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A. R. RUTH

METHOD AND APPARATUS FOR CLEANING RADIATOR TUBES AND THE LIKE

2,653,420

Filed May 2, 1947

3 Sheets-Sheet 1

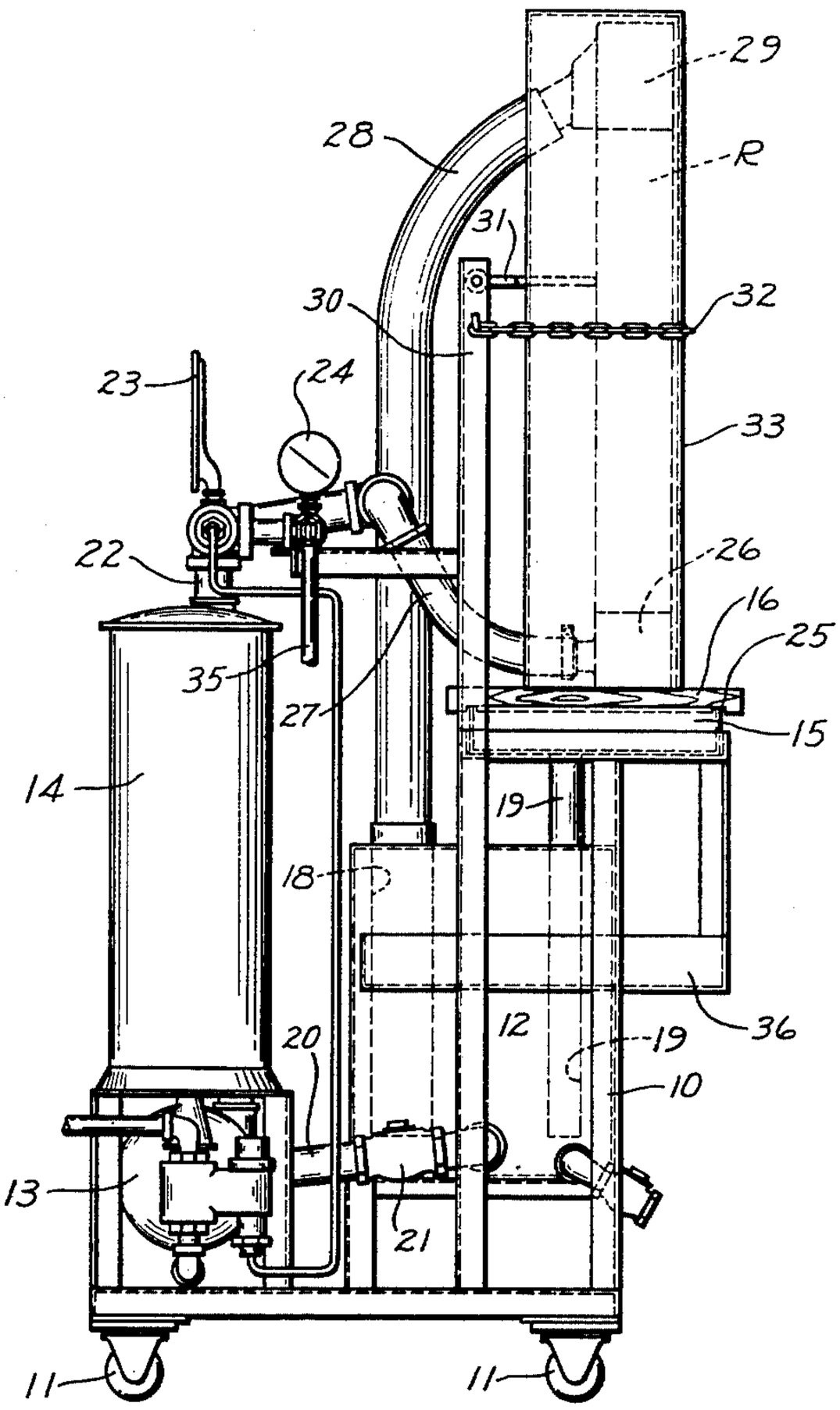

FIG. 1

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3 Sheets-Sheet 2

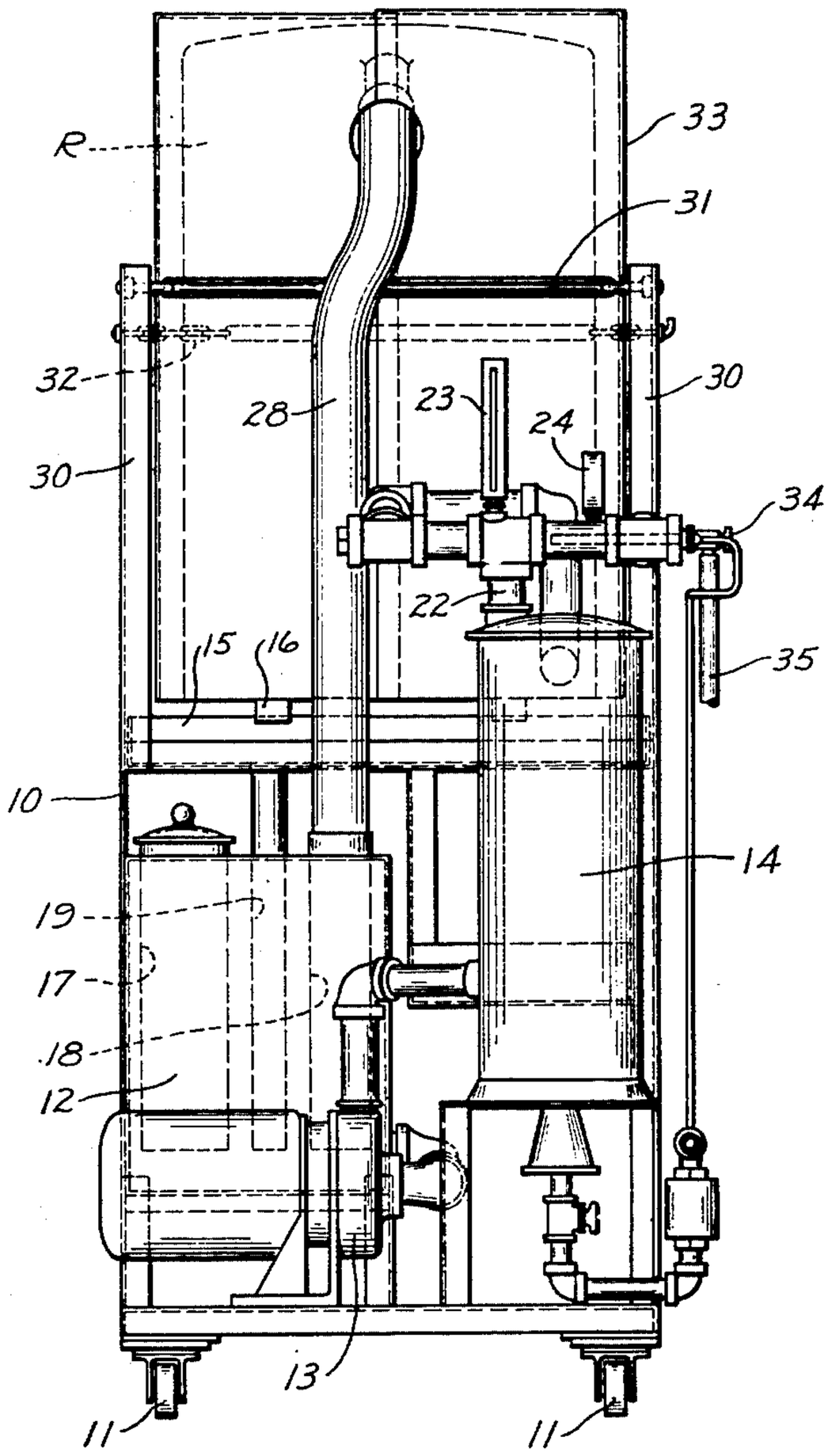

FIG. 2

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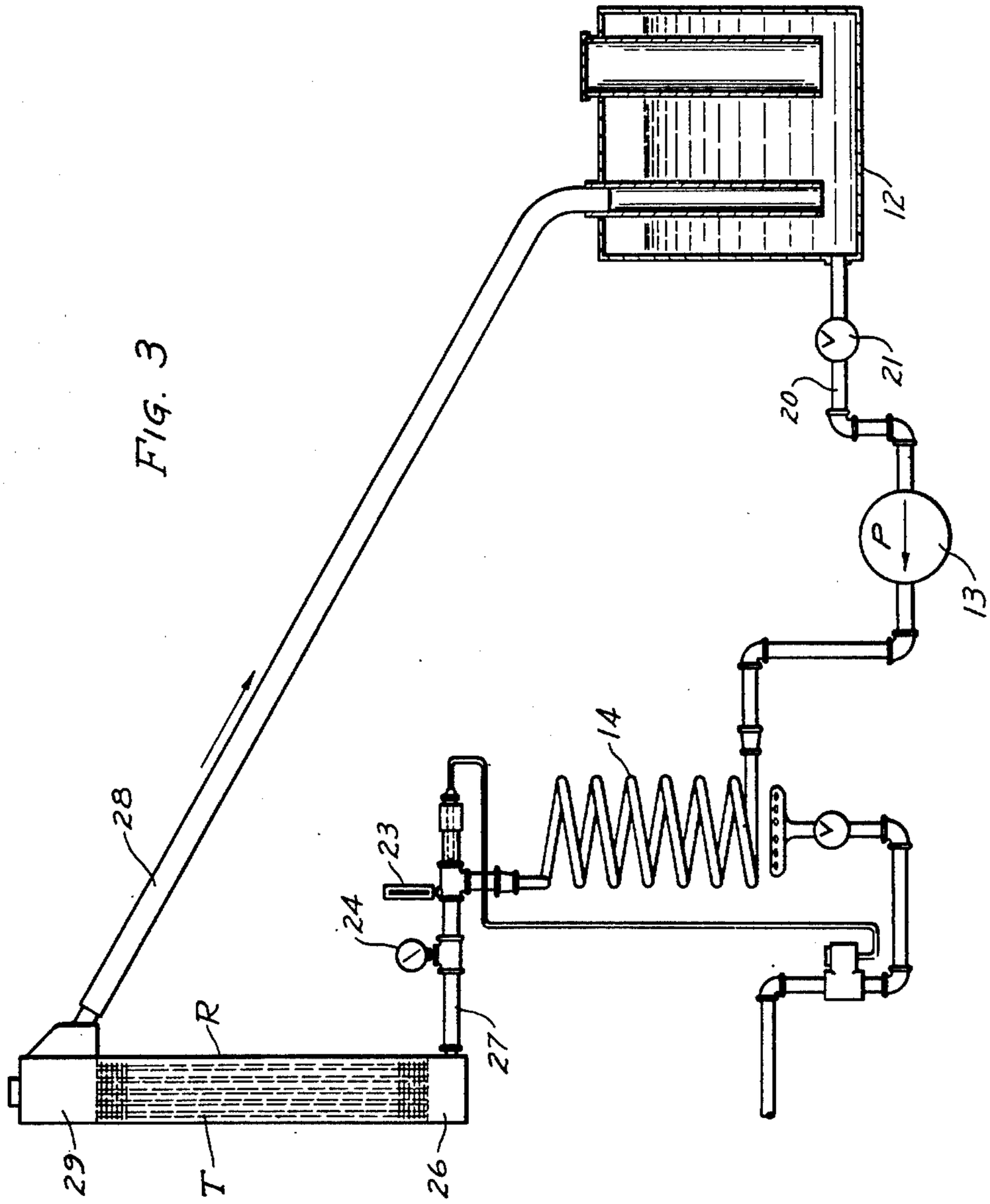
FIG. 3



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UNITED STATES PATENT OFFICE

2,653,420

METHOD AND APPARATUS FOR CLEANING RADIATOR TUBES AND THE LIKE

Acquilla R. Ruth, York, Pa.

Application May 2, 1947, Serial No. 745,380

9 Claims. (Cl. 51—8)

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This invention relates to the cleaning of radiators and the like and more particularly to a method of, and apparatus for removing scale rust, sediment and other foreign matter from the interior of thin walled circulation passages such as those of the radiator of an automobile cooling system.

The internal coating collected in time upon the inner surface of such passages materially reduces the efficiency of the radiator and in many cases will either completely clog a tube or so reduce its diameter at points that the flow is very slight and is easily checked by ambient foreign matter that would pass freely through a clean tube. This deposit or scale is a hard brittle skin composed mainly of calcium, magnesium, and silicates mingled with oxides of the metals forming the cooling system. In an automobile radiator the deposit is heaviest at the upper or entrance ends of the tubes decreasing in thickness progressively toward the bottom of the tubes and often absent near the lower ends thereof. It is formed at temperatures rarely exceeding 180° and on an average much lower. While soluble by certain chemicals having little or no effect on the materials of the circulation system, removal of the deposits by a static or even a circulated chemical solution is a lengthy and uncertain process and in the only practical method using such a solution, with which I am familiar involves in many cases the removal of one header of the radiator and displacement of the scale by forcing a rod through the clogged tubes, a procedure that obviously will often damage the tubes. Furthermore such procedure will not remove scale but merely forms an opening therethrough.

In accordance with my invention I utilize the difference in these deposits and the thin metal walls of the passage (the coefficient of expansion of scale is roughly estimated as about ⅕ that of steel and $\frac{1}{10}$ that of brass, the materials from which radiator tubes are most commonly formed) as an important factor in removing the scale. An aqueous solution of a solvent such as oxalic acid containing a finely divided abrasive is circulated through the tubes, at a temperature dependent on the speed of its delivery from the tubes and rising as the speed of delivery lowers. A radiator with clean tubes is capable of passing 40 gallons of solution per minute. Delivery of this amount of the solution is made to the lower header of a radiator by a pump capable of developing approximately 15 pounds pressure when the flow is sufficiently restricted

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through the radiator. The fluid is heated between the pump and radiator by an apparatus capable of imparting heat thereto at a rate such that the fluid at maximum delivery will reach the radiator at or near its boiling point. It will be obvious that where delivery is restricted and the pressure rises, much higher temperatures result (approximately 350° F. at 15 pounds). Where the scale and consequent constriction is slight and the flow rate high the solvent and abrasive action is increased and the scale is rapidly removed particularly since the temperature of the fluid of the solution will cause expansion of the tube resulting in its separation from the scale, which, as hereinbefore noted has been formed at much lower temperatures.

In the case of badly obstructed tubes the effort of the pump to deliver its normal output increases the pressure and the slower passage through the heater causes the fluid to enter the tubes at much higher temperatures and the extent of separation of the tube and scale is greater, allowing the solution and its suspended abrasive to more readily attack the scale. Since the scale is initially attacked at its weakest point it is soon broken away at this point. Scale particles are not removed from the solution but broken down and retained therein as added abrasive. This breakdown is attained partially through attrition, through impact in the pump, which is preferably of the centrifugal type, and through impact again the scale remaining on the walls of the tube. Obviously the expansion separation may be accelerated by heat insulating the radiator during the cleaning operation.

The above process can be carried out by a very compact apparatus which may be readily and cheaply produced and which is so easily operated and so nearly automatic in its operation that labor costs are kept at a minimum. Such an apparatus is illustrated in the accompanying drawings wherein:

Figure 1 is a side elevation of the apparatus;

Figure 2 is a front elevation thereof, and

Figure 3 is a diagrammatic illustration of the circulation system provided by the apparatus.

Referring now more particularly to the drawings, the numeral 10 designates a support preferably mounted upon casters 11 and of light but rigid construction. Mounted upon this support are a solution tank 12, a motor driven centrifugal pump 13, a solution heater 14, and a drain tray 15, the latter in turn mounting supports 16 for the reception of the lower end of the radiator R which is to be cleaned.

Tank 12 is preferably of the semi-sealed type and has inlets 17, 18, and 19, comprising respectively a filling inlet, an inlet for receiving the main discharge from radiator R, and an inlet for receiving liquid from tray 15. It is further provided with a discharge pipe 20 communicating with the inlet of pump 13. All of inlets 17, 18, and 19 are in the form of tubes having their lower ends opening into the tank below the liquid level maintained therein during cleaning operations whereby to avoid excessive foaming of the treating solution.

Pump 13 is, as previously noted, a centrifugal pump and is of that type of centrifugal generally known as a "slip" pump i. e. a pump which when confronted with a given head simply churns the pumped fluid passing only enough thereof to maintain such pressure. Practically it should also have the characteristics of the ordinary centrifugal "sand pump" having impeller blades capable of withstanding not only the erosive action of the abrasive contained in the circulated solution but likewise the impact and erosion of scale particles separated from the tubes during the cleaning operation. A pump of this type capable of delivering 42 gallons of the cleaning solution per minute and of developing 15 pounds gauge pressure as a maximum is ordinarily satisfactory for use with standard radiators of automobile or truck cooling systems. Reduction of the amount of fluid delivered by the pump may of course be effected by a valve 21 arranged in the intake connection 20.

Heater 14 may be of any suitable type a gas heater being at present shown. The capacity of this heater must be such that when the maximum amount of the cleaning fluid is being delivered through connection 22 the fluid is maintained at or about its boiling point. The heater should also be arranged to eliminate heat losses and to this end the connections 22 to the radiator R is made as short as possible. In the connection 22 I provide a thermometer 23 and a pressure gauge 24 for purposes presently to appear.

Tray 15 functions as a support for the radiator R and as a means for returning to tank 12 any leakage from radiator R and discharge from the overflow pipe (not shown) with which such radiators are usually provided. It is arranged above tank 12 and at the greatest convenient height to insure the maximum possible head pressure against pump 13. Supports 16 may be wooden bars notched at 25 to receive the tray walls and form a seat receiving the lower header 26 of the radiator R. Flexible connections 27 and 28 are used to connect the connection 22 and inlet 18 of tank 12 to the lower and upper headers 26 and 29 of the radiator.

Support 10 includes a suitable means for maintaining radiator R in a vertical position. In the present instance the framework of the support is shown as including vertical members 30 projecting upwardly at opposite sides of tray 15 and having adjacent their upper ends a brace 31 and flexible element 32 for confining the radiator R. A heat insulating jacket 33 of any suitable construction is provided for shielding the radiator from the ambient atmosphere. An outlet valve 34 is in connection 22 for the connection of a branch tubing 35 to enable use of the system in other cleaning operations. Support 10 may include a tray 36 for the reception of accessories.

In use of apparatus of this character the tank 12 is charged with the desired amount of the solution, for example, one containing 1 lb. (one pound) of oxalic acid and ⅓ lb. (one-third pound) of brick dust or similar abrasive. The radiator is placed on tray 15, connected to the connection 22 and inlet 18 of tank 12, jacketed, and secured to braces 31. Pump 13 is then started and heater 14 placed in operation. If the tubes T of the radiator are badly clogged this will be indicated by pressure and temperature rises in the connection 22. As the tubes T clear the pressure will drop and when the known low pressure is read on gauge 24 the radiator is clean. Continuing circulation for a short time will scour and polish the tubes surfaces. It will be seen that no skill is necessary to operation and that constant attendance is unnecessary, an occasional inspection of the thermometer and gauge being sufficient.

Since both the method and apparatus are capable of modification without departing from the spirit of my invention I do not wish to be understood as limiting myself to those described except as hereinafter claimed.

I claim:

1. The method of removing deposits of scale and the like from the inner surfaces of thin walled heat transfer circulation passages comprising, making attempted delivery through the passages of an amount of a scale dissolving solution under increased pressure and containing elements contributing to the removal of said deposits equal to the capacity of the passages when clean, and heating the solution between the point where the pressure thereof is increased and the passages at a rate such that said fluid when delivered to the passages at such capacity is approximately at least at its boiling point.

2. The method of removing deposits of scale and the like from the inner surfaces of thin walled heat transfer circulation passages comprising, making attempted delivery through the passages of an amount of scale dissolving solution under increased pressure and containing elements contributing to the removal of said deposits equal to the capacity of the passages when clean, inhibiting heat transfer from said passages and heating the solution between the point where the pressure thereof is increased and the passages at least at a rate such that said fluid when delivered to the passages at such capacity is approximately at its boiling point.

3. The method of removing deposits of scale and the like from the inner surfaces of thin walled heat transfer circulation passages comprising, making attempted delivery through the passages of an amount of a scale dissolving solution under increased pressure and containing elements contributing to the removal of said deposits equal to the capacity of the tubes when clean, heating the solution between the point where the pressure thereof is increased and the passages at a rate such that said fluid when delivered at such capacity is approximately at at least its boiling point, and terminating delivery of the solution to the passages when the pressure of the delivered fluid arrives at a predetermined minimum.

4. The method of removing deposits of scale and the like from the inner surfaces of thin walled heat transfer circulation passages comprising, making attempted delivery by pressure creating means of a solution of a solvent of the deposit to the outlet of the passages at a rate equal to the capacity of the passages when clean, limiting the pressure of delivery of the solution to that of predetermined safe rate for the pas-

sages, applying heat between said pressure creating means and the point of delivery to the passages to all of the fluid delivered by said means to the passages at a rate such as when the solution is delivered to the passages in amounts approximating the rated capacity of the passages the solution is at least at its approximate boiling point, and terminating delivery of the solution when the pressure of the solution as delivered to the passages is at a predetermined minimum.

5. Apparatus for cleaning scale deposits and the like from the interiors of motor vehicle radiators having thin walled tubes and inlet and outlet ports arranged respectively near the upper and lower ends of said radiators, said apparatus comprising in combination, a tank adapted to contain a quantity of scale solvent solution, a pump connected to said tank by a conduit, a heater for said solution connected to the inlet end of said pump by a conduit, a jacket arranged to enclose a radiator to be cleaned, a conduit extending between the outlet end of said heater and said jacket and arranged to be connected to one port of said radiator, and another conduit extending between said jacket and said tank, one end of the former conduit being arranged to be connected to the other port of said radiator, whereby upon said pump being operated said apparatus will function to deliver heated solution to said one port of said radiator and upon meeting obstruction to passage within said radiator tubes pressure will be developed within said heater and former conduit and thereby increase the temperature of said solution therein.

6. The apparatus set forth in claim 5 further including a tray adjacent the bottom of said jacket, said radiator being positionable above said tray, and a drain extending from said tray to said tank.

7. The apparatus set forth in claim 5 further including supporting means for a radiator within the lower portion of said jacket and bracing means positioned adjacent said support and operable to hold said radiator upon said support.

8. The apparatus set forth in claim 5 further characterized by said jacket being larger than but conforming generally in shape to a radiator and the major axis of said jacket being arranged vertically when in use, one wall of said jacket being apertured to receive said conduits connectible to said ports of said radiator and frame means engageable with said jacket to support it as aforesaid.

9. The apparatus set forth in claim 8 further characterized by the bottom of said jacket being open, whereby said jacket may be lowered onto a radiator substantially to enclose it.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,121,308	Thomas	Dec. 15, 1914
1,507,151	Bennett	Sept. 2, 1924
1,628,141	Gray	May 10, 1927
1,701,824	Robinson	Feb. 12, 1929
1,887,722	Schoener	Nov. 15, 1932
1,908,954	Carmin	May 16, 1933
1,939,112	Eulberg	Dec. 12, 1933
2,018,403	Hussar	Oct. 22, 1935
2,222,516	Powell	Nov. 19, 1940
2,235,885	Johnson	Mar. 25, 1941
2,254,075	Lawson	Aug. 26, 1941
2,254,980	Simmons	Sept. 2, 1941
2,418,063	Alling	Mar. 25, 1947
2,430,976	Dutra	Nov. 18, 1947
2,442,272	Jaffa	May 25, 1948