

H. F. KNAPP.  
Improvement in Steam-Cars.

No. 129,833.

Patented July 23, 1872.

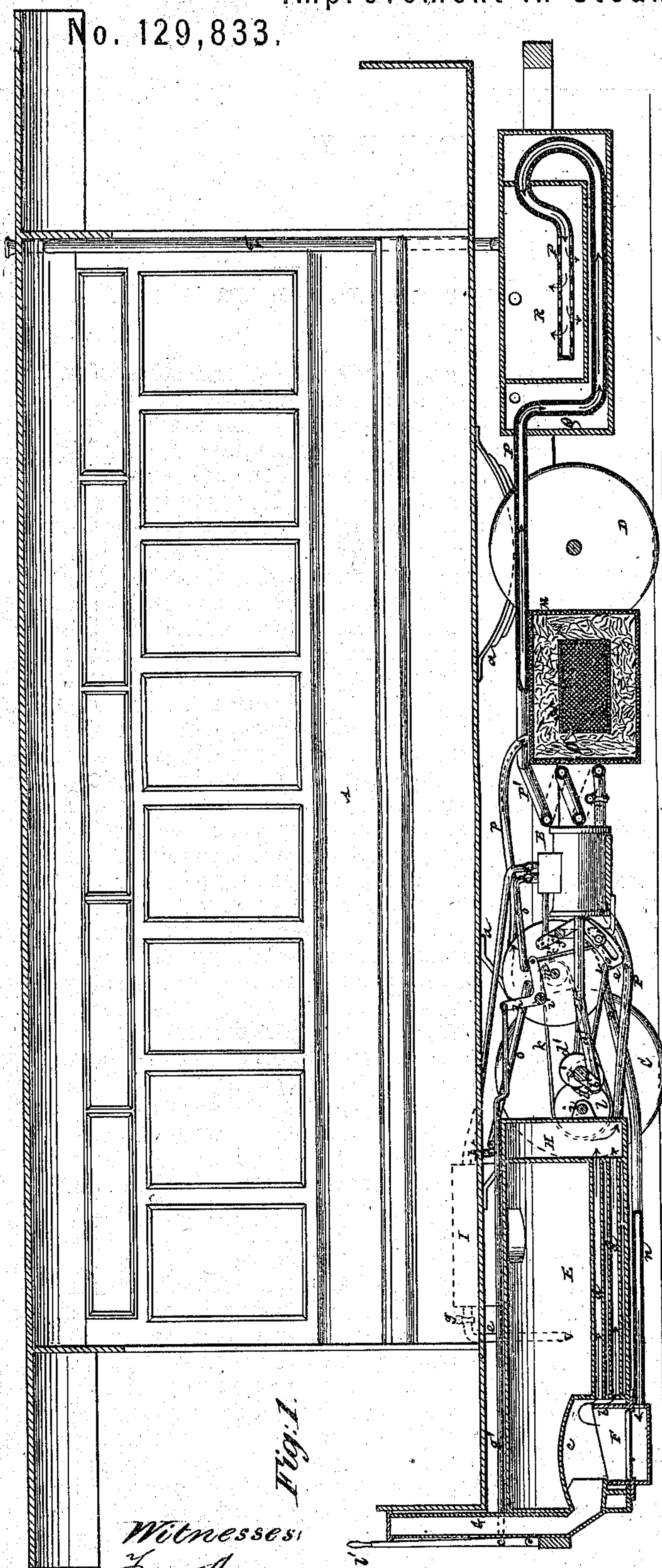


Fig. 1.

Witnesses:  
Fred Harnes  
R. R. Rabun

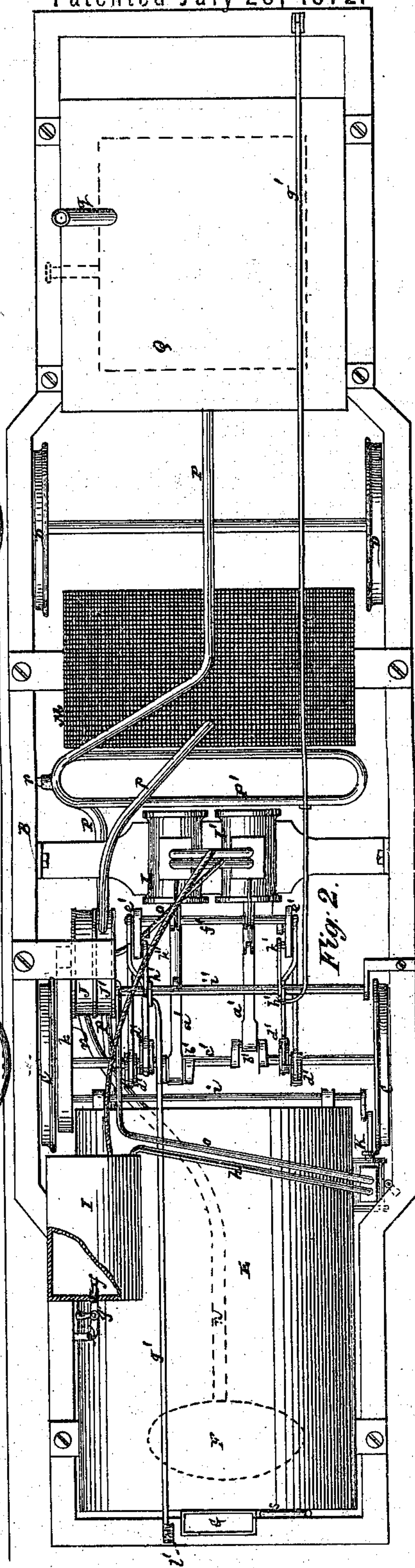


Fig. 2.

Henry F. Knapp



# UNITED STATES PATENT OFFICE.

HENRY F. KNAPP, OF NEW YORK, N. Y.

## IMPROVEMENT IN STEAM-CARS.

Specification forming part of Letters Patent No. 129,833, dated July 23, 1872.

Specification describing certain new and useful Improvements in Steam-Cars for Street-Railroads and other purposes, the invention of HENRY F. KNAPP, of the city, county, and State of New York.

This invention is more particularly designed for steam-cars on street-railroads; and consists in various novel details and combinations of parts pertaining to the propulsion of the car by steam-power, whereby the boiler and machinery are all arranged on the truck below the body of the car, a perfect combustion of the fuel is attained, the smoke is consumed or absorbed, the spent steam diffused or prevented from escaping in clouds or puffs to the atmosphere, and great safety with efficiency generally is obtained.

In the accompanying drawing, which forms part of this specification, Figure 1 represents a longitudinal sectional elevation of a street-railroad car with the invention applied thereto. Fig. 2 is a plan of the truck portion of the car with its propelling mechanism.

Similar letters of reference indicate corresponding parts in both figures of the drawing.

A is the body of the car, which may be of ordinary construction, and which rests, by springs *a a*, on the truck B. This truck is provided with four or more running-wheels, C C D D, two only, C C, of which may be drivers; or the several wheels may be coupled, as desired. Said truck carries the boiler and entire mechanism by which the car is propelled. It is mainly composed of an iron frame of suitable shape and strength for carrying said devices and the superincumbent load. E is the boiler, arranged at one end of the truck, and which is of an elliptical shape in its transverse section. F is the fire-box, with ash-pit combined. This fire-box, which may be of an oval shape, and be fitted so as to be removable when required, is arranged near the outer end of the boiler, the same projecting up within the latter from below, and so that the water in the boiler mainly surrounds it. Said fire-box increases in height or depth toward its back *b*, and is in open communication at its front with a fuel hopper or reservoir, G, for keeping up an automatic supply of fuel, which will be sufficient to continue the running of the car a given time or distance. The heat and products of combustion are first caused to

impinge upon a crown-sheet and sides of a fire-chamber, *c*, within the boiler, and then to pass off over the back *b* of the fire-box, and down to and along smoke-flues *d*, passing through the water-space of the boiler and connecting with a smoke-box, H, at the inner end of the boiler. The dip of the draught over the back of the fire-box gives additional combustion room to the furnace, and protects the flues from filling up with coal, room being necessarily restricted by the limited altitude of the boiler. I is a steam dome or chest mounted on one side of the boiler, and provided with a safety escape-pipe, *e*, fitted with a fusible plug, *f*, at its inner end, with a cock, *g*, between the plug and outer end of the pipe, so that in case of the steam reaching a dangerous pressure its excessive temperature will melt the plug and allow of the steam to escape, the cock *g* being open. The object of this cock is to shut off the escape after a sufficient quantity of steam has been discharged, to do away with the danger consequent on over-pressure, and so that a certain amount of steam may be retained to continue the running of the car. Fusible-plug attachments, as ordinarily applied to boilers, have no such provision. The draught is an artificial one, it being maintained by one, J, of two fans or other blowers, J' J'. These fans are arranged side by side, and are driven by a small engine, K, that derives its steam supply from the boiler by a pipe, *h*, or which may be started, when there is no steam in the boiler E, by connection with a stationary boiler. Power is communicated to the fans J J' from the driving-shaft *i* of the engine K by belt and pulleys *k l m*. The blast is conveyed from the fan J to the ash-pit of the fire-box F by a pipe, *n*. The spent steam from the engine K, as well as the spent steam from a pair of propelling-engines, L L', is passed by pipes *o o* to the fan J', where it is mixed with four or five times (more or less) of atmospheric air, and, thus mixed, forced by said fan through a pipe, *p*, which may be coiled or bent, to a perforated receiver, M N, composed of an inner and outer perforated case, with sponge or other suitable porous body O interposed between said cases. Any steam passing from this receiver will escape as an invisible vapor, or nearly so, instead of in a cloud or puffs, as spent steam usually escapes, the previous mixture of air with said



steam aiding to effect this result, and the distribution of the mixture by the receiver M N O completing it. The products of combustion are passed off from the smoke-box H by a pipe, P, which is coiled or of serpentine construction, as at P', to effect a partial condensation or cooling of said products. This pipe P passes to and within a feed-water tank, Q, from which the boiler E is supplied with water, said pipe giving out most or all of the remaining heat derived from the products of combustion to the water in the tank, thereby partially heating the feed-water and further condensing or cooling said products, which ultimately are conveyed by the pipe P, through a perforated continuation of it, to a vessel or chamber, R, within the tank Q. This inner receptacle is partially filled with milk of lime or other absorbent of the carbonic acid and carbonic oxide in the products of combustion, any of which latter remaining pass off by a small smoke-pipe, q, up the side of the car. By thus forcing the smoke through a liquid a back pressure is obtained on the draught from the furnace, which back pressure extends into the furnace and insures perfect contact of the gases, thereby inducing better combustion. The tank Q and inner receptacle R are provided with suitable inlets and outlets for filling and emptying them when required. The pipe P may also be provided with a branch, r, for starting or stimulating the draught by connection with any outside or stationary draught device or flue, and the engine K either be supplied with steam from a stationary boiler at starting, or be driven by temporary connection with a stationary engine till sufficient steam is obtained in the boiler E to keep said engine going. The feed-water is supplied to the tank Q by any suitable means, and drawn from the same to supply the boiler E by a pump or pumps worked by the engine or engines of the car. A glass water-gage, s, is fitted in the end of the boiler E for the purpose of ascertaining the level at which the water stands. This gage is set inclining, in order that the conductor or engineer may readily see from the platform of the car the level of the water in the gage. The propelling-engines L L' are connected by pitmen a' a' with cranks b' b' on or in the axle c' of the driving-wheels C C. This axle carries double or reversing eccentrics d d' for each engine, each pair of eccentrics being connected with an ordinary locomotive link-motion, e', for operating the valve-shaft f' of the engine,

and each link-motion being under the control of the engineer or conductor from either platform of the car by pulling on one or the other of two rods, g' g', according to the direction in which the car is required to be run. The connection of these rods g' with the link-motions e' is effected by bell-cranks h' fast to a rock-shaft, i', and connected with the links e' by rods k, so that to start the car it is only necessary to apply a removable or interchangeable lever, l', to either rod g' to draw it out on the end of the car which is designed to be foremost. To stop the car, said lever and rod to which it is fitted are adjusted half-way back. This arrangement of the stopping and starting rods scarcely admits of the possibility of mistake as regards controlling the movement of the car.

What is here claimed, and desired to be secured by Letters Patent, is—

1. The combination of the fan J' with the escape pipe or pipes o of the engine or engines, substantially as and for the purpose specified.
2. The exhaust-steam receiver or distributor, composed of perforated chambers or vessels M N and an interposed porous material, O, substantially as specified.
3. The combination of the air and exhaust-steam fan J' with the exhaust-steam receiver or distributor M, N, and O, essentially as described.
4. The combination of the perforated escape-pipe P for the products of combustion with the receptacle R containing liquid for the absorption of the escaping gases, substantially as specified.
5. The combination of the water-tank Q with the receptacle R and perforated escape-pipe P, when arranged in relation with each other essentially as and for the purposes herein set forth.
6. The combination of the propelling-engines L L', the fans J J', and the boiler E carried by the truck B, and arranged in relation with the car-body A substantially as specified.
7. The starting and reversing rods g' g', in combination with the bell-cranks h' h' and link-motions e' e' of the engines L L', when arranged in relation with the platforms of the car substantially as specified.

HENRY F. KNAPP.

Witnesses:

FRED. HAYNES,  
R. E. RABEAU.