May 28, 1968 D. L. SPAULDING 3,385,355

MOTOR-VEHICLE-RADIATOR TUBE-AND-FIN ABRASION-GUARD

Filed Sept. 1, 1967

FIG. 1

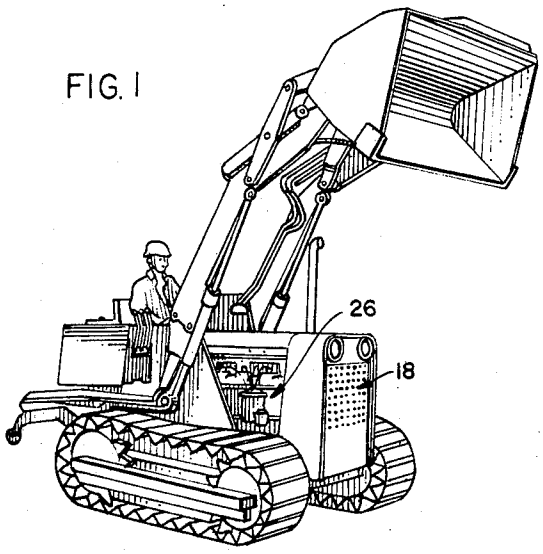


FIG. 2

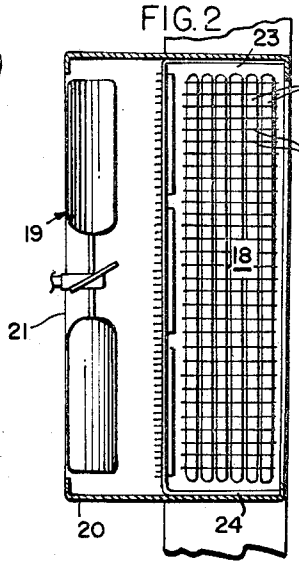


FIG. 5

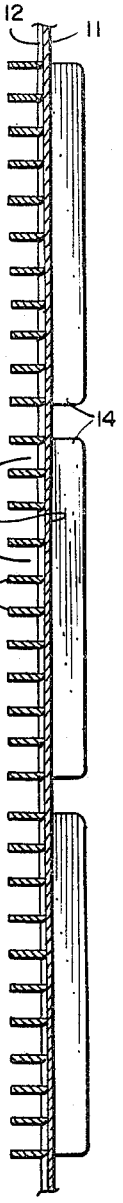


FIG. 3

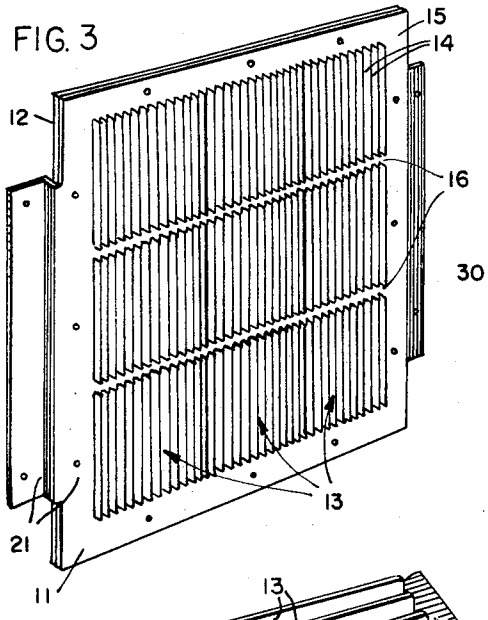


FIG. 6

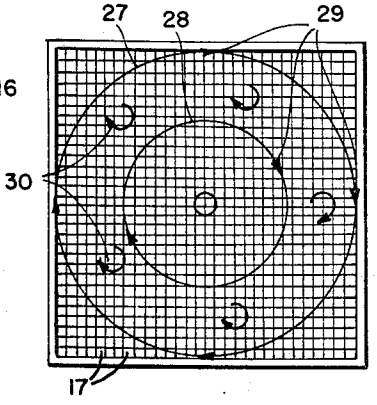
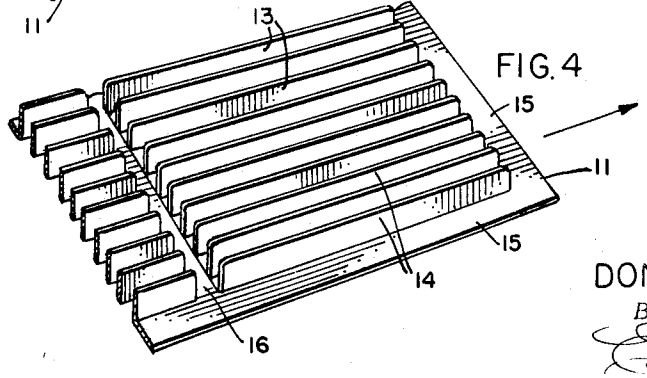


FIG. 4



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United States Patent Office 3,385,355 Patented May 28, 1968

3,385,355

MOTOR-VEHICLE-RADIATOR TUBE-AND-FIN ABRASION-GUARD

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Filed Sept. 1, 1967, Ser. No. 674,032
2 Claims. (Cl. 165—134)

ABSTRACT OF THE DISCLOSURE

The essential concept of this invention involves a shallow-depth lattice-type structure defiining a plurality of comparatively small parallel openings and having means for attachment of the structure to the air-flow entrance-face of a conventional motor-vehicle radiator to so deflect the particulated matter carried by the incoming air-flow as to prevent its direct impingement against the tubes and fins of the radiator.

This invention relates to an abrasion-guard for radiators required for the cooling systems for high-powered heat engines driving equipment involved in earth-moving operations.

Motor-driven vehicles involved in earth-moving operations generally are driven by high-powered diesel engines. These engines require sizeable tube-and-finned radiators with fan-driven air-flow therethrough at a comparatively high velocity to maintain the engine coolant at operative temperatures. Radiators used on certain types of earth-moving equipment are subject to excessive deterioration by reason of the abrasion of the tubes and fins. This is caused by the direct and constant impingement on these tubes and fins of particulated matter carried in the fan-forced air flow through the radiator.

This problem arises from reasons inherent in the structuring and operation of earth-moving equipment. One of the reasons is the fact that the radiators are cooled by a fan blowing the air through the radiator from the back or inner face rather than through the front face. Another of the reasons is that with this earth-moving equipment the air-flow created by the fan is laden with particulated matter which, naturally, is impinged against the radiator tubes and fins, in the event they are not protected.

As for the first of these reasons, it is a well-known fact that the air-flow from a propeller-type fan tends to swirl the air as it leaves the fan blades. In such earth-moving equipment the fan operates at usually high r.p.m. in relation to the designed maximum fan-tip speed; normal maximum tip speed is approximately 15,000 feet per minute.

As for the second of these reasons, the scooping up of earth from one place and moving it away to be dumped in another place naturally results in the ambient air-flow becoming laden with dust particles and small, and sometimes large, pebbles and other hard substances. Such particulated matter is drawn into the air stream created by the fan and shot with considerable force against the tubes and fins if not shielded in some way. Such particulated-matter-laden air-flow attains such a swirling impingement against the tubes and fins as tends to gradually wear them away to the extent, at times, of actually puncturing the tubes and the fins, thereby causing loss of coolant.

Various attempts in the past have been made to protect the tubes and fins from such abrasion. These past endeavors have focused on either a thickened wall of the fan-facing edge of the tubes or extra strips of metal superimposed over such fan-facing tube edges. The fins, on occasion, have been made from metal a bit thicker than

required for other types of heat exchangers. However, either of these provisions have been expensive and the results have not been too satisfactory. This has been the due partly to a lower rate of heat dissipation that is hindered by such modified tubes.

The main objects of this invention are; to provide an improved structuring of an abrasion-guard for use with radiators required for dissipating the heat from the collant for high-power heat-engines driving heavy, earth-moving equipment; to provide an improved structuring of an abrasion-guard of this kind having transversely-arranged groups of narrow louvers disposed at right angles to define small-size, shallow channel openings capable of so deflecting the incoming, particulated-mater-laden air-flow as to prevent direct impingement of the particulated matter against the tubes and fin, and to provide an improved abrasion-guard of this kind of such simple construction as to make highly economical its manufacture and marketing and exceedingly effective and durable the use thereof.

In the adaptation shown in the accompanying drawings;

FIG. 1 is a miniature, perspective view of one type of earth-moving equipment the radiator tubes and fins of which are most subject to abrasion by the particulated-matter-laden air-flow through the radiator;

FIG. 2 is a diagrammatic side view of an engine, radiator and fan, used in the equipment such as shown in FIG. 1 and mounting an abrasion-guard constructed in accordance with this invention;

FIG. 3 is a reduced, perspective view of a nine-unit abrasion-guard constructed in accordance with this invention;

FIG. 4 is a fragmentary, perspective segment of one of the plates illustrating how portions thereof are upset from the face of the plate to form louvers;

FIG. 5 is a side elevational view of the two-plate abrasion-guard constructed in accordance with this invention; and

FIG. 6 is a diagrammatic illustration of how an abrasion-guard, constructed in accordance with this invention, tends to protect the radiator from abrasion deterioration.

The herein shown abrasion-guard, for use with earth-moving equipment E, embodying the foregoing concept, comprises a pair of back-to-back grid-type plates **11** and **12** each formed with a plurality of groups **13** of louvers **14** struck-out from the plates and spanning marginal sections **15** and intersecting ribs **16**, the two plates being bonded together back-to-back to dispose the louvers **14** on the respective plates **11** and **12** at right angles to each other to form the battery of small, rectangular-shaped channels **17** (FIG. 6). These plates are designated as "grid-type" elements since a "grid" usually is referred to as a grating with parallel bars.

The plates **11** and **12** are identical in size and formation. Each is stamped out by the same series of dies, to the point of having the same number of groups **13** of the louvers **14**. In the specimen shown in FIG. 3 there are nine such groups **13**. As will be noted from FIGS. 2, 3 and 5 the louvers **14** are disposed normal to the respective plates **11** and **12**. The number of such groups **13** and the number of louvers **14** in each group will vary depending upon the over-all dimensions of the plates required for structuring an abrasion guard for a particular size and/or shape of radiator.

The width and depth of the louvers **14** is not necessarily critical. The plates **11** and **12** would be closely in the range of .0418" thick. The louvers would be approximately ⅜" in width or depth.

Two such identical plates **11** and **12** are superimposed on each other back-to-back and bonded together by spot welding, as shown in FIG. 3. When so superimposed the plates **11** and **12** are set with the groups **13** of louvers **14**

disposed oppositely-outward at right angles to each other. Thus, the two such plates define these comparatively small rectangular-shaped openings **17**. Such a formation and arrangement of these two plates well may be designated as a "lattice" type structure for the reason that "lattice" is defined as metal or wood openwork with crossing strips or bars.

Such an abrasion guard, as above described, is structured for use with an engine-cooling fan and radiator and is mounted closely adjacent the inner or rear face of the radiator **18** to direct the air-flow from the rear of the radiator **18** out through the front thereof. The fan **19** is mounted within a radiator shroud **20**. The radiator **18** and shroud **20** are more or less rectangular in exterior contour. However, the shroud **20** has a circular air-flow opening of a diameter slightly larger than the diameter of fan **19** (FIG. 2). The abrasion-guard is secured to the radiator **18** by some suitable bracket such as shown by the angle plate **21** of FIG. 3. The positioning of the abrasion-guard is closely adjacent the inner face of the radiator **18** and juxtaposed to the fan **19**.

As is well known, such radiators **18** have a battery of tubes **22** spanning and bonded to upper and lower tanks **23** and **24**. The tubes **22** mount a series of closely-spaced fins **25**.

It should be noted that side portions of the engine hood are open, as indicated at **26** in FIG. 1. Such openings are necessary to provide for air to be drawn in by the fan **19** for "blowing through" the radiator **18**.

During the operation of such a vehicle, as shown in FIG. 1, the scooping up of the earth, elevating it up over the forward portion of the unit and then dumping the earth either into a truck or at some other place in the operation, results in considerable amounts of earth dropping down onto and around the engine hood. Also, local wind conditions are bound to blow some of the loose earth around the equipment. Naturally, such particulated matter is drawn through such openings **26** and into the swirling air stream directed by the fan **19** against the radiator **18**.

To appreciate the full significance of the radiator protection, which is afforded by the hereinshown abrasion-guard, it is necessary to understand some well-known and verifiable facts about the nature of an air-stream peculiar to the propeller-type fan **19**, when discharging an air stream axially outward through the fan shroud **20**. Such an air stream is in the nature of a hollow cylinder rotating about the axis of the fan **19** somewhat in the form of a helix and, as hereinbefore noted, rotating at a fairly high r.p.m. Moreover, a propeller fan is effective in producing an outward thrust air stream over only about the outer half of the fan blades. Thus, the air stream comes off the fan blades somewhat in the form of an annulus. Also, it should be understood that the air coming off the tips of the fan blades tends to create some turbulence in the air stream that is directed toward the radiator **18**.

These facts have a significant bearing on what is believed to be accomplished by the hereinbefore-described abrasion-guard. In FIG. 6 the circles **27** and **28** represent the annular form of the air-stream that is directed toward the radiator **18** by the fan **19**. The arrows **29** are intended

to indicate the swirling helical movement of the air-stream. The arrows **30** are intended to indicate this tendency of the fan-blade tips to create something of a turbulence in the air stream. The cross-hatching is intended to indicate the louver arrangement of this abrasion-guard.

As this diagram should make clear, for the upper left-hand quarter of the abrasion-guard, there will be a tendency of the particulated matter in the air-stream to first impinge against the under faces of the horizontal louvers **14** and then against the left faces of the vertical louvers **14**. For the upper right-hand quarter of the abrasion-guard the particulated matter in the air-stream will tend to be impinged against the left faces of the vertical louvers **14** and then against the upper faces of the horizonal louvers **14**. For the lower right and left quarters of the abrasion-guard the articulated matter will impinge successively against the other faces of the other portions of these same disposed louvers **14**.

Obviously, therefore, these louvers **14** take the brunt of this metal-eroding air-stream, as it leaves the fan **19**. This particulated matter bounces around in these small openings **22** between the louvers **14**. This results in such a reduction of the forward thrust of the particulated matter as to cause it to lose its tendency to cause any material abrasion of the tubes and/or fins. Also, the passage of the air-stream through these openings tends to straighten out the flow so as to make a more direct impact on the tubes. This tends to increase the heat dissipation from the tubes.

Variations and modifications in the details of structure and arrangement of the parts may be resorted to within the spirit and coverage of the appended claims.

I claim:

1. A motor-vehicle-radiator fin-and-tube abrasion-guard comprising a pair of plates each having a plurality of portions thereof struck out from the plane of the plate to form closely-spaced louvers within bordering sections of the plate and normal thereto, the plates being superimposed and bonded together with the louvers of the respective plates extending oppositely outward to define a predetermined group of rectangular-shaped channels, and means for mounting the superimposed plates on a radiator with the openings disposed axially of the air-flow through the radiator to thereby deflect the particulated matter in the incoming air-flow from direct impingement on the tubes and fins of the radiator.

2. A motor-vehicle-radiator tube-and-fin abrasion-guard as set forth in claim **1** wherein the louvers are formed in predetermined groups within the border sections of the plate between a plurality of spacing ribs spanned and integrated at their ends with the border sections of the respective plates.

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