June 13, 1950 — H. E. SIMI — 2,511,549

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Filed Jan. 11, 1947 — 2 Sheets-Sheet 1

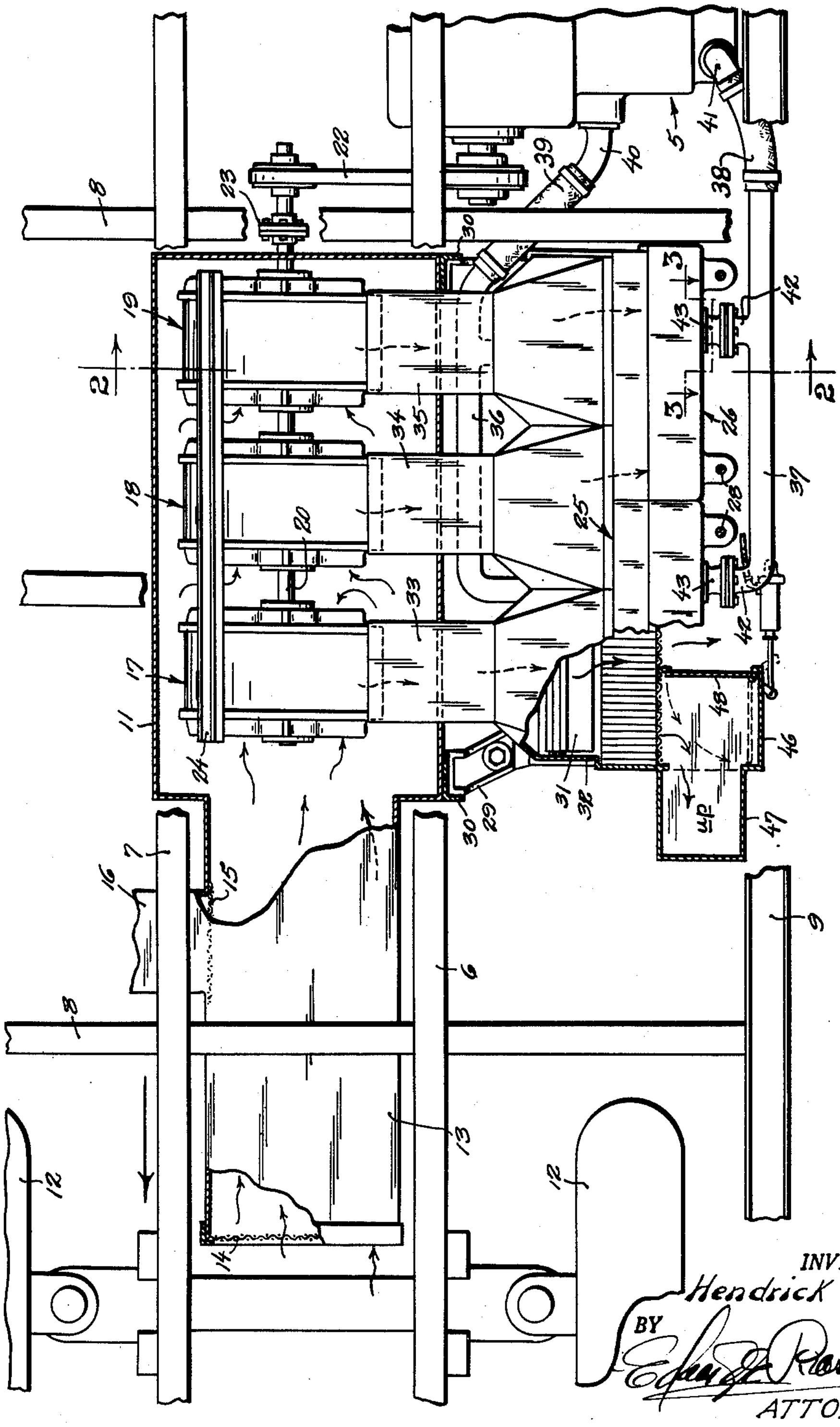

Fig. 1.

INVENTOR.
Hendrick E. Simi
BY
[signature]
ATTORNEY.

June 13, 1950 H. E. SIMI 2,511,549

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Filed Jan. 11, 1947 2 Sheets-Sheet 2

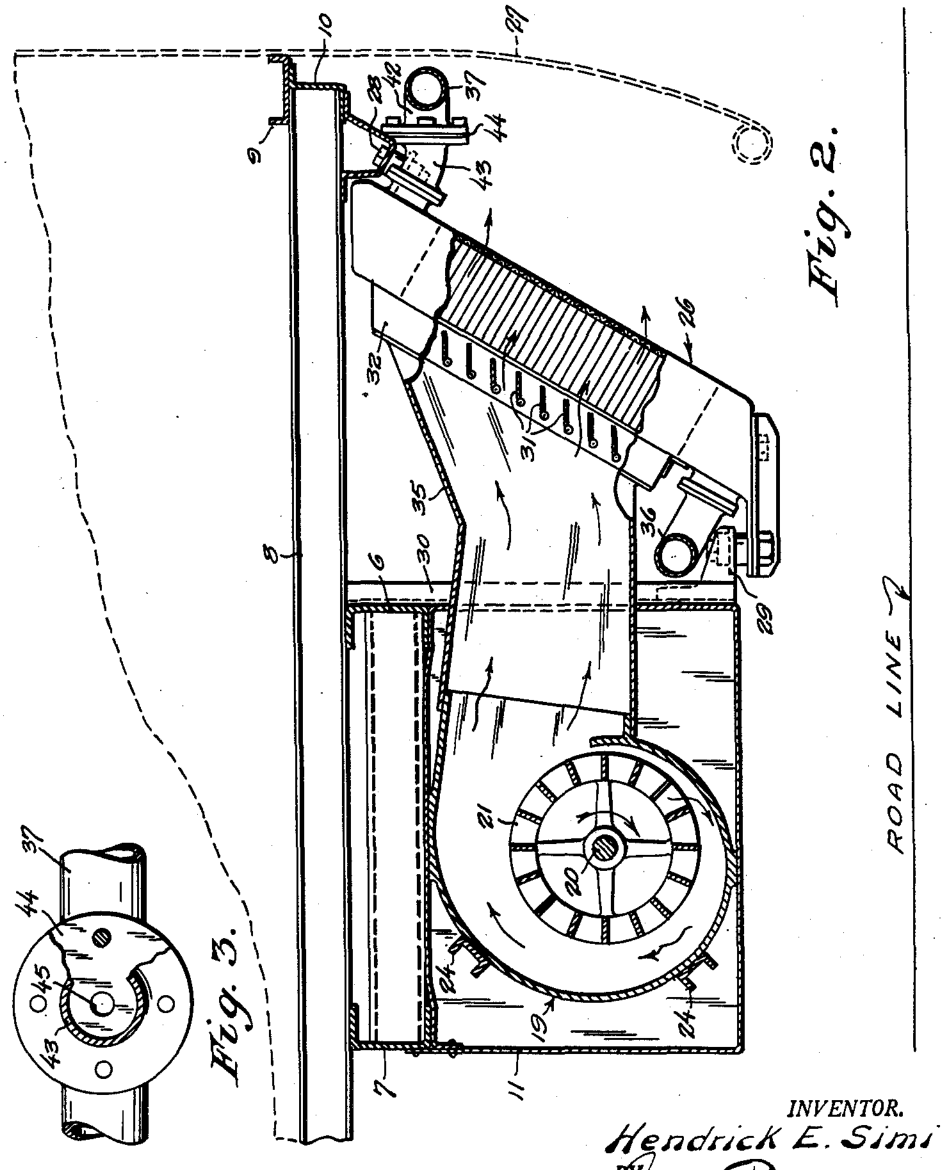

Fig. 2.

Fig. 3.

INVENTOR.
Hendrick E. Simi
BY
[signature]
ATTORNEY.

Patented June 13, 1950

2,511,549

UNITED STATES PATENT OFFICE

2,511,549

COOLING SYSTEM FOR INTERNAL-COMBUSTION ENGINES

Hendrick E. Simi, Seattle, Wash., assignor to Kenworth Motor Truck Corporation, Seattle, Wash., a corporation of Washington

Application January 11, 1947, Serial No. 721,521

7 Claims. (Cl. 180—54)

1

This invention relates to cooling systems for internal combustion engines, particularly engines of the water-jacketed type, and while especially applicable to the power plants of automotive vehicles, busses in particular, the system might advantageously be applied to a stationary engine.

The invention has for its object to provide an improved cooling system peculiarized in its employment of a turbine type of radiator fan so associated with the water-cooling radiator of the engine as to push the air through the radiator as distinguished from the more common practice of pulling the air therethrough. The turbine character of fan, commonly known as a squirrel-cage fan, has several distinct advantages over the more usually employed propeller type, being markedly quieter in operation, consuming considerably less horse-power and thus leaving more energy for powering the vehicle and assuring a longer service life in that the nature of a turbine-type fan permits sturdier construction, develops a modicum of destructive torque in operation, and readily permits a rubberized mounting of the arbor to completely insulate the moving parts from the vehicle frame. My advanced arrangement, by which the turbine fan used in the present invention causes the air to be pushed rather than pulled through the radiator, takes advantage of the generally recognized greater efficiency which this type of fan accomplishes when it is so applied and has to further advantage of achieving better control of the air after the latter passes through the radiator to enable this air to be usefully employed.

With the above and other still more particular objects and advantages in view, and which will appear and be understood in the course of the following description and claims, the invention consists in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Figure 1 is a fragmentary view, partly in plan and partly in horizontal section, looking down upon the chassis of a bus embodying a cooling system constructed in accordance with one embodiment of the present invention.

Fig. 2 is a transverse vertical sectional view on line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary longitudinal vertical sectional view taken to an enlarged scale on line 3—3 of Fig. 1 to detail a flow-choking feature incorporated in the present system.

The present invention comprehends an association of parts which are made to accomplish

2

the ends in view by reason of the particular way in which they are combined, and by which I mean the functional significance of the association rather than any particular mode of placing the parts to have the same occupy a particular location upon the bus or other vehicle to which the system may be applied. There are several ways of carrying the invention into practice, one of which I have elected to illustrate, another of which I will refer to hereinafter, and still others which will be largely self-evident having knowledge of these installations.

First describing the invention as it is shown in the drawings, the cooling system is here applied to a water-jacketed internal combustion engine denoted generally by the numeral 5 and which is suitably hung from the frame of the vehicle to lie below the coach floor in a position central, or approximately central, to the vehicle length. Transversely considered, the mounting of the motor places the latter well to one side of the vehicle's longitudinal center line. The frame, as illustrated, comprises the usual two longitudinal members 6 and 7, cross-channels 8, and, at each side limit, an outlying longitudinal channel 9 sustained by the cross-channels and reinforced by a subjacent Z-section 10.

Hung from the longitudinal center girders 6 and 7 to occupy a position to the front of the engine substantially midway between the side limits of the vehicle, and with its own width being appreciably less than that of the vehicle, there is provided a box-like fan housing 11, and serving to supply air to this housing from a point forwardly removed beyond the spray pattern of the front wheels 12 there is provided an intake tunnel 13. The term "spray pattern" signifies that area in which dust, water and the like is caused to be thrown rearwardly from the front wheels of the vehicle in the operation of the latter. This tunnel, which opens to the front, is fitted with a screen 14, and in its side wall presents a screened opening 15 permitting a minor part of the incoming column of air to be diverted by suction through a connecting duct 16 to a car heater (not shown).

Housed in the housing and exposed by their suction sides to the incoming air are three co-axially mounted turbine fans 17, 18 and 19. An arbor 20 common to each of the three fans drives the rotor members 21 of the latter, and this arbor, which projects through and is prolonged beyond the rear wall of the housing, takes its drive from the engine through a transfer V-belt 22, there being provided between the driven pulley and the arbor proper a flexible coupling **23**. The fans inherently make little or no noise in operation and are further quieted by mounting the ends of the arbor in rubberized anti-friction bearings carried by stands which are made fast to the fan casings, the fan casings being in turn fixedly anchored in relation to the fan housing. The casings for the fans are further rigidified by longitudinal tie bars **24**.

The radiators for the present cooling system, desirably two in number and designated **25** and **26**, are arranged to occupy a position immediately to the front of the engine between the fan housing **11** and a skirt prolongation **27** of the coach body, being placed longitudinal to the vehicle and in side-by-side relation canted somewhat from the perpendicular. To sustain these radiators, I employ hanger bolts **28** at the top and brackets **29** at the bottom, the brackets being welded to angle-iron posts **30** depending from the frame girder **6**. A set of shutters **31**, controlled either manually or automatically in the usual or a suitable manner, is mounted to the immediate rear of the radiators, and enclosing the shutter assembly is a shroud **32**. Made fast to this shroud are respective ducts **33**, **34** and **35** leading through the side wall of the fan housing from the outlet sides of each of the turbine fans. The tail ends of the outlet ducts are expanded to enlarge the cross-sectional area traversed by the pushed columns of air, and the slope which is given to the radiator cores makes it possible to accomplish an even greater cooling efficiency considered in point of the areal extent of the radiation surface.

Manifold pipes **36** and **37**, coupled by hoses **38** and **39** with the water connections **40** and **41** of the engine, feed by separate branches into the bottoms of the radiators and likewise draw by separate branches from the tops of the latter, there being also provided the usual filling pipes (not shown) which extend, by preference, to a raised auxiliary tank located at any point suitable for convenient servicing. Between the connection flanges which are provided upon the outlet branches **42** of the top manifold pipe **37** and upon the outlet pipes **43** from the radiators there is introduced a disc **44**, this disc being centrally apertured as at **45** (Fig. 3) and being characterized in that the same is replaceable to provide either a larger or a smaller aperture as weather conditions may dictate. This is to say that the flow capacity of the disc which is applied during hot-weather driving, in order to assure maximum cooling efficiency, would preferably correspond to the full-flow capacity of the branch **42** whereas, in cold weather, this flow capacity is appreciably choked and may, insofar as one of the twin radiators is concerned, be cut off altogether. The idea of inserting a flow-choking disc into a radiator's draw-off pipe is, I believe, properly credited to W. A. Kysor, of Kysor Heating Company, Cadillac, Michigan, and I therefore profess no novelty thereto, the principle being, however, especially applicable to my cooling system inasmuch as it gives a wide range of control when applied to two radiators which are entirely independent of one another insofar as the circulation of the contained bodies of water are concerned.

An advantage of my system of cooling which has recourse to pusher-applied turbine fans is that the air, after being forced through the radiators, may be thereupon used for purposes other than its primary cooling office, and I particularly have in mind two functions, one that of driving part of the warm air into the passenger compartment of the coach and the other that of causing the remaining air column to be swept toward and over the engine in order that the air blast may serve to blank out and divert the dust present under the vehicle and which, with an underfloor engine installation, ordinarily is deposited in a rather heavy layer upon the engine. Locating my engine, as I do, to the rear of the radiator, the issuing column of air is perforce caused to pass over the engine during those periods in which the vehicle is under way, and for controlling that portion of the air which is to be used for heating, I provide a box-like trap **46** upon the exhaust side of the foremost radiator and which covers, say, the forward half of the latter. This trap is open front and rear, and there is provided, to connect with the front opening, a duct **47** leading upwardly into the passenger compartment. Movable into and from a position closing the rear opening is a thermostatically-controlled damper **48** which is made responsive to the temperature which obtains within the passenger compartment. This heating instrumentality complements the vehicle's usual heater and allows the vehicle to employ a main heater of less B. t. u. output than is normally required.

As an alternative mode of applying my pusher-acting turbine fans, the radiators may be mounted horizontally at the bottom of the engine compartment with only so much tip as to assure drainage. This location of the radiators provides a positive water-fill of the core and tank spaces and consequently minimizes aeration which is a fault commonly present when the radiators are mounted vertically and such that their top end lies in a plane close to the top of the engine. In this horizontal mounting of my radiators I perforce employ a high filler pipe having a small auxiliary or surge tank at the upper end. With this last-described method of mounting the radiators, I have considered it desirable to also have the turbine fans lie within the engine compartment and cause the same to take a part of the air from the compartment, which serves the desirable end of putting the engine compartment under negative pressure, engine fumes being dispelled through the radiators into the atmosphere with a positive elimination of the possibility of the fumes seeping into the passenger compartment. The balance of the intake air for the turbine fans is drawn from the outside through louver openings in the side of the vehicle body.

It will be self-evident that the cooling system of the present invention may be applied either in an under-floor installation or within a rear chamber located behind the passenger compartment.

While the service life of a turbine type fan is considerably longer than that of a propeller-type fan it should be noted, in the event that any damage should occur from wear or other causes, that the replacement problem in the present system is considerably simplified by the interchangeability of parts. All three of the fans which I employ are exactly alike and it becomes therefore necessary that only one replacement part be carried in stock.

No limitations are to be implied from the foregoing detailed description of one embodiment of the invention and my somewhat cursory reference to a second embodiment departing therefrom primarily only in point of the location of the parts. It is my intention that all forms of construction and variations in detail coming within the scope of the hereto annexed claims will be considered as comprehended by the invention.

What I claim is:

1. A cooling system for a water-jacketed engine comprising, in combination with the engine, and with a water-cooling radiator having water-circulating connection with the engine, a plurality of co-axial turbine-type fans, hood shrouding the radiator, and respective ducts leading from the outlet sides of the several fans and joined by their tail ends to the shroud for conducting the pressure streams of fan-driven air to the core of the latter.

2. A cooling system for a water-jacketed engine comprising, in combination with the engine, and with functionally independent water-cooling radiators having water-circulating connection with the engine, a plurality of co-axial turbine type fans, a hood shrouding the radiators, and respective ducts leading from the outlet sides of the several fans and joined at their tail ends one with another and with the shroud for conducting the pressure streams of fan-driven air to the cores of the radiators.

3. In a wheeled vehicle, and in combination with a water-jacketed engine serving as the power plant therefor, a water-cooling radiator having water-circulating connection with the engine, a fan housing, an air-supply tunnel connecting with said housing and taking its air from the front of the vehicle at a point forwardly removed beyond the spray pattern of the front wheels, a plurality of functionally independent turbine fans, each complete with a squirrel-type rotor and a rotor casing, housed in co-axial spaced relation within the fan housing and each drawing air from within the housing, a hood shrouding the radiator, and respective ducts leading from the outlet sides of the several fan casings through a wall of the fan housing and joined at their tail ends with the hood for conducting the pressure streams of fan-driven air to the core of the radiator.

4. In a vehicle, and in combination with a water-jacketed engine serving as the power plant therefor, a water-cooling radiator having water-circulating connection with the engine, a fan housing providing an air-intake opening, a plurality of identical and functionally independent turbine fans, each complete with a squirrel-type rotor and a rotor casing, housed in co-axial spaced relation within the fan housing and each drawing air from within the housing, a drive arbor common to the rotors of each of the fans and driven from the engine, a hood shrouding the radiator, and respective ducts leading from the outlet sides of the several fan casings through a wall of the fan housing and joined at their tail ends with the hood for conducting the pressure streams of fan-driven air to the core of the radiator.

5. In a coach-type wheeled vehicle, and in combination with a water-jacketed engine serving as the power plant therefor, a water-cooling shrouded radiator having water-circulating connection with the engine, a turbine-type fan, an air tunnel leading to the intake side of the fan and taking its air from the front of the vehicle at a point forwardly removed beyond the spray pattern of the front wheels, a duct leading from the outlet side of the fan and joined at the tail end to the radiator shroud for conducting the pressure stream of fan-driven air to the core of the radiator, an air-trapping box overlying the outlet side of the radiator core and providing separate outlets one leading into the passenger compartment of the coach and the other spilling to the atmosphere, and a damper for the box thermostatically controlled by the temperature obtaining within the passenger compartment for controlling the volume of heated air fed from the box to the passenger compartment.

6. In a wheeled vehicle, and in combination with a water-jacketed engine serving as the power plant for the vehicle and mounted to occupy an under-floor position offset to one side of the vehicle's longitudinal center line, a water-cooling shrouded radiator placed longitudinal to the vehicle in front of the engine and having water-circulating connection with the engine, a fan housing placed alongside the radiator in a position more or less central to the width of the vehicle, an air tunnel connecting with the fan housing and taking its air from the front of the vehicle at a point forwardly removed beyond the spray pattern of the front wheels, a plurality of identical turbine fans, each complete with a squirrel-type rotor and a rotor casing, housed in co-axial longitudinally spaced relation within the fan housing and each drawing air from within the housing, a drive arbor common to the rotors of each of the fans and projecting by its rear end through the back wall of the housing, driving connection from the engine to the rear end of the arbor, and respective ducts leading from the outlet side of the fan casings through a side wall of the fan housing and joined at their tail ends with the radiator shroud for conducting pressure streams of fan-driven air to the core of the radiator, the column of clean air issuing from the radiator core being forced by pressure of the wind stream passing the vehicle to wash over the engine.

7. A cooling system for a water-jacketed engine comprising, in combination with the engine and with a water-cooling radiator having water-circulating connection with the engine, a turbine-type fan receiving its intake air through an end opening and discharging the air from a side opening, and an air-flow duct extending from the said side opening of the fan and leading to the radiator to cause the air to be pushed through the core of the latter, the axis of said duct being at a slope with the plane of the radiator to increase the areal extent of the radiation surface thereof.

HENDRICK E. SIMI.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,575,692	Knight	Mar. 9, 1926
1,820,091	Reavis	Aug. 25, 1931
1,867,678	Rayburn	July 19, 1932
1,974,033	Nallinger	Sept. 18, 1934
2,123,076	Madden	July 5, 1938
2,165,795	Holmstrom	July 11, 1939
2,232,587	Brandt	Feb. 18, 1941
2,250,382	Klavik	July 22, 1941
2,407,223	Caldwell	Sept. 10, 1946