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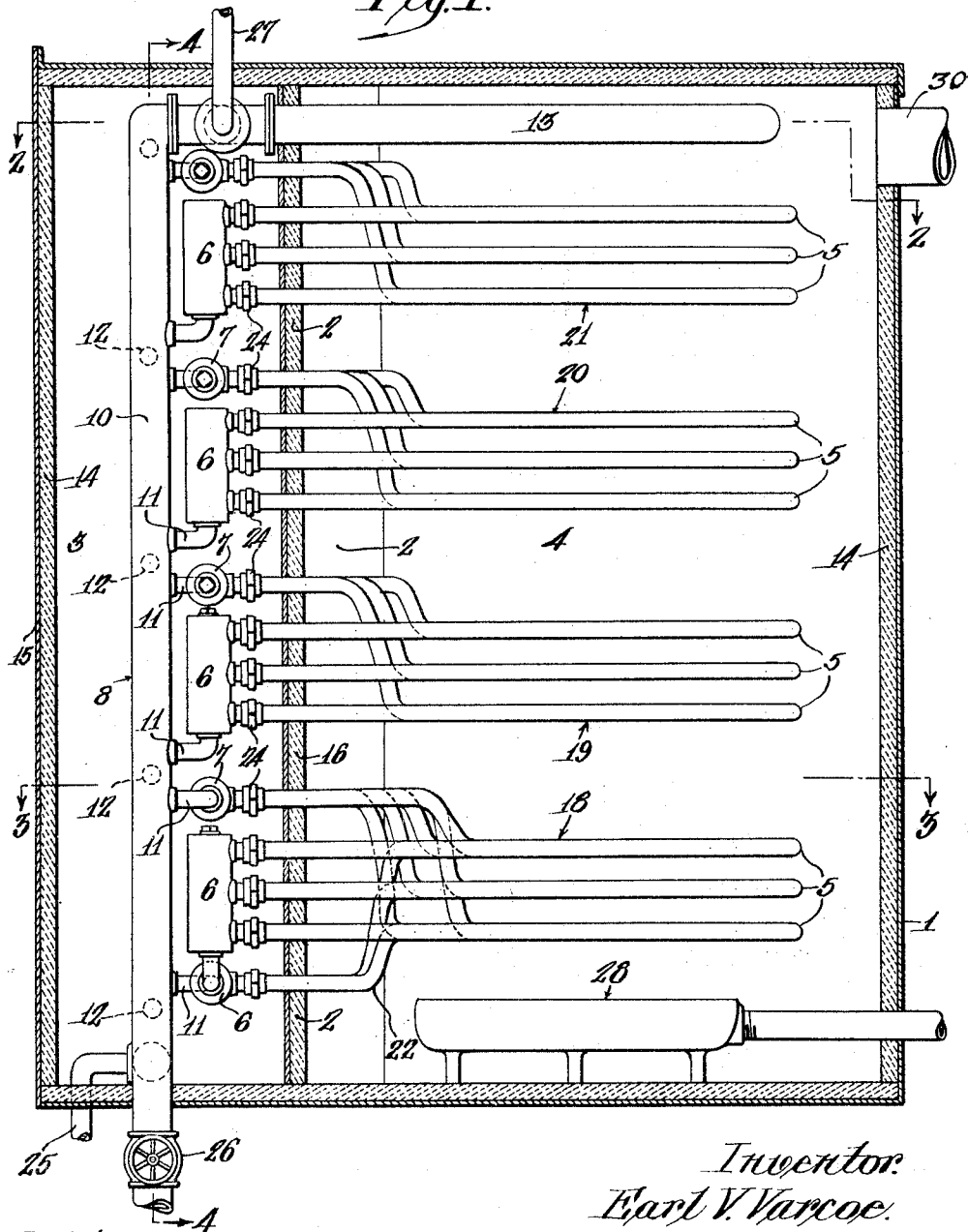
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1,727,458

STEAM GENERATOR

Original Filed Sept. 30, 1924 3 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

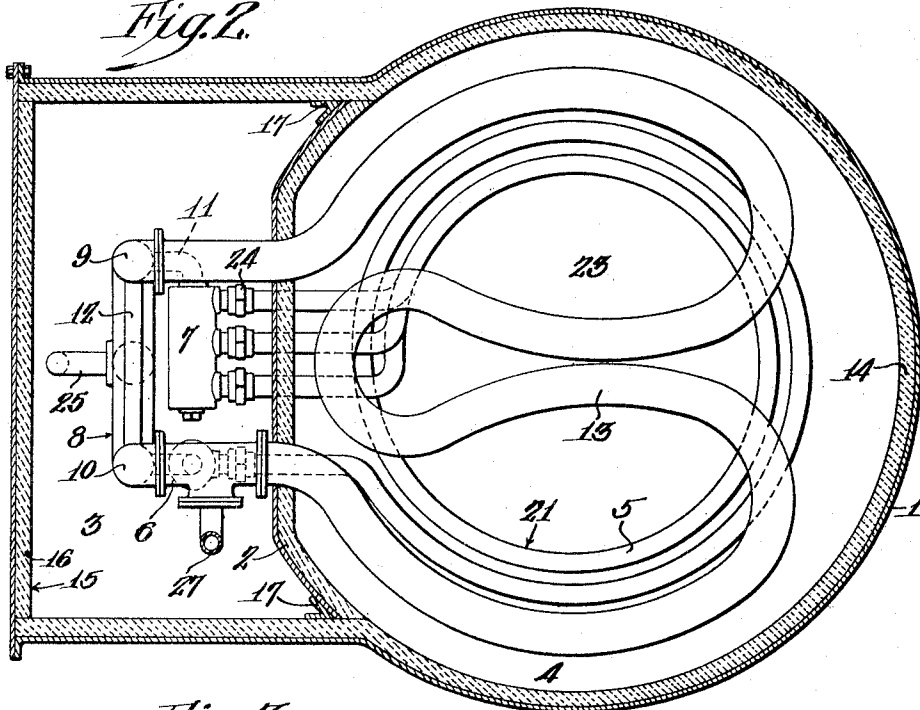
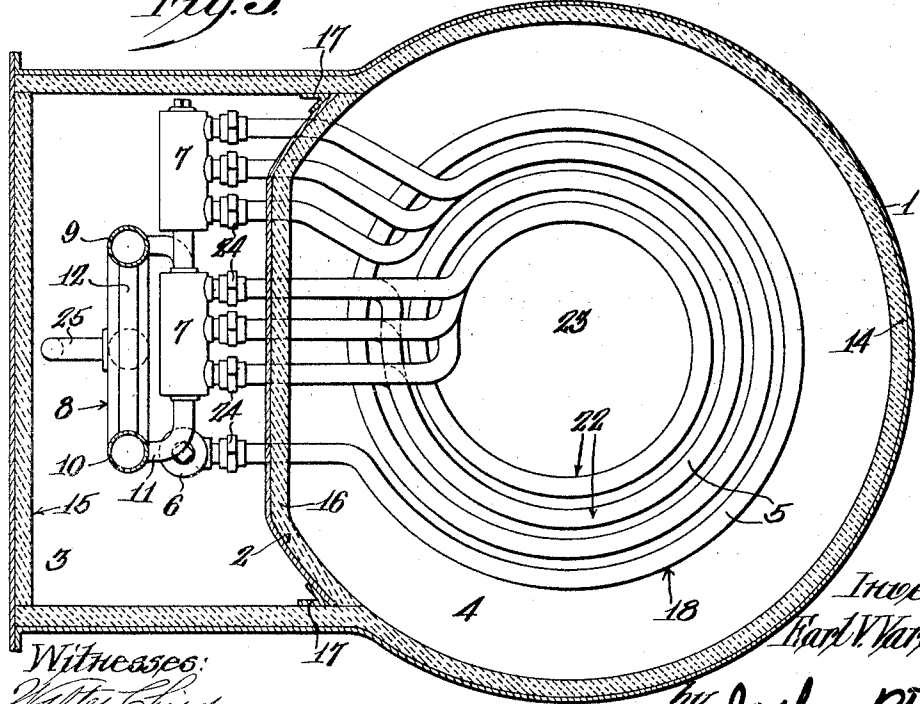


Fig. 3.



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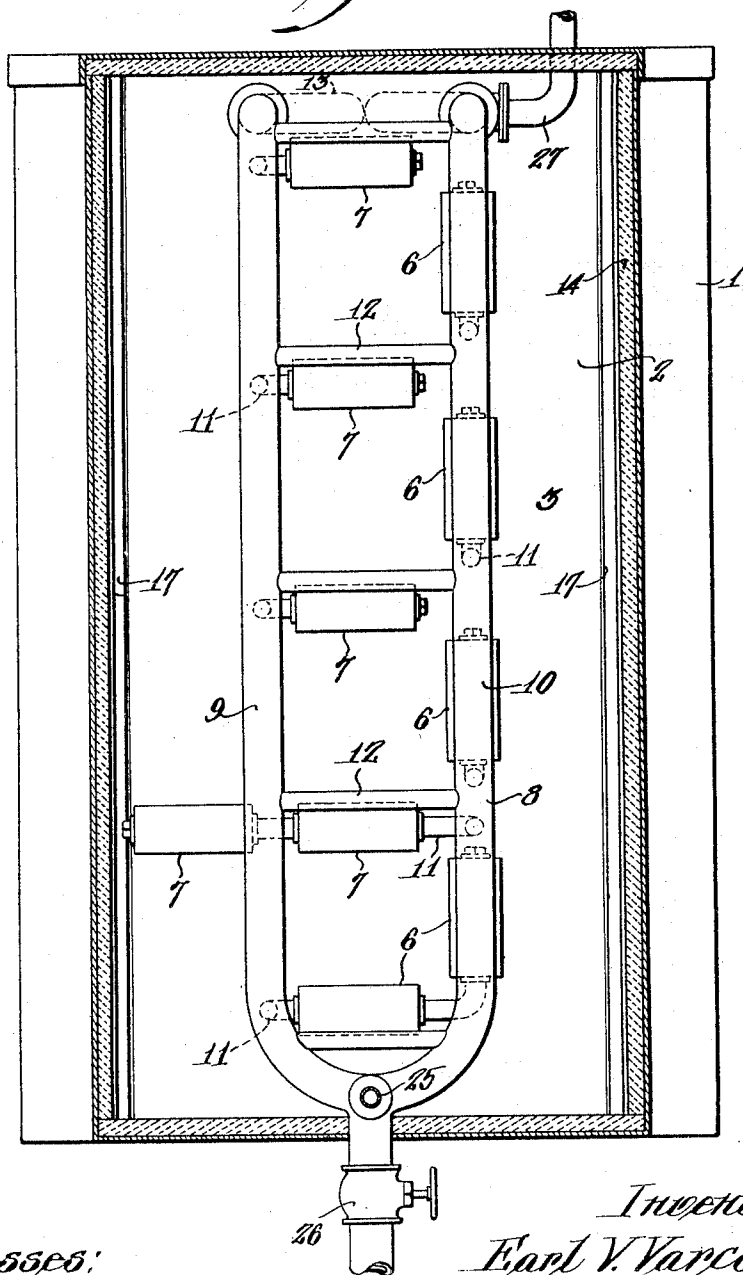
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Fig. 4.



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UNITED STATES PATENT OFFICE.

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STEAM GENERATOR.

Application filed September 30, 1924, Serial No. 740,711. Renewed February 12, 1929.

My invention relates to steam generators of the water tube type, especially adapted for use in motor-driven vehicles, such as automobiles.

5 The objects are to provide a steam generator of simple and durable construction which will have a large steam generating capacity and will occupy a small space; which will have all the pipe connections out of the
10 path of the products of combustion; which will have means whereby access to the connections may be readily had, and in which a defective tube may be quickly renewed.

15 These objects, and other advantageous ends which will be described hereinafter, I attain in the following manner, reference being had to the accompanying drawings in which

20 Figure 1 is a central section, partly in full, through a steam generator constructed in accordance with my invention,

Figure 2 a section on line 2—2 of Figure 1,

25 Figure 3 a section on line 3—3 of Figure 1, and

Figure 4 a section on line 4—4 of Figure 1.

Referring to the drawings, 1 indicates a casing, 2 a partition within the casing forming two compartments 3 and 4, 5 steam generating tubes coiled in any style, preferably as shown, within compartment 4 and having their inlet and outlet ends passing
35 through partition 2 into compartment 3, 6 and 7 inlet and outlet headers connected to the inlet and outlet tube ends respectively, 8 a U-shaped water column having its legs 9 and 10 connected to the headers by suitable fittings 11, 12 by-passes between the legs
40 9 and 10 and below each inlet header 6, and 13 a steam pipe disposed within the top of the casing above the steam generating tubes 5 and having its ends connected with
45 the ends of the legs 9 and 10.

50 The casing may be made from sheet metal and lined with heat insulating material 14. It may be shaped as desired so long as it has a removable side wall 15 on the compartment 3 which affords access thereto for

inspection, repairs, etc. of the pipe connections.

The partition 2, which may be made from sheet metal and lined with heat insulating material 16, is removably secured to the
55 casing by angles 17 or otherwise.

The steam generating tubes 5 may be any number, coiled in any style. As shown, the tubes are coiled to form units 18, 19, 20 and 21 having their inlets and outlets connected
60 to the inlet and outlet headers 6 and 7. The lowermost unit 18 has an additional inner set of coiled tubes 22 within the outer set. The spiral turns of each tube are disposed
65 in a horizontal plane and all of the tubes of each unit are disposed substantially in a spiral vertical plane. The outlet ends of the coiled tubes are disposed in a vertical plane
70 and the inlet ends, except those of tubes 22 which are in a horizontal plane are disposed in a vertical plane. This arrangement results in a compact boiler of high steam generating capacity. A space 23 is left within the coiled tubes so that when it is desired
75 to use a superheater or a water heater or both, they may occupy this space.

The headers 6 and 7 are connected with the inlet and outlet ends of the tubes 5 by unions 24 so that a defective tube may be quickly renewed.

80 The U-shaped water column 8 receives its feed water through the water pipe 25 connected at its bottom. When a water heater is used this pipe 25 is connected thereto. A blow-off valve 26 is connected to the bottom of the U-shaped water column below
85 the pipe 25 for blowing out the sediment which settles to the bottom.

90 The steam pipe 13 stores steam and has its steam outlet 27 connected in compartment 3. If a superheater is used, this outlet is connected thereto. The shape of pipe 13 may be of any style so long as sufficient storing capacity is obtained.

95 When the water in the coils 18 and 22 is heated by the burner it becomes hotter and lighter than the water in the adjacent portions of the U-shaped water column. The head of colder and heavier water in leg 10 between the coils 18 and 22 and the lower- 100

most by-pass 12 causes the water to flow downwardly and into the coils to displace the hotter and lighter water flowing therefrom. The hot water at the point where it enters the leg 10 from said coils having lost some of its heat by radiation is not as hot as the water in the coils, which is being heated. It is evident that all of the water entering leg 10 from the coils 18 and 22, is not of uniform temperature; the water in the center of the pipe being hotter than the water in contact with the walls of the pipe. This small difference in temperature is sufficient to cause the hotter water to rise, while the colder water will pass down the leg 10, across the lowermost by-pass 12, into leg 9 and into the coils to again displace the hotter and lighter water therein. The circuit thus created for the water is up coils 18 and 22, down leg 10 and across the lowermost by-pass 12 into leg 9, and into the coils again. This circuit is for the colder water issuing from the coils 18 and 22 into the leg 10. The hotter water from these coils passes upwardly and enters the next coil 19, and circulates in its circuit. It will be noted that the inlet and outlet ports for the coils 19, 20 and 21 are the reverse from those of the coils 18 and 22; that is, while coils 18 and 22 receive their water from the leg 9 and discharge into the leg 10, the other coils receive their water from the leg 10 and discharge the same into the leg 9. Where the water discharges from the coils 19, 20 and 21 into the leg 9, a similar separation of the hotter and colder water is effected as above described in regard to the water discharge from the lowermost coils. The colder water passes downwardly in the leg 9, through the next lower by-pass 12 and into the coil to be again heated. The hot water rises in leg 9, meets the downwardly flowing water from the coils next above and is caused to travel through the by-pass just above the header from which it has left. This causes a local circulation of the cooler waters through the several coils and at the same time causes the hotter water to rise to the higher coils, where it turns into steam, thereby avoiding water-hammering noises. When steam has formed in the uppermost coil it enters the leg 9 near the steam pipe 13. The water level may be below this point to prevent possible water-hammering noises. When the burner is on full so that the boiler operates at full capacity some steam is generated in the coils 20 and 19, and when this condition prevails a slightly different circuit is established for the circulating water. Steam coming out of coil 19 into the leg 9 rises and causes the water which would otherwise come downwardly from the coil 20, to pass upwardly and across through the by-pass 12, just above the coil 20 so that the circuit is up coil 20, through by-pass 12 above said coil (whereas before it was

through the by-pass 12 below the coil) down leg 10 and into the coil again. It will be noted that the circulation above described, resulting in the quiet action of the device, is attained by the by-passes 12 arranged above each of the outlets of the heating coils and one arranged below the inlet of the lowermost coil.

The source of heat may be a fluid fuel passing through a burner 28. An outlet is provided in the casing for the products of combustion.

It will be seen that with the use of my steam generator, a defective tube may be quickly renewed because all the pipe connections are out of the path of the products of combustion and access to these connections is readily had. The steam generating capacity may be easily increased by merely adding tubes to the steam generating units.

While I have described my invention as taking a particular form, it will be understood that the various parts may be changed without departing from the spirit thereof, and hence I do not limit myself to the precise construction set forth, but consider that I am at liberty to make such changes and alterations as fairly come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a device of the class described, a U-shaped water column, a plurality of superposed heating coil units, each unit having its respective ends connected to the opposite legs of said water column, and by-passes connecting the legs of said water column above the respective outlets of said coil units, substantially as described.

2. In a device of the class described, a U-shaped water column and a plurality of superposed heating coil units, each unit having its respective ends connected to the legs of said column respectively, and by-passes connecting the legs of said water column between the respective discharge ends of each said coil unit and the respective inlet ends of the coil unit next above, substantially as described.

3. A device as set forth in claim 2 further characterized by a by-pass connecting said legs below the inlet of the lowermost coil unit, substantially as described.

4. A steam generator including a casing; a partition within the casing forming two compartments; steam generating tubes coiled within one compartment and having their ends passing through the partition into the other compartment; a U-shaped water column in said last-named compartment; headers connected with the inlet end of the tubes and with one leg of the water column; headers connected with the outlet ends of the tubes and with the other leg of the water

column, and a steam pipe of larger diameter
than the coils disposed above the coils having
its ends passing through the partition, one
of its ends being connected with each leg of
5 the water column.

In testimony whereof I have signed my
name to this specification.

EARL VERNON VARCOE.

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