June 4, 1963 C. F. BROWN, JR., ETAL 3,092,325

ROAD STRIPING APPARATUS

Filed Sept. 9, 1960 3 Sheets-Sheet 1

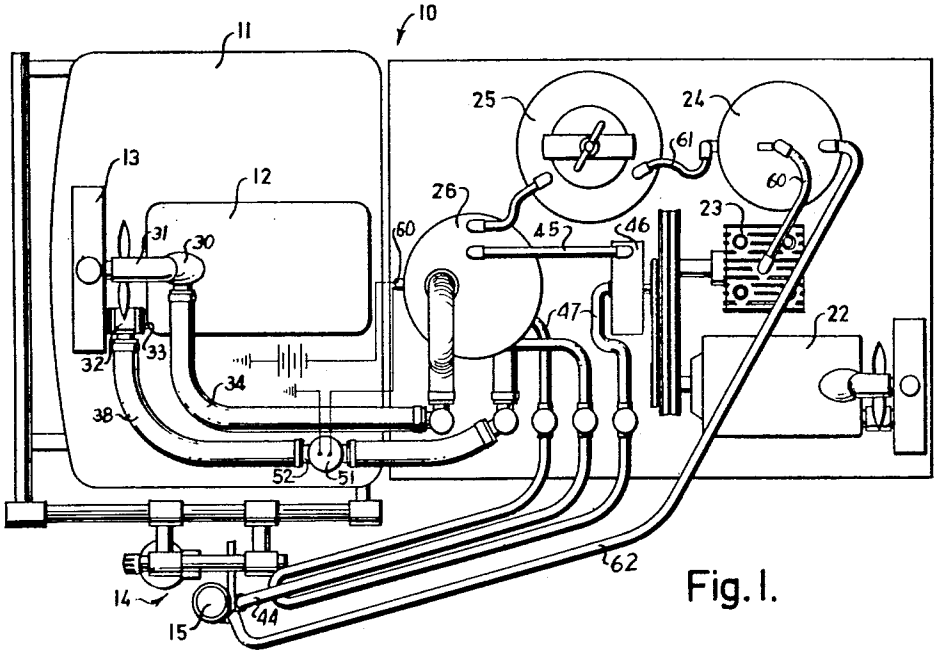
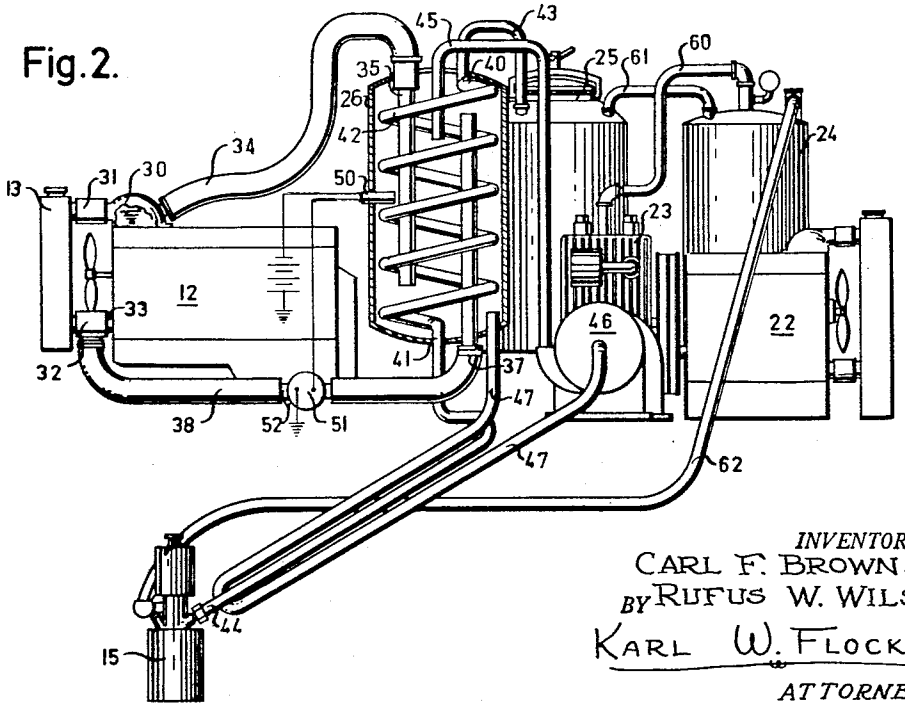


Fig. 1.

Fig. 2.



INVENTORS
CARL F. BROWN, Jr.
BY RUFUS W. WILSON
KARL W. FLOCKS
ATTORNEY

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ROAD STRIPING APPARATUS

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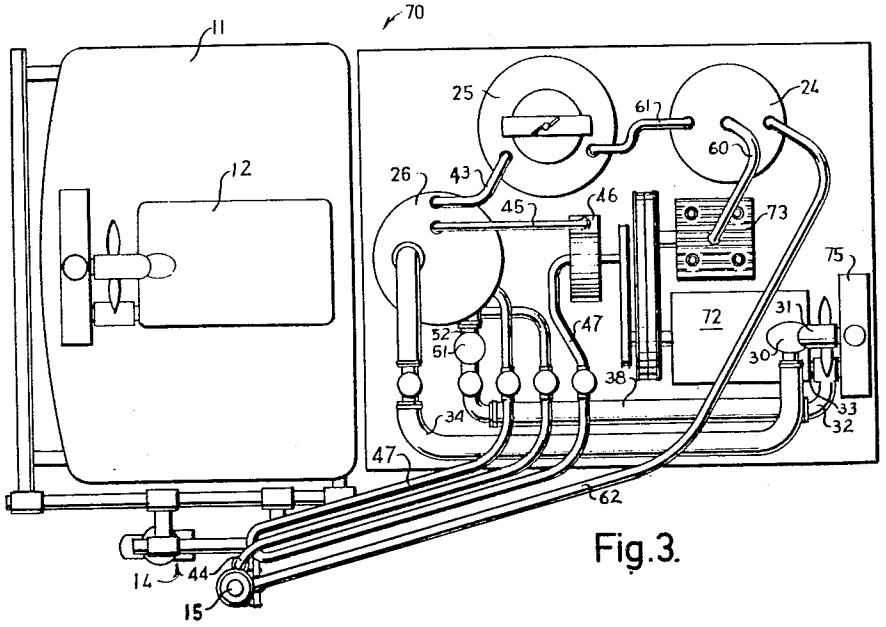

Fig.3.

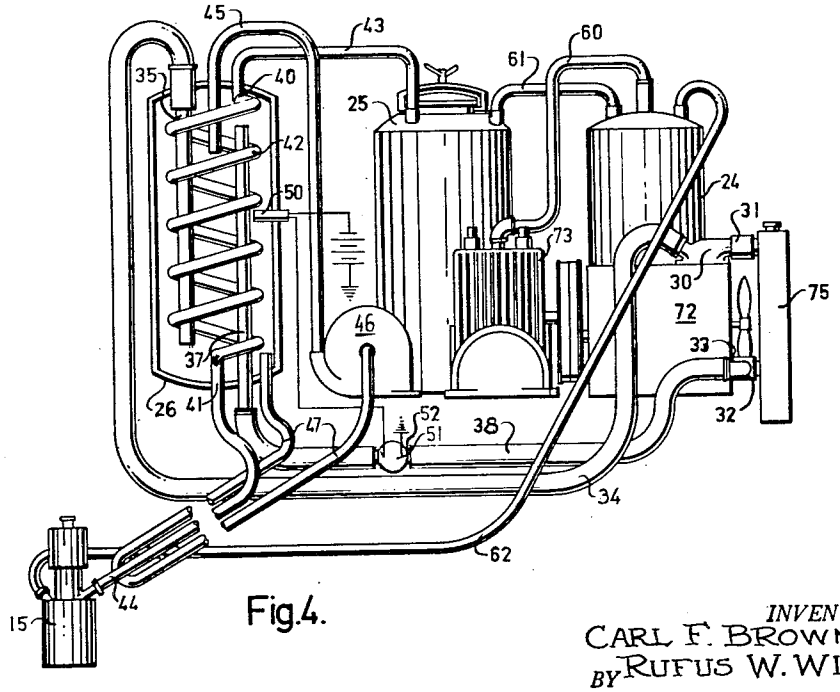

Fig.4.

INVENTORS
CARL F. BROWN, Jr.
BY RUFUS W. WILSON
KARL W. FLOCKS
ATTORNEY

June 4, 1963 C. F. BROWN, JR., ETAL 3,092,325

ROAD STRIPING APPARATUS

Filed Sept. 9, 1960 3 Sheets-Sheet 3

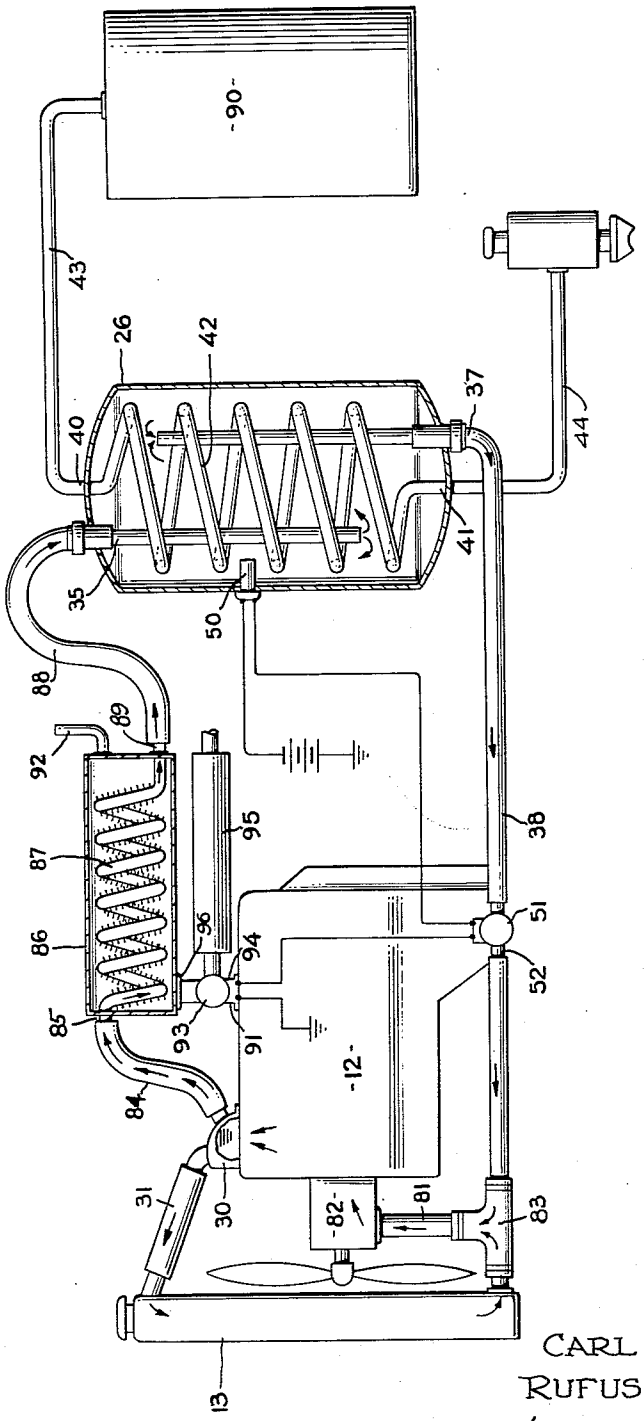

Fig. 5.

INVENTORS

CARL F. BROWN, Jr.

RUFUS W. WILSON

BY KARL W. FLOCKS

ATTORNEY

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ROAD STRIPING APPARATUS

Carl F. Brown, Jr., and Rufus W. Wilson, Huntingdon, Pa., assignors to Wald Industries, Inc., Huntingdon, Pa., a corporation of Pennsylvania

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3 Claims. (Cl. 237—12.3)

The present invention relates to road striping apparatus, and more particularly to road striping apparatus having heat exchange equipment incorporated thereon for heating the paint to be sprayed.

This application is a continuation-in-part of copending application Serial No. 814,449, now abandoned.

At the present time, road striping apparatus is known in which a vehicle has mounted thereon a container for paint, a paint gun and equipment such as an air compressor for causing the paint to flow from the container to the spray gun. The spray gun is directed at the surface over which the vehicle moves, such as a road, and thus applies a film of paint to the road. While the application of paint to a road surface by such equipment has been a marked improvement over the hand application of paint, it has been discovered that such equipment does have limitations.

In particular, where a crew and designated pieces of equipment are to be used for the striping of a certain portion of a road, the spraying often begins in the morning. Because the air temperature is generally lower during the early morning hours, the paint is usually thinned with solvent in order to reduce the thickness thereof and to permit it to be applied with ease. The use of solvents, however, creates false film and the resultant stripe suffers in hiding power and in lasting qualities. It often happens, also, that a busy crew does not notice the change in air temperature as it proceeds with its job, and later in the morning or in the early afternoon, the air has warmed considerably, so that solvents are actually not needed. However, solvents are sometimes added by the force of routine, and in these instances the paint becomes entirely too thin. The resultant line sprayed with the thinned paint at the higher mid-day temperatures has even less potential use and life.

It will be understood that the use of solvents and thinners is an added expense, not only because of the materials involved but also because of the time of the crew that is involved in determining the amount of solvent to be used and in actually introducing the solvent into the paint and mixing it therewith. Further, the use of solvent lengthens the drying time of the paint, and thus enhances the danger of traffic driving over the paint and causing it to streak. Solvent or thinner also requires that more atomizing air be used than is normal, and this causes an attendant increase in the work load on the air compressing equipment, which is generally supplied in order to furnish both atomizing air for the spray guns and air pressure in the paint supply container. The addition of solvents and thinners reduces the paint coverage, and thus reduces both the economy and the quality of the paint application. Thus, these additives reduce the solids to solvent ratio, and as a consequence reduce the film thickness; these thinner films also tend to shrink more than a film of unthinned paint. Where solvent is used, also, a greater spray fog is created than otherwise, thus causing both the spray equipment operator and any passing traffic considerable inconvenience.

An object of the present invention is to provide road striping apparatus that will permit the application of paint to a road or the like without the necessity of using solvent or thinner.

Another object of the present invention is the provision

of apparatus for heating and applying paint to a road or similar surface.

A further object of the present invention is to provide road spraying equipment, including apparatus for heating paint, which apparatus does not unduly raise the cost of the spray equipment.

A still further object of the present invention is the provision of road spraying apparatus in which paint is heated and in which the paint is supplied at an appropriately elevated temperature to the spray gun, and the provision of such apparatus which is not unduly costly.

Still another object of the present invention is the elimination of the undesirable roar of the engine exhaust which may be extremely uncomfortable for an operator in the truck cab on this type of mobile equipment.

Furthermore, it is an object of the invention to utilize practically all of the dissipated heat generated by the various components of the road striping apparatus and to use the combined heat of the hot water from the engine of the road striper apparatus further heated by the exhaust gases from the engine to provide more heat to heat the paint to higher temperatures than formerly attained by previous methods.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a plan view, partly schematic, of a road striping apparatus in accordance with the present invention.

FIG. 2 is a schematic view showing the paint heating and supply system of FIG. 1.

FIG. 3 is a plan view, partly schematic, of another embodiment of a road striping apparatus in accordance with the present invention.

FIG. 4 is a schematic view of the heating and supply system of FIG. 3.

FIG. 5 is a schematic view of a different embodiment of a road striping apparatus in accordance with the present invention.

Referring now to the drawings, wherein like reference numerals are used to designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a road striping apparatus generally designated **10** comprising a wheeled vehicle **11**. In the embodiment shown the vehicle **11** is a truck having a cab at the forepart thereof and a bed at the rear part thereof on which various parts of the apparatus are mounted, as will be hereinafter described. The vehicle **11** is driven by an internal combustion engine **12** having a radiator **13**, and it will be understood that the vehicle **11** is, in the embodiment illustrated, of the type in which the engine **12** is beneath the cab thereof. At the side of the vehicle, or in a convenient place, is a spray gun carriage **14** supporting a spray gun **15** thereon.

On the bed of the vehicle **11** is an engine **22** connected in driving relationship with an air compressor **23**. Also mounted on, or beneath, the bed of the vehicle **11** are an air tank or reservoir **24**, a paint supply container **25**, and a heat exchanger **26**. While both of the engines **12** and **22** may have integral water jackets therearound for cooling purposes, in the embodiment of the invention illustrated in FIG. 1, the engine **12** has, necessarily, such a water jacket.

There may be seen in FIG. 2 the internal combustion engine **12** having the integral water jacket therearound, as well as the radiator **13**. An outlet **30** from the water jacket of internal combustion engine **12** is connected by a conduit **31** to the inlet of radiator **13**, and a conduit **32** connects the outlet of radiator **13** with the inlet **33** of the water jacket of engine **12**. A branch conduit **34** con-

nects the outlet 30 of the water jacket of engine 12 with an inlet 35 of the heat exchanger 26, and an outlet 37 of the heat exchanger 26, which is fluid connected with the inlet 35 thereof, is connected by a second branch conduit 38 with the inlet 33 of the water jacket of engine 12.

A second inlet 40 and a second outlet 41 of the heat exchanger 26 are fluid connected with each other, as by a coil pipe 42, and a conduit 43 connects the inlet 40 of the heat exchanger 26 with the paint supply container 25. The paint spray gun 15 is connected with the outlet 41 of heat exchanger 26 by a paint delivery conduit 44.

The paint flowing through paint delivery conduit 44 is heated by hot water that is placed in heat exchange relationship with the conduit 44. This relationship is achieved, in the embodiment illustrated, by a hose 45 that connects the hot water section of heat exchanger 26 with a pump 46, the outlet of the pump being connected with a hose 47 that extends in folded relationship along the conduit 44, and then returns to the hot water section of heat exchanger 26.

A thermostatic element 50 is positioned in the heat exchanger 26, and is connected in circuit with a solenoid 51 that controls the valve 52 in the second branch conduit 38. Valve 52, which is a regulating type valve, is opened more or less depending upon the temperature sensed by thermostatic element 50 in heat exchanger 26, and thus permits more or less water to flow out of the heat exchanger 26 and to return to the inlet 33 of the water jacket of internal combustion engine 12. This serves to maintain the temperature of the paint delivered from the heat exchanger 26 at a constant value. The hose 47 serves to maintain the paint flowing through paint delivery conduit 44 at a sufficiently high temperature.

The air compressor supplies the air tank 24 through a conduit 60, in the usual manner, and conduits 61 and 62 lead from the tank 24 to the paint supply container 25 and the spray gun 15, respectively. While the various conduits have been shown in FIG. 1 to be connected into a plurality of control and diverter valves, this valving arrangement has been eliminated from FIG. 2 for purposes of simplicity, and since FIG. 2 is a schematic showing of the supply and heating systems.

Referring now to FIG. 3, there is shown a road striping apparatus 70 that also comprises a vehicle 11. While the vehicle 11 has an internal combustion engine 12, the water from the water jacket of the engine 12 is not used as a heat exchange medium, but instead there is provided an internal combustion engine 72 for driving the compressor 73, and it will be understood that the engine 72 and compressor 73 may be different parts of a unitary item of equipment. The engine and compressor unit 72, 73 is provided with a radiator 75, as is shown in FIG. 4; other than this difference, the embodiment of the invention represented in FIGS. 3 and 4 is the same as the embodiment represented in FIGS. 1 and 2, and further description thereof is therefore deemed unnecessary.

FIG. 5 shows still another embodiment of the road striping apparatus of this invention in a simplified schematic form. Several of the details of the air-paint system are omitted from this figure since they have been explained in detail in connection with the previous figures. In this embodiment superheated water is used to warm the paint to the consistency desired for best use with the road striping apparatus. Also, the heat exchange effect is incorporated into the system in such a manner so as to act as a muffler of the engine noises which tend to become uncomfortably loud with this type of equipment.

The internal combustion engine 12 has outlet 30 from the water jacket of engine 12 and is connected by a conduit 31 to the inlet of radiator 13, and a conduit 81 connects the outlet of radiator 13 with water pump 82 through T connection 83. Water pump 82 thereby moves the water into and through the water jacket of

engine 12. A branch conduit 84 connects the outlet 30 of the water jacket of engine 12 with an inlet 85 of the heat exchanger 86. Inside of heat exchanger 86 the water is passed through a coiled finned pipe 87 and out of water outlet 89 to conduit 88 to inlet 35 of a second heat exchanger 26; and an outlet 37 of this second heat exchanger 26, which is fluid connected with the inlet 35 thereof, is connected by a second branch conduit 38 through T connection 83 to conduit 81, water pump 82, and the water jacket of engine 12. The arrows in FIG. 5 show these paths of the water as described.

During the passage of the water as described above, the hot exhaust gases from engine 12 are passed through T connection 91 through gas inlet 96 into the shell of heat exchanger 86. These hot gases pass over the coiled finned pipe 87 further heating water therein which has previously been heated in the water jacket of engine 12. The gases, now somewhat cooled, pass out through exhaust pipe 92. The coiled finned pipe 87 in heat exchanger 86 also acts to muffle the sounds of the exhaust emitting from engine 12.

Paint under pressure is delivered from paint supply container 90 through conduit 43 to second inlet 40 and to heat exchanger 26 and second outlet 41 through paint delivery conduit 44 to a spray gun with the action taking place in heat exchanger 26 the same as described in connection with FIG. 2. In this case the paint is heated to a higher temperature due to the superheated water passing through heat exchanger 26.

Whenever the thermostatic element 50 positioned in heat exchanger 26 determines the temperature of the water therein to be too high then regulating valve 52 controlled by solenoid 51 is partially closed to cut down the flow of water through the part of the system involving heat exchanger 26 and 86. Solenoid 93, which is also connected in the circuitry with thermostatic element 50, also reacts at the same time to move butterfly switch 94 in T connection 91 to divert the exhaust gases from engine 12 through a conventional muffler 95 instead of through heat exchanger 86. This embodiment of the invention also serves to keep the temperature of the paint delivered from the heat exchanger 26 at a constant value, although at a higher temperature than the aparatus of the other embodiments described herein, and also provides an additional muffling action.

There has been provided herein a road striping apparatus that avoids all of the deficiencies inherent with the use of paint thinner or solvent. The apparatus of the present invention provides for the heating of paint in a heat exchanger by hot water from the cooling jacket of an internal combustion engine, which engine may either be the main propelling engine of the vehicle or an auxiliary engine used to drive an air compressor. Heat from the hot water is transferred to the paint in a convenient heat exchanger, and the delivery temperature of the paint from the heat exchanger is controlled by an automatic thermostat and solenoid control valve connected in a circuit. In addition, cooling of the paint between the spray gun and the heat exchanger is avoided by conducting hot water in heat exchange relationship with the paint delivery hose. Thus, the present invention provides for delivery of paint at a controlled temperature to the spray gun. Further, the utilization of the hot water from the internal combustion engine eliminates any fire hazard that would arise from any other heat source, and thus avoids any fire hazard.

Also, this invention has provided a road striping apparatus which eliminates the undesirable roar of the engine exhaust which is deafening to an operator in a truck cab on this type of mobile equipment, and this has been combined integrally with apparatus to superheat water already hot from being heated in the engine and thereby heating the paint to higher temperatures than formerly attained by other methods.

It will be obvious to those skilled in the art that various

changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. Road striping apparatus comprising a vehicle, an internal combustion engine for driving said vehicle, a water jacket integral with said internal combustion engine, a first water outlet connection connected to said water jacket, a first branch conduit connected to said first water outlet connection, a radiator mounted on said vehicle and receiving water from said first water outlet connection through said first branch conduit, a second branch conduit connected from said radiator back to said water jacket, a water pump connected to said second branch conduit to aid the flow of water in said water jacket and said radiator, a first heat exchanger comprising a water inlet and a water outlet, and a gas inlet and a gas outlet, a coiled finned pipe connected to said water inlet and said water outlet said water inlet connected by a third branch conduit to said first water outlet connection, a T connection gas conduit connected between said first heat exchanger and said internal combustion engine to channel exhaust gases through said gas inlet and said heat exchanger through said gas outlet after passing the gases over said coiled finned pipe whereby the sound from said internal combustion engine is muffled and the water in said coiled finned pipe is heated, a second heat exchanger for two fluids, a fourth branch conduit connecting said water outlet of said first heat exchanger with an inlet connection of said second heat exchanger, an outlet connection of said second heat exchanger fluid connected with said inlet thereof, a fifth branch conduit connecting said second heat exchanger outlet to said second branch conduit and said water pump, a secondary fluid, a second inlet and a second outlet in said second heat exchanger fluid connected with each other, a sixth conduit connected to conduct said secondary fluid to said second inlet of said second heat exchanger, a seventh conduit connected to receive said secondary fluid, a first solenoid controlled valve in said fifth branch conduit, a second solenoid controlled valve in said T connection gas conduit, a muffler attached to said T connection gas conduit and an electric circuit including said first and second solenoids and a thermostat in contact with the water in said second heat exchanger whereby a raise in temperature above a desired limit detected by said thermostat closes said first solenoid controlled valve and adjusts said second solenoid controlled valve to divert exhaust gases from said internal combustion engine through said muffler.

2. Road striping apparatus comprising a pair of fluid circuits connected in parallel including a first fluid circuit comprising an internal combustion engine and a water pump connected in series with a radiator, and a second fluid circuit comprising said internal combustion engine and said water pump connected in series with a first heat exchanger and a second heat exchanger, a T connected fluid branch circuit connected between said internal combustion engine and said first heat exchanger to allow exhaust gas to pass from said internal combustion engine into said first heat exchanger; a muffler attached to said T connected fluid branch circuit; a coiled finned tube in said first heat exchanger connected into said second fluid circuit; a third fluid circuit connected to pass through said second heat exchanger whereby fluid in said third fluid circuit is heated in said second heat exchanger by heated fluid in said second fluid circuit, a first solenoid, a second solenoid, and a thermostat electrically connected in series, a first valve controlled by said first solenoid and located so as to control fluid flow through said second fluid circuit, and a second valve controlled by said second solenoid and located in said T connected fluid branch circuit so as to control the flow of exhaust gas from said internal combustion engine to either said first heat exchanger or said muffler.

3. Road striping apparatus comprising a vehicle, an internal combustion engine for driving said vehicle having a water jacket integral with said internal combustion engine, and a T connection exhaust gas outlet on said internal combustion engine, a muffler connected to said T connection exhaust gas outlet, a water pump connected to be operated by said internal combustion engine, a radiator fluidly connected to said water jacket and said water pump, a first heat exchanger comprising a shell fluidly connected to said T connection exhaust gas outlet on said internal combustion engine, and a coiled finned pipe located inside of said shell, an inlet conduit means leading to said finned coil and fluidly connected to said water jacket, an outlet conduit means leading from said finned coil, a second heat exchanger having an inlet means fluidly connected to said outlet conduit means of said coiled finned pipe, an outlet means on said second heat exchanger fluidly connected to said inlet means on said second heat exchanger, a T connected fluid connection through which said radiator, said water pump, and said outlet means on said second heat exchanger are fluidly connected, means for conducting a secondary fluid through said second heat exchanger and heating it therein, whereby said secondary fluid is heated to the proper consistency for use in the road striping apparatus, a first solenoid controlled valve in said T connection exhaust gas outlet whereby controlled gas flow is directed to said shell and to said muffler, a second solenoid controlled valve located between said outlet means on said second heat exchanger and said water pump, and a thermostat in contact with water in said second heat exchanger serially connected with said first and second solenoids.

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