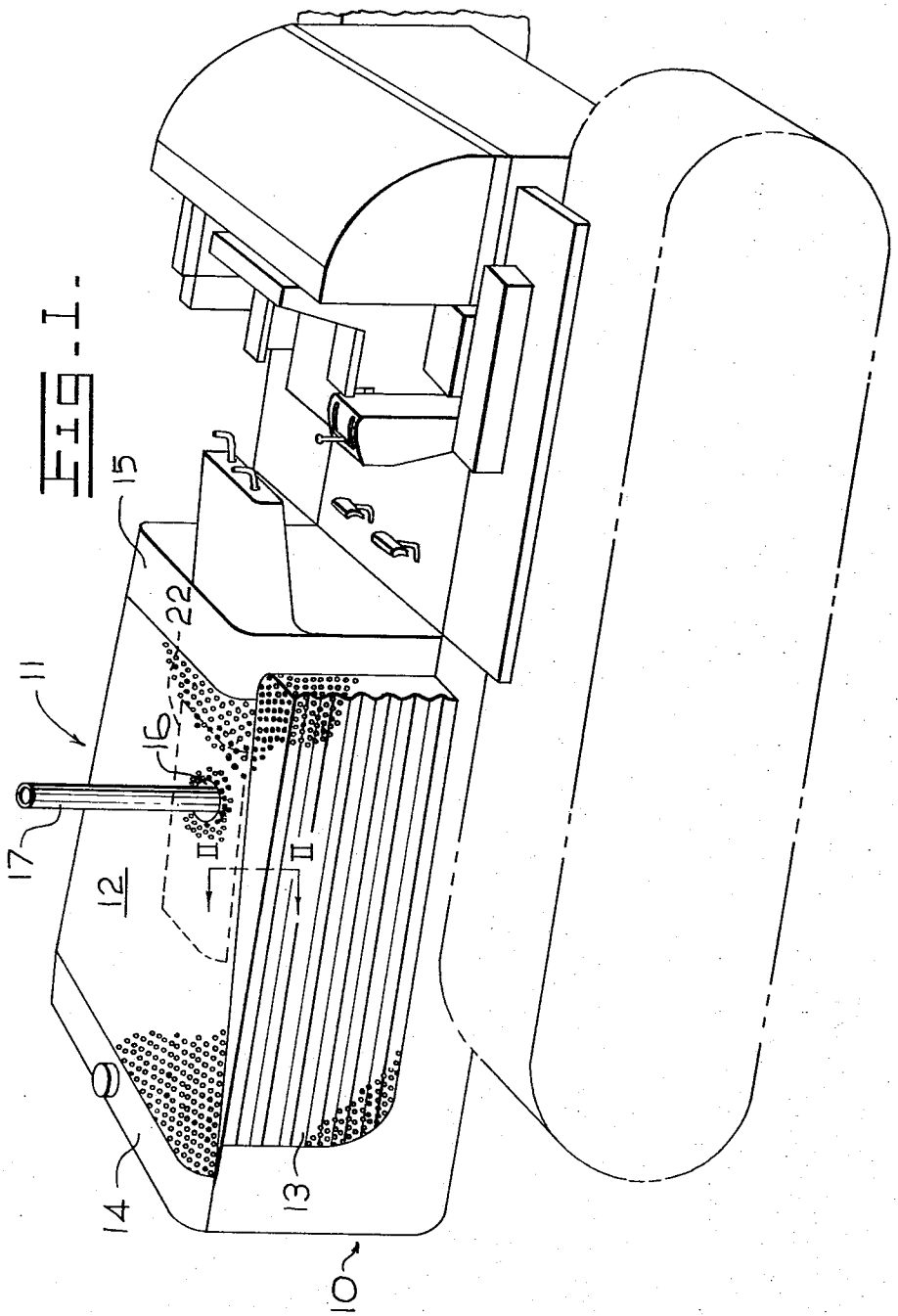
Dec. 19, 1967 J. E. BANGASSER ETAL 3,358,787

ENGINE ENCLOSURE

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Fig. 1.




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Fig. 3.

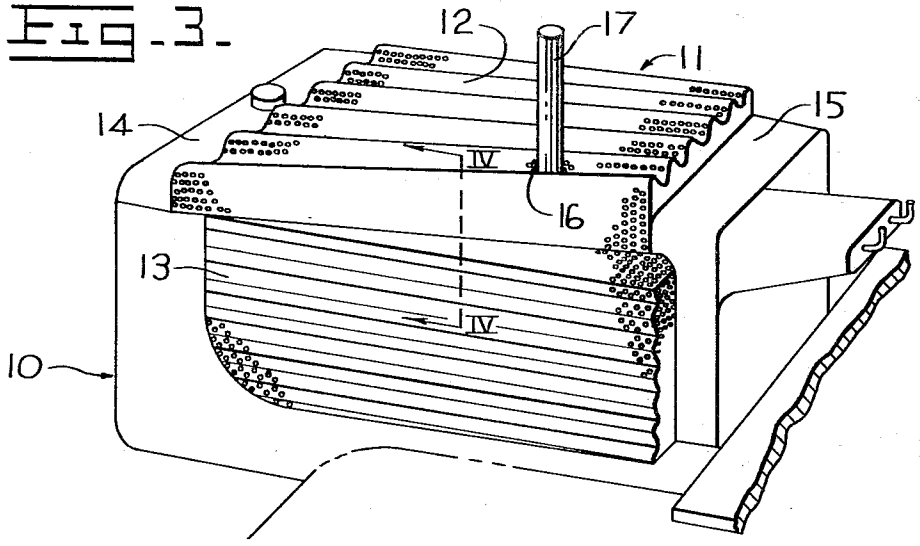



Fig. 2.

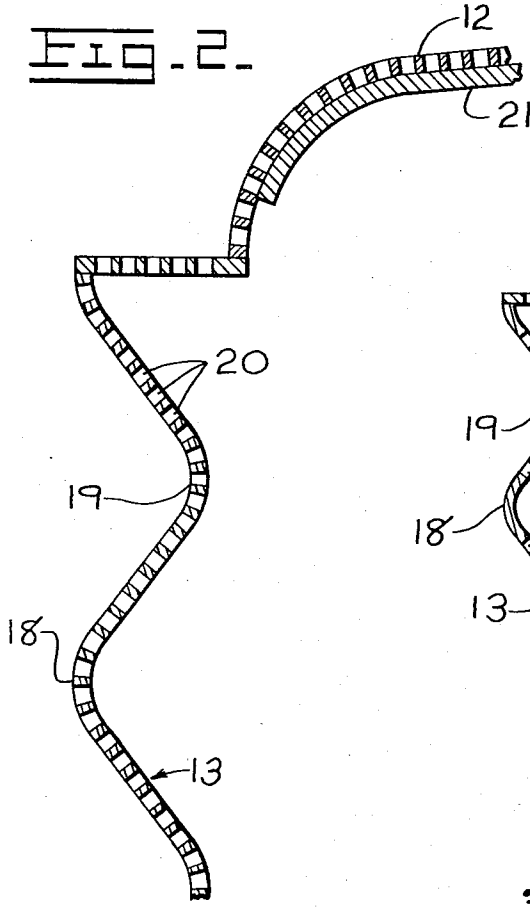
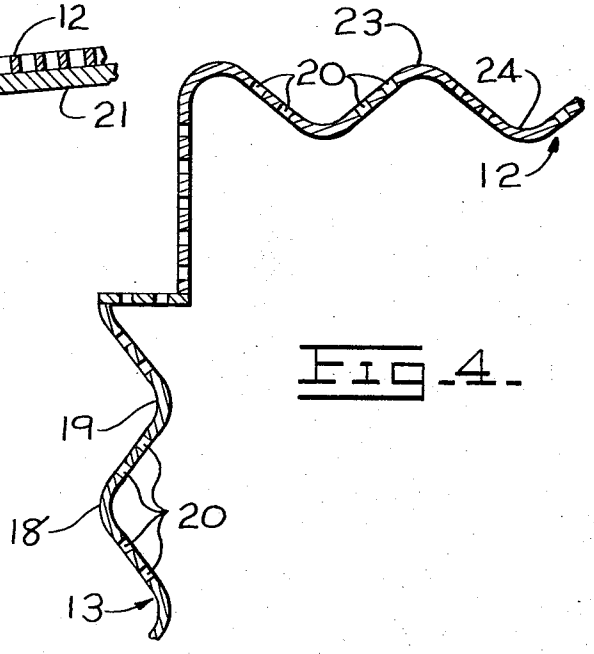



Fig. 4.




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United States Patent Office 3,358,787 Patented Dec. 19, 1967



3,358,787

# ENGINE ENCLOSURE

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Filed Mar. 3, 1966, Ser. No. 531,532
4 Claims. (Cl. 180—69)

## ABSTRACT OF THE DISCLOSURE

An improved engine enclosure for use in debris-cluttered environments can be fabricated by constructing the side doors of an engine enclosure of corrugated sheet material having a plurality of perforations and orienting sheet material with its ridges and furrows generally parallel with the longitudinal axis of the vehicle so that they will be self-cleaning. The hood of the enclosure may be similarly constructed and sloped so debris will slide off the hood.

This invention relates to enclosures for engines and more particularly for enclosures for liquid-cooled engines in tractors and the like which encounter debris-cluttered atmospheric environments during operation.

Liquid-cooled engines in tractors and like vehicles depend on air flow through a radiator core usually located in the front end of the vehicle to remove heat from a coolant circulating through the core and the engine, to maintain the engine temperature within desired operating limits. When the ability of the radiator core to remove heat from the coolant is jeopardized, it is possible for the engine temperatures to exceed safe operating limits. The volume of air passing to the radiator core substantially affects its ability to remove heat from the coolant which maintains the engine temperature within safe operating limits. If the volume of air through the core is reduced substantially, the core is no longer able to remove the necessary heat from the coolant, even though it may have been designed somewhat over-sized for the particular engine to provide a small extra margin of safety.

Blower fans are often employed adjacent to the radiator and driven by the engine to insure an adequate volume of air is forced through the radiator's core for cooling purposes. These blower fans can either draw or push air through the core depending upon the direction of rotation and pitch of the blades. With proper design parameters the above-described system provides adequate cooling for a tractor's engine.

However, since many times tractors are required to operate in debris-cluttered atmospheric environments, such as ground clearing operations wherein they encounter heavy foliage, the volume of air passing through the radiator's core is often substantially reduced by debris, such as leaves, branches and twigs, which tend to be carried into the core and held thereon by suction while entrained in the air moving into the core. Further, as portions of the core become cluttered with debris, the velocity of the air through the other open portions of the core increases sharply and additional debris is carried into the open portions of the core by the higher velocity of the air-stream, compounding the situation.

The obstruction of the air flow through the radiator core caused by debris covering air passages through the core, is often so severe in vehicles used in ground clearing operations that they must be shut down every 20 or 30 minutes to clean the debris from the core in order to keep the engine temperatures within the safe operating limits. Naturally, this "down time" on expensive vehicles is undesirable and in severe cases can reduce the operating time of the vehicles to less than one-half.



To help reduce the resulting plugging problem, and also to provide some comfort for the operator of the vehicle in hot weather, the blower fan is rotated to blow air from the engine compartment through the radiator core for cooling purposes. When this is done, the engine enclosure must be provided with sufficient communication with the atmosphere so that the necessary volume of air required by the blower fan will be available in the engine compartment. Often the side doors of the engine enclosure are removed, or are removed and replaced with screens in order that the engine compartment will have sufficient communication with the atmosphere for the air needed by the blower fan. However, if the side doors are removed completely, or replaced with screens, debris can still enter the engine compartment and be carried into the radiator core by the flow of air therethrough effected by the blower fan. Further, since the air flow now passes through the blower fan to the radiator core, debris entrained in the air-stream may be thrown into the radiator core with tremendous force from contacting the blower fan blades, thereby damaging the core.

Screens which are used to replace the side doors, prevent larger pieces of debris from entering the engine compartment, but are usually quite coarse in order to provide the necessary strength required to fend off brush and like contacting the screens. Further, if the mesh in the screen is reduced substantially to eliminate the larger particles of debris, the screen will also become plugged with the foliage and starve the blower fan of a sufficient supply of air. Of course, when the screens become plugged with foliage, it is also necessary to stop the vehicle and clean the screens to prevent the operating temperatures of the engine from exceeding safe limits. Actually, it was found that replacing the side doors with screens was not satisfactory since the screen's irregular, rough surface tended to cause larger pieces of debris to cling thereto, and increase the tendency of the screens to plug.

Accordingly, it is an object of the present invention to provide an engine enclosure which is not subject to plugging when working in debris-cluttered atmospheric environments.

Another object of the present invention is to provide an engine enclosure which is capable of withstanding contact with brush experienced in ground clearing operations, and yet able to provide adequate communication with the atmosphere for the blower fan requirements of the engine.

Another object is the provision of a strong, self-cleaning engine enclosure.

A still further object is the provision of an engine enclosure which has air vents shielded from debris and the like contacting the enclosure.

The above objects, and others which will be apparent from the specific description which follows, can be accomplished by fabricating at least the side doors of an engine enclosure with corrugated sheet material having a plurality of perforations below the outside parallel ridges of the corrugated sheet material, and orienting the parallel ridges and furrows substantially parallel with the line of travel of the vehicle on which the enclosure is used.

The above short description will be better understood by referring to the specific description, which follows, interpreted in view of the drawings wherein:

FIG. 1 is a perspective of a track-type crawler tractor showing the corrugated engine enclosure mounted thereon;

FIG. 2 is a partial section along line II—II of FIG. 1 showing additional detail of the novel engine enclosure;

FIG. 3 is a partial perspective of the front end of a track-type crawler vehicle, another embodiment of the engine enclosure; and

FIG. 4 is a partial section along line IV—IV of FIG. 3.

Referring to FIG. 1, a track-type tractor **10** is shown with one embodiment of the novel engine enclosure **11** mounted thereon. The basic three parts of the enclosure, which is generally a channel-shaped structure, are the hood **12** and the side doors **13**, all of which can be removed for access to the tractor's engine compartment.

The channel-shaped enclosure **11** cooperates with the upright radiator structure **14** at one end of the engine compartment, and the fire wall and operating console structure **15** at the opposite end to completely enclose the engine compartment. As can be seen in FIGS. 1 and 3, the hood **12** of the enclosure includes a port **16** for the engine's exhaust stack **17** and the side doors **13** are usually removably attached to the radiator structure, the edge of the hood and the fire wall and operating console structure in order to provide ready access to the engine compartment.

In the embodiment of the invention shown in FIG. 1 only the side doors **13** of the enclosure **11** are constructed of the corrugated sheet material. The actual construction of the side doors can be more easily seen in the section shown in FIG. 2 wherein the outside ridges **18** and the furrows **19** can be seen. The perforations **20** are located throughout the corrugated sheet, as can be seen in FIG. 2. It is sometimes desirable that the perforations not be located on, or near the apex of the ridges since these portions of the side doors will be contacted by debris carried into the side doors by the air flow or alternatively by debris brushing against the side doors as the vehicle moves through heavy foliage and the like.

By location of perforations **20** away from the apex of the outside ridges **18** of the corrugated side doors, it can be appreciated that they will be shielded to a large degree from debris coming into contact with the side doors of the enclosure. Also through this arrangement it is very difficult for the pieces of debris contacting the side doors from being held against the perforations by suction, since the irregular surface of the corrugated sheet material prevents the debris completely covering the individual perforations. This feature helps avoid the problem incurred when sap-containing foliage, such as leaves, is drawn against fine perforations and releases sap which will cause the area around the perforations to become sticky and cause the foliage to be adhesively held around the perforations. Further, by orienting the ridges and furrows of the corrugation parallel to the line of travel of the vehicle, generally horizontally, brush and the like which comes into contact with the side doors as the vehicle moves through dense brush, will tend to sweep away any debris sticking to the side doors giving it a self-cleaning feature. Further, since the ridges and furrows are oriented along the line of travel, the materials contacting the side doors will have very little tendency to catch and hang up, as would be the case if the ridges and furrows of the corrugation were oriented generally vertically.

In an actual field test, the side doors were made of 16 gauge sheet metal, and the perforations were 0.125-inch diameter holes on 0.188-inch centers. The sheet metal was corrugated sufficiently to develop a surface area 1.4 times the surface area of the engine enclosure covered by the side door, and the actual open area in the side door represented 56% of the open area covered by the door. Using this side door, a crawler-type tractor was operated in land clearing operations wherein heavy foliage was encountered for the full day without the necessity of stopping and cleaning the side doors. Another vehicle of the same type which had screen side doors and was operated in the same environment, had to be stopped for cleaning the screens approximately every 20 to 30 minutes.

If desired, the hood **12** of the enclosure can also be perforated with small diameter holes in order to provide additional air access to the engine compartment. This



feature is shown in FIG. 1 and a blocking baffle **21** is employed above the manifold and the turbocharger (not shown) as indicated by broken line **22**, to prevent water from falling on these parts. Alternatively the hood in the area of these parts may be left unperforated to provide protection for these parts.

An alternative embodiment is shown for the hood in FIG. 3 wherein it is also corrugated and is equipped with a plurality of perforations between the outside ridges **23** and outside furrows **24**. In this embodiment the perforations in the hood are generally restricted to the central area between the ridges and furrows and the hood is inclined either forwardly or rearwardly or alternatively sloping downwardly from the center line of the hood to each side door so that material collecting in the furrows can work off the hood. With the proper inclination on the hood structure, water will run off the hood without entering the engine compartment, running down the furrows in small rivulets. Also, smaller pieces of debris collecting in the furrows will tend to work toward the low end of the hood due to the vibration of the machine, and subsequently leave the hood in this manner.

This feature of the hood structure can be seen in FIG. 4 and it can be appreciated that the small channels at the bottom of the furrows can provide a path for the debris and/or water to leave the top of the hood without passing into the engine compartment through the perforations.

Corrugating the sheet panels of the engine enclosure gives it extra strength to fend off brush and the like, even though 40% or more of the material has been removed by the perforations.

In some situations it may be essential to have perforations in the hood since this provides additional area for air ingress into the enclosure and decreases the velocity of the air through the side doors. This is important where sap is extracted from foliage contacting the side doors by the suction and subsequently carried by the air stream into the core where it causes fine debris to stick in the core reducing its efficiency and plugging it.

What is claimed is:

**1.** An improved engine enclosure having side doors and a hood the improvement comprising forming said side doors with corrugated sheet material having a plurality of perforations, said perforations being located remote to the ridges and furrows of said sheet material and said ridges and furrows being oriented substantially parallel with the longitudinal axis of the vehicle.

**2.** The improved engine enclosure defined in claim **1** wherein the hood of the engine enclosure is corrugated sheet material having perforations centrally located between the outside ridges and furrows of said sheet material, said sheet material having said ridges and furrows.

**3.** The improved engine enclosure defined in claim **2** wherein the hood is inclined relative to the horizontal so that water and debris can exit along the exterior furrows in said hood without entering the engine compartment.

**4.** The improved engine enclosure defined in claim **2**, wherein the ridges and furrows of the sheet material are oriented substantially parallel with the longitudinal axis of the vehicle.


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