Oct. 13, 1942. J. C. RHOADS 2,298,902

HEAT EXCHANGE SYSTEM

Filed June 4, 1940

Fig. 1.

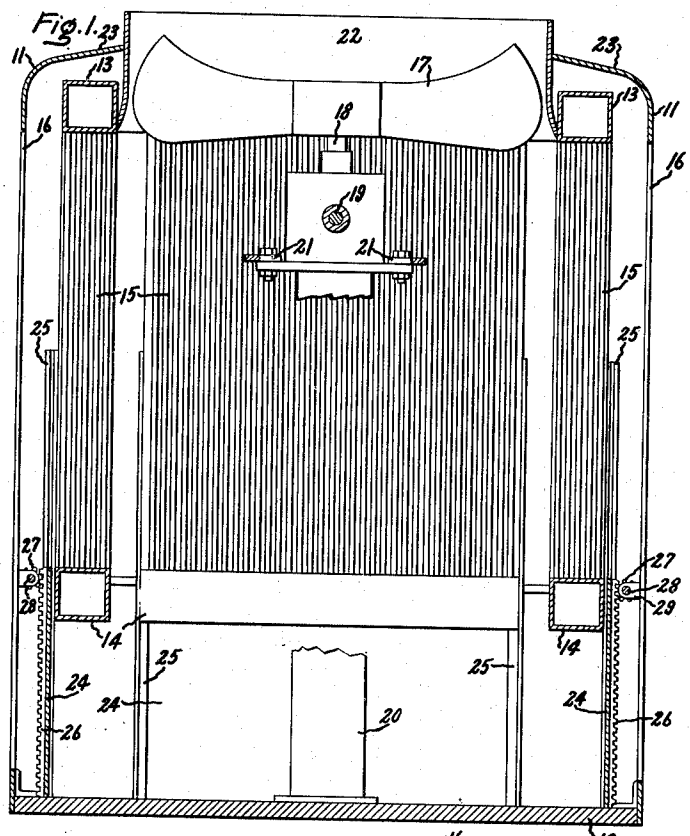


Fig. 3.

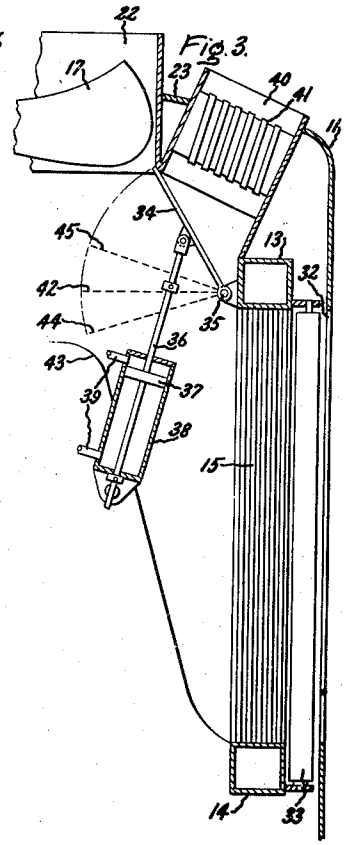
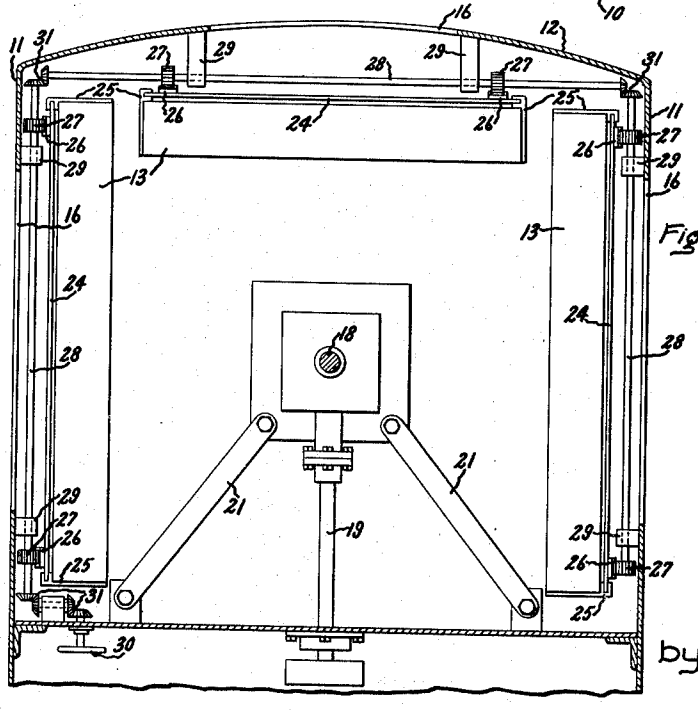


Fig. 2.



Inventor:
James C. Rhoads,
by Harry E. Dunham
His Attorney.

Patented Oct. 13, 1942 2,298,902

UNITED STATES PATENT OFFICE

2,298,902

HEAT EXCHANGE SYSTEM

James C. Rhoads, Erie, Pa., assignor to General Electric Company, a corporation of New York

Application June 4, 1940, Serial No. 338,752

7 Claims. (Cl. 105—26)

My invention relates to railway vehicle prime mover heat exchange systems.

In railway locomotives which are propelled by engines provided with water-cooling systems or by steam engines utilizing condensers, it has been found desirable to use forced ventilation to obtain the desired cooling of the heat exchange devices such as radiators or condensers. Furthermore, it has been found desirable to maintain substantially constant the amount of air flow through the air impeller which provides the forced ventilation in order to obtain the most efficient operation thereof. Under certain operating conditions where the load is heavy or where the ambient temperature is relatively high, it is necessary to provide a relatively larger flow of air through the heat exchange device than under light load conditions or when the ambient temperature is relatively low.

An object of my invention is to provide an improved heat exchange system for a railway vehicle prime mover.

Another object of my invention is to provide for a more efficient utilization of the air flow provided by an air impeller in a heat exchange system for a railway vehicle prime mover.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 is a sectional end view of a railway vehicle prime mover heat exchange system illustrating one embodiment of my invention; Fig. 2 is a plan view of the arrangement shown in Fig. 1, partly in section, and with the air impelling fan removed to illustrate more clearly the relative arrangement of the heat exchange device and the air baffle plates; and Fig. 3 is a partial end elevational view illustrating a modification of the arrangement shown in Figs. 1 and 2.

Referring to the drawing, a railway locomotive superstructure is shown having a floor 10 on which side walls 11 and an end wall 12 are supported. The vehicle is adapted to be propelled by any suitable prime mover, such as a Diesel or steam engine, which may be arranged to drive the vehicle directly or through the medium of electric motive power devices and is provided with a heat exchange system adapted to remove undesirable heat from the power source used to drive the prime mover. In the arrangement shown in Figs. 1 and 2, this includes a plurality of heat exchange devices having headers 13 and 14 between which is arranged a plurality of cooling tubes 15. These heat exchange devices are arranged adjacent air intake openings 16 formed in the vehicle walls 11 and 12 and air is circulated through the heat exchange devices by an air impeller fan 17 mounted upon a drive shaft 18 which is driven by a countershaft 19 driven by any suitable source of power available on the locomotive. This fan 17 is supported by a pedestal 20 and braces 21 extending from the top of the pedestal to one of the vehicle walls. With such an arrangement, air is drawn through the air intake openings 16 and passes over the cooling tubes 15 and out through an air exhaust opening 22 formed in the roof 23 of the locomotive.

As has been stated, it often is desirable under different operating conditions to vary the amount of air which passes through the heat exchange devices, and in order to provide this feature, a baffle plate 24 is arranged adjacent the lower portion of each heat exchange device with the outer edges of the plate in engagement with guiding tracks 25 which extend upwardly for a predetermined distance from the lower portion of each of the heat exchange devices. These baffle plates are adapted to be moved upwardly thus varying the effective size of the air passage, so as to vary the air passage or the circulation of air through the heat exchange device by closing off circulation from the lower part of the cooling tubes 15. In order to obtain the most efficient operation of the ventilating system, it is desirable to maintain substantially constant the amount of air flow through the air impeller 16, as if the air intake opening is materially reduced, a considerably larger amount of power is required to drive the fan. In order to obtain this substantially constant air flow, the intake openings 16 forming the walls of the vehicle extend substantially to the floor 10 and a pair of gear racks 26 is secured to each baffle plate adjacent the outer upwardly extending edge thereof. These gear racks are arranged in engagement with gears 27 mounted upon shafts 28 which are journaled in brackets 29. A hand wheel 30 is adapted to operate manually the gears 27 through a set of bevel gears 31, although a power drive may be provided if desired. In this manner, under light load conditions or when the ambient temperature is relatively low, the hand wheel 30 may be turned so that the baffle plates 24 will be raised to close

off the air passage or circulation of air from the lower portion of the heat exchange devices, and in doing so will provide an air by-pass intake opening to the exterior of the vehicle separate from the intake opening of the heat exchange device below the lower headers 14 of the heat exchange devices to maintain substantially constant the air flow through the air impeller. Under heavy load operating conditions or when the ambient temperature is relatively high, the baffle plates 24 can be lowered by the gears 27 and the gear racks 26, so that a larger proportion of the air passes through the heat exchange devices, as effective sizes of the air by-pass intake and the main air intake passages are varied substantially simultaneously and inversely.

In Fig. 3, I have shown another embodiment of my improved heat exchange system wherein the heat exchange devices are arranged with the cooling tubes 15 adjacent air intake openings 32 formed in the sides 11 of the vehicle, and these air intake openings are substantially only as large as the outer area of the cooling tubes 15. In this arrangement, movable air-directing baffles 33 also are arranged between the cooling tubes 15 and the air intake opening 32. As in the former arrangement, an air impeller fan 17 is arranged to draw air through the heat exchange device and to blow this air out through an exhaust opening 22 formed in the roof 23 of the vehicle. In order to provide the desired variation in the amount of air which passes through the heat exchange devices, a baffle plate 34 is pivotally mounted at 35 upon the upper header 13, and is adapted to be moved to various positions by an operating rod 36 secured to a piston 37 arranged in a control cylinder 38. The piston 37 may be moved to various positions in the cylinder 38 by varying the pressures on the two sides thereof by admitting or exhausting air, steam, or other suitable fluid from the cylinder through two ports which communicate with a fluid supply by a pair of tubes 39. In the position shown in the drawing, the baffle plate 34 is arranged over the inner open end of an air by-pass intake opening 40 to the exterior of the vehicle separate from the intake opening of the heat exchange device in which a braking resistor 41 is arranged. Under heavy load operating conditions and high ambient temperatures, it is desirable that the entire flow of air should pass over the cooling tubes 15 of the heat exchange device and the baffle plate 34 is moved so as to close the by-pass air intake opening as shown in the drawing. Under rheostatic braking conditions and relatively high ambient temperatures, the baffle plate 34 may be moved to the position indicated by the dotted line 42, so as to allow substantially the entire volume of air to pass over the braking resistor and out through the exhaust opening 22, as the baffle plate 34 substantially closes off most of the passage of air through the heat exchange device in this position. As can be seen, the outer edge of the baffle plate 34 is adapted to extend to a position closely adjacent a wall 43 arranged within the locomotive on the interior of the heat exchange device. Under braking conditions when the ambient temperature is relatively low, it is desirable that the amount of air passing through the heat exchange device be at a minimum to prevent freezing of the water in the tubes 15 in addition to allowing as much air as possible to pass over the braking resistors. This position is shown by the dotted line 44. When the ambient temperature is relatively low, it may be desirable to by-pass a certain amount of air even though the braking resistor is not in use, in order to prevent freezing of the cooling liquid in the heat exchange device. Such operation can be obtained by lowering the baffle plate 34 to a position such as is indicated by the dotted line 45. Thus, the quantity of air which passes through the heat exchange device and through the air by-pass intake is varied substantially simultaneously and inversely in accordance with predetermined operating conditions by varying the effective sizes of the different air passages, and the air flow through the air impeller is maintained substantially constant to obtain maximum efficiency in its operation.

While I have illustrated and described particular embodiments of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangements disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A railway vehicle prime mover heat exchange system including a heat exchange device having an air passage intake thereto for removing undesired heat from said prime mover, means including an air impeller for circulating air through said heat exchange device, an air by-pass intake opening to the exterior of the vehicle separate from the heat exchange device air passage intake, and means for varying the effective size of said air passage through said heat exchange device and for substantially simultaneously and inversely varying the effective size of said by-pass air intake passage to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

2. A railway vehicle prime mover heat exchange system including a heat exchange device having an air passage intake thereto for removing undesired heat from said prime mover, means including an air impeller for circulating air through said heat exchange device, an air by-pass intake opening to the exterior of the vehicle separate from said heat exchange device air passage intake and means including a movable baffle plate for varying the effective size of said air passage through said heat exchange device and for substantially simultaneously and inversely varying the effective size of said by-pass air intake passage to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

3. A railway vehicle prime mover heat exchange system including a heat exchange device having an air passage therethrough for removing undesired heat from said prime mover, means including an air impeller for circulating air through said heat exchange device, an air by-pass intake, a braking resistor arranged in said air by-pass intake, and means for varying the effective size of said air passage through said heat exchange device and for substantially simultaneously varying the effective size of said by-pass air intake passage to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

4. A railway vehicle prime mover heat ex-

change system including a heat exchange device having an air passage therethrough for removing undesired heat from said prime mover, means including an air impeller for circulating air through said heat exchange device, an air by-pass intake, a braking resistor arranged in said by-pass intake, and means for varying the effective size of said air passage through said heat exchange device and for substantially simultaneously varying the effective size of said by-pass air intake passage in accordance with predetermined operating conditions to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

5. A railway vehicle prime mover heat exchange system including a vehicle wall having an air intake opening therein, a heat exchange device arranged adjacent said air intake opening for removing undesired heat from said prime mover, an air by-pass intake opening to the exterior of the vehicle separate from the heat exchange air intake opening, means including an air impeller for circulating air from said air intake opening through said heat exchange device, and means for varying the effective size of said intake opening through said heat exchange device and for substantially simultaneously and inversely varying the effective size of said air by-pass intake opening to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

6. A railway vehicle prime mover heat exchange system including a vehicle wall having an air intake opening therein, a heat exchange device arranged adjacent said air intake opening for removing undesired heat from said prime mover, an air by-pass intake, a braking resistor in said air by-pass intake arranged to be cooled by the by-passed air, means including an air impeller for circulating air through said heat exchange device, and means for varying substantially simultaneously the effective size of said air intake opening in said heat exchange device and the effective size of said by-pass intake to maintain substantially constant the air flow through said impeller under varying operating conditions whereby said air impeller operates substantially under most efficient conditions.

7. A railway vehicle prime mover heat exchange system including a heat exchange device having an air passage therethrough for removing undesired heat from said prime mover, means including an air impeller for circulating air through said heat exchange device, an air by-pass intake, a braking resistor arranged in said air by-pass intake, and means for substantially closing off the air passage through said by-pass intake under predetermined operating conditions and for varying the effective size of said air passage through said heat exchange device and for substantially simultaneously varying the effective size of said by-pass air intake in accordance with other predetermined operating conditions to maintain substantially constant the air flow through said air impeller whereby said air impeller operates substantially under most efficient conditions.

JAMES C. RHOADS.