A. DOBLE.

PROTECTIVE MECHANISM FOR STEAM AUTOMOBILE POWER PLANTS.

APPLICATION FILED AUG. 27, 1917.

1,313,527.

Patented Aug. 19, 1919.

2 SHEETS—SHEET 1.

Fig. 2.

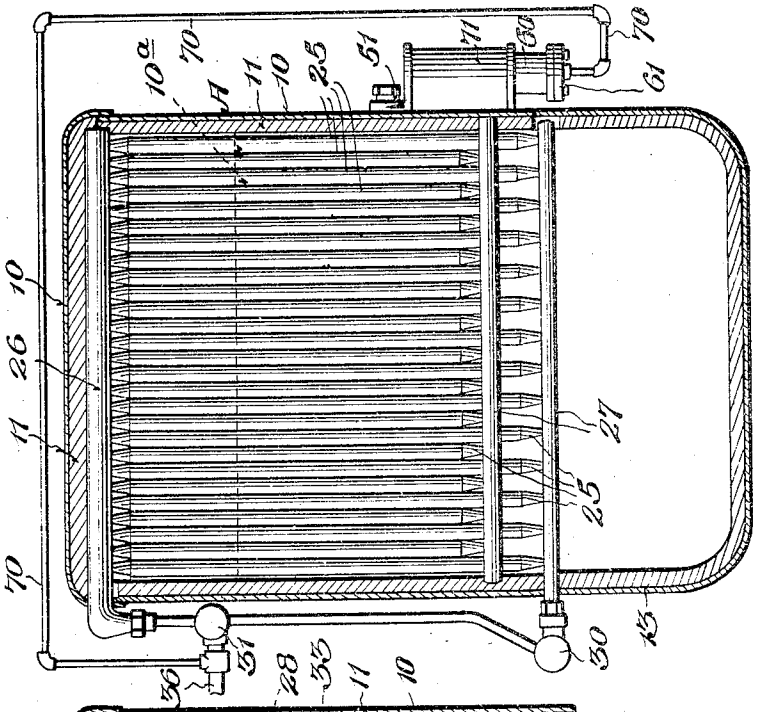
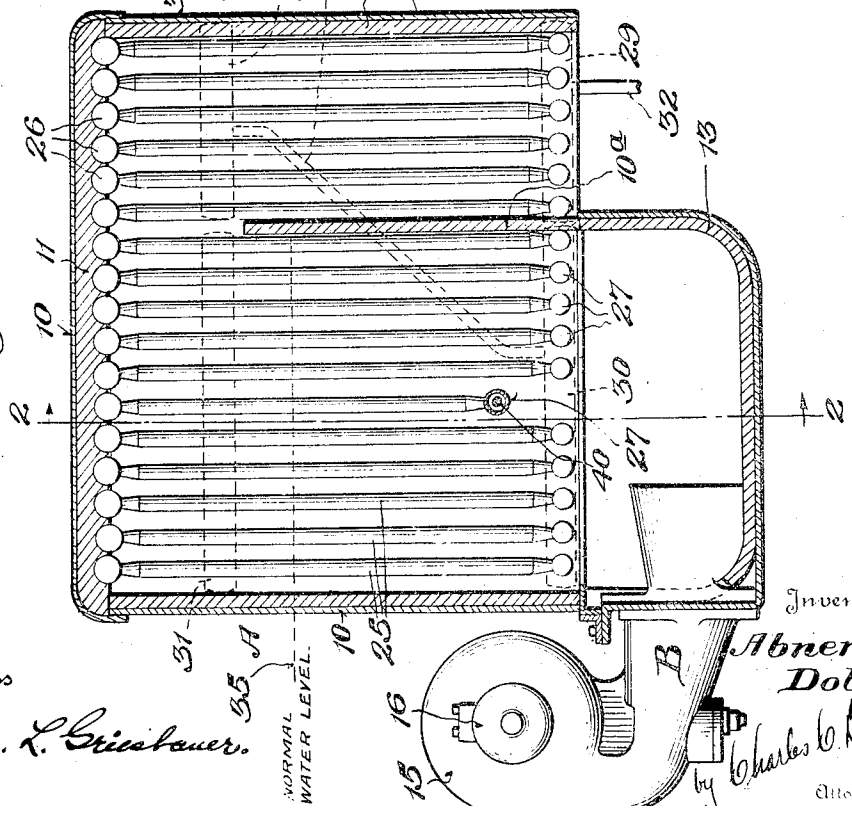


Fig. 1.



Witness

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2 SHEETS—SHEET 2.

Fig. 3.

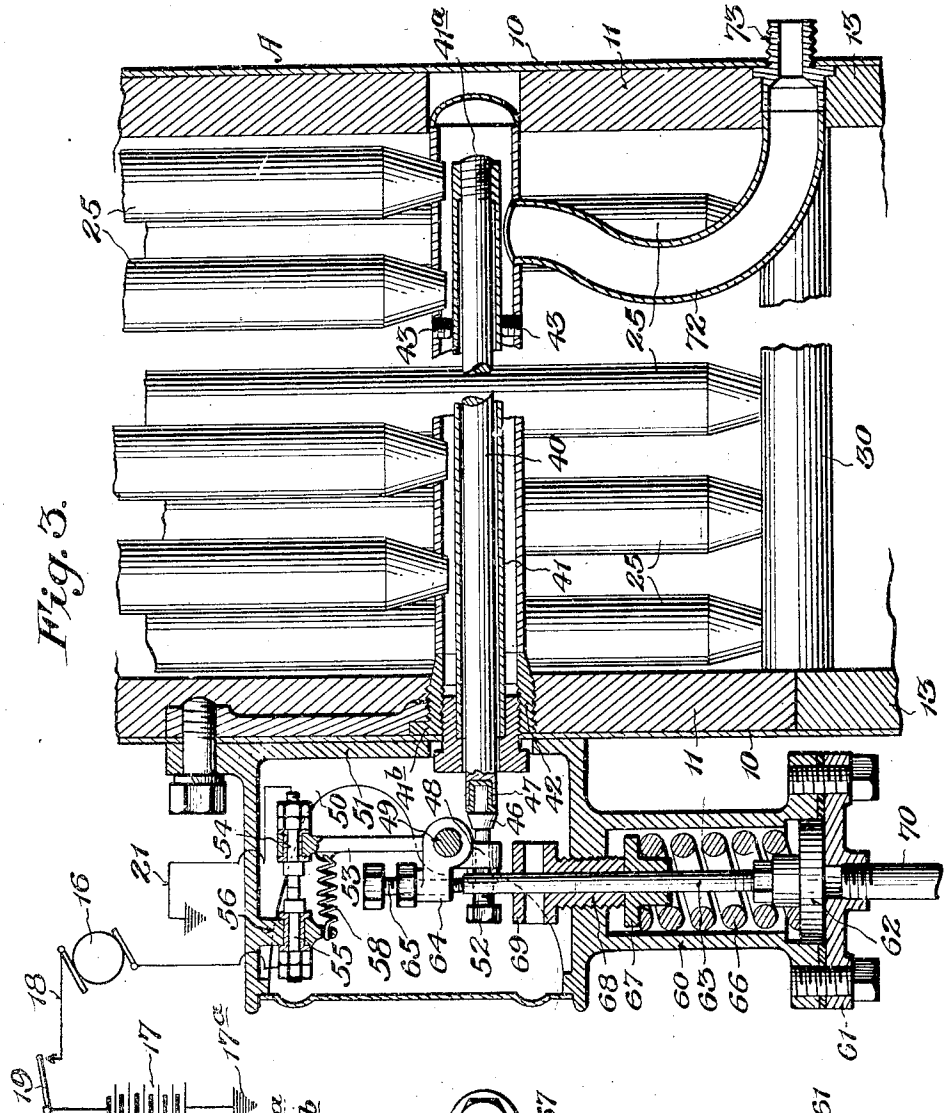
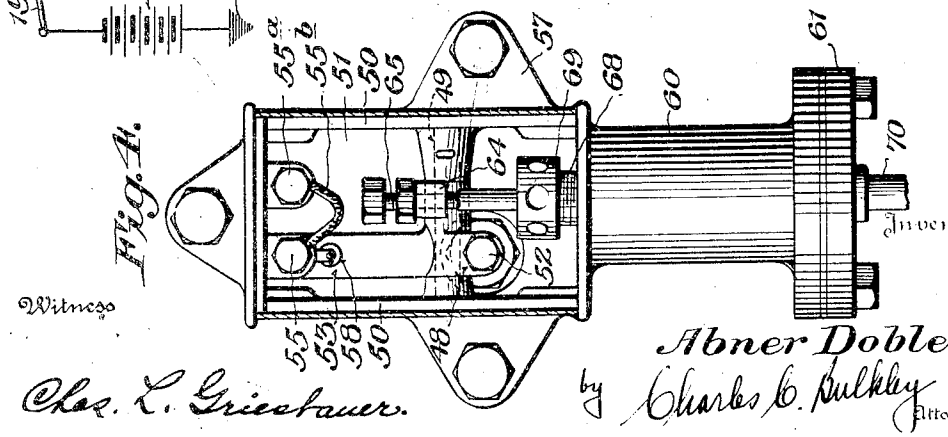


Fig. 4.



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UNITED STATES PATENT OFFICE.

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PROTECTIVE MECHANISM FOR STEAM-AUTOMOBILE POWER PLANTS.

1,313,527. Specification of Letters Patent. Patented Aug. 19, 1919.

Application filed August 27, 1917. Serial No. 188,503.

To all whom it may concern:

Be it known that I, ABNER DOBLE, a citizen of the United States of America, and resident of Detroit, Wayne county, Michigan, have invented a certain new and useful Improvement in Protective Mechanism for Steam-Automobile Power Plants, of which the following is a specification.

My invention relates to improvements in protective devices for the power plants of steam driven automobiles.

My object is to provide an improved automatic mechanism responsive to abnormal conditions in the power plant of the vehicle for rendering the power plant less operative or discontinuing its operation pending the restoration of normal conditions, my purpose further being to provide mechanism of this character which will be simple, durable and reliable in construction, and effective and efficient in operation.

Other objects of my invention will appear hereinafter.

My invention consists in the features of novelty exemplified by the construction, combination and arrangement of parts herein described, shown in the accompanying drawing and more particularly set forth in the appended claims.

Referring to the accompanying drawings:—

Figure 1 is a vertical sectional view of an automobile steam generator, fuel burners and combustion chamber, in which my invention is illustrated as being embodied.

Fig. 2 is a transverse vertical section on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail section of the short section portion of the generator, together with the pressure operated mechanism and the cut-off switch mechanism.

Fig. 4 is a view of the cut-off switch mechanism, the cover being in section to disclose the interior operating parts.

The steam generator illustrated in the drawings, and in connection with which I will describe my invention is designed for the rapid production of high pressure steam for use as the propelling force for vehicles such as automobiles. This generator is further designed to develop a great amount of power within the confines of the comparatively small and limited space permitted for the power plant of an automobile. To meet these requirements, the generator is provided with a large number of upright water tube sections or units assembled together in compact relation and inclosed within a refractory lined casing or housing A. The housing consists of the side, end and top walls 10 having refractory linings 11 and disposed in rectangular relation. This housing is divided into two compartments by means of the refractory partition 10^a which terminates short of the top wall so as to provide at the top a communicating passage between the two compartments. Each compartment contains a group of tube sections, one group containing about twice the number of tubes as the other group and constituting the steam generating group. The smaller group serves as the economizer or feed water heater group. The lower end of the larger compartment is entirely inclosed by a refractory fire-pot 13 forming a combustion chamber within which a sprayed or atomized mixture of liquid fuel, such as kerosene, and air is burned. The heated products of combustion rise directly upward in the larger compartment around the water tubes and rapidly generate steam in these tubes. The spent gases pass over the partition wall and thence downwardly in the smaller compartment where the available remaining heat units are absorbed by the water in the tubes in this compartment to heat the feed water. The fuel mixture is supplied to the combustion chamber, in the structure shown, by means of a spraying or atomizing mechanism B which projects into said chamber at one end of the fire-pot. This fuel spraying mechanism requires no particular description except to say that the liquid fuel is sprayed or atomized by the air from a blower 15 which also supplies all of the air necessary to support complete combustion of the fuel. This blower is driven by a small electric motor 16 mounted thereon and supplied with current from a battery 17 or other source carried by the vehicle, this battery having one of its terminals grounded at 17^a and its other terminal connected by conductor 18 through an operator's controlling switch 19 to one terminal 20 of the motor. The other terminal of the motor is grounded at 21.

The water tube sections or units each consists of a plurality of parallel upright tubes 25 integrally connected to common upper and lower headers 26 and 27 respectively. These units are suitably supported side by side in the compartments of the casing. The upper headers of the economizer group in the smaller compartment are connected to a common water manifold 28, while the lower headers of said group are connected to a common water manifold 29. In like manner the lower headers of the large group are connected to a common water manifold 30, and the upper headers to a common steam manifold 31. The water is supplied from a suitable water tank to the lower water manifold 29 through the pipe 32 by means of a suitable pump, and from thence the water rises in the economizer group to the upper manifold 28, thence through a connecting pipe 33 to the lower water manifold 30 of the steam generator group. The water in these tubes rises to a level indicated by the dotted lines 35 which in practice is preferably somewhat above half the height of the tubes. This provides a large number of small columns of water directly subject to the heat of combustion of the fuel, and above the water level the tubes form a plurality of steam zones which supply steam to the manifold 31 and thence to the engine through the pipe 36. The water level is in practice maintained substantially constant, preferably automatically by means of a suitable regulator provided for the purpose.

In the structure of this character abnormal conditions of temperature or steam pressure are likely to arise to the damage of the structure and in order to protect against such conditions I provide mechanism which is automatically responsive to these abnormal conditions and operates to discontinue the fuel burning mechanism until such conditions are relieved. In one of the headers 27 (preferably of one of the middle sections) I provide a thermostatic element 40 so that it will be directly subject to the heat from the combustion chamber. This thermostatic element consists of an expansible rod 41 positioned concentrically in said lower header and extending substantially the entire length thereof. The rod however is contained within a non-expansible tube 41 so that the end of the rod may be extended from the header to operate the cut-off mechanism and at the same time seal the header against leakage. One end 41^a of the thermostatic rod is threaded into the corresponding end of the tube to seal the end of the tube and also anchor the end of the rod. The other end of the rod extends through and beyond the end of the header to operate the cut-off mechanism. One end of the tube is welded or otherwise fastened to a screw plug 41^b and this plug is screwed into the enlarged end 42 of the header so as to firmly anchor this end of the tube. The tube however is supported at its inner end centrally of the header by screws 43 of which there are three disposed at 120° apart, but these screws do not interfere with the longitudinal movement of the thermostatic rod in the tube. The rod normally is of course submerged in the water in the header, but in the event that the water level reaches a dangerously low point the expansion or elongation of the rod will, as hereinafter explained cut off the fuel burning mechanism. This dangerously low point is determined by making the tube section which contains the thermostatic element shorter than the other sections, thus raising its lower header and the thermostat somewhere above the plane of the lower headers of the remaining sections. This insures the single thermostat section header becoming dry before any of the other sections, and hence insures the operation of the thermostat before the water level becomes dangerously low in the other sections. This is true even though the generator might at the time be in an inclined position, as when the automobile is running up or down a steep grade. On the other hand if the thermostat header was in the same plane as the other headers, the tilting or inclining of the generator would empty some of the other headers, particularly the headers farthest from the center of the structure, without affecting the thermostat.

The end of the thermostat rod has a small button 46 at its end suitably insulated by the insulating material 47 so the heat of the rod will not be transmitted to the operating parts. This end of the rod operates against one arm 48 of a three-arm rocking lever which is journaled on a transverse shaft 49 supported by the ears or side webs 50 of a bracket 51, the bracket being bolted to the side of the generator casing. The arm 48 carries a screw 52 the end of which directly bears against the end of the thermostat rod so that the relation between the thermostat and the arm may be accurately adjusted. Another arm 53 of the lever is considerably longer and serves as a switch. It carries a contact screw 54 which is arranged to engage a similar stationary contact screw 55 mounted in a lug 56 of the supporting bracket. Both of these contact screws are properly insulated from their respective mountings, and both have nuts on their opposite ends to form binding posts to which connection may be made. I also provide a stationary binding post 55^a to which one end of the motor circuit conductor is connected, and this binding post is connected by the flexible conductor 55^b to the switch arm. The other end of the motor circuit conductor is connected to binding post 55. The contacts are maintained normally en-

gaged by the spring 58 which is connected between the arm 53 and the lug 56. Thus it will be observed that when the thermostat header becomes dry the thermostat rod elongates to such an extent that it swings the switch arm 53 about its pivot and opens the motor circuit, thus discontinuing the operation of the fuel burning mechanism until the structure has cooled down to normal. The generator is thus protected against damage which would result if the water level were allowed to become too low or if the generator became entirely dry.

The supporting bracket has a depending cylinder 60 preferably formed integrally therewith and the lower end of the cylinder is inclosed by a head 61. The cylinder contains a piston 62 which has a rod 63 extending upwardly through the upper cylinder head and adapted to engage the third arm 64 of the switch lever and to actuate said switch arm and open the motor circuit in the event that the steam pressure becomes abnormal. This arm 64 also has an adjustable screw 65, the end of which directly engages the piston rod, so that the relation between the arm and piston rod may be accurately adjusted.

The cylinder also contains a coiled spring 66 which bears against the piston at one end, and against a movable collar 67 at its other end. The collar bears against an adjustable sleeve 68 threaded through the upper end of the cylinder. This sleeve forms a bearing for the piston rod, and has a head 69 provided with several radial holes into which a rod may be inserted for rotating the sleeve. Thus the pressure exerted by the spring on the piston can be accurately adjusted to the mechanism for operation at any pre-determined steam pressure. The cylinder is connected with the upper steam manifold of the generator by means of the pipe 70, so that the piston will be directly subject to the pressure of the generated steam. Thus any predetermined abnormal rise in the steam pressure will render the fuel burning mechanism ineffective until the normal pressure condition is restored whereupon the switch will again close the motor circuit.

The operating parts are inclosed by a casing 71 which is fastened to the bracket in any suitable way so that access may be gained to the interior. It is to be noted that all of the operating parts are mounted upon a casting and inclosed in a suitable housing, and that the structure thus forms a self-contained unit which may be readily mounted in position or demounted without disturbing adjustments, and without disturbing the thermostat or the generator in any way.

On account of the fact that the thermostat header of the short section is elevated above the other headers, I provide a short curved connecting pipe 72 which extends downwardly within the generator casing and its lower end 73 is terminated in the same plane as the other headers so that connection may be made with the lower water manifold 30 of the generator.

I claim:—

1. The combination of a steam generator having a plurality of upright water tubes with upper and lower headers, one of said lower headers being elevated above the plane of the remaining lower headers, a fuel burner for said generator and a thermostat associated with said elevated header responsive to a predetermined water level in said tubes for rendering said burner ineffective.

2. The combination of a steam generator having a plurality of upright water tubes with upper and lower headers, one of said lower headers being elevated above the plane of the remaining lower headers, a fuel burner for said generator and a thermostat associated with said elevated header responsive to a predetermined water level in said tubes for rendering said burner ineffective, and means associated with said thermostat responsive to a predetermined steam pressure for rendering the burner ineffective.

3. The combination of a steam generator having a plurality of upright water tube sections and lower water headers and arranged to contain water at a given normal level, a shorter section having its lower header positioned above said other headers at a point corresponding to an abnormally low water level, a motor driven fuel burner for the generator, a circuit for the motor, a switch for opening the circuit to stop the motor, and a thermostat in said short section header operable when the water level becomes abnormally low to actuate said switch.

4. The combination of a steam generator having a plurality of upright water tube sections and lower water headers and arranged to contain water at a given normal level, a shorter section having its lower header position above said other headers at a point corresponding to an abnormally low water level, a motor driven fuel burner for the generator, a circuit for the motor, a switch for opening the circuit to stop the motor, a thermostat in said short section header operable when the water level becomes abnormally low to actuate said switch, and a pressure responsive device, operable when the steam pressure becomes abnormally high, to actuate said switch.

5. The combination of a steam generator having a plurality of water headers, one of said headers being elevated above the plane of the remaining headers, a fuel burner for said generator, and a thermostat associated with said elevated header responsive to a predetermined water level in said generator for rendering said burner ineffective.

6. The combination of a steam generator having a plurality of water headers, one of said headers being elevated above the plane of the remaining headers, a fuel burner for said generator, and a thermostat associated with said elevated header responsive to a predetermined water level in said generator for rendering said burner ineffective, and means associated with said thermostat responsive to a predetermined steam pressure for rendering the burner ineffective.

Signed by me at Detroit, Mich., this 23rd day of August, 1917.

ABNER DOBLE.