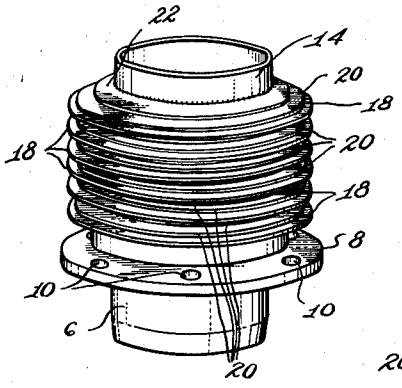


Fig. 2

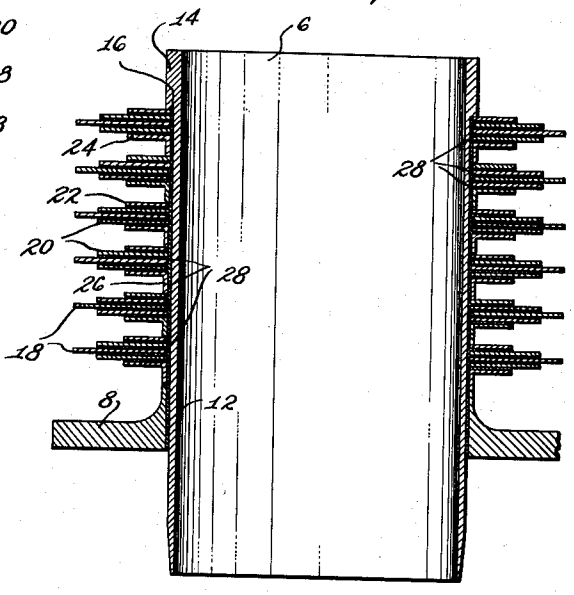
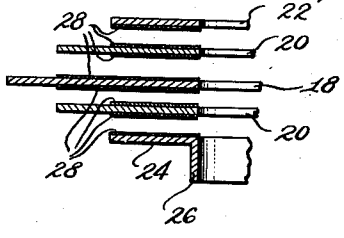


Fig. 3



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ENGINE COOLING FIN ASSEMBLY

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3 Claims. (Cl. 257—262.16)

This invention relates to a cooling fin assembly which, while capable of other uses, is particularly adapted for use as an engine cooling fin and more specifically an aircraft cylinder cooling fin.

An optimum shape for cooling fins is that of a relatively flat taper which diminishes toward the outer edge of the fin. It is impractical to make such fins either by casting or machining. These two methods have been used but they have disadvantages. A casting is relatively heavy and casting practices prevent the production of thin, closely spaced fins. Machining is a time-consuming and costly method. Furthermore, in both of these methods the fins are made of the same material as the engine cylinder or other body to be cooled and the fins do not have the desired qualities of internal heat conduction and surface heat transfer to the desired degree.

Objects of the present invention are to provide a cooling fin assembly in laminated form which is made up of a plurality of ring-like sections of different widths to produce a fin which tapers toward its outer edge; to provide a laminated fin which can be readily assembled from a relatively small number of sections which are duplicated in each fin structure so that the sections can be made up in large quantities in advance of the assembling operation; to provide a laminated cooling fin assembly wherein the fin sections are made of a metal having a high degree of surface heat transfer efficiency and wherein the sections are bonded by a metal having a high degree of heat conductivity, the bonding metal being absent from external fluid heat transfer surfaces.

Other objects and advantages will more fully appear from the following description made in connection with the accompanying drawing.

Fig. 1 is a perspective view of an aircraft engine cylinder with my cooling fin assembly incorporated therewith.

Fig. 2 is an enlarged vertical sectional view through the structure of Fig. 1.

Fig. 3 is a fragmentary sectional exploded view through a portion of one of the fins.

Fig. 2 shows a cylinder sleeve **6** of a type such as is used in aircraft engines. Adjacent the lower portion of the sleeve is a flange **8** having stud apertures **10**, as shown in Fig. 1. The flange is provided as a means of connecting the cylinder to the engine block. Said flange is secured to the sleeve **6** by brazing or other suitable bonding **12**. The upper portion of the cylinder sleeve **6** has its wall thickened, as shown at **14**, providing a shoulder **16**.

One of the cylinder fin units is shown in fragmentary section and in exploded form in Fig. 3. It includes a central ring **18** above and below which are rings **20** of less outside diameter than the central ring **18**. A top ring **22** is shown to be of less outside diameter than its adjacent ring **20**. Below the lower ring **20** is a ring **24** of approximately the same outer diameter as ring **22**. The ring **24** has a cylindrical skirt portion **26** which, as shown in Fig. 2, serves as a spacer relative to the top ring of the fin unit therebelow.

All of the rings have open central portions of the same diameter so that the rings will slip fairly snugly on the reduced diameter of the major portion of the cylinder sleeve **6**.

The several rings **18**, **20**, **22** and **24** are assembled as fin units on the cylinder as shown in Fig. 2 and are bonded together and to the cylinder by means of brazing indicated at **28**. As a result, the brazing will unite the ring assemblies into substantially integral fins which are firmly bonded to the outer cylinder wall.

The stepped arrangement of the rings produces fins which in cross section taper toward their outer edges. Experiments have determined that the most efficient type of cooling fin is one in the form of a relatively flat isosceles triangle with the taper toward the outer edge. The drawing exaggerates the actual thickness of the fins which in practice are so thin that the step from one ring to another is scarcely noticeable and the overall thickness of each fin is considerably less than illustrated.

The material of the rings is a metal which has a relatively high degree of fluid contact heat transfer efficiency and the brazing or other suitable bonding material is preferably a metal or alloy having a high degree of heat conductivity. It is preferred that the rings themselves be made of soft steel having an outer surface which will readily transfer heat from these surfaces to the surrounding air or liquid, as the case may be. While soft steel has this desirable characteristic, it has a low rate of heat transmission or conductivity. In order to overcome this disadvantage the rings making up the fins are bonded with a material such as copper which has a relatively low radiation efficiency but a high degree of efficiency in transmission or conductivity. Thus the desirable characteristics of the two types of metal are combined.

It should be noted that the copper bonding **28** lies between opposed surfaces of the rings but does not cover any of the exposed ring surfaces. The bonding material efficiently carries heat to the outer portions of the rings where it is dissipated from the surface of the rings.

As stated above in the objects of the invention, formation of cooling fins on cylinders or other articles by casting or machining is a costly operation and it is not possible to produce the most efficient types of fin shapes and proportions. A fin formed in accordance with the present invention can be made very cheaply and readily assembled on their supporting structures. It will be seen that there are three kinds of rings in the assembly shown. These three types can be made in any number and taken from stock for rapid assembling on the cylinders. The portions of the rings to be bonded can be coated with copper or other equivalent bonding material prior to assembling and the finished fabrication can be completed by passing the units through an oven. One type of oven for this purpose is the well known type of continuous feed hydrogen fired annealing and brazing oven.

While I have shown and described the invention for use in connection with internal combustion engine cylinders, the fins can be used on cylindrical cylinder heads or upon any other structure wherein it is necessary to dissipate heat from within that structure. It should be understood that any suitable fin and bonding materials can be used as long as the fin material has a high degree of heat transfer efficiency and the bonding material has a high degree of conductivity. It should be further understood that the general structure and shape of the fins is considered an important feature of the invention regardless of the heat transfer or heat conductivity of the material or materials from which the fins are made. Furthermore, various changes can be made in proportions and other details without departing from the spirit of the invention.

I claim:

1. In combination, a hollow tubular metallic body and an annular cooling fin transversely surrounding said body and attached thereto in thermally conductive relationship, said cooling fin comprising three laminations of ferrous sheet material bonded together by copper, said copper covering the entire area of the mutually contacting surfaces of the laminations, a first of the laminations extending a greater distance from the body than the second and third of the laminations, said second and third laminations extending equal distances from the body and being on opposite sides of the first lamination, whereby the fin tapers from its narrowest width at its greatest distance from the body to its widest width adjacent the metallic body.

2. Combination according to claim 1 in which a fourth and a fifth lamination of ferrous material are bonded by copper to the respective surfaces of the second and third laminations, which are remote from the first lamination, said copper covering the entire area of the mutually contacting surfaces of the laminations, said fourth and fifth laminations extending equal but lesser distances from the body than the second and third laminations, respectively.

3. Combination according to claim 1 in which a plurality of said laminated cooling fins are attached in spaced relation along said tubular metallic body.

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