No. 702,529. Patented June 17, 1902.

W. N. BEST.

APPARATUS FOR SUPPLYING AIR AND HYDROCARBON.

(Application filed June 3, 1901.)

(No Model.) 2 Sheets—Sheet 1.

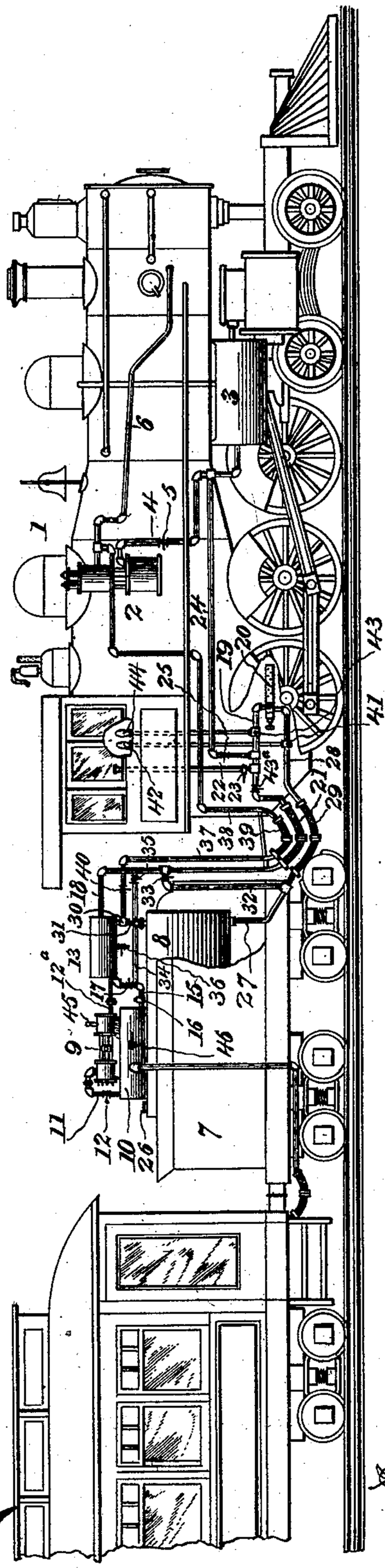

Fig. 1.

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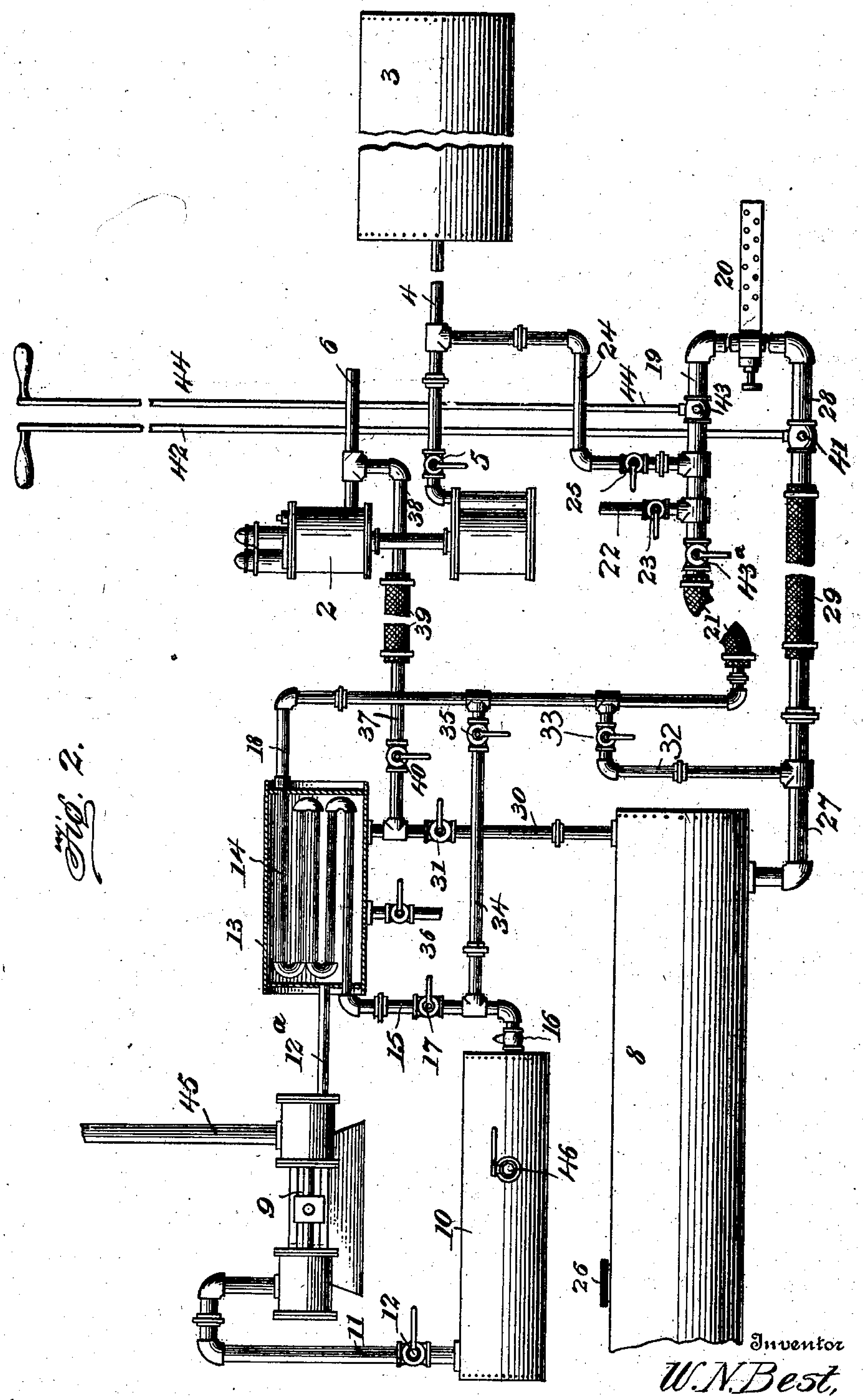

Fig. 2.

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UNITED STATES PATENT OFFICE.

WILLIAM NEWTON BEST, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF TWO-THIRDS TO JOHN H. BEST AND EZRA BEST, OF QUINCY, ILLINOIS.

APPARATUS FOR SUPPLYING AIR AND HYDROCARBON.

SPECIFICATION forming part of Letters Patent No. 702,529, dated June 17, 1902.

Application filed June 3, 1901. Serial No. 62,907. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM NEWTON BEST, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Apparatus for Supplying Air and Hydrocarbon; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention has for its object to provide an improved hydrocarbon-fuel-supplying system especially designed for locomotives and improved air compressing and storing means for use in connection therewith.

The invention consists of certain novel features of construction, combination, and arrangement of parts, as will be hereinafter more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a fragmentary view of a locomotive with its tender, showing the application of the invention thereto; and Fig. 2 is a diagrammatic view of the system, showing also the connection of the same with the coöperating elements on the locomotive.

1 in the drawings represents the locomotive, on which is mounted the air-compressor 2 for supplying air to the main air-reservoir 3 for use in the brake system. The air passes from the air-cylinder of the pump to the air-reservoir through the air-supply pipe 4, which is provided with a controlling-valve 5, whereby in case the air-valves of the pump are not in working order the flow of air through said pipe to and from the pump may be cut off. The exhaust-steam from the operating-cylinder of the pump 2 discharges in the usual manner through an exhaust-pipe 6, leading to the smoke-stack, into which the escaping steam is discharged in order to institute a force draft.

On the tender 7 is located the oil-supply tank 8, which occupies the space usually reserved for coal and supports the auxiliary air-compressor 9 of the fuel-supply system and the air-tank 10 of said system. The air-compressing cylinder of the compresser 9 is connected with one end of the air-tank 10 in order to supply air thereto by an air-conducting pipe 11, in which is arranged a controlling-valve 12, while the power or operating cylinder of said compressor is connected, by means of an exhaust-pipe 12^a, to a superheating chamber or drum 13, into which the exhaust-steam from said cylinder is conducted by said pipe to be utilized in heating the compressed air from the tank 10 to vaporize and place the liquid hydrocarbon fuel from the tank 8 into condition for perfect combustion.

In the superheater 13 is located a superheating-coil 14, which is connected at one end with a pipe 15, leading from the air-reservoir 10, which pipe is provided with a check-valve 16 for preventing the return of air to said tank and with a cut-off valve 17, by means of which the flow of air from the tank or reservoir 10 may be cut off from the coil 14. The opposite end of the coil 14 is connected with a hot-air-conducting pipe 18, which is in communication with a pipe 19, connected with the burner 20 to supply air thereto to atomize or vaporize the hydrocarbon fluid and to supply oxygen to support combustion. The two pipes 18 and 19 are connected by an intermediate hose or flexible connection 21, which extends between the tender and locomotive and allows for the independent play thereof when the locomotive is running. The pipe 19 has connected thereto a steam-supply pipe 22, leading from the boiler of the locomotive, whereby steam may be supplied to take the place of air for vaporizing the oil in the event that the compressor 9 should become disabled or inoperative. This pipe 22 is provided with a controlling-valve 23. The pipe 19 has also connected therewith a shunt or by pipe 24, which leads therefrom to the air-supply pipe 4, communicating between the compressor 2 and main air-reservoir 3, and this pipe 24 has located therein a controlling-valve 25, whereby the flow of air from the pipes 18 and 19 to the main reservoir 3 through the said supply-pipe 24 may be cut off.

The oil-supply tank 8 has an oil-inlet or filling-opening 26, through which oil is supplied to, and the oil is fed therefrom to the burner 20 by gravity through an oil-conducting pipe 27, in communication with a com-

panion pipe 28, connected directly with the burner 20. The two pipes 27 and 28 are located, respectively, upon the tender and locomotive and are connected by an intermediate hose or flexible pipe connection 29, which yields to allow for the vertical play of the said tender and locomotive when the latter is in operation. In order to provide for the heating of the oil within the tank 8 to vaporize or to place it in condition to be effectively vaporized by the current of air, so as to effect rapid combustion, I conduct the exhaust-steam from the superheating-drum 13 to said tank or reservoir 8 through a pipe 30, provided with a controlling-valve 31, whereby the passage of steam from the drum to the tank may be cut off whenever desired. By thus using steam to heat the oil and bringing it in direct contact with the oil in the manner shown much better results are obtained than if the steam were caused to circulate through a pipe or coil arranged within the tank, and the oil is placed in better condition for combustion, as the steam effects the rapid heating thereof even when the oil is cold after the tank or reservoir has been refilled. The heavier particles of oil are also kept in a fluid state and prevented from congealing and choking up the pipes. In the event, however, that the pipes 27 and 28 should become partly or completely choked by the deposit of asphaltum or other heavy residuum therein I provide means whereby the same may be readily cleared, such means consisting of a blast-pipe 32, connecting between the pipes 18 and 27 and having a controlling-valve 33, which may be opened when necessary to allow air under pressure from the pipe 18 to pass into the pipe 27 and force the obstructing substances through the same and through the pipes 28 and 29 to the burner.

The passage of air from the tank or reservoir 10 to the superheater 13 may be cut off by closing the valve 17 and the air made to pass through a shunt-pipe 34, connecting the pipe 15 directly with the pipe 18, forming a short circuit, by which the air may be supplied from said reservoir to the burner or to both the burner and the main air-reservoir 3 of the locomotive and also to the latter alone. This pipe 34 is provided with a cut-off valve 35, controlling the passage of the air therethrough. The water of condensation from the steam condensing in the superheater 13 may be drawn off whenever necessary through a valved drain-pipe 36, and the steam therefrom may be cut off from the oil-tank 8 by closing the valve 31 and allowed to pass through short-circuit pipes 37 and 38, arranged, respectively, on the tender and locomotive and connected by a flexible hose or coupling 39.

The pipe 38 is connected with the steam-exhaust pipe 6 of the air-compressor 2 and the pipe 37 provided with a cut-off valve 40, whereby the flow of steam from the superheater to the exhaust-pipe 6 may be cut off whenever desired. By closing the valve 31 and opening the valve 40 steam from the superheater is allowed to pass through the pipes 37, 38, and 39 to the exhaust-pipe 6 and in connection with the exhaust-steam from the compressor 2 used as a blast in the smoke-stack of the locomotive for creating a forced draft.

The supply of oil through the pipe 28 to the burner 20 may be regulated with certainty, so as to feed the burner fast or slow, by means of a regulating-valve 41, arranged in said pipe, to the stem of which valve is connected an operating-rod 42, which projects upwardly in the cab of the locomotive in convenient position to be manipulated by the fireman, whereby the oil-supply to the burner may be readily controlled. The air-pipe 19 also contains a regulating-valve 43 and a cut-out valve 43^a, said regulating-valve serving as a means for controlling the supply of air to the burner 20 to commingle with and oxygenate the vaporized oil, and to the stem of this valve is connected an operating-rod 44, which also projects upwardly in the cab of the locomotive, so as to be conveniently operated by the fireman. Provision is thus made for regulating the feed of both the oil and the air or steam to the burners in any definite proportionate quantities desired.

Steam is supplied to the steam-cylinder of the auxiliary air-compressor 9 through the medium of a steam-supply pipe 45, to which is in practice connected a flexible tube or hose suitably connected with the boiler of the locomotive to conduct steam to said pipe 45.

The air tank or reservoir 10 is provided with a valved connection 46 for attachment thereto of a hose or pipe provided with means for spraying the air, whereby the coaches of the train may be quickly and conveniently cleaned by means of an air-blast at the ends of runs or divisions. When the air from the tank 10 is supplied for this purpose, the locomotive remains coupled up to the cars in order that steam may be supplied to the air-compressor 45 to maintain the latter in operation as long as desired.

In the operation of the apparatus the valve 41 is opened to allow the oil from the tank 8 to feed by gravity to the burner 20 and the valves 12, 17, 43^a, and 43 are opened to allow the air from the compressor 9 to pass to the air-tank 10, thence to the superheater, and finally through the pipes 18, 19, 20, and 21 to the burner to atomize and oxygenate the oil to insure perfect combustion. The other valves during this the normal operation of the parts are closed, so as to prevent the passage of any air out of the normal circuit. The exhaust-steam from the compressor 9 passes through the pipe 12 into the superheating-drum 13 to heat the coil 14 therein, while the air from the tank 10 passes through the pipe 15 and into and through said coil 14 and is thereby heated, and the hot air thence discharges from the coil and feeds through the pipe 18 and connecting-pipes to the

burner, the hot air serving to effect the more perfect vaporization of the oil and admixture of the oxygen of the atmosphere therewith, the flames from the burner or burners 20 thereby heating the boiler of the locomotive and generating steam for operating the locomotive and its connections from the auxiliary air-compressor 9.

When through any cause the air-compressor 2 on the locomotive becomes injured or disabled, the air from the compressor 9 and tank 10 may be supplied to the main air-reservoir 3 to operate the brakes of the train by closing the valve 17 and opening the valves 35 and 25, whereby the air from the tank is caused to take a short circuit through the pipes 34, 18, 21, 19, and 24, and thence through the pipe 4 to the main air-reservoir 3. During this operation of the parts the regulating-valve 43 is also allowed to remain open in order to permit of the passage of a sufficient amount of air to the burner 20 to effectively support combustion. The superheater 13 is thrown out of circuit when air is supplied from the tank 10 to the reservoir 3 for operating the brakes, as the use of heated air in this connection is not deemed necessary or desirable.

Should the auxiliary air-compressor 9 become injured or disabled, the flow of air to the burner is cut off by closing the valves 17 and 35, and the valve 23 is then opened to allow steam from the locomotive to pass through the pipes 22 and 19 to the burner 20 to take the place of air in vaporizing the oil. When steam is used in this manner, it will of course be understood that the valve 43^a is closed to prevent the steam from passing back into the superheater.

When steam dies down in the locomotive, as when the locomotive is allowed to remain over night in the roundhouse, or when the steam-pressure within the locomotive is not sufficient to operate the auxiliary compressor 9, the burner may be operated by the compressed air remaining in the tank 10 to start the generation of steam in the locomotive-boiler, which may be raised to a point sufficient to set the compressor 9 into operation within a very short interval of time. When the locomotive is run into the roundhouse or the steam is allowed to die down therein, the valves 12, 17, and 35 are closed to confine the air within the tank 10, so that when it is desired to take the locomotive out sufficient air under compression will remain in said tank to operate the burner or burners to start the generation of steam.

In case crude oil is not used as a fuel and ordinary bituminous coal is used, the auxiliary compressor and its attachments may be employed to furnish hot air for the hollow grates on the locomotive to distribute air through the fire-box in order to secure more perfect combustion, also to provide a safety appliance whereby compressed air may be supplied for operating the brakes in the event that the main air-compressor 2 should get out of order. When the air from the tank 10 is allowed to pass through into the reservoir 3 for this purpose, it will of course be understood that in addition to closing the valve 17 and opening the valves 35 and 25 the valve 5 must also be closed in case the air-valves of the compressor 2 are not in perfect working order.

From the foregoing description, taken in connection with the accompanying drawings, the construction, mode of operation, and advantages of the invention will be readily understood without a further extended description.

Changes in the form, proportion, and details of construction may be made within the scope of the invention without departing from the spirit or sacrificing any of the advantages thereof.

It will of course be understood that the parts of the apparatus may be mounted solely upon the locomotive instead of having the air or oil supplying connections located on the tender, as in the present instance.

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

1. The combination with a main air reservoir and compressor and a burner; of fuel-supplying means including a liquid-fuel reservoir, auxiliary air-supplying means for supplying air to said burner, means for heating the air supplied from said auxiliary means, steam-supplying means, means for controlling the flow of air and steam to the burner, means for cutting off communication between the main air-reservoir and the main air-compressor and establishing communication between said reservoir and the auxiliary air-supplying means, and means for cutting out the said heating means, substantially as described.

2. The combination with a main air reservoir and compressor; of an auxiliary compressor, an auxiliary air-reservoir in communication with the auxiliary compressor, a drum receiving the exhaust-steam from said auxiliary compressor, a burner, an air-supply pipe heated by the drum and extending between the auxiliary air-reservoir and burner, a short-circuiting connection between the auxiliary reservoir and air-supply pipe, a connection between the air-pipe and main reservoir, and valves controlling the flow of air through said pipe and connections, substantially as specified.

3. The combination with a main air reservoir and compressor; of an auxiliary air-compressor, an auxiliary air-reservoir in communication with the auxiliary compressor, a drum receiving the exhaust-steam from said auxiliary compressor, a burner, an air-supply pipe heated by the drum and extending between the auxiliary air-reservoir and burner, means for conducting the exhaust-steam from the drum to the oil-reservoir of the oil-supply

means, a short-circuiting connection between the auxiliary reservoir and air-supply pipe, a connection between the air-pipe and main reservoir, and valves controlling the flow of air through said pipe and connections, substantially as and for the purpose set forth.

4. The combination of an air-compressor, a burner, oil-supplying means including an oil-reservoir for the burner, a heating-drum, a steam-exhaust pipe leading from the compressor to said drum, an air-conducting pipe for conveying air from the compressor to the burner and passing through said drum, a short-circuiting connection between the compressor and the air-conducting pipe whereby the air may be caused to pass from said compressor to the pipe without passing through the drum, and valves for controlling the flow of air through the pipes, substantially in the manner set forth.

5. In a hydrocarbon-fuel feed for burners, the combination of a burner and oil-supply tank, a pipe leading therefrom to the burner, an air-compressor, an air-tank connected thereto, a heating-drum receiving the exhaust-steam from the compressor, an air-supply pipe leading to the burner and connected with the air-tank and heated by the drum, a short-circuit pipe between the air-tank and the air-conducting pipe, an air-blast connection between said air-conducting pipe and the oil-conducting pipe, and valves for controlling the flow of air and oil through the several pipes, substantially as described.

6. In a hydrocarbon-fuel supply, the combination of an air-compressor, a storage-tank connected therewith, a burner, a pipe for conducting the air from the tank to said burner, a heating-drum heated by the exhaust-steam from the compressor and adapted to heat the air passing through said pipe, and a short-circuit connection whereby the air may be conducted to the burner without being heated by said heating device, substantially as specified.

7. In a hydrocarbon-fuel feed, the combination with a main air compressor and reservoir; of a burner, means for supplying steam to the burner, an auxiliary air-compressor, an auxiliary air-reservoir, a hydrocarbon-fuel tank, means for supplying air from the auxiliary air-reservoir to the burner, means for conducting oil from the tank to the burner, means for regulating the supply of oil, air and steam to the burner, and means whereby in case of injury to the main air-compressor, air from the auxiliary compressor may be supplied to the main air-reservoir, substantially as specified.

8. In a hydrocarbon-fuel feed, the combination of a burner, means for supplying steam thereto, an air-compressor, an air-reservoir supplied therefrom, a hydrocarbon-fuel tank, a pipe for conveying air from the air-reservoir to the burner, a pipe for conducting oil from the hydrocarbon-fuel tank to the burner, a heating device for heating the air passing through the air-supply pipe, means for regulating the supply of steam, air and oil to the burner, a short-circuiting connection in the air-supply pipe whereby the air may be caused to pass therethrough without being heated by said heating device, and a connection between the said air-supply pipe and oil-supply pipe, whereby a blast of air may be supplied to the latter-named pipe for freeing the same from obstructions, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM NEWTON BEST.

Witnesses:
R. M. SMITH,
E. L. POTTER.