Sept. 1, 1953 F. HOKE 2,650,602

CLEANER FOR ENGINE COOLING SYSTEMS

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Fig. 1

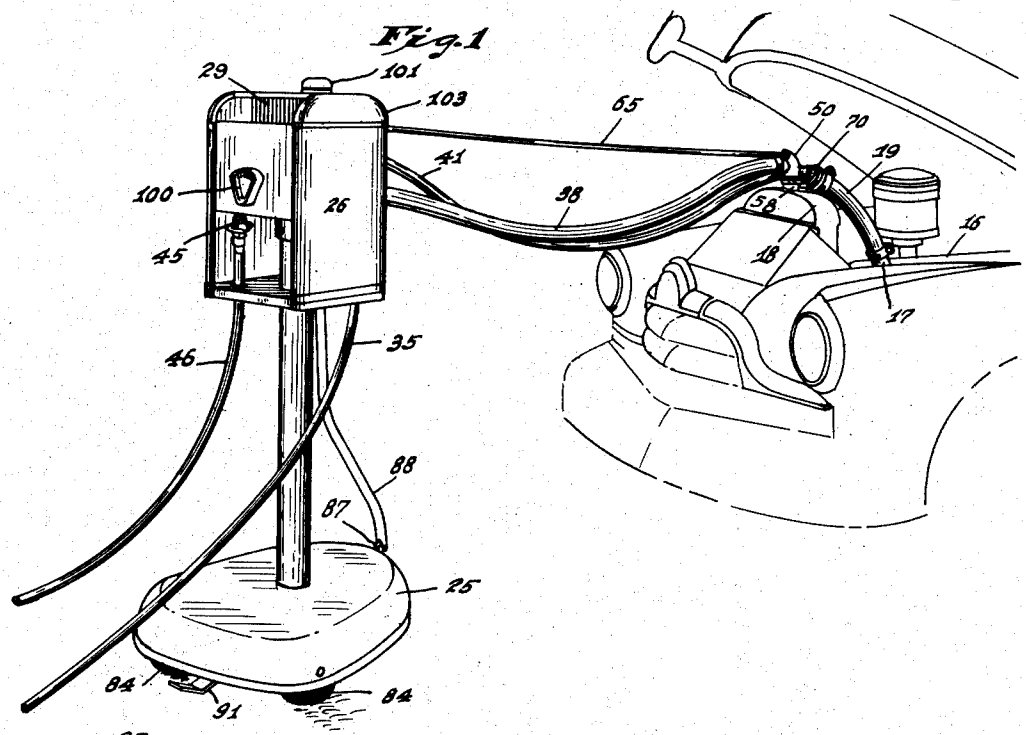

Fig. 6.

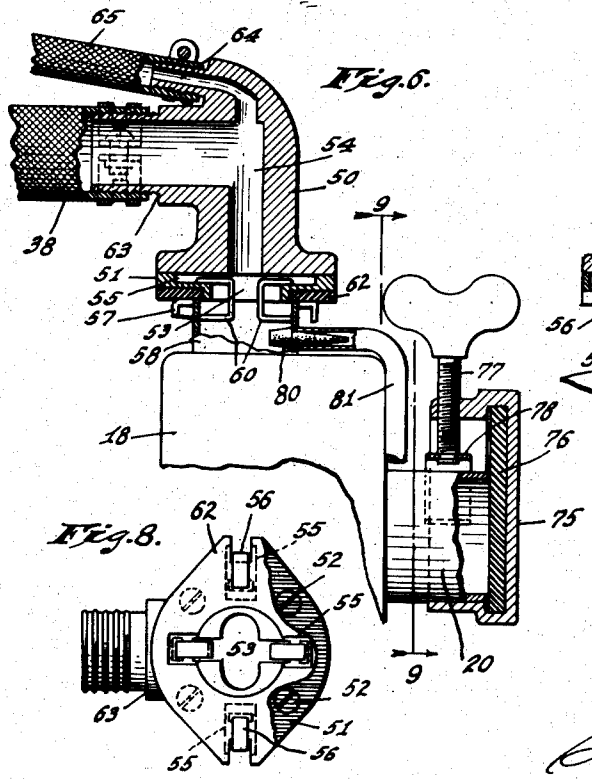

Fig. 7.

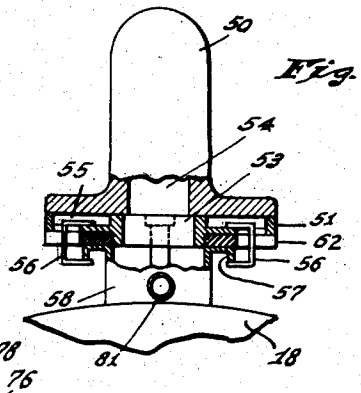

Fig. 8.

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Fig. 2.

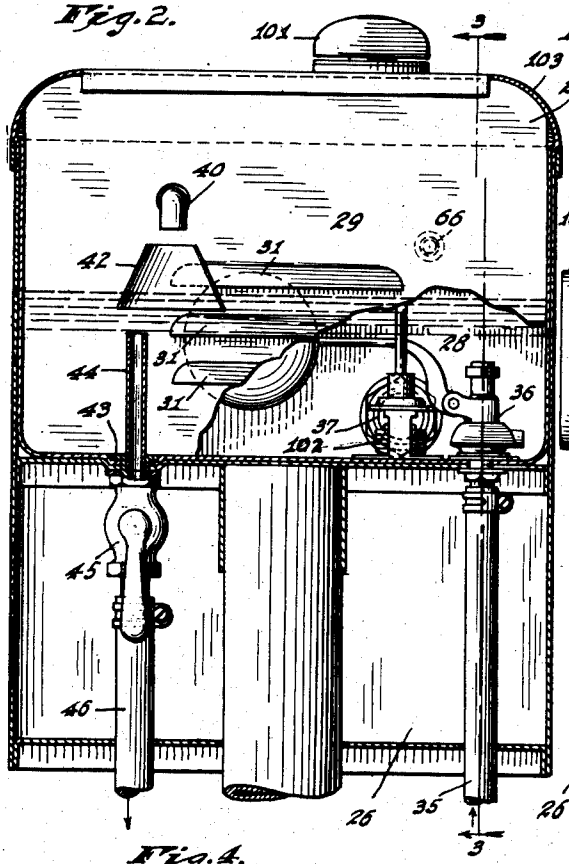

Fig. 3.

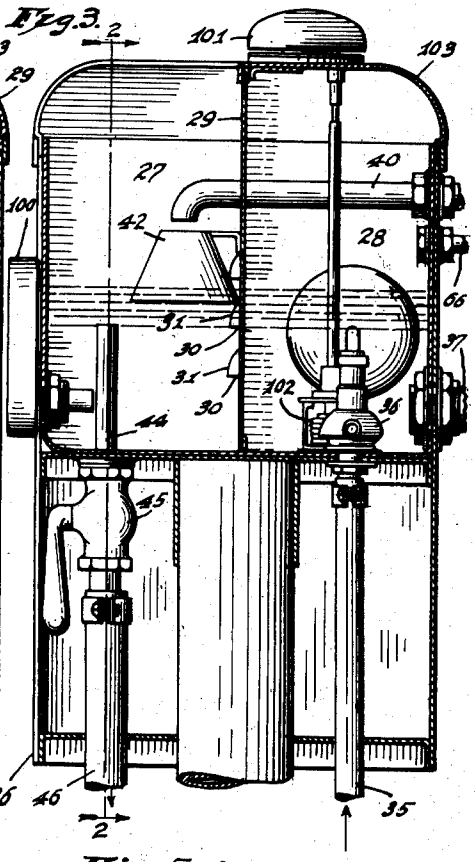

Fig. 4.

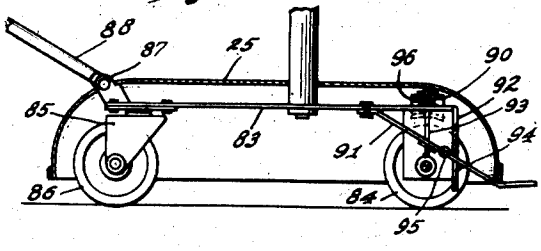

Fig. 5.

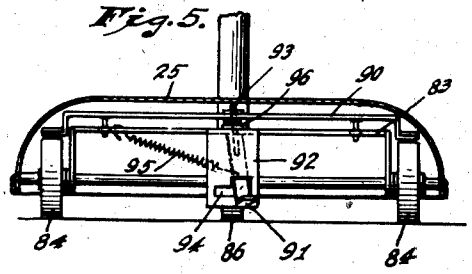

Fig. 9.

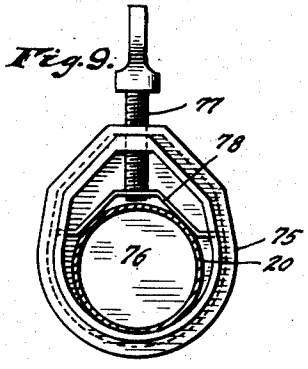

Fig. 10.

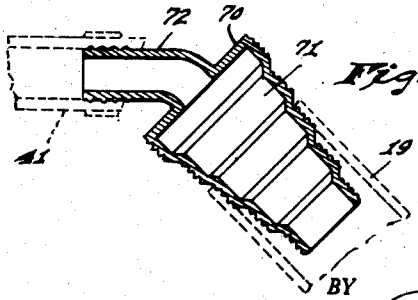

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Fig. 11.

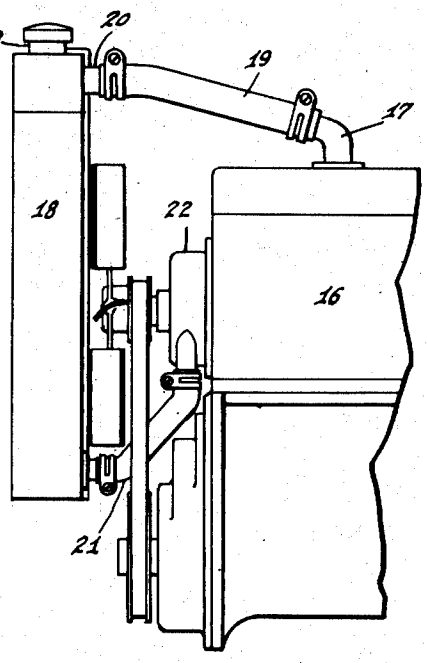


Fig. 12.

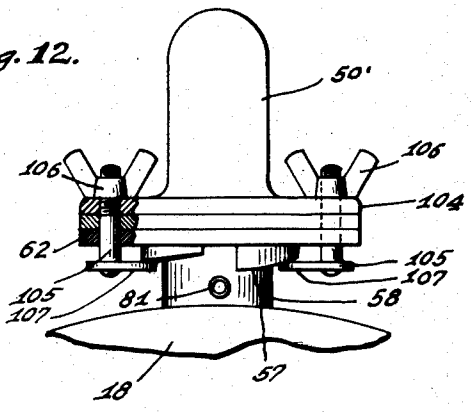
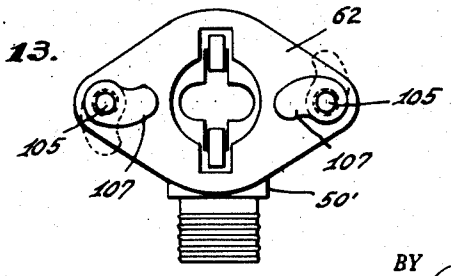


Fig. 13.



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UNITED STATES PATENT OFFICE

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CLEANER FOR ENGINE COOLING SYSTEMS

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Application September 21, 1948, Serial No. 50,272

3 Claims. (Cl. 134—112)

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This invention relates to apparatus adapted for use in flushing and cleaning the cooling systems of internal combustion engines, and particularly automobile engines, with a cleansing and scale-removing solution. It is known that as a water-cooled internal combustion engine is used, deposits of scale consisting principally of calcium carbonate, rust, and sludge are gradually built up within the radiator and the water-jacket of the engine. Such deposits may eventually result in serious interference both with circulation of the coolant and with the transmission of heat to or from the coolant. It has heretofore been proposed to clean the radiator of an internal combustion engine cooling system by disconnecting it from the water jacket of the engine and circulating through it a solution capable of dissolving accumulated scale. Apparatus employed in such an operation necessarily embodies a pump or other source of pressure for supplying the power necessary to circulate the solution; and in some instances, the cleaning apparatus has been provided with a heating means for maintaining the circulating medium at an elevated temperature to increase its effectiveness. The necessity for a pump or its equivalent and the desirability of the heating means renders prior cooling-system cleaning apparatus of which I am aware relatively cumbersome, complicated, and expensive.

It is an object of this invention to provide an apparatus which can be employed to clean the entire cooling system of an internal combustion engine without the aid of any exterior source of power or heat. A further object of the invention is to provide a cooling-system cleaning apparatus which can be simply and economically manufactured and which can be inexpensively operated. Still another object of the invention is to provide improved means for connecting the cleaning apparatus into the engine cooling system to be cleaned.

In carrying out the invention, I employ a tank supported in an elevated position on a wheeled truck. Delivery and return hoses are provided for connecting the tank into the engine-cooling system to be cleaned, and the tank is additionally provided with a supply hose for fresh water and a discharge or drain hose through which the cleaning solution may be removed. The return hose, through which cooling solution is returned to the radiator of the engine cooling system, is desirably connected to such radiator through a fitting having at its top an air-vent opening connected through a vent hose with the aforesaid tank at a point above the liquid level therein and higher than the top of the radiator. The vent hose has an effective length less than the lengths of the return and delivery hoses, and the wheeled support for the tank is provided with a

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brake, whereby the tank and its support may be disposed in a position such that the vent hose is taut and straight and the brake then set to maintain the vent hose in such condition. The device is connected into the cooling system of the engine in such a way that liquid from the engine is delivered to the tank through the delivery hose, circulated through the tank in contact with suitable chemicals which dissolve to form the cleaning solution, and returned to the top of the radiator for recirculation through the engine-cooling system, the liquid being forced over the described path by the ordinary coolant-circulating pump of the engine, which is maintained in operation during the cleaning process. Desirably, the tank is provided with a thermometer for indicating the temperature of the circulating liquid; and in addition, the tank may also be provided with an alarm adapted to be actuated when the circulating liquid reaches a predetermined maximum temperature.

The accompanying drawings illustrate the invention: Fig. 1 is a perspective view illustrating the apparatus in association with the engine of an automobile; Fig. 2 is a vertical section through the aforesaid tank on the line 2—2 of Fig. 3; Fig. 3 is a section on the line 3—3 of Fig. 2; Figs. 4 and 5 are respectively, a longitudinal section and a transverse section of the tank-supporting truck; Fig. 6 is a side elevation, in partial section, illustrating a fitting employed at the top of the radiator; Fig. 7 is a fragmental rear elevation of the structure shown in Fig. 6, with portions of the device broken away and appearing in cross-section; Fig. 8 is a bottom plan view of the outlet fitting shown in Fig. 6; Fig. 9 is a section on the line 9—9 of Fig. 6; Fig. 10 is an axial section through a fitting employed to interconnect the delivery hose with the water jacket of the engine; Fig. 11 is a diagrammatic side elevation illustrating a conventional automobile engine and the associated cooling-system elements; Fig. 12 is a view similar to Fig. 7 illustrating a modified form of construction for the fitting employed at the top of the radiator; and Fig. 13 is a bottom plan view of the fitting shown in Fig. 12.

As indicated in Fig. 11, the common form of present day automobile embodies an engine 16 having a water jacket which is provided at its top with an outlet nipple 17. Associated with the engine is a radiator 18 which communicates with the engine water-jacket through a hose 19 connected at its rear end to the outlet nipple 17 and at its front end to an inlet nipple 20 at the top of the radiator. The bottom of the radiator is connected through a hose 21 with the inlet of a pump 22 which discharges into the engine water-jacket.

The apparatus which I employ in flushing and

cleaning the cooling system of an engine, particularly an automobile engine, comprises a wheeled truck 25 which supports a tank 26 in an elevated position. Referring to Figs. 2 and 3, it will be obvious that the tank 26 is divided into front and rear compartments 27 and 28 by a vertical partition 29 provided with openings 30, located both above and below the normal liquid level in the tank, which afford communication between the two compartments 27 and 28. Desirably, the openings 30 are provided with louvers 31 which extend downwardly and inwardly of the front compartment 27.

The rear compartment 28 of the tank 26 is provided at its bottom with a supply nipple connected to a water-supply hose 35. Entrance of water into the compartment 28 from the supply hose 35 is controlled by a float valve 36 which operates to open and admit water to the tank whenever the liquid level in the compartment 28 drops below a predetermined elevation. In its rear wall, the compartment 28 is provided with an outlet nipple 37 connected to a return hose 38 (Fig. 1).

Extending across the compartment 28 and bent to discharge downwardly into the compartment 27 is an inlet pipe 40 which projects rearwardly through the rear wall of the compartment 28 for connection to a delivery hose 41. Desirably, the pipe 40 discharges into the compartment 27 through a frusto-conical splash guard 42. In its bottom wall, the compartment 27 is provided with a fitting 43 which, interiorly of the tank, has an upwardly opening recess adapted to receive removably an overflow pipe 44. Exteriorly of the tank, the fitting 43 is connected to an outlet valve 45 which is in turn connected to a drain hose 46.

For the purpose of connecting the return hose 38 to the top of the radiator 18 I may employ a fitting of the type illustrated in Figs. 6, 7, and 8. Such fitting comprises a generally L-shaped body 50 to the lower end of which a plate 51 is secured as by means of screws 52. The plate 51 is provided with a central opening 53 in line with the passage 54 in the body 50; and in the upper face of the plate 51 I provide four lateral grooves 55 arranged at equal angular intervals about the axis of the hole 53. One pair of diametrically opposite grooves 55 receive a pair of inwardly directed U-shaped coupling members 56 adapted to cooperate with an interrupted flange 57 projecting outwardly from the upper end of the conventional filler-neck 58 of the radiator 18. The other diametrically opposite pairs of grooves 55 receive outwardly directed U-shaped members 60 which extend through the opening 53 for cooperation with an interrupted, inwardly directed flange on the filler-neck of a radiator.

In ordinary use, the filler-neck of an automobile radiator is closed with a radiator cap held in place by cooperation between ears on the cap and an interrupted flange on the neck of the radiator, the cap being applied by passing the ears thereon through the notches which interrupt the flange on the radiator neck and by then rotating the cap to tighten it in place. Radiator necks are of various diameters and may have the interrupted cap-retaining flange extending either inwardly or outwardly. Where the flange extends outwardly, as indicated at 57 in Figs. 6 and 7, the inwardly directed U-shaped members 56 are employed, being radially adjusted in the slots 55 to such a position that they will engage beneath the flange 57 to accommodate the fitting to radiator necks of varying diameters. If the interrupted flange on a radiator-neck is an inwardly directed flange, the outwardly directed U-shaped members 60 are employed, such U-shaped members being radially adjustable in the slots which receive them to accommodate the fitting to radiator-necks of different diameters.

Desirably, a gasket 62 is secured to the lower face of the plate 51 to seat against the upper end of the radiator-neck when the fitting 50 is tightened thereon.

The fitting 50 is provided with a laterally projecting member 63 for reception within the end of the return hose 38. Desirably, a second nipple 64 is also provided on the fitting 50, such nipple communicating with the passage 54 and being received within a vent hose 65. The opposite end of the vent hose 65 is connected with a nipple 66 mounted in the rear wall of the rear compartment 28 of the tank 26. As the purpose of the nipple 64 and vent hose 65 is to prevent the trapping of air or other gaseous substance within the cooling system, the nipple 64 is located at the top of the fitting 50, and the nipple 66 on the tank 26 is disposed at an elevation well above the top of the radiator of any automobile with which the apparatus is to be used.

I contemplate that my apparatus will be connected into the cooling system of an internal combustion engine by removing the hose 19 from its normal connection with the nipple 20 and connecting it to the delivery hose 41 as shown in Fig. 1. For this purpose, I may employ the fitting 70 illustrated in Fig. 10. Such fitting comprises a body 71 having portions of progressively decreasing diameter each adapted to be received within a hose 19 of any of the diameters commonly used in automobiles. The opposite end of the fitting 70 is formed as a nipple 72 adapted for reception within the delivery hose 41.

To close the nipple 20 and prevent the escape of liquid therefrom after the hose 19 has been removed from it, I may employ the closure illustrated in Figs. 6 and 9. Such closure comprises a cup-like body 75 the bottom of which is faced interiorly with some compressible material 76, such as soft rubber or its equivalent. The inner diameter of the body 75 is made large enough to receive the inlet nipple 20 of any automobile in common use, and the side wall of the body is provided with a screw-threaded opening for the reception of a clamp screw 77. Mounted on the inner end of the clamp screw 77 is a shoe 78 having diverging sides adapted to engage a radiator nipple 20 at angularly spaced points.

In using the apparatus described, the radiator hose 19 is removed from its connection with the nipple 20 and is secured to the fitting 70 in the manner indicated in Fig. 10. The closure 75 is placed over the radiator nipple 20, forced thereagainst so that the gasket 76 will seal the open end of such nipple, and the screw 77 is tightened to clamp the nipple between the shoe 78 and the closure-body 75. The radiator cap normally in place on the filler-neck of the radiator is removed, a plug 80 is inserted in the radiator-overflow tube 81, and the fitting 50 is applied in place of the cap. With the apparatus so arranged, and with the engine 16 operating, the coolant pump of the engine will force water through the water jacket, nipple 17, hose 19, fitting 70, delivery hose 41, and delivery pipe 40 into the front compartment 27 of the tank 26. From the bottom of the compartment 27, the liquid passes through openings

30 in the partition 29 into the compartment 28 and returns by gravity through the return hose 38 and fitting 59 to the top of the radiator 18. Air or vapors trapped within the circulatory system escape through the nipple 64 and vent hose 65 into the rear tank-compartment 28 above the normal liquid level therein. To insure that the escape of air or vapor through the vent hose 65 will not be prevented by any body of liquid trapped in such vent hose, the nipple 66 on the tank 26 is located at an elevation such that the hose 65 will extend upwardly toward the tank 26. To prevent such hose from sagging, it is made effectively shorter than each of the hoses 38 and 41 and the truck 25 is provided with a brake by means of which the hose 65 may be maintained taut and straight.

One appropriate form of brake mechanism is illustrated in Figs. 4 and 5. As there indicated, the truck 25 has a rigid frame 83 supporting a pair of coaxial rear wheels 84 and a front caster 85 including a single front wheel 86. The caster 85 is provided with an upwardly extending bracket 87 to which there is pivotally secured a handle or tongue 88 that can be employed in moving the truck 25 from place to place. Extending transversely of the frame 83 above the wheels 84 is a brake member 90 the end portions of which are adapted to be lowered into contact with the wheels 84 and prevent their rotation. A brake-operating member 91 loosely pivoted to the frame 83 extends rearwardly below the brake member 90 and outwardly through an ear 92 rigid with the frame. A bolt 93 extending through the brake member 90 and the brake-operating member 91 interconnects them so that when the outer end of the operating member 91 is depressed the ends of the brake member 90 will be forced downwardly into contact with the wheels 84. The ear 92 is provided with an opening 94 through which the operating member 91 projects, such opening having a horizontal extent greater than the width of the member 91 to permit a limited horizontal swinging of such member. The upper side of the opening 94 is stepped, having upper and lower portions which limit upward movement of the free end of the operating member 91. The lower portion of the upper side of the opening 94 is disposed at such an elevation that when the operating member is in contact with it, the ends of the brake member 90 will engage the wheels 84. A spring 95 biases the operating member 91 for movement toward the lower portion of the upper side of the opening 94, while one or more springs 96 bias the brake member 90 upwardly or away from the wheels 84.

When the return hose 38 and delivery hose 41 are connected into the cooling system of the automobile engine 16 in the manner above described, the truck 25 is moved away from the automobile until the vent hose 65 is taut, and the brake member 90 is brought into engagement with the wheels 84 by depressing the free end of the operating member 91 and swinging it beneath the lower portion of the upper side of the opening 94, in which position the operating member will be releasably retained by the spring 95. With the brake 90 set, the hose 65 will be maintained taut and straight, so that air or vapor can escape from the cooling system through it into the upper portion of the tank-compartment 28. The hoses 38 and 41, and especially the hose 38, should not be long enough to sag unduly when the hose 65 is taut.

The supply hose 35 is connected to a suitable

source of water under pressure, and water is admitted into the tank 26 under the control of the float valve 36. If the cooling system of the automobile was drained before the cleaning operation was begun, water entering the tank 28 through the supply hose 25 will run by gravity through the return hose 38 to fill the engine-cooling system. When the engine-cooling system has been filled and the water level in the tank 28 has raised sufficiently, the float valve 36 will close to prevent the admission of further water. The automobile engine is started and chemicals used to aid in the cleaning of the cooling system are deposited in the front compartment 27 of the tank 26. As the engine runs, the coolant pump 22 circulates water through the engine water-jacket and the hoses 19 and 41 into the float compartment 27 of the tank. Coming into contact with the chemicals in that compartment, the water dissolves them and passes through the lower opening or openings 30 into the rear compartment 28, from which it flows by gravity to the upper end of the radiator 18 to pass downwardly therethrough to the coolant pump. The venting of the upper portion of the radiator through the hose 65 prevents the pump 22 from applying suction to liquid in the tank 26. Any scale and solid particles discharged into the front tank-compartment 27 settle to the bottom thereof and are trapped, as the lowermost of the openings 30 is above the tank-bottom. In the same way, any solid chemicals deposited in the front compartment will be retained therein, but will be dissolved by the circulating water.

A thermometer 100, secured to a wall of the tank 26 and responsive to the temperature of water therein may be employed to apprise the operator of such temperature. In addition, the device may be provided with an audible alarm 101, actuatable under the control of a temperature-responsive element 102 mounted below the normal liquid level in the tank 26.

If the tank 26 is provided with a cover 103, such cover is desirably cut away over the tank-compartment 27 to permit the operator to observe the character of the liquid discharged from the inlet nipple 40 and, if desired, to take samples of such liquid for testing. The cover 103 need not fit tightly over and seal the rear compartment 28, and preferably does not do so. Any air which is vented from the engine cooling system and which enters the rear compartment 28 through the fitting 66 can escape past the loosely fitting cover 103, or, if necessary, through the upper opening 30 into the uncovered front compartment 27.

Operation of the engine is continued until it has been determined that the cooling system has been adequately cleaned. When this occurs, the drain valve 45 is opened permitting liquid in the tank 27 to escape through the drain hose 46. The supply hose 35, however, remains connected to the fresh water supply; and in consequence, the float valve 36 operates to replace with fresh water the solution escaping through the drain hose. During this phase of the operation, the removable overflow pipe 44 is in position. The upper end of such overflow pipe is below the normal liquid level maintained by the float valve 36, thus permitting the solution to escape while insuring that all water will not be pumped from the engine cooling system should the supply of fresh water through the supply hose fail. Continued operation of the engine under these conditions results in a gradual replacement of the cleaning

solution by fresh water. When such replacement has progressed to the desired extent, the automobile engine is stopped, the plug **80** and the fittings **50** and **75** are removed from the radiator, and the hose **19** is reconnected to the radiator-inlet nipple **20** as shown in Fig. 11. The supply of fresh water to the hose **25** is shut off, and the overflow pipe **44** is removed to permit all liquid remaining in the tank **26** to escape through the drain hose **46**.

In Figs. 12 and 13 I have illustrated a modification of the fitting **50** shown in Figs. 6, 7, and 8. The modified fitting embodies a fitting-body **50'** generally similar to the fitting-body **50** except for the means employed to secure the fitting to a radiator neck **58** in which the interrupted flange **57** is located exteriorly. The fitting body has at its bottom a flange **104** which provides a mounting for two members **105** disposed vertically and located diametrically opposite each other. The members **105** are screw-threaded at their upper ends for the reception of nuts **106** and at their lower ends with retaining fingers **107** which can be brought into engagement with the lower edge of the flange **57** on the radiator-neck **58**. When the fingers **107** are disposed in the dotted-line position shown in Fig. 13, the fitting can be seated on the radiator neck, and by then rotating the members **105** to or toward the full-line positions indicated the fingers are brought into engagement with the lower edges of the interrupted flange **57**. Tightening of the nuts **106** will then seat the fitting tightly on the neck **58**. This arrangement not only permits the fitting **50'** to be applied to radiator necks of varying diameter, but also makes it unnecessary to rotate the fitting as a whole in applying it to a radiator-neck.

The principal constituent of the scale formed within an internal combustion engine cooling system is ordinarily relatively soluble in acid solutions, such as, for example, solutions of oxalic acid. However, the deposits usually embody a certain amount of oil or of an oil residue which interferes with the free attack of the acid solution on the scale. Ordinary soaps, being alkaline in character, cannot satisfactorily be used in conjunction with acid solutions, as they would neutralize the acidity necessary to dissolving of the scale. For that reason, the ordinary solution employed in flushing engine cooling systems embodies an acid and a neutral detergent, the latter serving to remove the oily substance and prevent it from interfering with the attack of the acid solution on the scale. All the neutral detergents of which I am aware, when used in a solution for cleaning engine cooling systems, result in the formation of relatively large quantities of foam. In the system described, such foam is delivered to the tank **26** in which the foam has an opportunity to break down, the entrapped gases escaping to the open air. As the foam is not dense enough to support the float associated with the valve **36**, such valve operates to insure the existence within the compartment **28** of a substantial quantity of water free from entrapped gases, with the result that the liquid returned to the engine cooling system through the hose **28** is substantially foam-free. This is a desirable attribute of the apparatus, because the foam is relatively ineffective as a medium for transferring heat, and overheating of the engine might result if provision were not made for maintaining within its cooling system an adequate supply of foam-free liquid.

My apparatus needs neither a pump for circulating the cleaning solution nor means for heating some cleaning solution; for circulation is maintained through the cooling system and the tank **26** by the ordinary coolant-circulating pump **22** of the automobile engine, and the heat generated within the cylinders of the engine as it runs heats the cleaning solution to increase its effectiveness in removing the scale.

Further, by observing the rate at which the cleaning solution is being discharged into the tank-compartment **22**, it is possible to ascertain whether or not the pump **22** is operating to maintain coolant circulation at a satisfactory rate.

I claim as my invention:

1. In a device for cleaning the cooling system of a liquid-cooled internal combustion engine having an associated radiator and pump for circulating liquid through the radiator and engine-jacket, a wheeled truck, an elevated tank on said truck having an inlet and an outlet, a flexible delivery hose for connecting said inlet to the outlet of the engine-jacket, a flexible return hose for connecting the tank-outlet with the inlet of the radiator, a vent hose for connection to the top of the radiator and communicating with said tank, said vent hose being effectively shorter than the other hoses whereby said truck and tank can be moved away from the radiator to tighten the vent hose, and brake means on said truck for holding it in a position in which the vent hose is taut.

2. The invention set forth in claim 1 with the addition of a fitting adapted for application to the top of the radiator in communication therewith, said delivery and vent hoses being connected to said fitting.

3. In a device for cleaning the cooling system of a liquid-cooled internal combustion engine having an associated radiator and pump for circulating liquid through the radiator and engine-jacket, a tank disposed at an elevation greater than that of said radiator, said tank having an inlet and an outlet, hoses adapted to connect said inlet and outlet respectively with the outlet of the engine-jacket and with the radiator whereby liquid may be forced by said pump through the engine-jacket and into the elevated tank and returned from the latter to the radiator under the influence of gravity, a supply conduit for conveying liquid from a source to said tank, means responsive to the level of liquid in the tank for controlling the admission of liquid thereto from said supply conduit, said tank being provided with a drain opening at its bottom, and a drain pipe removably positioned in said drain opening and extending upwardly therefrom to a point below the liquid-level maintained in said tank.

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