2 Sheets—Sheet 1.

W. S. SALISBURY.

Steam-Motor for Propelling Street-Cars.

No. 219,770. **Patented Sept. 16, 1879.**

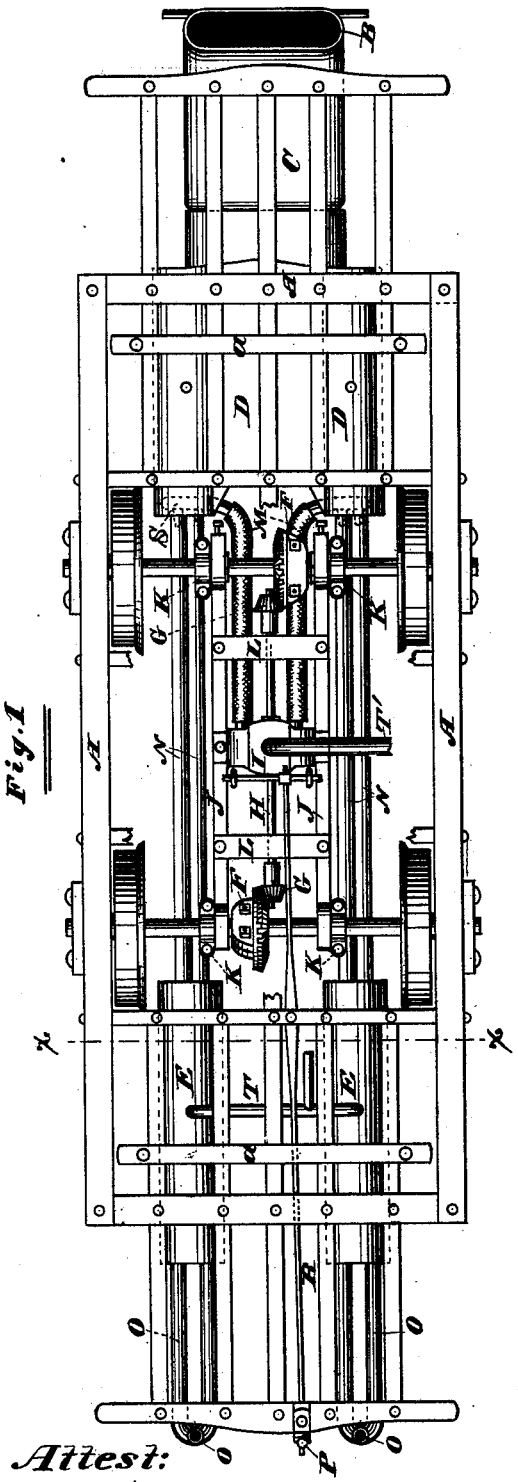

Fig. 1

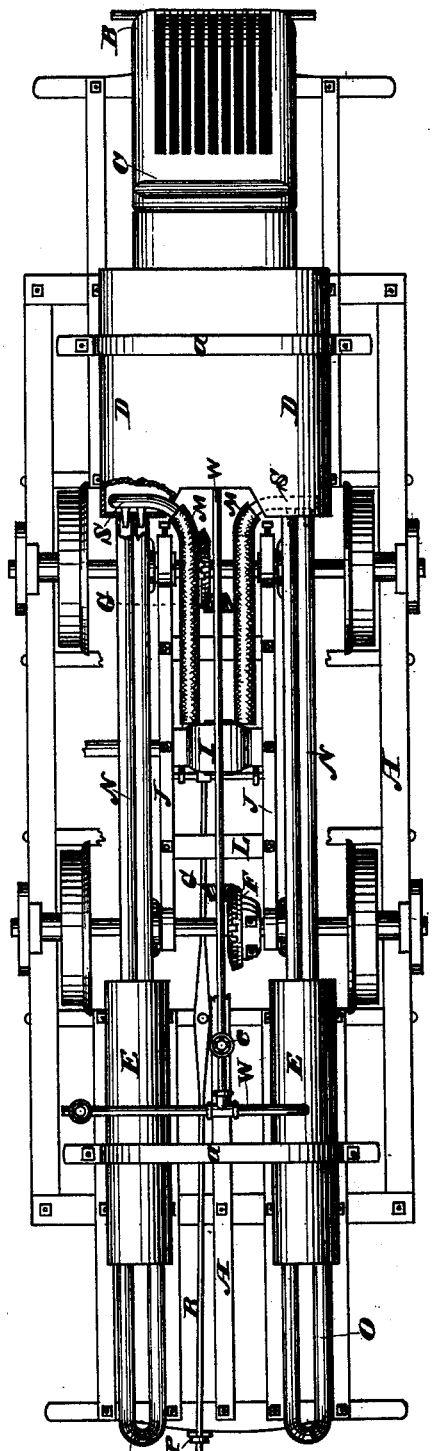

Fig. 2

Attest:
W. L. Baker
C. B. Baker

INVENTOR:
Wilber S. Salisbury

2 Sheets—Sheet 2.

W. S. SALISBURY.

Steam-Motor for Propelling Street-Cars.

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Fig. 4

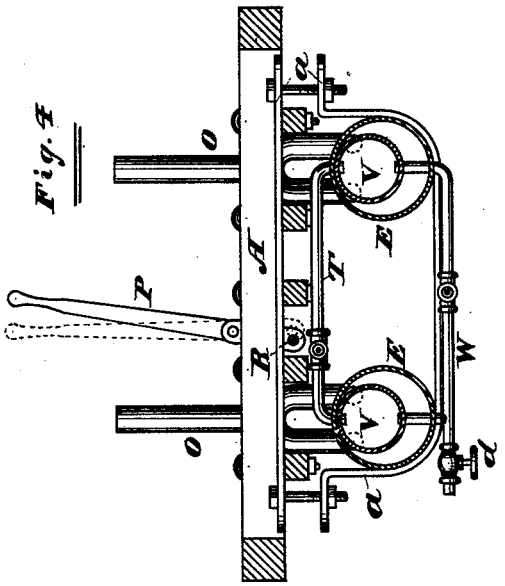


Fig. 5

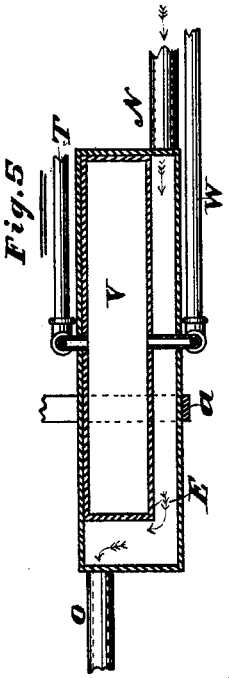


Fig. 3

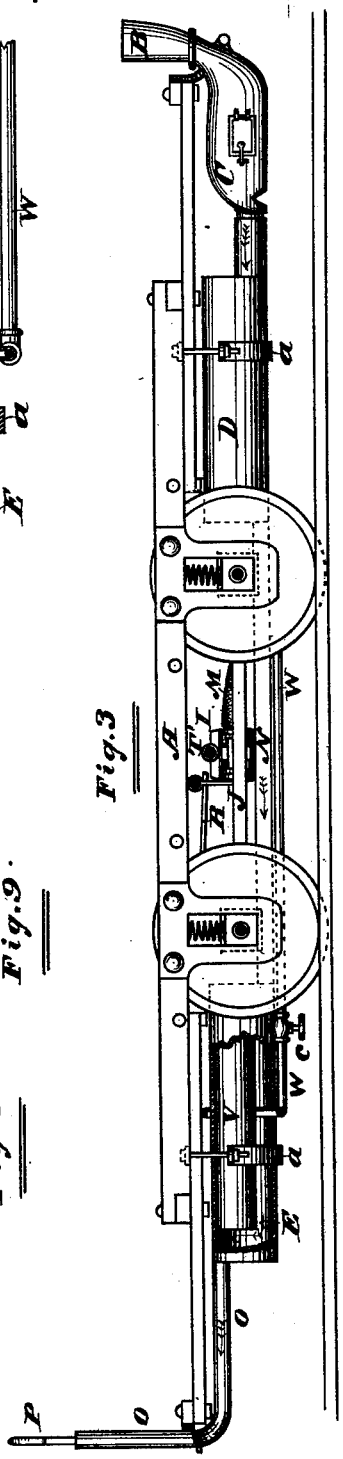


Fig. 6

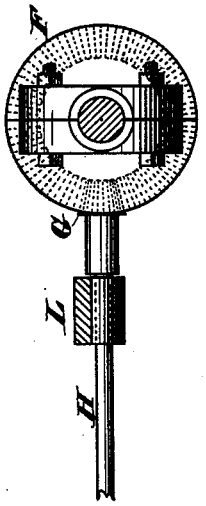


Fig. 7

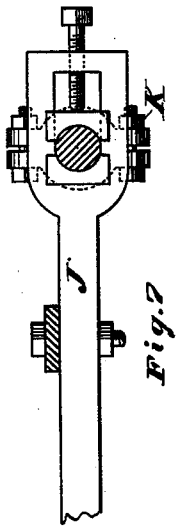


Fig. 9.

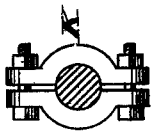
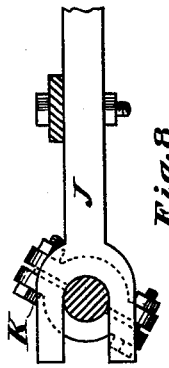


Fig. 8



Attest:

Wm. L. Baker

C. B. Baker

INVENTOR:

Wilber S. Salisbury

UNITED STATES PATENT OFFICE.

WILBER S. SALISBURY, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN STEAM-MOTORS FOR PROPELLING STREET-CARS.

Specification forming part of Letters Patent No. **219,770**, dated September 16, 1879; application filed July 14, 1879.

To all whom it may concern:

Be it known that I, WILBER S. SALISBURY, of Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Steam-Motors for Propelling Street-Cars, of which the following is a specification.

This invention has for its object the arrangement of the propelling mechanism, including the self-feeding furnace and boiler, under the car and out of sight, in such a manner as to be under the control of the engineer as completely as though placed on the platform of the car.

Heretofore much difficulty has been experienced in utilizing the ordinary street-car for self-propulsion, also the present street-rail, in consequence of too heavy and expensive machinery, resulting in greater wearing of the road-bed, which, consequently, required continual repairs; and, furthermore, in occupying carrying-room, thereby lessening the traffic ordinarily secured.

The object is to obviate the difficulty mentioned in producing a light, safe, economical, noiseless, vaporless, smokeless, and handy machine, causeless of annoyance or hinderance to the ordinary traffic of the streets, and practically applicable to the present street-car without utilizing any of the present carrying-room or requiring any change in the construction of the car, and also to apply to cars on elevated railways.

To this end my invention consists in the arrangement of a reversible rotary engine, and bevel-gearing attached to the car-axles, whereby to transmit power for propelling a car in either direction.

It also consists in application of steam-boiler, furnace, and water-tanks to the body of the car; and it finally consists in the particular details or subordinate arrangements of mechanism.

In the accompanying drawings, in which similar letters of reference indicate like parts, Figure 1 is a top-plan view of an ordinary street-car frame and truck with machinery. Fig. 2 is a bottom-plan view of machinery as attached. Fig. 3 is a longitudinal vertical side elevation, in part sectional, showing the machinery in working position under the body of car. Fig. 4 is a cross-section, showing the arrangement of water-tanks and lever for operating the engine. Fig. 5 is a longitudinal vertical section of water-tanks. Fig. 6 is an enlarged side view of bevel-gearing. Fig. 7 shows an enlarged part-sectional view of engine-frame with adjustable boxing. Fig. 8 is a view of the reverse end of same. Fig. 9 is a view of clamp which is placed on each journal on either side of engine-frame.

A A are the trucks and floor-frame to an ordinary street-car. B is the feeder to furnace. C is the body of furnace or fire-box. D D is the boiler, without steam-dome, pipes, &c., (said boiler and furnace used being subject-matter of a pending application.) E E are shells or drums which receive the hot gases and exhaust-steam from the boiler previous to letting them waste. F F are the split bevel-wheels attached to the car-axles. G G are the bevel-pinions, attached on each end of engine-shaft and gearing into the bevel-wheels. H is a shaft to engine, extending equally either side, for the purpose shown. I is a reversible rotary engine, supported upon the bars between the car-axles, as represented. J J are the supporting-bars, provided with forked ends and adjustable boxes for car-axle to work in. K K are split clamps or collars fastened upon axles, to keep the supporting-bars J J in line. L L are the boxes for engine-shaft to play through, and are attached to the supporting-bars. M M are flexible exhaust-pipes, and connect the engine with boiler and exhaust-nozzles, as shown. N N are connecting flues or pipes for transmitting the gases between the boiler D and drums E E. O O are the pipes for the escape of the hot gases to top of car to waste. P is the working-lever for operating engine in stopping or starting the car. R is the connecting-rod from lever to engine. S S are the exhaust-blowers. T is the steam-pipe connecting both water-tanks on top, also to the engine and boiler. V V are the water-supply tanks, placed inside of drums E E, and so arranged that the waste gases and exhaust upon entering said drums will pass underneath the water-tanks, that thereby the units of heat may become more completely absorbed by the feed-water before letting the hot gases escape. W is the feed-water pipe, connecting both water-tanks at the bottom, and leading to the boiler.

a a are supporting-hangers; *d*, throttle-valve for filling up tank; *c*, throttle-valve for shutting off feed-water between tanks and boiler.

The operation of the moter is as follows: To charge the apparatus with water may be done direct from a hydrant or tank by means of a suitable connection with pipe at valve *d*. By this means water enters the tanks V V and boiler D at the same time by the way of pipe W until they are full, which is determined by a suitable overflow-pipe attached. Then valve *c* on pipe W is closed, thereby preventing further admission of any water to the boiler. Next fire up in furnace C. As soon as well started, fill up feeder B with hard coal. The products of combustion are drawn along the bottom of boiler from the furnace, and pass through the pipes N N to the bottom of drums E E; thence out at the top part of the opposite end, and, by the means of pipes O O, finally to top of the car, where they are let go.

As will be seen, when the steam-pipe T is connected from boiler to top of feed-tanks there is equal pressure on them all, and, by virtue of the hot gases passing through said drums, they become to a great extent absorbed by the means of the feed-water tanks before passing out, thus, having my feed-water at boiler-pressure, I have only to open valve *c* to recharge the boiler. Then close the valve *c* and shut off steam from the top of tanks by the throttle-valve, and let the steam then remaining in the tanks escape until the pressure is gone; then recharge the tanks full again. By this process no pump or injector is required to feed the boiler.

In the act of throwing the lever P over I start the engine. In bringing same to an erect position it stops the engine. Then, passing over to the opposite side, it reverses the engine, and, by virtue of said bevel-gearing attached to either axle, I have perfect control in stopping, starting, or backing up, thus doing away with the usual brakes, the engine being all-sufficient for the purpose.

It is quite apparent that, whereas the boiler being full of water, it would deter the working of the engine, which would be the case in any other form of engine; now, with the reversible rotary engine used by me, I have no difficulty, as has been repeatedly shown in actual trial with a full-sized working machine, the engine being always ready to start at any point, and without opening the usual petcocks to let out the water.

By the invention set forth herein I have accomplished the following results, such mode constituting new and valuable improvements in the art of steam-railroad engineering: First, in the use of a furnace or fire-box separated from the boiler sufficient to prevent the too intense heat coming in direct contact with the boiler while combustion is in progress, and not allowing any water to come in contact with the furnace, more perfect combustion is secured, with economy in fuel, and perfect safety should the water be low in the boiler. In various trials made I have charged the boiler full of water, and run until there was not two pails of water that could be blown out, while the coal in the furnace was at a white heat, and by reversing the engine while under full headway have come to a full stop suddenly, and then started with a full open throttle at one hundred and twenty pounds steam-pressure. No increase pressure was shown, as the result would have been if any part of the boiler becomes overheated, as the motion of the car in stopping suddenly would cause the water to surge rapidly over the surface. Second, in the manner of dividing my exhaust-pipes, and the use of the four blowers in the four connecting-pipes between the boiler and drums, as shown, I secure important results by drawing the products of combustion along the bottom of boiler from the furnace, and at their point of exit they heat the pipes, into which the blowers are attached, and aid in drying the exhaust-steam, and in the exhaust commingling with the said gases in further passage through pipes aforesaid it quite destroys the offensiveness arising from the carbonic-acid gas. When finally let go no exhaust-steam or gases are visible, thereby completely getting rid of the exhaust. Also, in the arrangements of the water-tanks and outside drums for passing the exhaust and hot gases through, I heat the feed-water, and by a non-conducting covering it aids to deaden the sound of the exhaust-blowers quite effectually. Also, by the aforesaid arrangements I can use a lower boiler than by any other plan. As the boilers are made from wrought-iron pipe, and tested by hydrostatic pressure at from six hundred pounds to one thousand three hundred and fifty pounds per square inch, I combine absolute safety with lightness. Also, by the use of the reversible rotary engine and bevel-gearing, as set forth, I provide for the motion requisite for play to axles and boxes while passing around curves.

I claim—

1. The combination, substantially as described, in a railroad street-car, of a reversible rotary engine, boiler, self-feeding furnace, and operating mechanism, all constructed and arranged under the car, substantially as shown and described.

2. In combination with a street-car carrying a boiler and engine, a fire-box, and a furnace separated from the boilers to prevent the too intense heat coming in direct contact with the boiler while combustion is in progress.

3. In combination with a street-car propelled by steam-power, the arrangement of the water-tanks V and outside drums E, for the purposes stated.

4. The combination, in a street-railroad car, of a furnace or fire-box separated from the boiler and not surrounded by water, two ex-

haust-pipes, S S, with two blowers in each, located at the bottom of the boiler, in the exit-passage, for drawing the gases from the furnace, the longitudinal connecting-pipes N N, and heating-drums E E, arranged substantially as described, and for the purposes set forth.

5. In a street-railroad car, the feed-water tanks V V, inclosed by the drums E E, and connected by steam-pipe T at the top and water-supply pipe W at the bottom, in combination with the boiler D and pipes N N, for heating the feed-water and deadening the sound of the exhaust, substantially as set forth.

WILBER S. SALISBURY.

Witnesses:
C. E. KREMER,
WILLIAM ARMSTRONG.