May 14, 1946. A. A. MERRY 2,400,157

BRAZED CYLINDER MUFF

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Fig. 1.

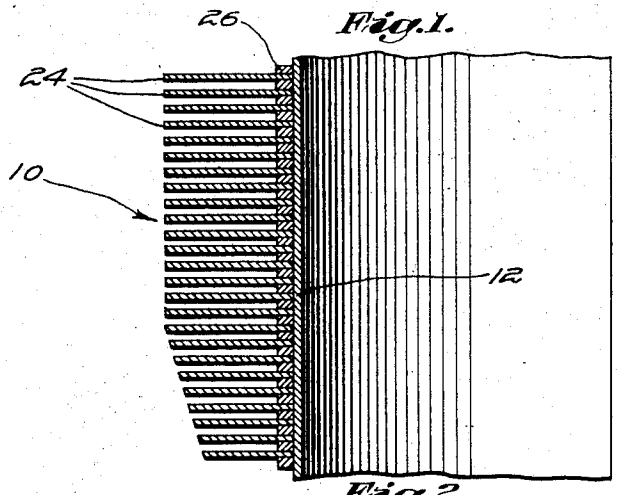


Fig. 2.

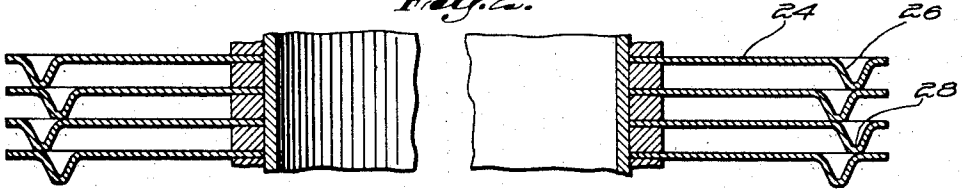


Fig. 3.

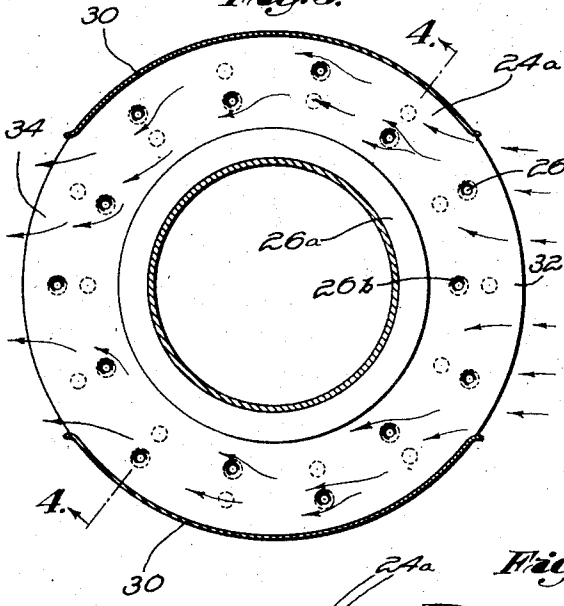


Fig. 5.

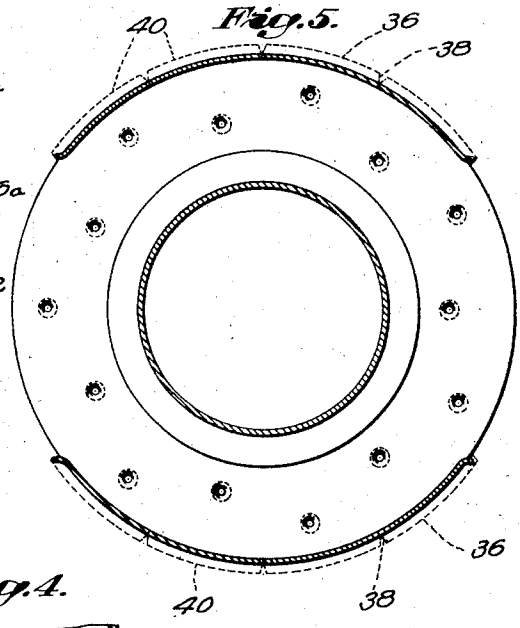
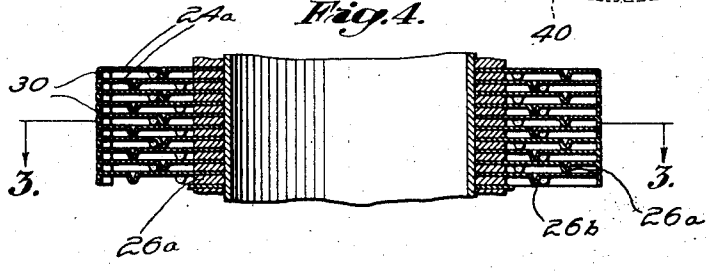


Fig. 4.



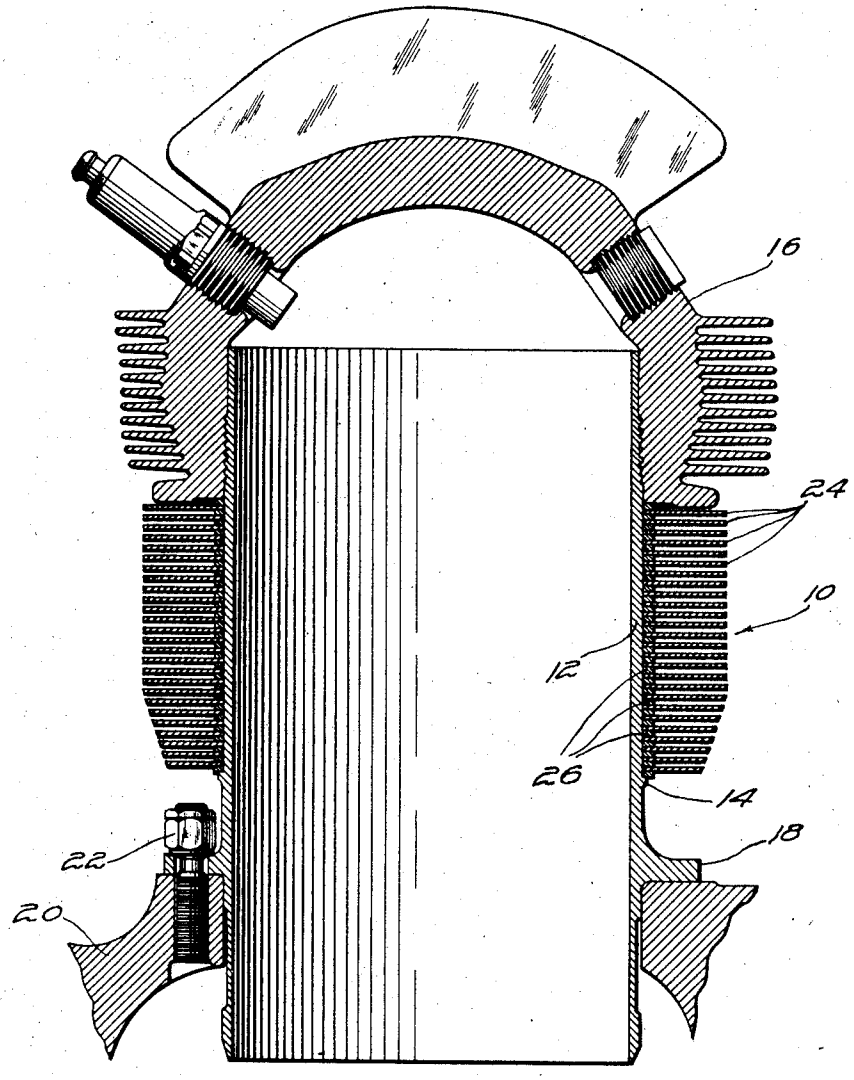
INVENTOR
Arthur A. Merry
BY Charles L. Shelton
Attorney

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Fig. 6.



INVENTOR
Arthur A. Merry
BY Charles L. Shelton
Attorney

Patented May 14, 1946

2,400,157

UNITED STATES PATENT OFFICE

2,400,157

BRAZED CYLINDER MUFF

Arthur A. Merry, West Hartford, Conn., assignor to United Aircraft Corporation, East Hartford, Conn., a corporation of Delaware

Application September 11, 1943, Serial No. 501,982

2 Claims. (Cl. 257—261)

This invention relates to improvements in heat transferring structure and has particular reference to an improved heat radiating structure for internal combustion engine cylinders and to an improved method of making the same.

An object of the invention is the provision of an improved unitary heat radiating structure and more particularly such a structure especially adapted for use on the cylinders of air-cooled engines of the type used in aircraft.

A further object of the invention is the provision of a cylindrical finned muff of the character indicated having improved heat abstracting and radiating characteristics.

A further object of the invention is the provision of a brazed or welded aluminum cylinder muff made from sheet metal stampings.

A still further object of the invention is the provision of such a muff in which the fins are shaped to form the cylinder cowling for directing a cooling stream of air through the fins.

A yet further object of the invention is an improved method of making aluminum muffs for air-cooled engine cylinders.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent from the following description.

In the accompanying drawings, in which like reference characters refer to similar parts throughout, several forms of the invention are shown for purposes of illustration.

In the drawings—

Fig. 1 is a fragmentary sectional view of a cylinder muff embodying the invention;

Fig. 2 is a somewhat similar view on an enlarged scale showing a modified fin construction;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 4 illustrating a further modified construction.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 3 showing a further modified construction; and

Fig. 6 is a sectional view showing the muff of Fig. 1 associated with an engine cylinder.

Referring to the drawings in detail and particularly to Fig. 6, the heat transferring structure is illustrated as a cylinder muff, generally indicated at 10, mounted on the barrel portion 12 of an engine cylinder between a lower annular shoulder 14 and the cylinder head portion 16. The particular cylinder shown is adapted to be mounted on the crankcase 20 of a conventional radial type engine used in aircraft, the usual external flange 18 and the stud and nut connection 22 being provided. It will be understood, however, that the invention is shown in connection with the cylinder of an air-cooled engine for the purpose of illustration only and that it is equally well adapted to any other use in which it is desired to transfer heat from a surface. For example, the cylindrical muff structure shown obviously can be used to cool the cylinders of air compressors, fluid heating or cooling devices and various other devices where such a heat transferring structure would be useful.

The muff 10 comprises a plurality of generally similar centrally apertured thin discs, or fins, 24 spaced apart by somewhat thicker rings, or spacers, 26 which are similarly apertured and extend around the apertures in the discs. These discs and spacing rings are secured together to form a unitary structure as by welding or brazing. The discs 24 which comprise the heat radiating fins of the muff are made of soft aluminum which has good heat conducting qualities, while the spacers 26 are made of a harder, stronger aluminum alloy. When welded or brazed together the rings and the contiguous parts of the discs provide a strong sleeve portion for the muff adjacent the barrel portion 12 of the engine cylinder which, when the muff is shrunk onto the cylinder barrel, provides intimate contact between the sleeve of the muff and the barrel of the cylinder as is required to obtain rapid and uniform heat flow from the cylinder to the muff. The importance of such a firm and uniform connection between the muff and the cylinder will be evident when it is noted that the barrel 12 of the engine cylinder is very thin, as is customary in aircraft engine practice.

The discs 24 comprising the fins and the rings 26 comprising the spacers may be bonded together in any suitable manner, as by welding or brazing. A preferred method of brazing the stack of fins and spacers together consists in rolling out sheet aluminum from the billet with a coating of brazing material adhering to the surfaces of the sheet from which the fins and rings are stamped.

The fins and spacers are stamped out with the apertures therethrough slightly smaller than the outside diameter of the barrel. The muff is then assembled with the apertures in the fins and spacers in vertical alignment, preferably about a mandrel. Pressure is then applied longitudinally to the sleeve of the muff while the muff is heated to brazing temperature, at which the brazing material on the surface of the fins

and spacers fuses. Pressure is maintained on the assembled fins and spacers until the muff has cooled below the brazing temperature. The inside of the sleeve is then finished to accurate dimension to enable it to be heat shrunk onto the cylinder barrel 12 in a usual manner.

As a result, a unitary structure is provided in which the fins 24 which are of soft aluminum conduct the heat very readily from the cylinder side walls with which their inner surfaces are constantly maintained in direct pressure contact, while the spacers 26, being of stronger aluminum alloy, provide the necessary strength to enable the muff to be shrunk onto the cylinder barrel with sufficient pressure to maintain this good heat conducting relationship between the muff and the cylinder.

It will be further noted that as a result of this construction the fins can be spaced more closely together than has been possible with the solid forged type of muff previously used in which the fins were formed by machining grooves in the forging. Moreover, the present construction by utilizing soft aluminum material for the fins enables faster heat conduction from the cylinder wall while permitting as good or even better heat conductivity as the result of the stronger pressure provided by the shrinkage strength of the aluminum alloy spacers between the fins. It will also be noted that considerable saving in material, in cutting tool costs and in labor is effected by the above described method of uniting the stamped aluminum fins and spacers into an integral muff.

In Fig. 2 the fins 24 are provided with indentations, or dimples, 28 located adjacent the outer periphery of the fins. Preferably these dimples are staggered so that the dimple in one plate is offset relative to the dimple in the next adjacent plate. As shown in Fig. 2 the dimples 28 are provided in alternate fins at different distances from the vertical axis of the muff to provide a radially staggered arrangement, although it will be obvious that all of the fins could be stamped with the same die and the staggering could be accomplished by assembling the fins in different angular relation to provide circumferential staggering of the dimples. The dimples have a slightly flattened bottom surface 28 and are of the same depth as the interfin spacing so that each fin will be engaged by the dimple of an adjacent fin. This is especially important where very thin and soft aluminum sheet is used for the fins, serving not only to prevent vibration of the fins but also to support the same adjacent their free outer periphery and prevent sagging.

The provision of the dimples 28 has a further advantage in that it increases the cooling area of the fins presented to the air stream flowing between the latter. The cooling effect of these dimples is considerable since they project into a part of the air stream which otherwise does not contact the fin area.

In Figs. 3 and 4 a modified fin construction is shown in which the heat abstracting effect of the dimples 28 is made even more effective. In this construction the fins 24a are made of very thin sheet stock and the spacers 26a are also made thinner so as to provide very close spacing between the fins. Here it will be noted that the spacers 26a have their radial thickness increased so as to provide the same strong holding pressure on the cylinder barrel. The fins 24a are further provided with integral depending peripheral flanges 30 which depend therefrom a sufficient distance to engage the top surface of the next lower fin and provide a peripheral support for the latter while also closing the interfin space between adjacent fins. Portions of these flanges 30 are cut away at diametrically opposite sides of the cylinder to provide inlet and outlet areas 32 and 34 for the airstream passing across the engine cylinder, the portions of the flanges 30 which are not removed constituting in conjunction with the sleeve of the muff, semi-circular air passage means between the fins. In this modified construction dimples 28a and 28b are provided in the fins in two annular rows arranged in staggered relation as indicated in Fig. 3. Also it will be noted that the dimples of adjacent fins are staggered so that the dimples provide vertical support for the thin fins as well as projecting into the semi-circular air streams passing between the fins in such manner as to cause the air to follow a tortuous path as it passes therebetween.

In Fig. 5 a still further variation of fin construction is shown. In this form of the invention the fins are stamped out with opposed peripheral extensions 36 which are provided with a series of V-shaped notches 38 at spaced points along their periphery to provide a series of ears 40. These ears are then bent at right angles to the plane of the fin to provide fin cowling similar to that described in connection with Figs. 3 and 4, it being noted that in bending the ears 40 the notches 38 become closed and permit the ears to form the smooth peripheral flanges shown in full lines in Fig. 5.

As a result of these improvements it will be evident that a cylinder muff has been provided which is light in weight, utilizes a minimum of material and enables softer, better heat conducting thin material to be used than has hereto been possible with the forged type muff. It will also be evident that this improved construction enables greater heat transfer and better distribution of the cooling air stream due to the provision of dimples in the fins while also enabling the cylinder cowling to be formed integral with the fins and thus also to assist in dissipating the heat. It will also be evident that as a result of the built-up muff construction from sheet metal stampings any desired spacing of the fins is possible, all limitations as regards machining grooves being eliminated. Further, the improved brazed sheet metal construction and the method of forming the fins and spacers into an integral unit by brazing results in a considerable saving in labor and material.

While there are shown in the accompanying drawings several embodiments which the invention may assume in practice, it will be understood that these are shown for purposes of illustration only and that numerous changes may be made in the construction and arrangement of the parts without departing from the scope of the invention as defined in the following claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. In an air-cooled cylinder for an internal-combustion engine, a cylinder barrel and a heat dissipating muff shrunk thereon, said muff comprising a stack of alternately arranged fins and spacers having aligned apertures therein for receiving said cylinder barrel, the fins of said muff being formed of soft aluminum having a high coefficient of thermal conductivity and the spacers being formed of harder aluminum alloy, said

fins and spacers being integrally united at their mutually engaging surfaces to form a sleeve having the inner peripheral edges of both said fins and spacers flush and in direct pressure contact with the outer surface of said barrel with equal pressure throughout the operating temperature range of the engine.

2. In an air-cooled cylinder for an internal-combustion engine, a cylinder barrel and a heat dissipating muff shrunk thereon, said muff comprising a stack of alternately arranged fins and spacers having apertures therein for receiving said cylinder barrel, the fins of said muff comprising preformed sheets of thin soft aluminum having a high coefficient of thermal conductivity and said spacers comprising preformed rings of thicker sheets of harder aluminum alloy, said fins and spacers being integrally united at their contacting surfaces with the apertures in alignment to form a sleeve having the inner peripheral edges of both said fins and spacers in pressure engagement with said barrel throughout the range of engine operating temperature.

ARTHUR A. MERRY.