

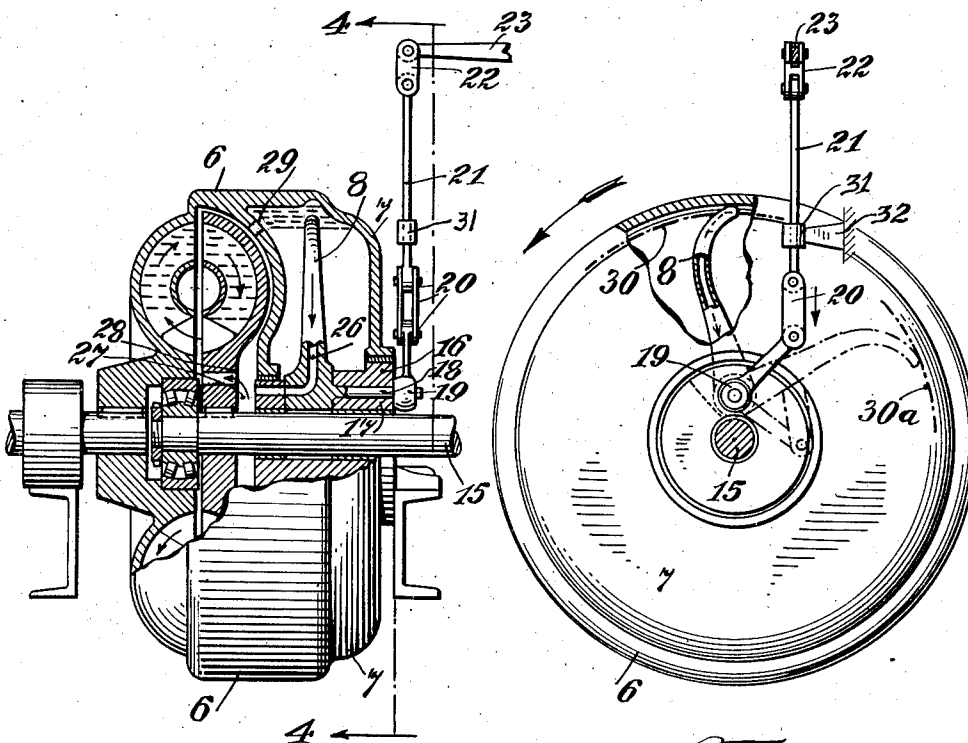
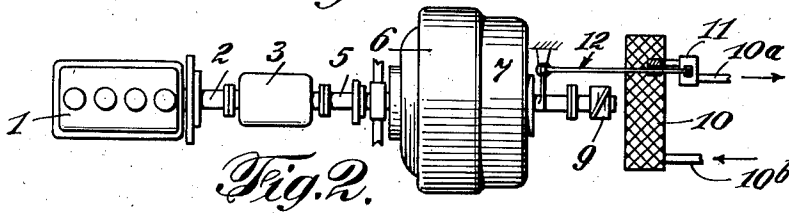
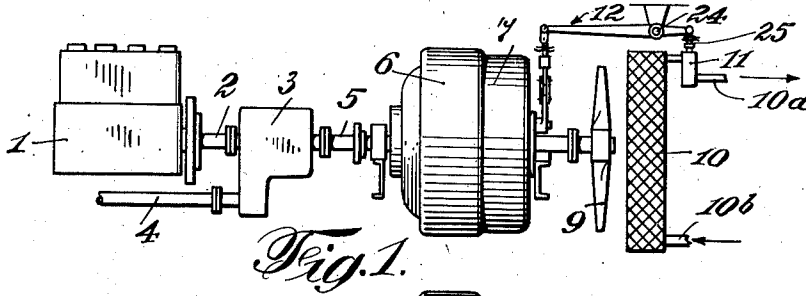
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COOLING DEVICE FOR AN INTERNAL COMBUSTION ENGINE

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BY

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COOLING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Internal combustion engines for rail or road vehicles are equipped with radiators (coolers) through which air is blown by fans. The cooling effect must be controlled in order to keep the cooling water temperature of the motor at a certain level. For this purpose the cooling circuit may be diminished by a device of shutters or by a bypass for the cooling air, or the air current may be throttled, or lately a mechanical clutch is installed to stop the fan occasionally.

The control systems which do not directly influence the speed of the fan but aim to divert or throttle the air current are not economical, because the portion of the energy used by the fan in order to move the air must be destroyed. The system operating the fan by clutch has the disadvantage that it wears out too quickly the clutch liners. This wear is caused by the high moment of inertia and the frequent starting and stopping of the fan.

As the space available for the cooling system of the vehicle, e. g. of a rail car, is generally very limited as a rule, high speed fans must be used. The increasing speed of the fan increases the noise as well which is especially annoying in rail cars.

All these disadvantages are eliminated according to the present invention by the fan being driven by a hydraulic coupling, and its speed is controlled by varying the degree of the coupling's filling. The speed of the fan may be varied from zero to its full speed, i. e. it may be adapted to the prevailing operation conditions by changing the degree of filling which is effectively and automatically controlled by a thermostat.

The dimensions of the cooling system and the speed of the ventilator are generally laid out, as it is well known in the art, for the most unfavourable conditions, as to keep the temperature below a certain maximum even at the hottest day. That means that the capacity of the cooling plant is nearly never completely put into use. Therefore in some well known systems the ventilators are mostly driven in a semi-throttled state or with many interruptions; the high speed of the fan causing an annoying noise because the plant is laid out for the above mentioned most unfavourable conditions.

An object of this invention is the full elimination of said disadvantages by controlling the speed of the fan. By controlling the filling of the coupling the fan always runs at a certain speed which is necessary to keep the tempera-

ture of the cooling fluid below a certain limit. Only in rare cases the highest speed will be necessary to meet the most unfavourable conditions for which the cooler is constructed. On all other conditions, i. e. nearly all the time of the run, the fan turns noiselessly with a low speed.

Another advantage of the invention consists of the proposed arrangement of the cooling system using less power than all other systems practically most of the time. To prove this the power consumption of the cooling plant with shut off device may be compared with that of the present invention. Suppose that the cooling plant may have to eliminate only half of the heat quantity corresponding to its total capacity, the fan with shut off device would run in this case for about half a minute at its full speed and then it would stop for another half a minute and so forth. Its power consumption therefore corresponds on the average to half of the full output during the same unit of time. According to the present invention the fan would run continuously with half the speed because the hydraulic coupling would work with a slip of 50%, i. e. its input speed is the double of its output speed. As the fan, while running at half speed, uses only one quarter of its full torque, the power consumption measured at the driving shaft of the coupling is only one quarter of the full output as compared with the half, which is measured at the driving shaft of the shut off device. Besides these advantages the hydraulic coupling damps, as it is well known, the vibrations existing between motor and fan. According to the above mentioned control of the speed by an adjustable hydraulic coupling, it is further possible to lay out the dimensions of the cooling plant so that even at the lowest motor speed the full capacity of the cooling plant is completely put in use. In this way, the fan may run at its highest speed while the motor runs slowly, without increasing again the speed of the fan when increasing the motor speed. An uneven run or even the endangering of the fan is avoided at the same time. The arrangement described above is of special advantage for rail cars with turbo gears in case the latter are also used for braking purpose. While used as a brake the motor idles or turns with only a little speed while the cooling plant has to deal with a great heat quantity. This heat is generated by the braking process in the gear fluid and must be eliminated by the cooler serving both motor and gear. Because the speed of the fan is controlled, the fan needs not run with the

speed corresponding to the reduced speed of the motor, but may be running at its highest speed. This gives the possibility to use the capacity of the plant even at low motor speed.

The same as is described above for automotive engines, may apply for stationary engines, in case very much changing working conditions are prevailing.

In the accompanying drawing,

Fig. 1 is a side view of the components of my invention;

Fig. 2 is a plan view of the same;

Fig. 3 is a section partly in elevation of one of the components of my invention, namely the hydraulic coupling with a scoop tube and means for swinging it, and

Fig. 4 is an end elevation partly broken away to show the scoop tube.

Similar characters of reference indicate the same parts.

One design of the invention is shown diagrammatically in the drawing. The motor 1 drives over shaft 2, the gear 3 and shaft 4 an axle of the vehicle (not shown). Another drive 5 goes from the motor or the gearbox respectively through the hydraulic coupling 6, which is equipped e. g. with the rotating container 7 and scoop tube 8, to the fan 9, which blows cooling air through the radiator 10. A thermostat 11 is arranged at the radiator 10 working by a rod system 12 on a lever which is connected with the scoop tube 8. The position of the scoop tube, regulating the degree of filling of the coupling, and thereby the speed of the fan, is controlled by the thermostat.

The coupling 6 is well known and is not described in detail.

Upon the shaft 15 is a stationary member or tube 16, provided with a bore 17, through which a rod 18 passes. At the free end of the rod 18 is a bell crank lever 19, pivotally connected at 20 with a lever 21, pivotally connected at 22 with a lever 23, pivoted at 24, and having its free end pivotally connected at 25 with the operative member of the thermostat 11. The lever 21 is slidably supported by a socket 31 mounted on a fixed bracket 32. The other end of the rod 18 is screwed to or made a part of a movable scoop tube 8 having a bore 26 which enables the fluid to pass through from the peripheral portion of the container 7 to the passage 27, as indicated by the arrow 28. Thereby this fluid again enters the coupling as is known. The coupling has a leak off valve or nozzle 29 which enables the fluid to be discharged from the coupling to the container 7, as is also known.

In Figure 4, the scoop tube 8 is shown in full lines, almost contacting with the perimeter of the inner part of the container with a fluid level at the dot-dash line 30 in order to scoop gradually all of the fluid into the coupling. In Fig. 4

is also shown the scoop tube in dash-dotted lines, and in this position the scoop tube scoops only fluid along the circumferential dot-dash line 30, that is, fluid radially inwards of said line 30a, maintaining thereby fluid between the line 30 and the perimeter of the container. With the scoop tube 8 in the full line position of Fig. 4, the coupling will be maintained completely filled, while with the scoop tube in the dot-dash position, the coupling will be practically empty with all the fluid remaining in the container. Intermediate positions of the tube will produce varying degrees of filling in the coupling, one of which is shown in Fig. 3; as is known the inlet and outlet pipes 10b and 10a, are connected to the engine to lead the cooling medium to and from the engine.

From the foregoing it is seen that the improvement consists in a combination of a cooling fan, driven by an engine through a coupling, in which means for varying the amount of fluid in the coupling dependent upon and changing with the amount of the cooling required by the engine, are provided.

I have described an embodiment of my invention, but it will be clear that changes may be made within the principle of the invention described, without departing from the scope of the subjoined claims.

Having thus fully described my invention, what I claim is:

1. In a cooling system, in which a cooling fan is driven by an engine through the intermediary of an hydraulic coupling, the combination therewith of means for varying the amount of fluid in the coupling, dependent upon and changing with the amount of the cooling required by the engine.

2. In a cooling system, in which a cooling fan is driven by an engine through the intermediary of an hydraulic coupling, the combination therewith of means for varying the amount of fluid in the coupling, dependent upon and changing with the amount of the cooling required by the engine, said means consisting of a scoop tube within the coupling for returning discharged fluid to the operative circuit of the hydraulic coupling, and a device responsive to the temperature of the cooling fluid of the engine for controlling the position of said scoop tube.

3. In a cooling system, the combination of a motor; a turbo coupling driven by the motor, a fan driven by the turbo coupling and adapted to supply cooling air, a part of the motor to be cooled in the path of the cooling air, and means on said last named part regulating the fluid of the turbo coupling to vary the speed of the fan to increase or decrease it depending on the temperature of the part to be cooled.

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