C. E. BROAD.

STEAM GENERATING APPARATUS.

APPLICATION FILED DEC. 24, 1917.

1,364,178.

Patented Jan. 4, 1921.

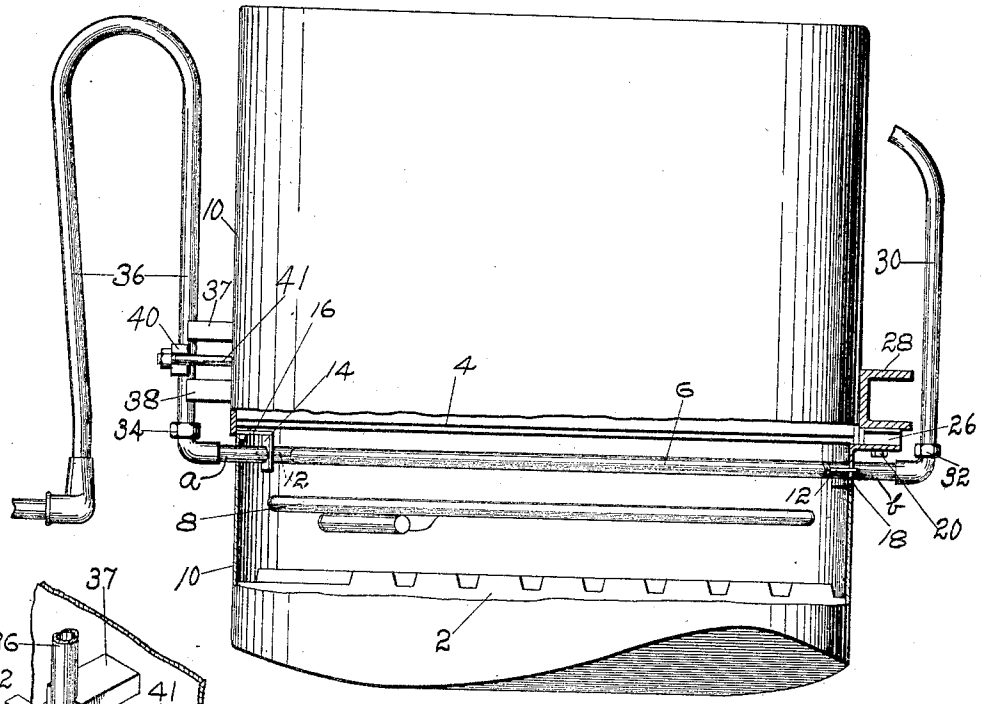


Fig 1

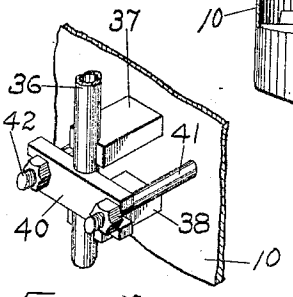


Fig 4

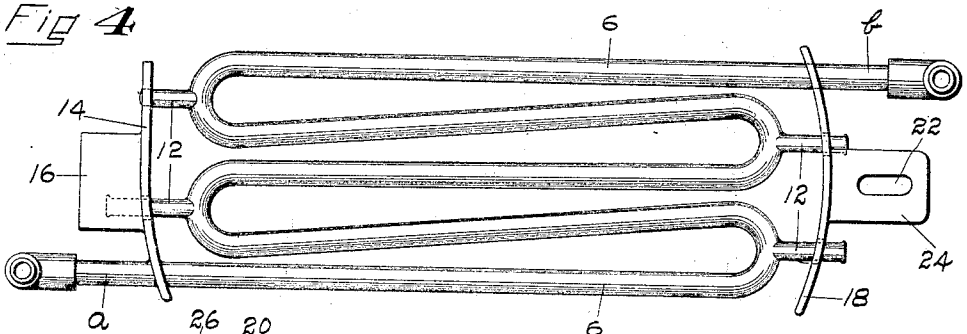


Fig 2

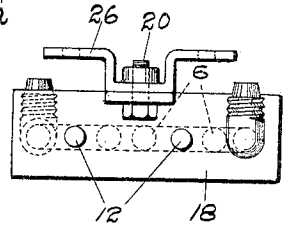


Fig 3

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# UNITED STATES PATENT OFFICE.

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## STEAM-GENERATING APPARATUS.

1,364,178. Specification of Letters Patent. Patented Jan. 4, 1921.

Application filed December 24, 1917. Serial No. 208,551.

*To all whom it may concern:*

Be it known that I, CHARLES E. BROAD, a citizen of the United States, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Steam-Generating Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to the steam generating apparatus of steam driven vehicles, and the like. Apparatus of this character usually comprise a burner, a boiler located immediately above the burner, and a superheater located between the boiler and the burner. Since the superheater is located in the hottest part of the fire it deteriorates much more rapidly than other parts of the apparatus, and accordingly this device must occasionally be removed and replaced by a new one. In the commercial constructions, the boiler, burner and superheater are all inclosed in a casing and it is necessary to do considerable dismantling of the apparatus in order to obtain access to the superheater, even for purposes of inspection. Furthermore, the superheaters of the type now commonly used are so connected with the other parts of the apparatus that it is difficult to disconnect them, even after the preliminary dismantling operations have been performed; and the construction is such that there is considerable danger of injuring the boiler in removing a superheater, particularly if the connections between the superheater and boiler have become corroded.

The present invention is concerned particularly with the problem presented by this state of facts, and it aims to devise a steam generating apparatus of the character indicated in which the superheater can be easily removed either for inspection or replacement, and in which the replacing operation will not be liable to injure other parts of the apparatus.

The manner in which it is proposed to accomplish these objects will be readily understood from the following description and the novel devices of the invention will be particularly pointed out in the appended claims.

Referring now to the accompanying drawings:

Figure 1 is a view, partly in side elevation and partly in cross section, of those parts of a steam generating apparatus with which the present invention in concerned;

Fig. 2 is a plan view of the superheater with which the apparatus shown in Fig. 1 is equipped;

Fig. 3 is a front elevation of the superheater shown in Fig. 2, showing a part of its supporting means connected therewith; and

Fig. 4 is an angular view showing certain details of construction.

The drawings show an apparatus designed particularly for application to the vehicle known commercially as the Stanley steam car.

This apparatus comprises a burner 2, a boiler 4 located above said burner, and a superheater 6 supported between the bottom of the boiler and the top of the burner. Liquid fuel, such as kerosene or gasolene, usually is employed in apparatus of this character and the drawings show a part 8 of the vaporizer for this liquid fuel. The burner and boiler are approximately circular in cross sectional outline. This entire apparatus is inclosed in a casing 10 consisting of an upper section secured to the boiler and a lower section secured to the burner.

The superheater, as best shown in Fig. 2, consists of a pipe or tube bent into a zig zag form to provide a series of pipe lengths or sections lying in the same plane and positioned closely adjacent to each other. In other words, this pipe or tube is bent to form a plurality of U-shaped portions lying side by side in the same plane and all connected together to form a superheater unit. The general shape of the superheater unit is rectangular, and the bends connecting the adjacent lengths of the pipe are located at the opposite ends of the rectangle so that the substantially parallel pipe lengths extend longitudinally of the rectangle. This arrangement provides a relatively long length of pipe, through which the steam must circulate, arranged in a very narrow space.

In order to support the superheater, pins or lugs 12 are welded to the bent portions of the pipe and extend substantially parallel

to the opposite sides of the superheater unit. One of the two pins 12 at the rearward end of the superheater unit is welded into the vertical wall of a plate 14 which also is provided with an extension 16. Preferably also the end portion *a* of the superheater pipe is welded to this plate 14. The opposite end portion *b* of the superheater pipe and the pins 12 at that end extend loosely through holes in a similar plate 18. The ends of these pins 12 preferably are headed over to prevent the plate from sliding off them. The casing 10 of the boiler is provided with an aperture through which the entire superheater unit may be inserted and placed in the position in which it is shown in Fig. 1. When in this position, the flange 16 of the plate 14 rests on the top of the lower section of the casing 10 that encircles the burner, and the end portion *a* of the superheater pipe projects through a hole in the casing at the rear side of the boiler. The plate 18 practically closes the aperture through which the superheater is inserted, and this plate is secured in place by means of a bolt 20, projecting through a hole 22 formed in an extension 24 of the plate 18, and threaded into a boss in the upper side of a U-shaped bracket 26 that is riveted to a frame member 28 of the machine. This frame member also is utilized to support the boiler.

The connections that supply steam to the superheater comprises a pipe 30 which is connected to the intake end *b* of the superheater by means of a threaded pipe coupling 32 of the usual form. According to the usual arrangement, the steam is conducted from the boiler to a throttle valve and the pipe 30 conducts the steam from this valve to the superheater. Another threaded pipe coupling 34 connects the opposite end *a* of the superheater to one end of a U-shaped expansion pipe 36 which delivers the steam to the steam-line leading to the engine. The peculiar shape of the pipe 36 enables it to take up the expansion and contraction of the steam line. For the purpose of supporting the end of this pipe adjacent to the coupling 34, the upper section of the casing 10 is provided with two lugs 37 and 38 arranged one above the other and each having a seat formed in its end to receive the pipe. A yoke 40, having a similar seat to engage the pipe 36, bears against the outer wall of the pipe and holds the pipe securely in the seats in the lugs 37 and 38. Nuts threaded on bolts 41 and 42 that project from the casing and pass through the yoke 40 clamp the yoke against the pipe. The fact that this end of the pipe 36 is rigidly supported and is secured to the end *a* of the superheater pipe by the coupling 34 enables the rigid connection between the latter pipe and the plate 14 to prevent the flange 16 of this plate from sliding off the upper edge of the lower section of the casing. At the same time this construction provides a firm support for the U-shaped pipe 36 and leaves one end of this pipe free to move toward or from the clamped end, as may be necessary to take up the expansion and contraction of the pipe line that conducts the steam to the engine.

When this apparatus is in use, it usually is covered with a plastic composition containing asbestos, or some other heat-insulating material, and the pipe connections also are usually inclosed in a heat-insulating jacket of some character. When it is desired to remove the superheater for inspection or replacement, it is merely necessary for the mechanic to break this jacket or coating away from the couplings 32 and 34 and the bolt 20. The couplings are next unscrewed, the bolt 20 is removed, and the superheater may then be withdrawn through the opening in the casing that normally is closed by the plate 18. The flange 16 slides freely off the top of the lower casing section at the beginning of the withdrawal movement. It is then merely necessary to slip a new superheater back into the position formerly occupied by the old one, care being taken to see that the flange 16 of the plate 14 rests on the upper edge of the lower section of the casing 10. As soon as the couplings 32 and 34 are secured and the bolt 20 is replaced, the layer of heat-insulating material may be applied, and the apparatus then is ready for use. This entire operation takes only a few minutes time and does not require any dismantling of the apparatus other than that just described. The relative positions of the boiler and burner are not disturbed. It will be noted that the pipe couplings and the bolt 20 are all outside of the casing 10 so that they are readily accessible. This arrangement and the type of coupling used not only facilitates the removel of the superheater but also avoids any possibility of injuring other parts of the steam generating apparatus during the removal of this device. The disadvantages above described attending the use of the present construction thus are completely avoided. Furthermore, the fact that the superheater may be easily removed, reduces the temptation to delay an inspection of a superheater that has been in use for a long time and is nearing the bursting point. It will also be noted that the construction shown provides a support for the superheater pipe at very frequent intervals so that all danger of the pipe sagging is eliminated. The fact that the pins 12 at one end of the superheater and the pipe portion *b* at that end extend loosely through the plate 18 allows these parts to slide relatively to

the plate as the superheater expands or contracts without interfering with the support of these members.

While I have herein shown and described the best embodiment of the invention of which I am at present aware, it is obvious that this embodiment may be modified in many respects while still retaining the essential spirit and characteristics of the invention. The invention, therefore, is not limited to embodiment in the specific form shown.

What I claim as new is:

1. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler above said burner, a casing substantially inclosing said boiler and burner, a superheater positioned between said boiler and burner and comprising a pipe arranged to form a series of pipe sections or lengths lying closely adjacent to each other and occupying a relatively narrow space in the casing, and means for supporting said superheater in said position comprising plates connecting said pipe lengths at their opposite ends.

2. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler above said burner, a casing substantially inclosing said boiler and burner, a superheater positioned between said boiler and burner and comprising a pipe arranged to form a series of pipe sections or lengths lying closely adjacent to each other and occupying a relatively narrow space in the casing, means for supporting said superheater in said position comprising plates connecting said pipe lengths at their opposite ends, said casing having an opening therein through which said superheater may be inserted or removed as a unit, and means for securing one of said plates in position to substantially close said opening.

3. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler above said burner, a casing substantially inclosing said boiler and burner, a superheater positioned between said boiler and burner and having an end projecting through said casing, connections for conducting steam to said superheater, a U-shaped pipe coupled to said projecting end of said superheater, and means for clamping the end portion of said U-shaped pipe securely in position at a point adjacent to its connection with said projecting end of the superheater.

4. A superheater for the boiler of a steam driven vehicle, comprising a pipe bent to form U-shaped portions lying substantially in the same plane and connected together to form a superheater unit of substantially rectangular outline, the turns or bends of said section lying at the opposite ends of the said rectangular unit, supporting pins projecting from said bends, and plates supporting said pins.

5. A superheater for the boiler of a steam driven vehicle comprising a pipe bent to form U-shaped portions connected together to form a superheater unit of substantially rectangular outline, the turns or bends of said section lying at the opposite ends of the said rectangular unit, supporting pins projecting from said bends, and plates supporting said pins, certain of said pins being loose in said plates and others fixed therein to permit expansion and contraction of the pipe with reference to said plates.

6. A steam generating apparatus for a vehicle comprising, in combination, a burner, a boiler located immediately above said burner leaving a thin vertical space separating said burner and boiler, a casing substantially inclosing said burner and boiler, a superheater located in said space, said casing having an aperture therein through which the superheater may be inserted or removed without disturbing the relative positions of the boiler and burner, freely disengageable means within the casing for supporting one end of the superheater, supporting means connected to the other end of the superheater and having a part projecting outside of said casing, and fastening means engaging said projecting part and securing the superheater in place.

7. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler located immediately above said burner leaving a thin vertical space separating said burner and boiler, a casing substantially inclosing said burner and boiler, a superheater located in said space, said casing having an aperture therein through which the superheater may be inserted or removed without disturbing the relative positions of the boiler and burner, means for supporting said superheater in its operative position including a freely disengageable means within the casing for supporting one end of the superheater, said superheater having a part thereof projecting through said casing, and clamping means exterior to said casing and connected both with said part and with the casing for assisting in supporting said superheater and for preventing disengagement of said freely disengageable means inside the casing.

8. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler located immediately above said burner leaving a thin vertical space separating said burner and boiler, a casing substantially inclosing said burner and boiler, a superheater located in said space, said casing having an aperture therein through which the superheater may be inserted or re-

moved as a unit without disturbing the relative positions of the boiler and burner, freely disengageable means for supporting the inner end of said superheater, additional supporting means connected to the other end of said superheater and forming a closure for said aperture, the latter means having a projecting part outside of said casing, and fastening means coöperating with said part to secure the superheater in its operative position.

9. A steam generating apparatus for a vehicle, comprising, in combination, a burner, a boiler located immediately above said burner, said boiler and burner being substantially circular in horizontal cross section, a casing substantially inclosing said boiler and burner, a superheater supported horizontally in the space between said boiler and burner and comprising a pipe bent to form a series of pipe lengths lying closely adjacent to each other in substantially the same horizontal plane, said casing having an aperture formed therein through which said superheater may be inserted or removed as a unit, said superheater being of an elongated rectangular form of sufficient length to reach substantially across the space inside said casing and relatively narrow in width, whereby only a relatively short opening is required in said casing to permit the passage therethrough of the superheater, and means for closing said opening.

10. A superheater for the boiler of a steam driven vehicle, comprising a pipe bent to form U-shaped portions lying substantially in the same plane and connected together to form a superheater unit, and pins projecting from said pipe at the opposite ends of said unit.

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

CHARLES E. BROAD.