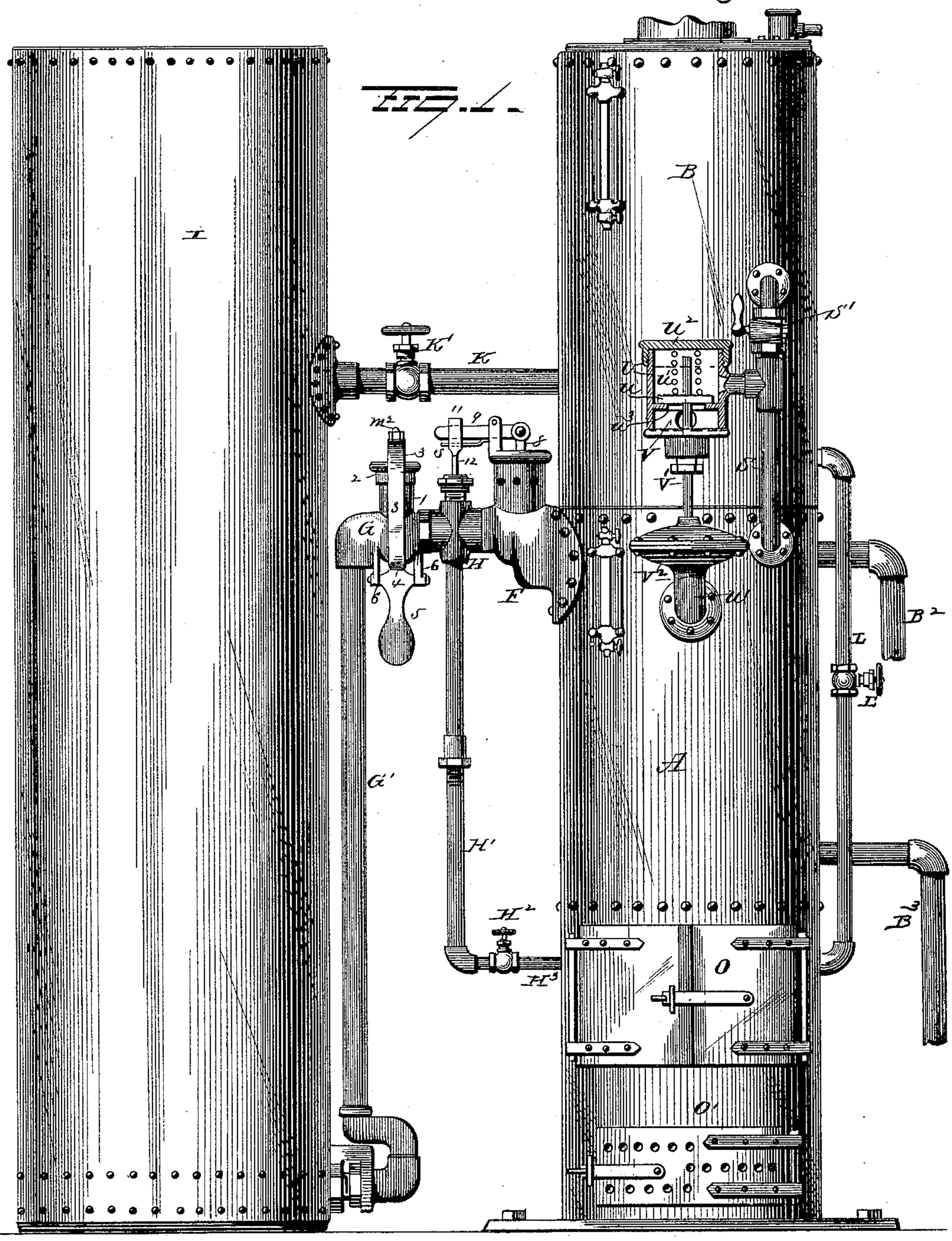
(No Model.) 3 Sheets—Sheet 1.

W. P. PATTON.

CAR HEATING APPARATUS.

No. 368,489. Patented Aug. 16, 1887.



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(No Model.) 3 Sheets—Sheet 2.

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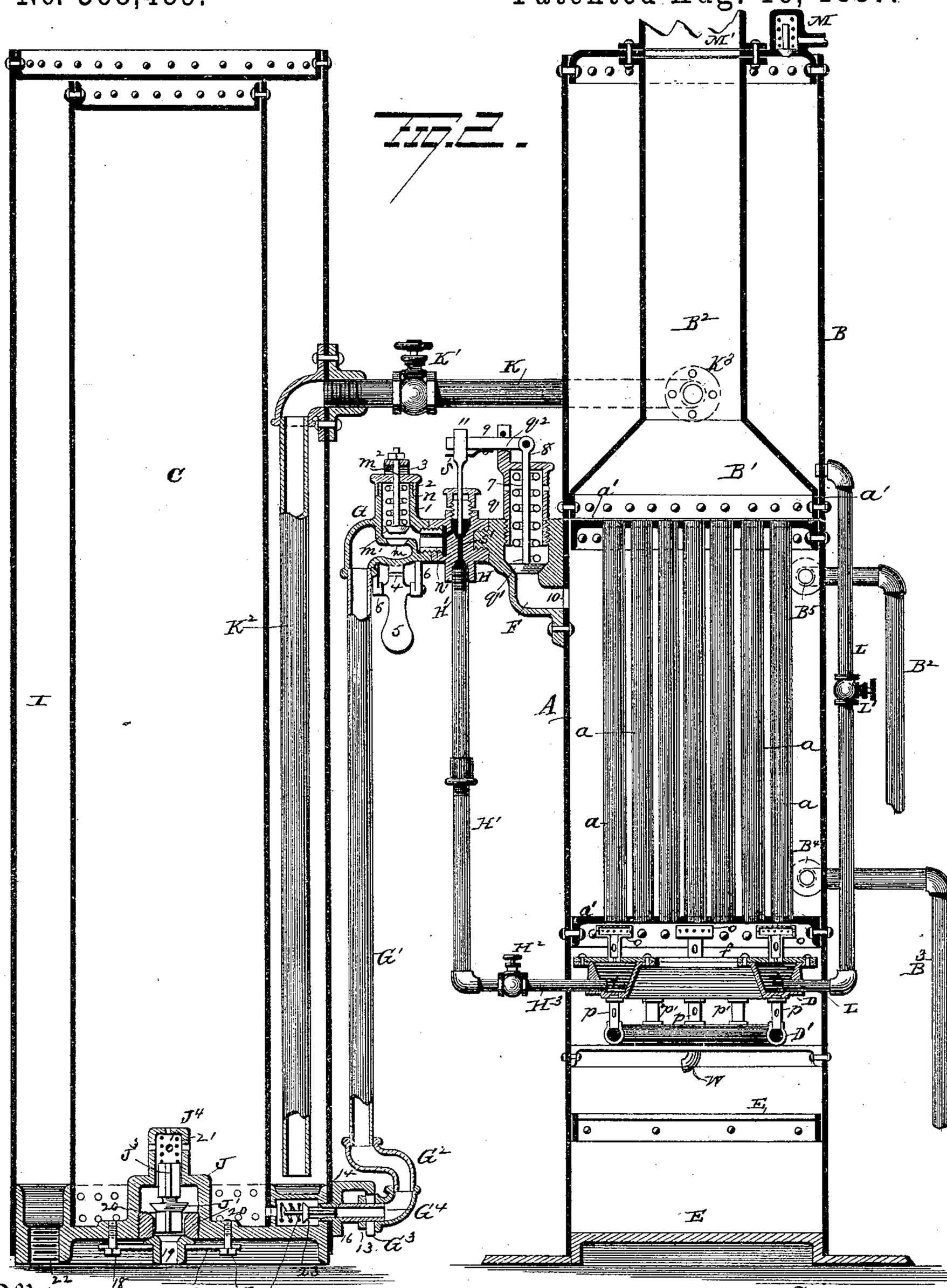

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(No Model.) 3 Sheets—Sheet 3.

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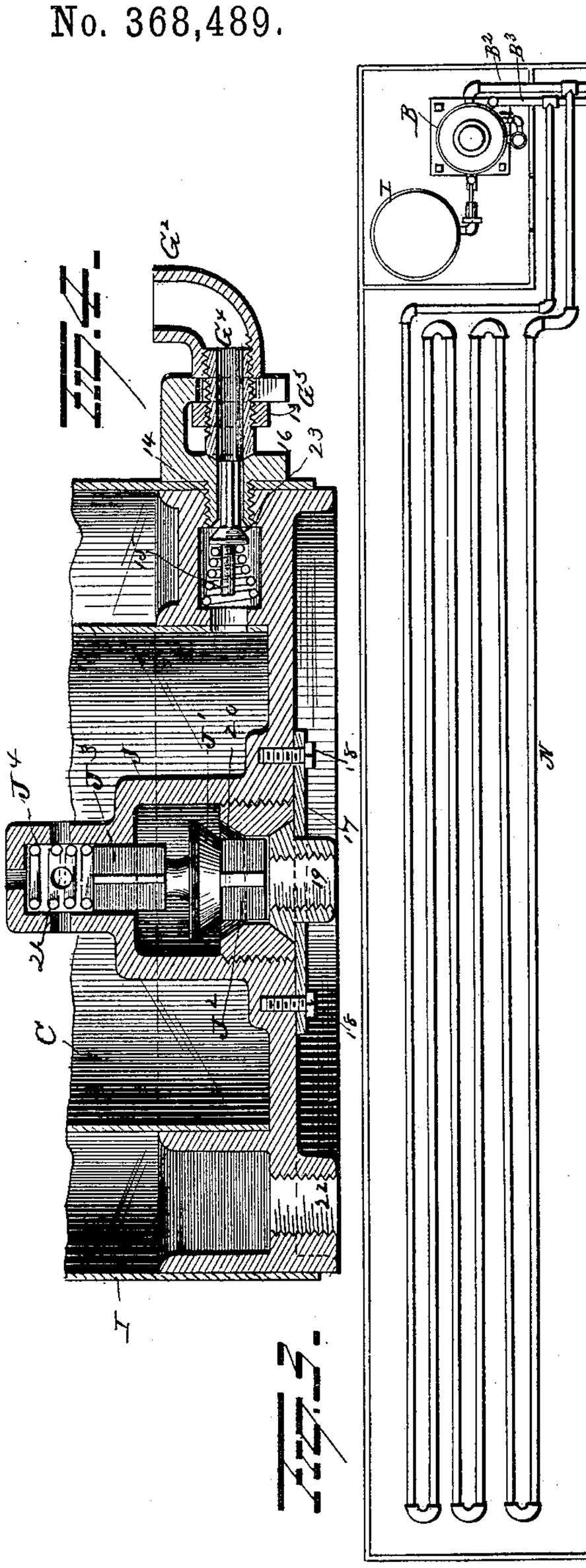

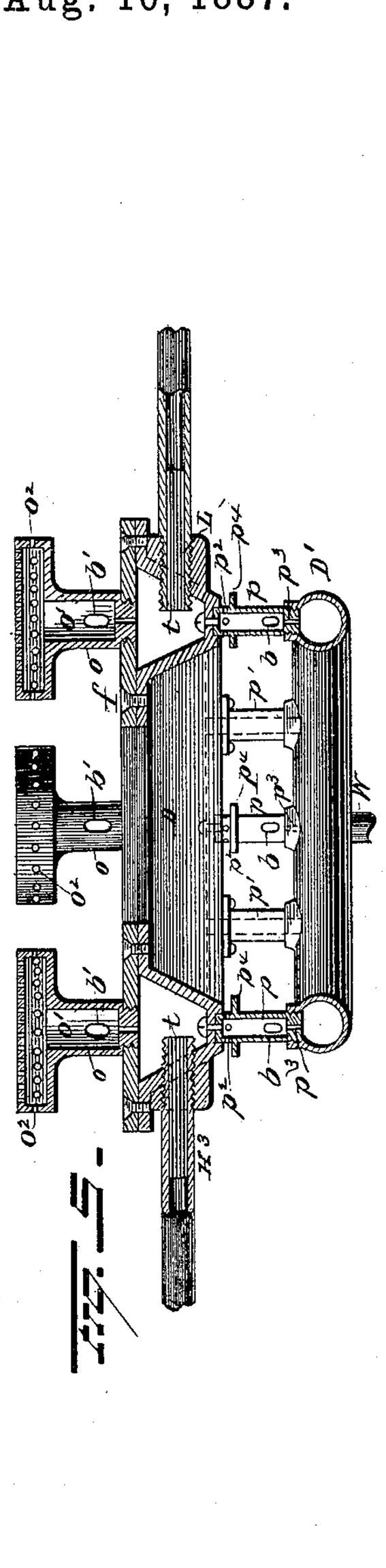

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UNITED STATES PATENT OFFICE.

WILLIAM P. PATTON, OF HARRISBURG, PENNSYLVANIA, ASSIGNOR OF THREE-FOURTHS TO WILLIAM T. HILDRUP, SR., WILLIAM T. HILDRUP, JR., AND J. HERVEY PATTON, ALL OF SAME PLACE, AND SEYMOUR W. TULLOCK, OF WASHINGTON, DISTRICT OF COLUMBIA.

CAR-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 368,489, dated August 16, 1887.

Application filed April 8, 1887. Serial No. 234,156. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. PATTON, of Harrisburg, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Car-Heating Apparatus; and I do hereby 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.

My invention relates to an improvement in apparatus for heating cars, and more particularly for the warming of passenger-cars with safety, the device being also applicable to general heating of houses or apartments.

The primary object of this invention is to afford a safe car-heater and one that will be reliable, practical, and of simple construction, taking up but small space in a car, and be under perfect control while in use.

A further object is to furnish an apparatus for heating a car with low-pressure steam or hot water, and provide a means whereby the regulation of heat generation is assured, and the extinguishment of the flame in the boiler in case of accident that either crushes a car endwise or oversets it on either side will be effected.

A further object is to provide a compact apparatus for car-heating purposes that will be economical in consumption of materials for heat development, be perfectly free from dirt, ashes, or sulphurous fumes, and further possess capability for self-regulation as regards water and carbonaceous liquid feeding to a large degree, to prevent an injurious overheat in the generator if neglected by the party in charge of the apparatus.

With these objects in view, my invention consists in certain features of construction and combinations of parts, that will be hereinafter described, and pointed out in the claims.

Referring to the drawings making a part of this specification, Figure 1 is a front elevation of the water-heating device and attached water-tank. Fig. 2 is a front elevation in section of the water-heater and the connected supply-tanks, the connecting-pipe of the water-supply tank being partially shown in perspective. Fig. 3 is a plan view of a car-floor, showing the position of the heating apparatus and the manner of connecting it to a water or steam circulating coil. Fig. 4 is an enlarged sectional view of the base of the supply-tanks, showing the details of construction of the safety filling and feeding valves of the oil chamber or tank. Fig. 5 is an enlarged view in section of the gas-generating retort and attached burners.

A represents an upright cylindrical boiler-shell; *a a a*, &c., a series of upright tubes or flues fixed in the flue-sheets *a' a'*, the shell A resting upon the base-plate E'. Upon the upper end of the boiler-shell A (see Fig. 2) the water-chamber B is placed and properly secured. This water-chamber has an interior vertical flue, B^2, that is concentric to the shell of the water-chamber B, the flue B^2 having a conical bottom, B', extended laterally to be connected "edge to edge" with the shell B. The flue B^2 is made to project slightly above the car-roof, if the device is to be used as a car-heater. The lower portion of the boiler A forms a fire or combustion chamber, in which the grate E is placed. Access to this chamber is afforded by the doors O, and below the grate by the door O', which is perforated to afford a supply of air to support combustion. (See Fig. 1.)

Below the lower flue-sheets *a'* a retort, D, is placed (see Fig. 2) and suitably retained in position. This retort is annular in form and preferably V-shaped, with a close bonnet, *f*, (see Fig. 5,) to make a proper gas-generating chamber, for which purpose the retort is intended.

An annular tubular ring, D', is connected to the retort D by the pipes *p'*, so that the gas produced in the interior of the retort will descend into the pipe-ring and circulate in it, a suitable number of the pipes *p'* being provided to hold the ring in place and afford a full supply of gas thereto. Alternating in position with the pipes *p'* the burner-pillars or hollow columns *p* are secured in place between the retort D and pipe-ring D'. (See Fig. 5 for details of the retort and burner.)

The pillars *p* have each a plug in their bases

where they are attached to the gas supplying ring D′, which is perforated to allow a small jet of gas under pressure from the retort to escape into the body of the pillars *p*. Immediately above these perforated plugs the shells of the burner-pillars are perforated at opposite points in their sides with air-inlets *b*, which afford a proper supply of atmospheric air to mix with the jets of gas issuing from the jet-holes p^3. The portions of the pillars *p* just below their point of attachment to the retort-base are perforated in their side walls at spaced intervals to permit the volume of gas and air that is commingled in the pillar-chambers to escape just above the deflector-flanges p^4, that are made to project from the bodies of the pillars at these points.

From the bonnet *f* of the retort D a series of gaseous-fuel burners, *o*, are made integral or are secured, they having pillars *o′* exactly similar in form to the pillars *p* below the retort, and have enlarged chambers o^2, (see Fig. 5,) secured to the tops of the pillars *o′*, to receive the injected gas and air that this gas draws into the pillars through the holes *b′*, made for such air-supply. The chambers o^2 are perforated to permit the escape of this gaseous fuel at numerous points on their sides and tips, which, when ignited, will burn with a blue smokeless flame, as will be further explained.

The material from which gas is produced in the retort D is a mixture of any carbonaceous liquid, preferably coal-oil and hot water, these two liquids being introduced separately into the retort at proper points. The water is supplied through the pipe L and enters the retort at *t*, (see Fig. 2,) the drip of the water into the retort being regulated by the valve L′, it being preferably of the style known as a "needle-valve," which affords a means of close graduation of the water-supply that is conducted from the base of the water-chamber B downwardly by the connecting-pipe L, as shown.

The main water-supply tank I is located in the same apartment with the water-heating apparatus, and in case the heater is used for warming a passenger-car a small room is partitioned off from the interior of the car for reception of the heating apparatus, preferably at one end of the same, as shown in Fig. 3.

The vertical water-tank I is made of sheet metal, and is of such a height and diameter as to afford a water-space around the oil-tank C, which is located inside the water-tank and stably secured at the base to the same bottom.

The annular water-space between the tank C and the wall of the water-tank I is such that a sufficient supply of water may be introduced through the orifice 22, made in the bottom of the tank I and threaded to receive a water-supply pipe, which may extend to a convenient point at the side of the car to receive a supply of water under pressure. A hand force-pump may be employed to fill the tank; or, in case there is a water-supply with adequate pressure to introduce water into the tank, a direct attachment may be made to a service-main to effect the purpose.

Water is conducted to the water-chamber B by the supply-pipe K, that has an extension, K^2, which is made to reach nearly to the base of the water-tank I and afford a continuous water-conduit from the interior of this tank, the water being raised by air-pressure. As the contained air is compressed into a small space when water is introduced through the hole 22 to nearly fill the tank, this air by compression acts upon the surface of the water in the tank and forces it to flow into the water-receiving chamber B, when the valve K′ is opened, by reason of the connection of the pipe K at K^3 to this water-chamber.

The oil or other carbonaceous liquid is introduced into the interior tank, C, through a pipe that is attached by screw-threads to the nipple 19, which is clamped in place upon the bottom of the oil-tank near its center; and it should be mentioned that the oil is introduced into the tank C without a discharge of contained atmospheric air from the same, so that an elastic air-cushion is produced that will increase in pressure as the oil is forced into the tank. This provision is similar to that made in regard to the water-tank B, acting in the same manner to afford a proper feed of oil to the retort D. Ordinary pipes and stop-cocks should be fitted to the oil and water inlets 19 22 to allow these fluids to be introduced into the tanks. These pipes are not shown, as their construction and operation are common and self-evident.

The nipple 19 is provided with a ball-joint surface at its upper end, that is made to fit a true concave surface on the bottom of a nipple, 20, which is introduced into the bottom of the oil-tank C. A vertical valve-chamber, J, is formed integral with the bottom of the tank, and a valve, J′, provided with winged extensions J^2 J^3, is given a position in this chamber such that the wings J^2 will loosely fit in the cylindrical passage formed through the nipple 20, the valve J′ being held off its seat made on the top surface of this nipple 20 by reason of the abutment of the lower terminations of the wings J^2 upon the edge of the conical head of the nipple 19, so that while the connection of this nipple 19 remains intact with the lower joint formed on nipple 20, the clamped attachment of nipple 19 being undisturbed, the valve J′ will remain open, and oil may be introduced through a pipe that is attached to the nipple 19, as before stated.

The upper portion of the valve-chamber J is made to receive a spiral spring, J^4, which has a bearing on the winged projection J^3 of the valve J′, to cause this valve to instantly close on its seat and thus prevent any escape of oil in case the connections of the oil-supply pipe are ruptured or torn off at the point of clamped connection. The valve J′ is preferably held open to avoid the additional labor of raising its spring J^4 when a hand-pump is used to fill the tank C with oil; but it is evi-

dent that by shortening the wings J^2 the valve J′ may be made to remain seated, and in such a position act as a check when the operation of filling the tank is in progress.

The feeding of oil to the retort D from the tank C is effected through the valve 23, which is constructed and arranged substantially the same as the valve by which oil is introduced into the tank, and an attachment is made by an open bracket, G^3, which is secured to the outer surface of the water-tank I, at 14. The pipe G^2 is connected to the oil-tank C by a threaded nipple, G^4, which joins the passage that leads direct into this tank. The valve 23 is engaged by the spiral spring 15, (see Fig. 4,) to close it when the means for holding it open are removed. This latter operation is effected by a winged extension of valve 23 engaging the cone end of the nipple G^4, to compress the spring 15, when this nipple is held in engaged position by the nut 13, that is placed on the threaded surface of the nipple G^4 and has forcible contact with the bracket G^3, which contact holds the pipe G^2 in proper position to receive oil from the tank C and raise it to the valve G, through which it passes into the needle-valve H, thence downwardly through the valve H^2, that is also a regulating or needle valve, located in the branch pipe H^3, which is made to have threaded engagement with the wall of the retort D and enter the same at a point about opposite to the point of insertion of the water-pipe L. (See Figs. 2 and 5.)

The portions of the feed-pipes for oil and water that enter the retort D are filled for a short distance with fine brass or copper wire, *t*, that is cut to a proper length and inserted into the bore of the pipes to fill them. These wires, by reason of their being small cylinders, allow slight spaces to intervene between them, through which the oil and water are forced by the air-pressure in the tanks I and C when the valves H^2 and L′ are adjusted to permit it. This insertion of wire assists to graduate the quantity of liquid that enters the retort, and in regard to the oil prevents an improper back-pressure in the feed-pipe H′ or undue heating of the oil or other carbon liquid employed in the generation of the gas.

The safety cut-off valve G is intended to close automatically when a car is derailed and thrown on its side, and by cutting off the oil-supply at once stop the generation of gas, as the oil is an indispensable ingredient in the matter of gas generation. It follows, therefore, that when the supply of oil is cut off the gaseous fuel by which combustion is maintained ceases to flow into the burners, and all fire is instantly extinguished.

The body or chamber of the cut-off valve G is globular where the valve-seat *m* is located. The valve *m*′ is attached by its shank m^2 to the yoke 3, (see Figs. 1 and 2,) which yoke 3 encompasses the body of the cut-off-valve chamber G as a continuous loop, the lower portion upon its outer surface being adapted to receive the upper projecting toe, 4, of the swinging weight 5, which is supported to rock on points fixed in the depending arms 6. The engagement of the toe 4, holding the yoke 3 and attached valve *m*′, is such a position that this valve will be raised off of its seat *m* and permit the free passage of oil through the opening thus afforded.

The spiral spring *n*, retained in place in the case 1, has bearing contact on the top surface of the valve *m*′, and is somewhat compressed between the cap 2 and this valve when the yoke 3 is raised.

The form of the toe 4 and the engaged surface of the yoke 3 is such relatively that the inclination of a car in which the heater is placed to cause it to assume an angle of forty-five degrees or more with the track, or to be upset and caused to fall on either of its sides, will swing the weight 5 sufficiently to free the engagement of its toe 4 with the yoke that holds the valve *m*′ open, and in consequence of this the valve will automatically be closed by the pressure of the spring *n*, and the passage of oil be cut off, as has previously been explained.

In order to supply water to the tubular boiler A, when this is necessary, a branch pipe, S, is made to connect the chamber B and boiler A, and a stop cock, S′, is introduced in this boiler branch pipe, to regulate the quantity of water fed or prevent its passage entirely under ordinary circumstances. In case of a neglect of the attendant to supply water when needed, and from its low stage in the boiler the heat applied raises steam above a pressure that is desirable, I have provided an automatic water-feeding device to pass water into the boiler by the action of the steam on a yielding diaphragm. The construction of this device is as follows: The diaphragm-valve V^2 is simply two cupped shells joined in the center and an elastic diaphragm inserted or clamped between these shells to divide the interior into two compartments. The lower shell is provided with a branch pipe, *w*, which is secured by its flange to the shell of the boiler A, a perforation being made in the shell at this point to afford a passage for water or steam from the interior of the boiler beneath the diaphragm. Upon the upper surface of the diaphragm the lower end of the valve-rod V′ is seated, the rod being extended upwardly to enter the cylindrical chamber U, in which a transverse partition or valve-seat, w^3, is formed integral with this chamber.

The valve *u*, preferably faced with a proper elastic material—such as vulcanized rubber—is made to seat upon the valve-seat w^3 and cover the opening made through it, this opening being made to afford a passage for water from the chamber B through the orifice V into the chamber U, and thence to the boiler through the pipe S, when the diaphragm of chamber V^2 is raised by pressure below it, the

chamber U having a branch by which it is attached to the shell of the water-chamber B, the orifice V being a perforation through this branch pipe.

In order to afford a means of regulating the supply of oil to the retort D and cut down the free generation of gas when there is too great a pressure in the boiler, chiefly due to a want of proper water-supply, the automatic feed-controller composed of the two valves H F is employed.

The valve F is simply a spring or "pop" safety-valve, which has its coiled or spiral spring *q* made of proper strength to be compressed and permit an upward movement of the valve *q'* when pressure of steam that enters the branch 10 is sufficient to overcome the tensional strength of the spring *q*. The valve *q'* has its stem 8 made of such a length as to project above the top of the case 7, in which the spring *q* is retained, this stem being pivotally connected to the horizontal lever 9, that has a fulcrum-bearing upon an upright post which is fixed to the top of the case 7. The lever 9 is extended farther to have a sliding engagement with the boxed end 11 of the vertical valve-rod 12, it being of a proper length to seat itself, and so cut off the flow of oil through the passage *s'* into the pipe H', when the pressure in the boiler is strong enough to raise the valve *q'* and vibrate the lever 9. A spring, *s*, is introduced between the lower side of the box 11 of the valve-rod 12 and the lever 9, to neutralize any chattering action of the valve *q'* when it is suddenly raised by the steam-pressure exerted on it.

To provide a means for permitting the expansion and consequent pressure of water that is introduced cold into the chamber B and heated, a spring check or safety valve, M, is attached at the top of this chamber B, the spiral spring that holds the valve on its seat being of proper tensional strength to resist the ordinary pressure of the air-cushion in the water-tank I when communication is established between the chamber B and this tank, but that will yield and allow the valve to open and permit a discharge of water when an undue pressure of expanded water occurs in the water-chamber.

The water-pipes B^2 B^3 are extended from the boiler A, which they are connected with, to join the circulating-coils N N', (see Fig. 3,) that are located in proper receptacles below the floor of the car, the latter being perforated at suitable points to allow heat-registers to cover these holes near the feet of seat-occupants.

The coils N N' are so arranged with regard to their connections to each other and the boiler A that a free circulation of hot water will proceed from the boiler, and the cooled water that has parted with its heat by radiation be returned to the boiler continuously while heat is maintained in the combustion-chamber of the boiler, and a constant uniform heat under perfect control will be maintained in the car-that is perfectly free from smoke, dirt, or sulphurous fumes incident to the use of stoves.

The connected operation of the heating apparatus will now be explained.

Oil and water having been forced into the tanks I and C to nearly fill them, and thus produce a pressure from the compression of air previously contained in them, water is introduced into the chamber B and boiler A, as well as the attached heat-radiating coils N N', and a wood or coke fire is placed on the grate E to heat the retort D and start the generation of gas in this retort. When the retort is made quite hot, which will occur quickly, owing to its thin walls, the oil-valve H^2 is opened and oil permitted to drop slowly into the retort. The oil will instantly become vaporized and, issuing from the burners in that form, be lighted. Water is now allowed to drip into the retort. This will be flashed into superheated steam by contact with the hot walls of the retort. The commingling of the carbon vapor and superhot steam will cause a decomposition and recomposition to take place, the oxygen of the steam combining with the carbon atoms, and in this way the generation of oxyhydrocarbon gas is accomplished. The volume of gas evolved will increase by turning on more oil and water, the pressure in the retort thus produced forcing jets to issue into the burner-bodies and burn by admixture with heated air, the flame being smokeless, blue, and intensely hot. The water is soon made hot and caused to circulate in the manner before stated. The springs of the automatic water and oil controlling devices that have been described should be of a proper tension to yield when the pressure in the boiler is as high as is considered advisable to maintain, and these springs should be of the same tensional strength, so that the water-valve will be raised by its diaphragm when the pop safety-valve opens, and in this way the oil-supply will be cut down, gas generation nearly cease, and water be introduced at the same time, which joint action will speedily reduce the pressure in the boiler, when the valves will close and the heater assume a normal condition.

If it is desired, and the capacity of the retort D is made sufficient, a service-pipe for the supply of gas for illumination of the car may be attached to the branch W, made on the pipe-ring D', this pipe being extended to such points in the car as it is desired to accommodate burners for lighting the interior of the car, and it is evident that if the car is so lighted any accident that extinguishes the fire in the boiler in the manner already explained will instantly and automatically put out the lighted burners, so that no fire can result from this source in case of a disaster that upsets and mashes the cars of a train.

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

1. In a heating apparatus for cars, the com-

bination, with a water-supply tank that is connected to supply a car-heater which is located in a car, of an oil-tank located within the water-tank and provided with automatic valves to prevent an escape of oil when the pipe-connections of the oil-tank are broken off from this tank, substantially as set forth.

2. In a heating apparatus for cars, the combination, with an upright boiler located in a car and provided with a gas generating and consuming device that burns the gas as it is produced, of a water-chamber located above the boiler, that is adapted to receive heat from the gas-burners that heat the boiler proper and furnish this heated water to the boiler by means of a communicating pipe, and a pipe and valve to furnish a graduated water-feed at proper intervals between the water-chamber and tubular boiler, substantially as set forth.

3. In a heating apparatus for cars, the combination, with an upright tubular or flue boiler placed in a car, a gas-generating retort with burners located below these flues, and a water-chamber with a central flue that receives the heat of the burners which are made to heat the boiler, of a self-acting water-feeder that is adapted to open its valve for the passage of water from the upper chamber to the boiler below it when the pressure in the boiler exceeds a predetermined limit, substantially as set forth.

4. In a heating apparatus for cars, the combination, with an upright cylindrical tubular or flue boiler, a cylindrical water-chamber heating a single flue, an annular gas-generating retort that is provided with burners to heat it, and a series of burners that receive gas from the retort, of a water-tank and an oil-tank placed in the water-tank, and provided with a valve on the inlet and outlet passages that are adapted to close and seal these passages when the pipes connected to them are broken off, substantially as set forth.

5. In a heating apparatus for cars, the combination, with an upright boiler placed in a car, a water-heating chamber supported above or on the boiler, a retort for gas generation located in the combustion-chamber of the boiler to heat the water in the boiler by gas and air mixed in a series of burners, and a series of burners, of an oil-supply tank and a water-supply tank, the oil-tank placed in the water-tank, a valve to control oil-feed when pressure is too great in the boiler, and a valve that opens to supply water automatically when the pressure exceeds a fixed limit in the boiler to which this valve is connected, substantially as set forth.

6. In a heating apparatus for cars, the combination, with an upright boiler, a heat-radiating coil, a gas-generating retort, burners to heat the retort, and burners to heat the boiler, of a water-tank, an oil-tank in the water-tank, valves that prevent oil-escape if the oil-pipes are broken off, and a valve in the oil-pipe that is adapted to cut off the flow of oil if the car is thrown over upon either side, substantially as set forth.

7. In a car-heating apparatus, the combination, with an upright tubular boiler, a heat-radiating coil attached to the boiler to have water-circulation through it, a water-gas-generating retort, one or more burners placed to heat the retort, and burners attached to the retort to heat the boiler, all the burners being adapted to consume a mixture of water-gas and air, of a self-acting water-feeding device, a self-acting oil-cut-off valve that closes when a car is upset on either side, a water-tank, an oil-tank located inside of the water-tank, pipes to connect the oil and water tanks to the water-chamber and retort, and inlet and outlet valves on the oil-tank adapted to close and prevent escape of oil if the pipe-connections to these valves are broken off, substantially as set forth.

8. In a car-heater, the combination, with an upright oil-tank, a water-tank that envelops the oil-tank, and inlet-passages to the oil and water tanks, of a feed-pipe that connects the water-tank with the water-heating chamber, a valve in this feed-pipe, an oil-pipe that feeds the retort, an automatic valve that is in connection with the oil-inlet passage, and an automatic valve that closes the oil-outlet passage when a car is crushed in endwise, substantially as set forth.

9. In a car-heater, the combination, with an oil-tank and a water-tank that surrounds the oil-tank, both resting on a common base, of an automatic valve that will close the oil-passage into the oil-tank and an automatic valve that will close the oil-passage from the oil-tank, both these valves being adapted to shut when a car is crushed in endwise, so as to break pipe-connections to these inlet and outlet valves, substantially as set forth.

10. In a car-heater, the combination, with a vertical tubular boiler, a heating-coil, a gas-generating retort and burners, a spring safety-valve having a fulcrumed lever, a passage leading from the valve to the boiler, and a spindle-valve that is operated by the fulcrumed lever of the spring safety-valve to control the passage of oil through it, of a spring shut-off valve attached to an oil-feed pipe to cut off oil when a car is thrown on either of its sides, an oil-feed pipe, and a water-jacketed oil-tank, substantially as set forth.

11. In a car-heater, the combination, with an oil-tank that is located in a water-tank, of a spring-actuated valve, an open bracket, a threaded nipple, a nut, and an oil-feed pipe that is connected to the gas-generating retort, so that the bracket will break and release the spring-valve to cut off escape of oil from the oil-tank and stop gas generation in the retort when a car is crushed in endwise, substantially as set forth.

12. In a car-heater, the combination, with a water-jacketed oil-tank and an oil-feed pipe connected to the tank, of a safety shut-off valve adapted to close when a car is thrown

on either side, an automatic spindle-valve that is operated to restrict or entirely prevent the flow of oil into a retort when pressure is excessive in the water-heating boiler, an upright tubular boiler, a circulating-coil, and a gas-generating retort located in the combustion-chamber of the boiler, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM P. PATTON.

Witnesses:
S. G. NOTTINGHAM,
G. F. DOWNING.