March 13, 1945. W. B. BRONANDER 2,371,144

COOLING FINS

Filed Nov. 5, 1942 3 Sheets-Sheet 1

Fig. 2,

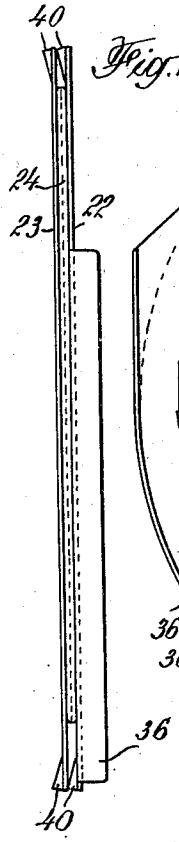


Fig. 1,

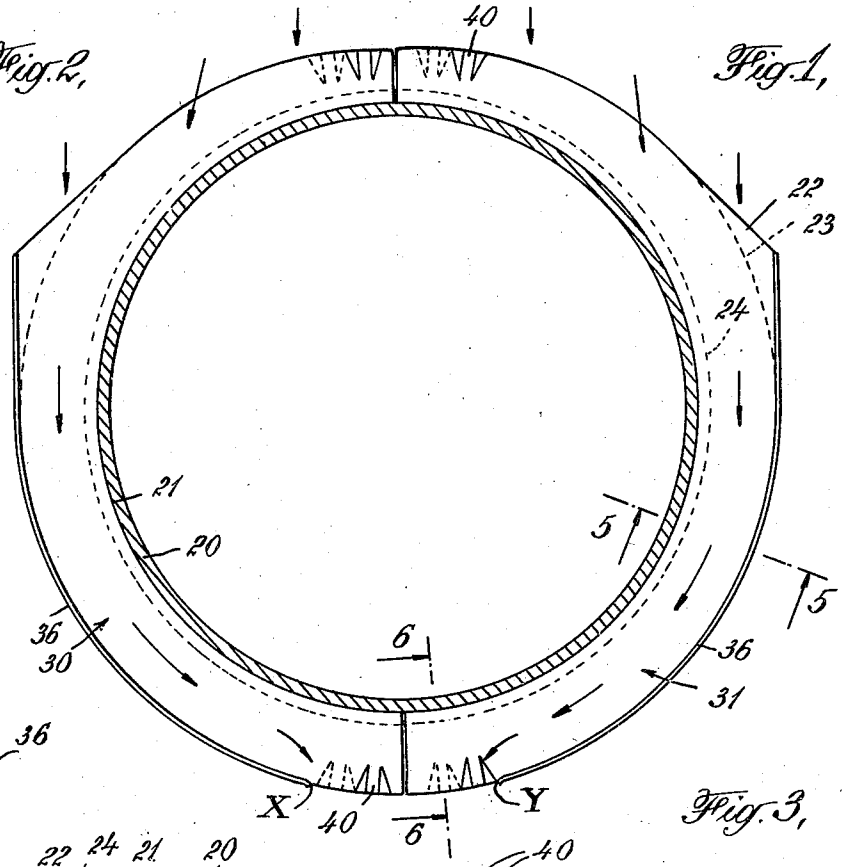


Fig. 3,

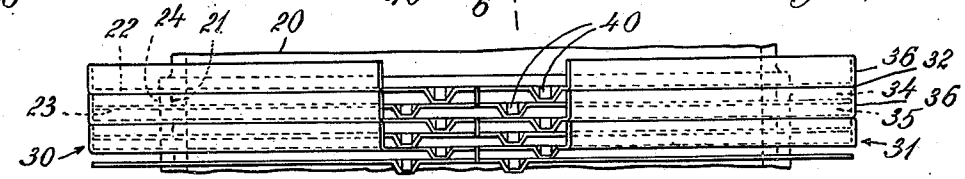


Fig. 5,

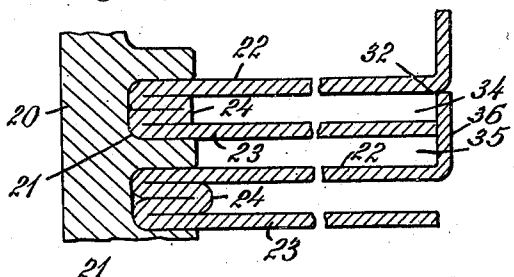


Fig. 4,

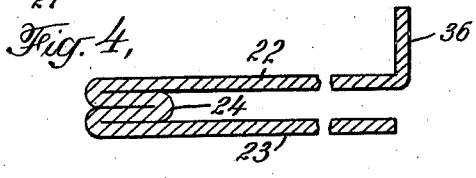
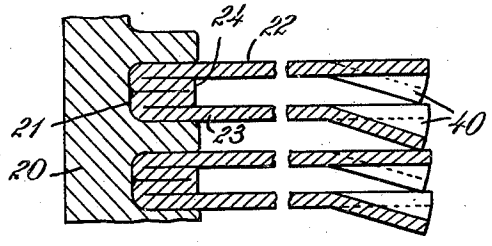


Fig. 6,



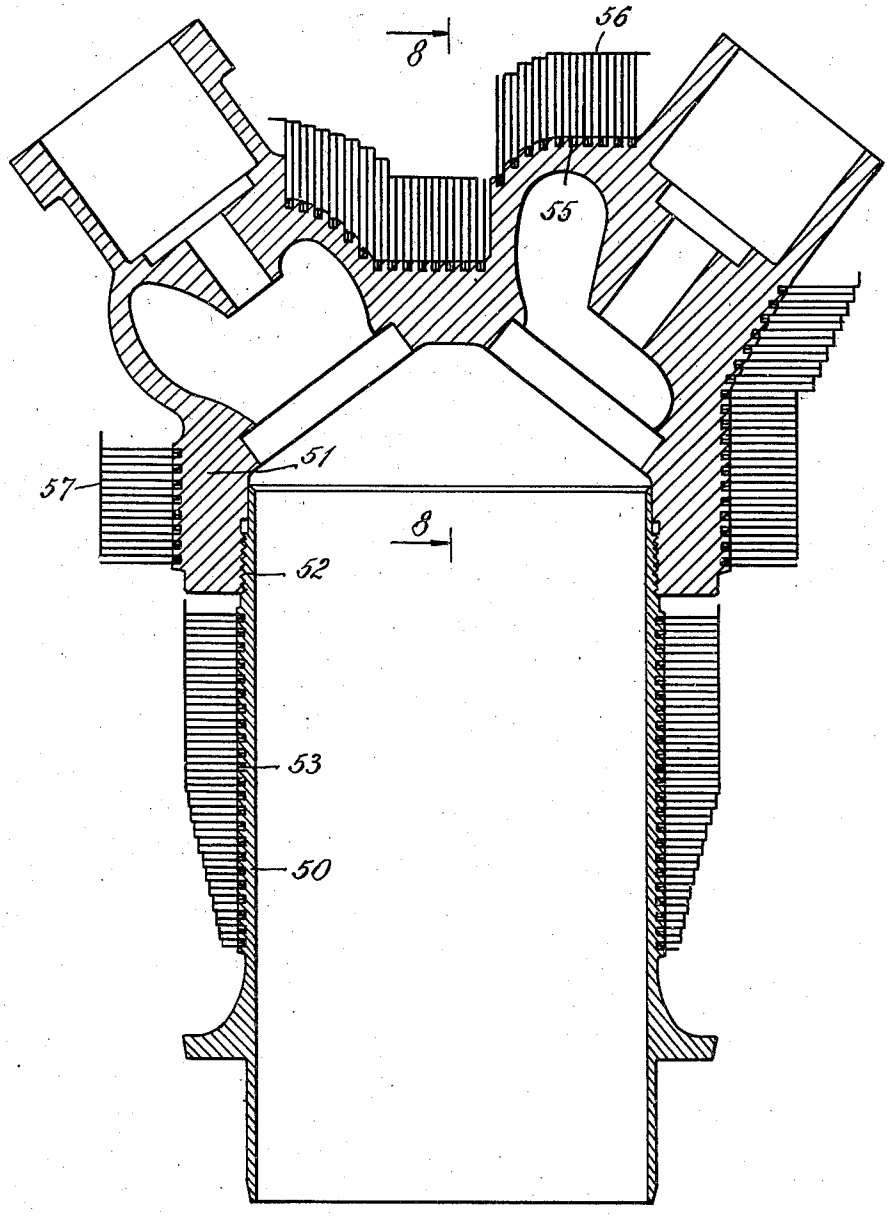
INVENTOR.
Wilhelm B. Bronander
BY
Luther W. Hawley.
ATTORNEY

March 13, 1945. W. B. BRONANDER 2,371,144

COOLING FINS

Filed Nov. 5, 1942 3 Sheets-Sheet 2

Fig. 7.



INVENTOR.
Wilhelm B. Bronander
BY
Luther W. Hawley.
ATTORNEY

March 13, 1945. W. B. BRONANDER 2,371,144

COOLING FINS

Filed Nov. 5, 1942 3 Sheets-Sheet 3

Fig. 8,

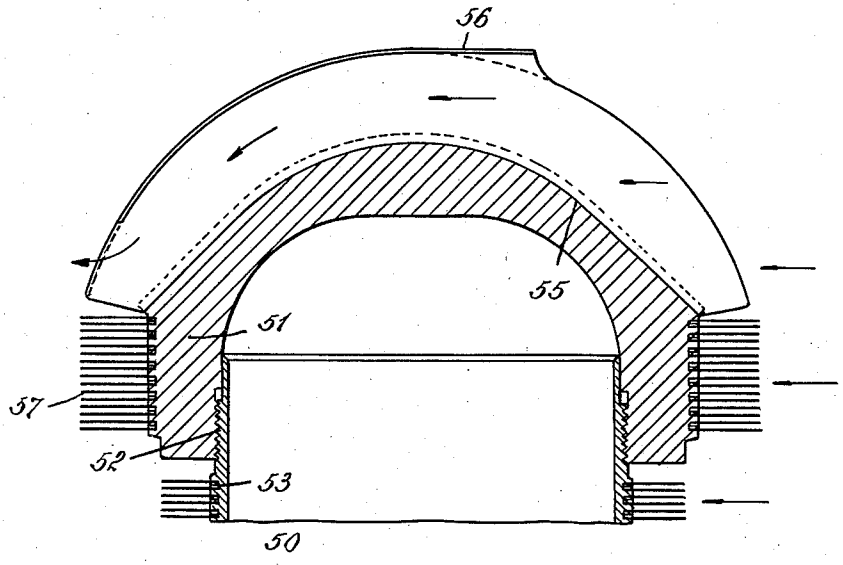


Fig. 9,

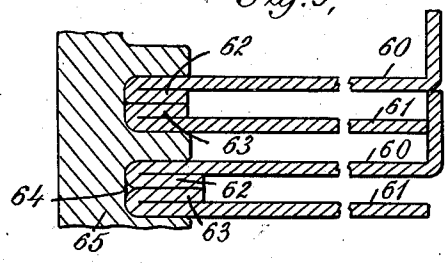
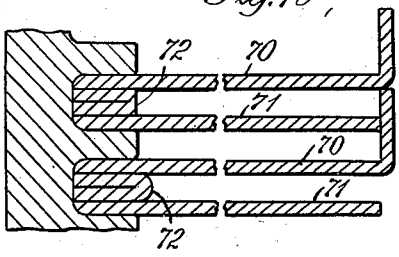


Fig. 10,



INVENTOR.
Wilhelm B. Bronander
BY
Luther W. Hawley
ATTORNEY

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UNITED STATES PATENT OFFICE

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COOLING FIN

Wilhelm B. Bronander, Montclair, N. J.

Application November 5, 1942, Serial No. 464,628

4 Claims (Cl. 257—261)

This invention relates to cooling fins.

It is the usual practice to form cooling fins integral with the part to be cooled or to braze or solder fins thereto. The casting of integral fins involves the use of expensive patterns and fins so cast are brittle and easily broken. Furthermore, the casting process limits materially the number of fins per unit of length since they must be spaced apart materially in order to be cast. Brazing, welding or soldering fins to the part to be cooled is expensive and time consuming and does not, as a rule, result in a rigid and efficient heat conducting joint.

It has been found that air cooling with cooling fins is effective on the surface of the element to be cooled on the side nearest the air inlet or air impact, but that the remote surfaces are not effectively cooled since the air is deflected outwardly by the surface first engaged or contacted. This is particularly true of engine cylinders, cylinder heads, and like parts.

At the present time, under war conditions there is an ever increasing demand for aircraft engines with higher compression, more power, and more speed. With higher compression great heat is developed and greater heat dissipating capacity must be provided. In aircraft engines, therefore, one of the big problems is the effective cooling of the engine and the power of the engine is limited by the capacity of the cooling means to dissipate the heat. Deflectors carried by engine parts have been used to deflect the air to parts remote from the air inlet or inflow but such deflectors are spaced from the cooling fins and do not confine the air to passages between the fins. The deflectors themselves are more effectively cooled than the engine.

Comparatively thin fins of metal, such as aluminum, have been used to some extent, but such fins, due to the ductility of the metal, are easily bent or warped out of shape, thus impeding the passage of air therebetween.

This invention has for one of its objects to provide a cooling fin structure that is simple and practical and can be economically manufactured and secured to the part to be cooled.

Another object of the invention is to provide a simple and practical connection between the fin and cylinder or member to which the fin is applied, so constructed that the fin will be firmly and rigidly anchored and the connection will effectively conduct the heat.

Another object of the invention is to provide a cooling fin and air deflector so designed that the deflector will not only deflect the air and confine it to the passages between the fins but will serve to increase the radiating and heat dissipating capacity of the fins.

Another object of the invention is to provide simple and practical means for maintaining cooling fins in proper spaced relation.

Another object of the invention is to provide simple and practical means for deflecting the cooling air as it passes around the element to be cooled and between the fins so that the portion of the element or member on which the fins are mounted, remote from the portion first engaged by the air, will be effectively cooled.

Further objects of the invention will appear from the following specification taken in connection with the drawings which form a part of this application, and in which

Fig. 1 is a plan view of a member to be cooled having fins mounted thereon constructed in accordance with the invention;

Fig. 2 is an edge view taken at right angles to Fig. 1;

Fig. 3 is an elevational view of the structure shown in Fig. 1;

Fig. 4 is a sectional elevation of one of the fin strips prior to its application to the cylinder or other member to be cooled;

Fig. 5 is a sectional elevation taken substantially on line 5—5 of Fig. 1 and on an enlarged scale;

Fig. 6 is a sectional elevation on an enlarged scale taken substantially on line 6—6 of Fig. 1;

Fig. 7 is a vertical sectional elevation of a cylinder and cylinder head having mounted thereon fins constructed in accordance with the invention;

Fig. 8 is a vertical sectional elevation at right angles to Fig. 7 and taken substantially on line 8—8 of Fig. 7, this view being broken away;

Fig. 9 is a view similar to Fig. 5 but illustrating a slightly modified form of fin structure; and

Fig. 10 is a view similar to Figs. 5 and 9 but illustrating another modification of the fin structure;

The invention briefly described comprises the combination of a member to be cooled, such as a cylinder, cylinder head or like part, having grooves therein, and cooling fins secured in the grooves and including or having means incorporated therein arranged to engage other fins and maintain the fins in proper spaced relation. Deflecting means are provided on the fins whereby the air is confined and directed to remote surfaces of the part to be cooled and these means

are preferably integral with the fins and thus increase the capacity for heat dissipation.

In the structure illustrated this is accomplished by providing certain of the fins with means arranged to overlap certain other fins, thereby confining the space between certain portions of the fins and the wall on which the fins are mounted, thus providing a passageway for the air passing between the fins and causing this air to be deflected inwardly against the portions of the wall remote from the portions initially engaged or impacted by the air. The fins are preferably secured in the grooves by compressing material disposed therebetween, thereby forcing the fins laterally into firmly anchored position against the walls of the grooves.

Further details of the invention will appear from the following description.

The fin and fin structure involving the invention may be mounted on any member or element to be cooled such, for instance, as a cylinder wall, cylinder head, and so forth.

In the form of the invention illustrated particularly in Figs. 1 to 6 inclusive, there is shown a member having a wall 20 provided with a plurality of grooves 21 which are usually disposed either in spiral form or in parallel relation.

In the form of the invention shown in Fig. 1, the fins are formed of a strip of material which is bent or formed in any suitable manner, as by extrusion, into the shape shown in Fig. 4. In this figure the fin comprises walls 22 and 23 which are preferably substantially parallel and an intermediate connecting portion 24 which takes the form of an inverted V. The fin itself, including the two walls and connecting portion, is W shaped. It will be noted that the wall 22 is longer than the wall 23 for reasons hereinafter explained.

In Fig. 1 the fin structure mounted in each peripheral or circumferential groove in the wall 20 comprises two semi-circular sections 30 and 31. These sections are formed by bending the strips above described into a semi-circumference. These half sections are then placed in a groove and the intermediate portion 24 between the fin walls 22 and 23 is compressed as shown at the upper portion of Fig. 5. As this material 24 is compressed it will be forced toward the bottom of the groove, thereby exerting a lateral pressure on the walls 22 and 23 and forcing these walls into tight and firm gripping engagement with the walls of the groove.

For a portion of its length each fin section 30 and 31 has the outer end of the wall 22 thereof bent at right angles to the remaining portion of the wall. These bends are made before the fins are secured in the grooves and do not interfere with the caulking or tamping of the portion 24 since the fins are successively caulked and the flange of one fin overlaps the next fin. This bent portion forms a flange which overlaps the shorter wall 23 of the next adjacent double walled fin, after the fins have been secured in place, and engages, as shown at 32, the longer wall 22 of the next adjacent fin. The flange thus forms passage chambers 34 and 35 bounded by the fin walls and by the outer wall of the member 20. As shown in Fig. 2, the cooling air enters at the top of the figure and passes around the wall, being deflected by the flanges 36 so that the cooling air will engage the portions of the wall 20 remote from the portion engaged by the entering air. The cooling air leaves the fins and flanges 36 at the points X and Y shown in Fig. 1.

The flanges, in addition to deflecting the air, act as heat radiating or dissipating surfaces, thus materially increasing the radiating capacity of the engine fins.

In order to maintain the fin walls in proper spaced relation and preferably in parallel relation to each other so that the passage of air therebetween will not be impeded, the walls are provided with indented or offset portions 40 which are preferably staggered, as shown in Fig. 3. These offset portions engage the next adjacent walls, as shown in Fig. 6, and since they extend inwardly from the outer edges of the fins a relatively short distance, the passage of air between the fins is not impeded.

Fig. 7 illustrates an engine cylinder 50 having a cylinder head 51 mounted and secured thereon as by the threaded connection 52. The cylinder head may be formed of aluminum.

The cylinder wall 50 is circumferentially grooved, as shown at 53, and fins are secured thereto in the manner hereinabove described and illustrated in Figs. 1 to 6 inclusive.

The cylinder head 51 is provided with grooves 55 and fin sections dimensioned to fit the grooves 55 are bent longitudinally to conform to the contour of the grooves. These fins are then secured therein by compressing the material disposed between the fin walls in the manner above described and have deflecting flanges 56 which are formed before the fins are anchored and extend over the outer ends of certain of the fin walls so that these ends will overlap other walls and contact still further adjacent walls, in the manner shown in Fig. 5. The fins 57 shown in Fig. 7 which are disposed around the cylindrical portion of the head 51 are preferably mounted in the manner shown in Fig. 1.

Fig. 9 illustrates a slightly modified form of fin structure in which the two walls 60 and 61 are formed of separate strips. One edge of each strip is bent back on itself, as shown at 62 and 63, and the portions 62 and 63 are disposed in abutting relation and folded edges of the fin walls 60 and 61 are positioned in the groove 64 formed in the wall 65 of the part to be cooled. After the fins are thus positioned in the groove the material formed by the parts 62 and 63 is compressed, thereby forcing this material toward the bottom of the groove and forcing the walls 62 and 63 laterally into tight gripping engagement with the walls of the groove 64.

As in the form of the invention illustrated in Fig. 5, a portion of each wall 60 is formed longer than or extends beyond the outer end of the wall 61. Before the fin walls have been anchored in the groove this extending portion is bent laterally and the flange thus formed overlaps one fin wall and engages the next one.

In Fig. 10 a three piece construction is illustrated comprising flat strips or walls 70 and 71 and an intermediate folded portion 72 positioned between the walls 70 and 71. This intermediate portion 72 is depressed to anchor the walls in the groove. The flanges are formed in the same manner as that above described.

The fins may be of any desired width and, as shown in Fig. 7, may be tapered in width since the inner ends of the cylinders do not require as great an amount of radiation as the outer ends thereof.

Although certain specific embodiments of the invention have been particularly shown and described, it will be understood that the invention is capable of modification and that changes in

the construction and in the arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention, as expressed in the following claims.

What I claim is:

1. In combination, a member to be cooled having a plurality of grooves therein arranged side by side, a plurality of double walled fins secured in said grooves, the space between the portions of said double walls disposed in the grooves being filled in by material compressed to secure the fin walls in tight gripping engagement with the walls of the groove, one wall of certain fins being longer than the other wall and being bent laterally to form a flange extending over the shorter wall of the fin on one side thereof disposed in the next adjacent groove, whereby each unit can be anchored by compressing material between the walls without interference of the flange, said flange engaging the outer edges of a plurality of fins and confining the spaces therebetween.

2. In combination, a member to be cooled having a plurality of grooves therein arranged side by side, a pair of fin walls secured in each groove, the space between the portions of said fin walls disposed in the grooves being filled in by material compressed to secure the fin walls in tight gripping engagement with the walls of the groove, one fin wall in each groove being longer than the other wall and being bent laterally to form a flange extending over the shorter wall of the fin on one side thereof disposed in the next adjacent groove, whereby each unit can be anchored by compressing material between the walls without interference of the flange, said flange engaging the outer edges of a plurality of fins and confining the spaces therebetween.

3. In combination, a member to be cooled having substantially parallel grooves therein, fin units secured in said grooves, each unit comprising a pair of parallel walls, and material disposed between the inner edges of the walls and compressed to force the fin walls into firm engagement with the walls of the groove, one fin wall of certain of the fin units being bent laterally in a direction away from the other fin wall to form a flange engaging the nearest fin wall of the next adjacent unit, whereby said compressible material between the walls of said unit can be engaged and compressed, said flange engaging the outer edges of a plurality of fin walls confining the spaces therebetween.

4. In combination, a member to be cooled having substantially parallel grooves therein, fin units secured in said grooves, each unit comprising a pair of parallel walls, and material disposed between the inner edges of the walls and compressed to force the fin walls into firm engagement with the walls of the groove, one fin wall being longer than the other wall and being bent laterally away from said wall to form a flange adapted to extend over the shorter wall of the next unit.

WILHELM B. BRONANDER.