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Duclo

[11] **3,835,948**

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[54] **LIQUID COOLING SYSTEM FOR USE ON SNOWMOBILES**

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[52] **U.S. Cl.** .... **180/5 R,** 123/41.01, 180/68

[51] **Int. Cl.** **B62m 27/02,** B62k 11/04

[58] **Field of Search** .... 180/5 R, 68, 54 A, 54 R

[56] **References Cited**

UNITED STATES PATENTS

657,684	9/1900	Vorreiter	180/54 A
2,581,072	1/1952	Brezek	180/68 R
3,404,745	10/1968	Smieja	180/5 R
3,485,312	12/1969	Swenson	180/5 R

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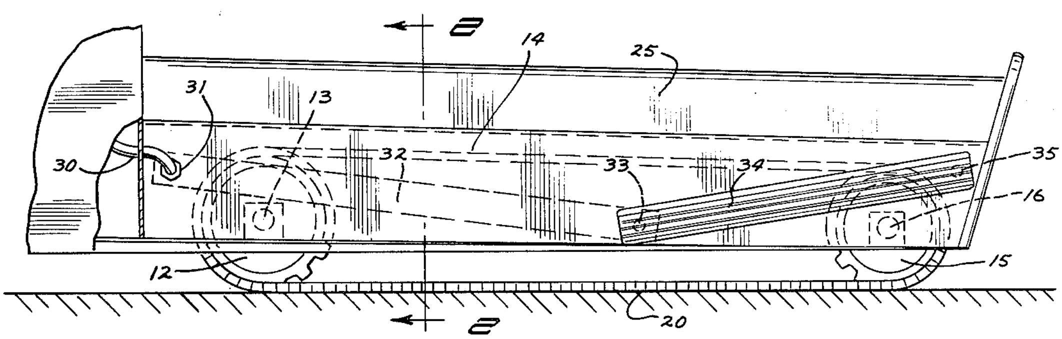
[57] **ABSTRACT**

A cooling system for the engine coolant of a liquid cooled snowmobile engine. The cooling system is provided as a substitute for or a supplement to a conventional radiator normally used with internal combustion, liquid cooled engines. The cooling system comprises elongated tubes mounted adjacent the tunnel used for the snowmobile drive track whereby snow will drop directly onto the tubes to remove heat from the coolant at a relatively high rate as the snow is changed into a liquid.

7 Claims, 5 Drawing Figures



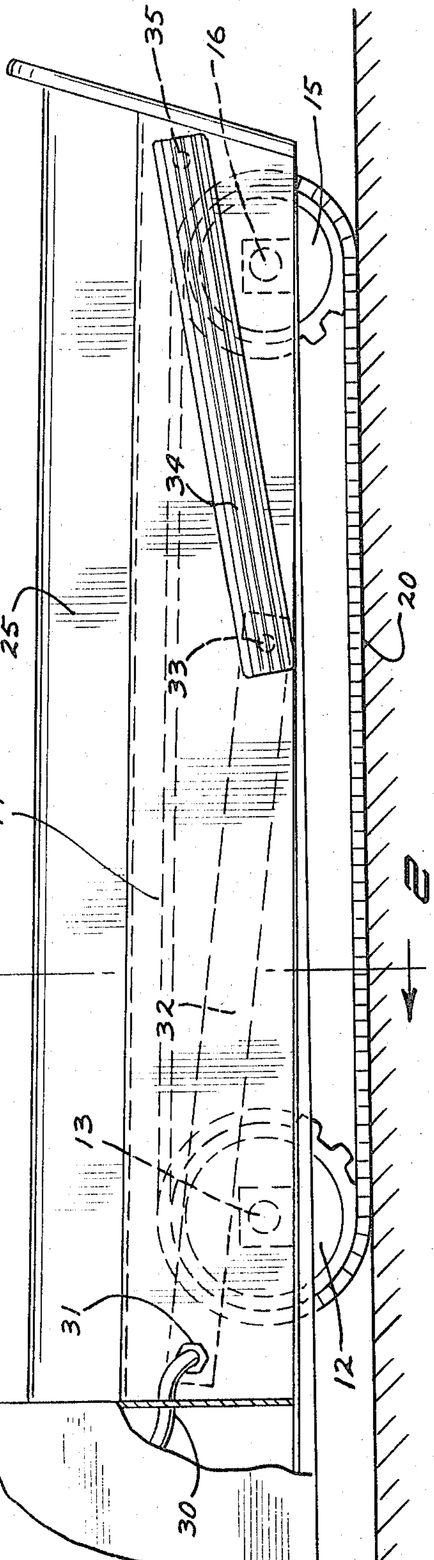

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FIG. 1

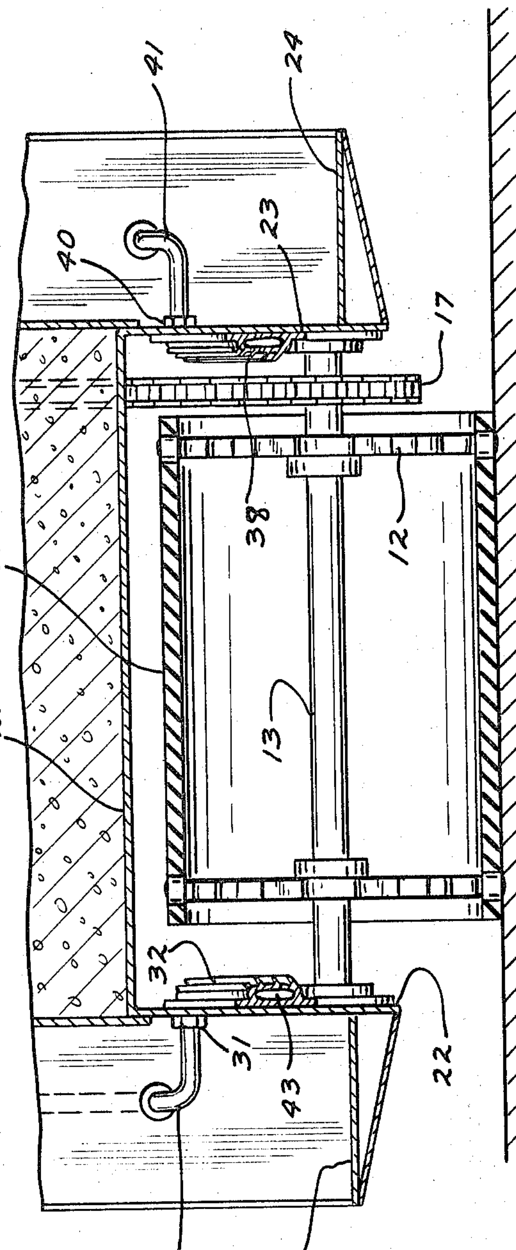
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FIG. 2

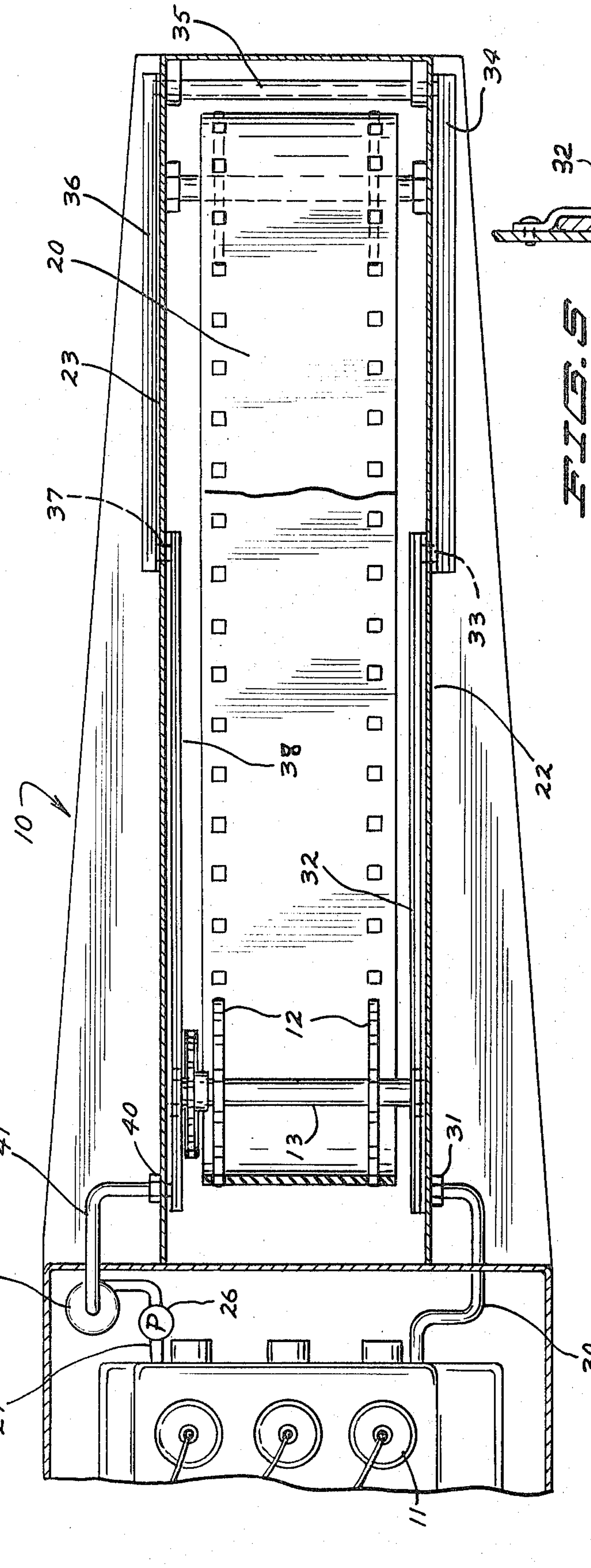

FIG. 3

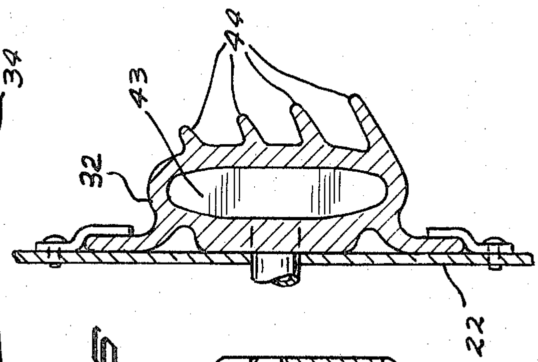

FIG. 5

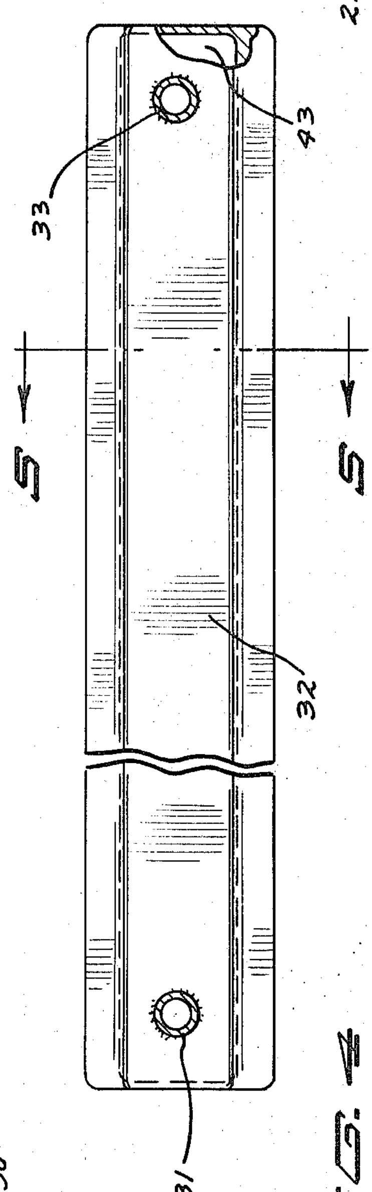

FIG. 4

LIQUID COOLING SYSTEM FOR USE ON SNOWMOBILES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to cooling systems for snowmobiles having liquid cooled engines.

2. Prior Art

The usual snowmobile construction is well known, and has gained wide popularity in the areas that have snow. The advent of liquid cooled engines for snowmobiles, which have several advantages in operation, as opposed to the more usual air cooled engine, has given rise to a problem on how to adequately cool the engine without taking up a great deal of space, and without providing power consuming fans. Conventional radiators for cooling internal combustion engines of course are known, and there have been units that have used auxiliary cooling coils or radiators for automobiles. For example, U.S. Pat. No.'s 2,503,411 and 2,581,072 relate to the general concept of auxiliary cooling radiators that are spaced away from the engine itself.

However, even this involves the use of a supplementary radiator as well as the conventional radiator and these require a substantial amount of space.

On the other hand, in the operation of snowmobiles, the machine itself is in an enviroment which includes a frozen solid, namely snow, that will provide cooling if the material is utilized. Also, most snowmobiles use an endless drive track or belt and this belt is usually enclosed within a housing or tunnel. The belt carries snow with it as it moves, and the snow carried into the tunnel forms a cooling medium. The usual tunnel and drive belt construction is well known, and typical constructions are shown in U.S. Pat. No. 3,485,312 and U.S. Pat. No. 3,701,394.

SUMMARY OF THE INVENTION

The present invention relates to a cooling system for use in snow vehicles which have liquid cooled engines. The cooling system comprises elongated tubular members for carrying the liquid coolant from the engine into position where the tubes will be contacted by snow as the vehicle moves. In the form shown, the tubes are mounted on the tunnel for the drive track of a snowmobile, and are positioned so that the snow thrown up by the drive track will contact at least a portion of the tubes to provide for a heat exchange. The melting of the solid snow requires a substantial amount of heat which is removed from the coolant.

The unit can be used in combination with a conventional radiator, or without a radiator. In addition, the mounting in the tunnel will help to provide for air circulation because the belt carries air with it as it moves inside the tunnel.

In the form disclosed, the unit is made with a surge tank but without any conventional radiator. The engine has a water pump on it, to provide for circulation of the coolant through the tubes. The tubes as shown have sections mounted on the inside of the vertical walls of the tunnel, and other sections on the outside of the tunnel. A cross over pipe to the rear of the track carries coolant in a closed path from one side of the tunnel to the other and then other tube sections carry coolant back to the engine. The tubes can include fins for catching the snow, and also for better heat exchange.

The elongated tubes result in efficient heat exchange between the coolant and the snow contacting the tubes. The snowmobile does not have to be made to accommodate a radiator, nor does it have to have provision for air flow across the radiator in the engine compartment. This makes the styling of the snowmobile easier, and also insures that the heated air coming from the radiator is not a problem in snowmobile operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic side elevational view of a typical snowmobile showing a drive track and the location of the cooling tubes made according to the present invention;

FIG. **2** is a sectional view taken as on line **2—2** in FIG. **1**;

FIG. **3** is a sectional view in plan showing the positioning of the coolant tubes on the sides of the tunnel, and also showing fragmentarily the snowmobile engine;

FIG. **4** is a side view of a typical coolant tube used with the present invention; and

FIG. **5** is a sectional view taken as on line **5—5** in FIG. **4.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. **1** and **3**, a snowmobile indicated generally at **10** is provided with a liquid cooled internal combustion engine **11**, as shown a three cylinder engine, which has the usual internal cooling passageways around the cylinders in a conventional manner. The internal passageways of the engine are not specifically shown because they are well known and can be made in any desirable configuration. Suitable drive means are provided from the crankshaft of the engine to drive sprockets **12** mounted on a suitable cross shaft **13** mounted on a support frame tunnel **14** to the rear of the engine. A pair of idler sprockets **15** are also provided on a shaft **16** rotatably mounted at the rear end of the snowmobile in the usual manner. The drive from the engine to the shaft **13** is shown only schematically and is represented by a chain and sprocket **17.** The drive can be any desired type now used with snowmobiles. A suitable torque converter and variable speed drive coming from the output shaft of the engine is normally provided.

An endless snowmobile drive track **20** of usual design is mounted over the sprockets **12** and **15.** The drive track **20** has provisions for the teeth of the sprockets **12** and **15** to engage. Normally these tracks are molded but can be of any other desired construction. The track has a lower portion or length that engages the snow and an upper portion extending between the top of the sprockets mounting the track. The tunnel **14** is made with a top wall **21**, with a first side wall **22**, and a second side wall **23** attached to the top wall. The tunnel forms a frame member for the machine, and also has support members **24** on opposite sides thereof for the operator's feet. The top wall **21** of the tunnel can support a seat **25.** The tunnel is fastened into the other frame members of the snowmobile.

The engine cooling system includes a pump shown schematically at **26** that is driven by the engine in the usual manner, and the output port of the pump has a pipe 27 leading to the internal passages of the engine. The output side of the engine has a tube 30 leading therefrom, and passing through a frame member to a suitable fitting 31 which extends through the first wall 22 of the tunnel. This fitting 31 is connected to the interior of a cooling tube section 32 which is mounted on the inside of the first wall 22 of the tunnel adjacent the edge of the track 20. This cooling tube section 32 extends rearwardly and downwardly, to a point about midway back in the tunnel and is connected to a suitable fitting or pipe 33 which extends through the wall 22 to a second cooling tube section 34 mounted on the exterior of the wall 22. This second cooling tube section 34 extends rearwardly and upwardly, and is connected to a cross over tube 35 extending between and through the tunnel walls 22 and 23. The cross over tube 35 extends through the wall 23 to the exterior side thereof and connects to a third cooling tube section 36 that extends downwardly and forwardly and is connected to a connecting tube 37 which is used for connecting the interior of the third tube section 36 to the interior of a fourth cooling tube section 38 on the inside of the wall 23. The tube 37 extends through the wall 23. The cooling tube section 38 extends forwardly and upwardly to the forward edge of the tunnel. There, a tubular fitting or connecting tube 40 passes through the wall 23 and connects to a return pipe 41 that in turn is connected to a surge tank 42. The surge tank 42 can have suitable filler opening so that make-up liquid coolant can be added to the surge tank. The surge tank insures that the pump 26 will have an adequate supply of coolant. The pump 26 is shown only schematically, and of course can be positioned in any desired location. Two pumps could be used on the unit, one in the tube or pipe 30 if desired. The tubes or pipes 30, 35, and 41 can be flexible hoses that are attched with suitable hose clamps. The connection tubes which pass through walls 22 and 23 and which are connected between the cooling tubes may be sealed to the cooling tubes with suitable O rings.

When the engine 11 is running, and the pump 26 is driven, the coolant from the engine will be pumped through the cooling tubes and connection tubes in a fluid circuit. A typical cooling tube section is shown in FIG. 4. The tube section 32 is shown for illustrative purposes, and the other tubes are similarily constructed. The connection tubes 31 and 33 are at opposite ends of the tube, and the cooling tube has a hollow interior passageway 43 that extends the length of the cooling tube. The cooling tube walls are formed so that the cooling tube will fit tightly against the tunnel side walls, and on the side of the cooling tube that is opposite from the tunnel side walls, the tubes are provided with cooling fins 44, that extend generally upwardly in direction. The fins 44 as shown then form small scoops on which falling snow will collect because of the upwardly extending direction of the fins 44. The coolant in the interior chamber 43 of course conducts heat rapidly to the walls of the tube sections because the tube sections are made of metal, and this heat will cause any snow collecting on the tube sections or fins to melt. The heat required to melt the snow into a liquid is quite high, and thus the heat is removed from the coolant in the chambers 43 quite rapidly.

The other cooling tube sections are constructed substantially the same, and provide for adequate heat exchange in the tubes. When the snowmobile is being operated, the track of course will be moving and this will generate air currents, and also will carry snow upwardly around the back of the track up over to the top portion of the belt. Snow will also be churned up from the bottom length of the belt, so the tunnel will be filled with snow mixed with air. The quantity of snow thrown up is substantial. The snow will fall off the sides of the belt and down onto the fins 44 particularly on the first and fourth cooling tube sections 32 and 37. The cooling tube sections 34 and 36 extend the cooling tubes back to the cross over tube without interfering with the back shaft and sprockets of the drive track. The tubes 34 and 36 on the outside of the tunnel are exposed to atmospheric air and provide for heat exchange with the air. Also snow thrown up by the track will collect on these cooling tube sections and the cooling effects of the melting snow are present at these tubes as well.

The form of the cooling tubes can be varied of course, and the length can be changed to suit existing conditions. Mounting the tubes on the interior of the tunnel where they are sure to be contacted by snow from the track, or adjacent the track is important because it provides for a positive means for getting a solid frozen material to contact the tubes so that the heat exchange process is aided from the heat requirement for changing the solid to a liquid.

It should be noted that the flanges on the cooling tubes, as shown in FIG. 5, as upper and lower flanges can be bolted, riveted or clipped directly to the tunnel side walls in order to hold them in position, and also to insure that the connecting tubes between the cooling tubes remain in position and sealed properly.

The use of cooling tubes in a snow vehicle and the positioning of the cooling tubes adjacent the drive means so that when operating the vehicle the snow churned up by the drive means will contact the tubes, insures adequate cooling.

The liquid coolant used may be any desired type, and of course, in cold weather will include a suitable antifreeze solution, such as an ethylene glycol and water solution. The cooling system also may be pressurized by use of a pressure cap on the surge tank opening of the type normally used on cooling systems in automobile engines.

What is claimed is:

1. A cooling system for a liquid cooled internal combustion engine mounted on a snowmobile, said snowmobile having a belt like drive track powered by said engine and engaging the snow for propelling the snowmobile, said track having a lower portion engaging the snow and an upper portion, at least one tubular coolant carrying member connected to said engine, means for circulating coolant through said engine and said tubular member, and means to position said tubular member adjacent to said track whereby snow carried into the air by said track will contact said tubular member.

2. The cooling system of claim 1 wherein said snowmobile includes track support means comprising a tunnel member having spaced apart, generally upright side walls positioned on opposite longitudinal sides of said track, and means to mount said tubular member on said side walls.

3. The cooling system of claim 2 and a plurality of cooling fins mounted on said tubular member in position to catch snow dropping from the edges of said track.

4. A snowmobile having a power unit and a liquid cooling system for said power unit, said snowmobile comprising a main frame member, said power unit being positioned adjacent to one end of said main frame member, and drive means for said snowmobile comprising means which contact the surface over which the snowmobile moves in at least longitudinally spaced locations with respect to said frame, longitudinally extending support means for supporting the drive means in longitudinally spaced locations, and an elongated tubular coolant carrying member connected to said power unit cooling system and providing circulation of power unit liquid coolant therethrough, and means to mount said coolant carrying member on said support means and extending in longitudinal direction adjacent to said drive means to provide a path of flow of coolant remote from said power unit, and in a location where movement of air is affected by said drive means.

5. The combination as specified in claim 4 wherein said drive means comprises an endless track member mounted to extend longitudinally along said frame.

6. In a cooling system for a snow vehicle having a power unit with a liquid cooling system, said snow vehicle having drive means for engaging the snow comprising an endless track member, and support means for said endless track member comprising a downwardly open inverted U shaped tunnel, the improvement comprising tubular coolant carrying means connected to said power unit cooling system, and means to mount at least portions of said tubular coolant carrying means toward the interior of said tunnel adjacent to said endless track member to provide a path of flow of coolant remote from said power unit.

7. A snowmobile having a frame, a power unit for propelling said snowmobile, a liquid cooling system for said power unit, and an endless drive track member for said snowmobile, a support for said endless drive track member comprising a pair of side wall means spaced laterally apart on said frame, and means substantially closing the space between said side walls above said drive track member with upper portions of said drive track member being above the lower edges of said side walls, a tubular coolant carrying means connected to the power unit cooling system to carry coolant flow remote from said power unit, at least portions of the tubular coolant carrying means being positioned on said side walls remote from said power unit and adjacent to said drive track member.

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