June 22, 1965 C. S. SIMPELAAR 3,190,352

RADIATOR TUBE PROTECTOR

Filed Aug. 23, 1962

Fig. 1.

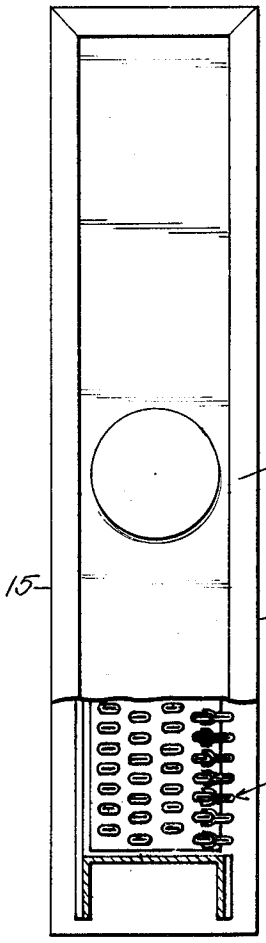


Fig. 2.

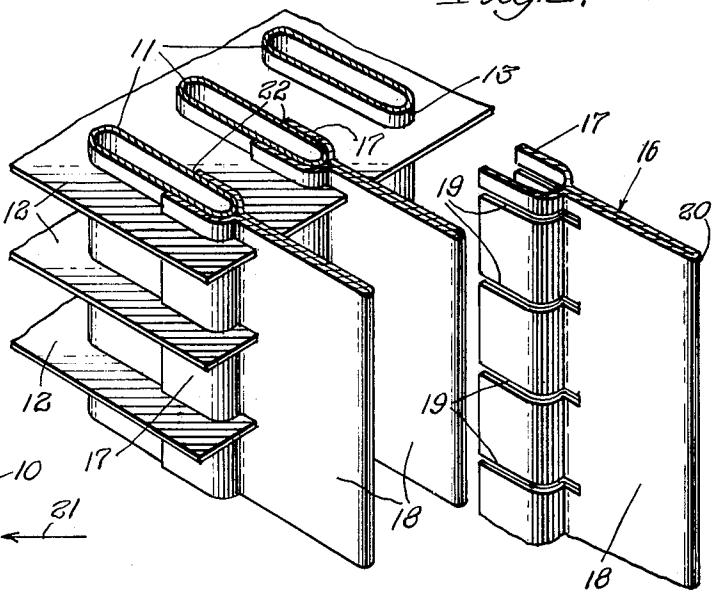


Fig. 3.

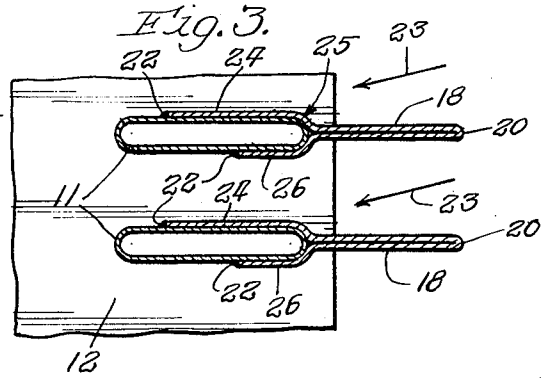
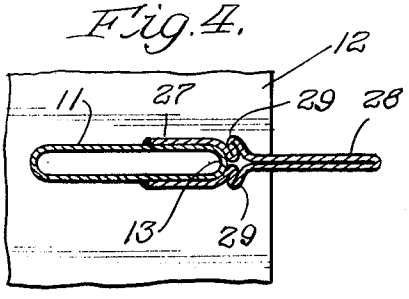


Fig. 4.



INVENTOR.

Clyde S. Simpelaar,

BY

Hofgren, Brady, Wegner, Allen & Stellman, Attys.

United States Patent Office 3,190,352 Patented June 22, 1965

3,190,352

RADIATOR TUBE PROTECTOR

Clyde S. Simpelaar, Racine, Wis., assignor to Modine Manufacturing Company, a corporation of Wisconsin

Filed Aug. 23, 1962, Ser. No. 218,976
6 Claims. (Cl. 165—134)

This invention relates to a protector for protecting against solid particles abrasion of the leading side of each of a plurality of tubes of a radiator core adapted to have cooling air blown toward these leading sides and between the tubes.

The radiator cores of internal combustion engines, particularly of the type used in heavy duty earth moving equipment, each are cooled by a fan that blows air through the core from the inner surface to the outer surface. In such earth moving equipment, particularly where earth with entrapped stones is raised as by a shovel, the air stream from the fan normally contains abrasive particles that tend to wear away the tubes, particularly at their leading sides which are contacted first by the air stream and the entrained particles. The protector of this invention provides protection for these radiator core tubes to prevent this abrading and wearing away.

One of the features of this invention is to provide an improved protector for the leading side of each of a plurality of tubes of a radiator core adapted to have cooling air blown toward the leading sides and between the tubes in which the protector provides practically complete protection without substantial interference with heat transfer between the tubes, fins and the cooling air stream.

Other features and advantages of the invention will be apparent from the following description of certain embodiments thereof as illustrated in the accompanying drawings. Of the drawings:

FIGURE 1 is a plan view partially broken away and in section of a radiator including a core containing a plurality of tubes, the first row of which is supplied with protectors according to this invention.

FIGURE 2 is an enlarged fragmentary perspective view with one portion exploded of a radiator core equipped with protectors of the type illustrated in FIGURE 1.

FIGURE 3 is an enlarged fragmentary horizontal sectional view through a pair of tubes equipped with protectors illustrating a second embodiment of the invention.

FIGURE 4 is a view similar to FIGURE 3 but illustrating a third embodiment of the invention.

In the embodiment of FIGURES 1 and 2, the radiator 10 is provided with a plurality of vertical tubes 11 of the customary type each of oblong cross-section with the longitudinal axis of each oblong extending generally from front to rear of the radiator. The tubes of the radiator are connected by the usual spaced fins 12 for aid in heat transfer with the cooling fluid, usually air, forced between the tubes 11 and fins 12 as by the customary cooling fan (not shown).

In this type of construction, particularly when used on tractors or the like, employed in dirty atmospheres as encountered by earth moving equipment, the cooling fan that blows air between the tubes 11 and fins 12 also blows solid foreign particles such as rocks so that the rocks impinging on the leading sides 13 of the tubes 11 tend to wear the tubes away beginning at these leading sides. The protectors of the present invention therefore protect the tubes at these critical areas. As shown in FIGURE 1, the tubes of the typical radiator 10 are arranged in rows extending from the inner side 14 to the outer side 15 of the radiator. The inner row of tubes is provided with the protectors.

As shown in FIGURE 1 and in enlarged detail in FIGURE 2, each protector 16 is generally Y shape with a sleeve 17 embracing each tube 11 at the leading side and a forwardly projecting fin 18 extending upstream of the cooling air flow. In the preferred embodiment the assembly of fins 18 are substantially parallel to each other, as illustrated in FIGURES 1, 2 and 3, so that they aid in directing the flow of air and entrained particles straight through the radiator core. The sleeves 17 by closely embracing relatively large areas of the sides of the tubes 11 not only protect these sides at the leading edge 13 but do so without substantial interference with heat transfer from the tubes to the air stream. As can be seen, most clearly in FIGURE 2, there are substantially no spaces between the sleeve 17 and the tube 11. In addition, the protector 16 contacts closely the fins 12 and the protector is provided with spaced slots 19 engaging the fins 12.

In the preferred construction the protector 16 is constructed of sheet metal folded on itself at the fold line 20 with the edges spaced apart to form the sleeve portion 17 and the part of the sheet metal forming the fin 18 being arranged in contact with itself.

With this construction air blown through the radiator 10 performs not only the usual cooling function by contact with the fins 12 and tubes 11 but also is more efficient in its cooling because of the provision of the additional fins 18. Furthermore, these fins 18 aid in directing the air flow and entrained particles through the radiator core. Then the particles instead of impinging on the tubes 11, particularly in the areas at and around the leading sides 13, actually impinge on the sleeve 17 so that these are worn instead of the tubes. Actual tests have shown that the tubes 11 do not begin to wear until substantially all of the sleeve 18 is worn away. When this occurs, the protector can of course be replaced with a new one.

In constructing a radiator core according to this invention the protectors are bonded on the tubes as in the normal bonding operation, as indicated at 22. This of course is normal radiator construction procedure, as the tubes 11 and fins 12 are normally bonded to each other.

Actual observations have shown that air flow from the cooling fan is not always exactly parallel as suggested by the arrows 21 of FIGURE 1. Thus, with a counterclockwise rotating fan viewed when facing the rear or the engine side maximum erosion occurs at the positions equal to two and seven o'clock on a clock face. In any event, at various positions the air flow is not exactly parallel but is somewhat angled, as indicated by the arrows 23 in the embodiment of FIGURE 2. Thus, in this embodiment one side 24 of the sleeve 25 is made larger than the other side 26 so as to protect a larger area of the tube. In this type of construction the long leg 24 would be located on the right-hand side of the upper half of the tube when facing the rear or inner side of the radiator and would be located on the opposite side for the bottom half of the tube. The center line which divides the upper and lower half of the tube would be substantially coincident with the center of rotation of the fan.

In the third embodiment illustrated in FIGURE 4, the sleeve 27 is provided with a thickened portion on opposite sides of the fin 28 with the thickened portion being formed of a fold 29 in the sheet metal. As can be seen from an inspection of FIGURE 4 each fold 29 provides three layers of metal that must be worn away before exposing the leading side of the tube 11. The folds 29 which provide the thickened portions have their outer edges extending to approximately the outer extremities of the leading side 13 of the tube.

Having described my invention as related to the em-

bodiments shown in the accompanying drawing, it is my invention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A vehicle radiator core, comprising: a plurality of spaced coolant tubes subjected when in use to a cooling air stream carrying entrained solid particles, the air stream flowing through said core from an upstream side of the core to a downstream side; and a tube protector for each tube comprising a sleeve closely abutting each said tube on the air receiving upstream side of said tube and a fin integral with each said sleeve extending upstream to said air stream.

2. The radiator core of claim 1 wherein said protector fins are substantially parallel to each other and at an angle to said air stream so that each fin protects the next angularly downstream tube.

3. The radiator core of claim 2 wherein each said sleeve comprises a pair of sleeve sides closely abutting its tube sides, the one of said pair of sleeve sides that is upstream of said air stream being of larger area than the other of said pair of sleeve sides to protect a correspondingly larger area of its tube.

4. The radiator core of claim 1 wherein said protector comprises a strip of sheet metal folded on itself to form

said fin with edge portions of said strip beyond said fin comprising said tube abutting sleeve.

5. The radiator core of claim 1 wherein each said protector sleeve side is provided with a thickened portion adjacent its fin, each said portion extending from said fin substantially to the outer extremity of said upstream side of its tube.

6. The radiator core of claim 1 wherein said protector fins are substantially parallel to each other and at an angle to said air stream so that each fin protects the next angularly downstream tube, each said sleeve comprising a pair of sleeve sides closely abutting its tube sides, the one of said pair of sleeve sides that is upstream of said air stream being of larger area than the other of said pair of sleeve sides to protect a correspondingly larger area of its tube, said protector comprising a strip of sheet metal folded on itself to form said fin with edge portions of said strip beyond said fin comprising said tube abutting sleeve sides.

References Cited by the Examiner

UNITED STATES PATENTS

1,782,829	11/30	Nash et al.	165—134
2,205,984	6/40	Kromas	165—148
2,774,384	12/56	Wallace	165—134 X
2,795,402	6/57	Modine	165—134
2,902,264	9/59	Schick et al.	165—134

CHARLES SUKALO, *Primary Examiner.*