(No Model.) 4 Sheets—Sheet 1.

M. F. LANCRENON.

SYSTEM OF HEATING BY STEAM.

No. 489,748. Patented Jan. 10, 1893.

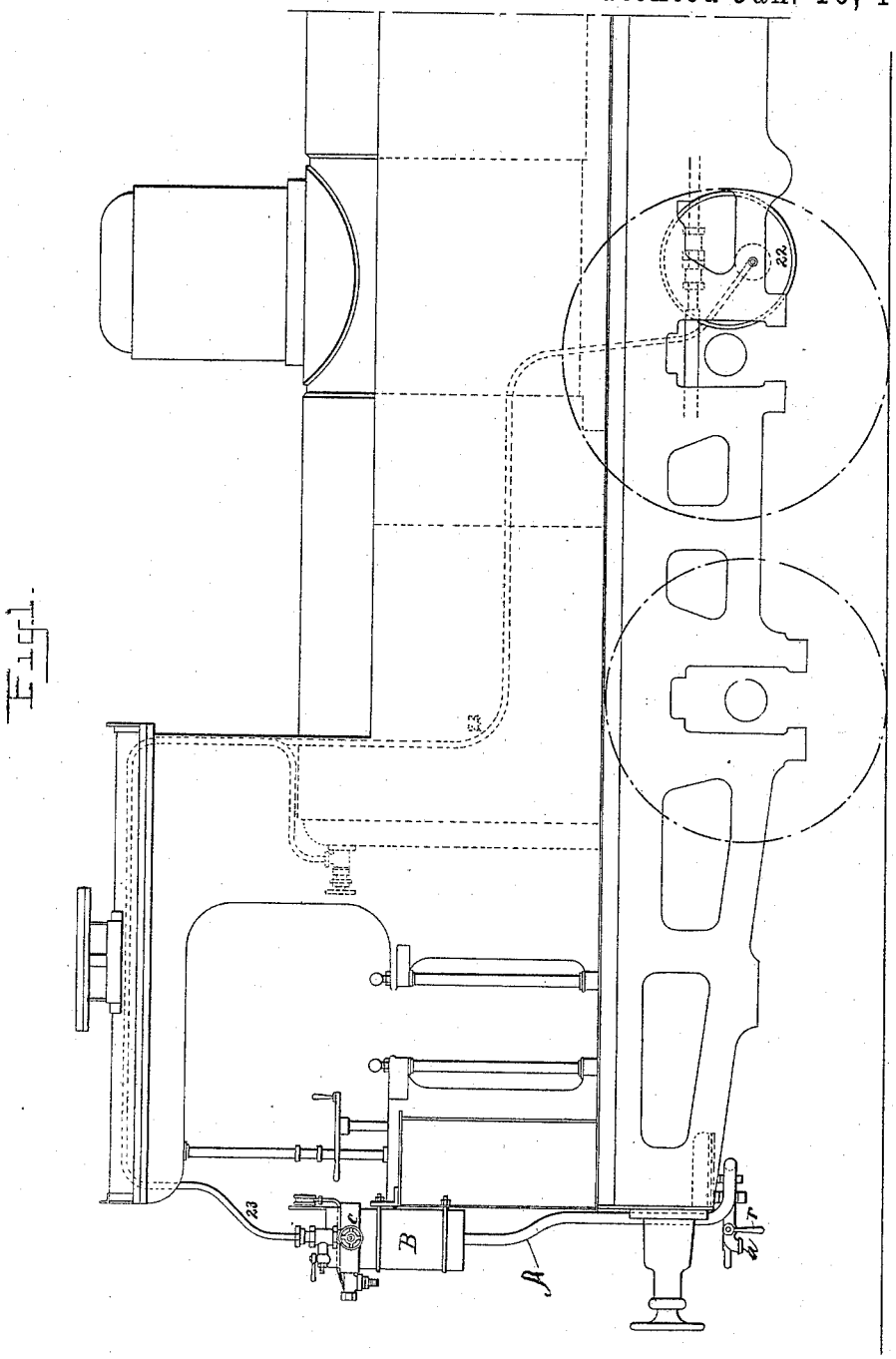


Fig. 1.

WITNESSES:
George Baumann
John Revell

INVENTOR
Marie Ferdinand Lancrenon
BY
Howson and Howson
his ATTORNEYS

(No Model.) 4 Sheets—Sheet 2.

M. F. LANCRENON.

SYSTEM OF HEATING BY STEAM.

No. 489,748. Patented Jan. 10, 1893.

Fig. 2.

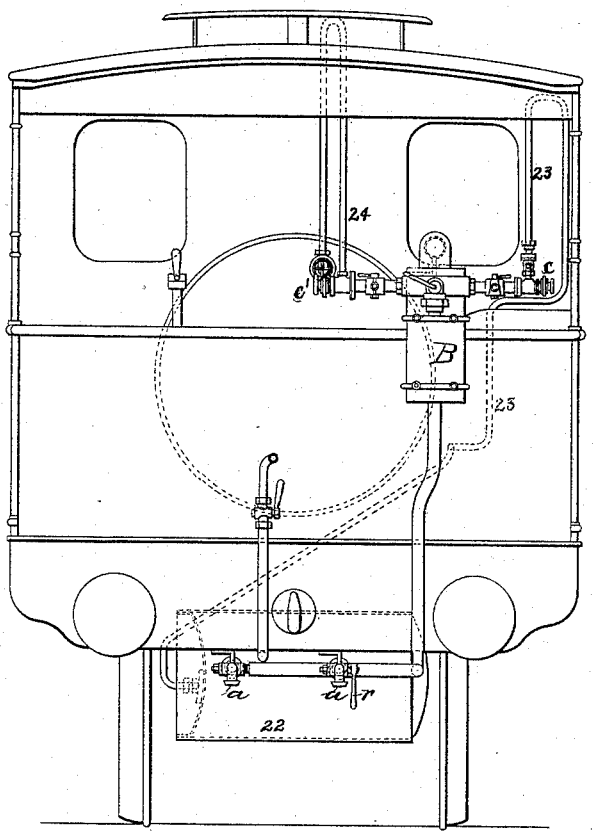


Fig. 4.

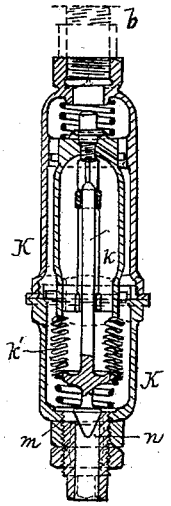
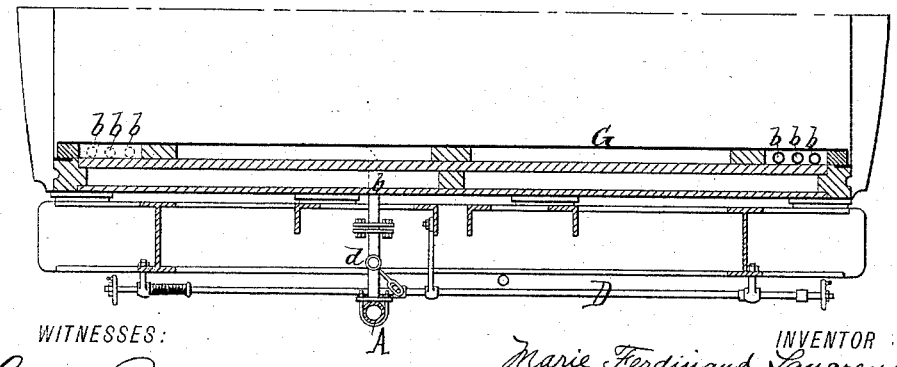


Fig. 5.



WITNESSES:

George Baumann

John Revell

INVENTOR

Marie Ferdinand Lancrenon

BY

Howson and Howson

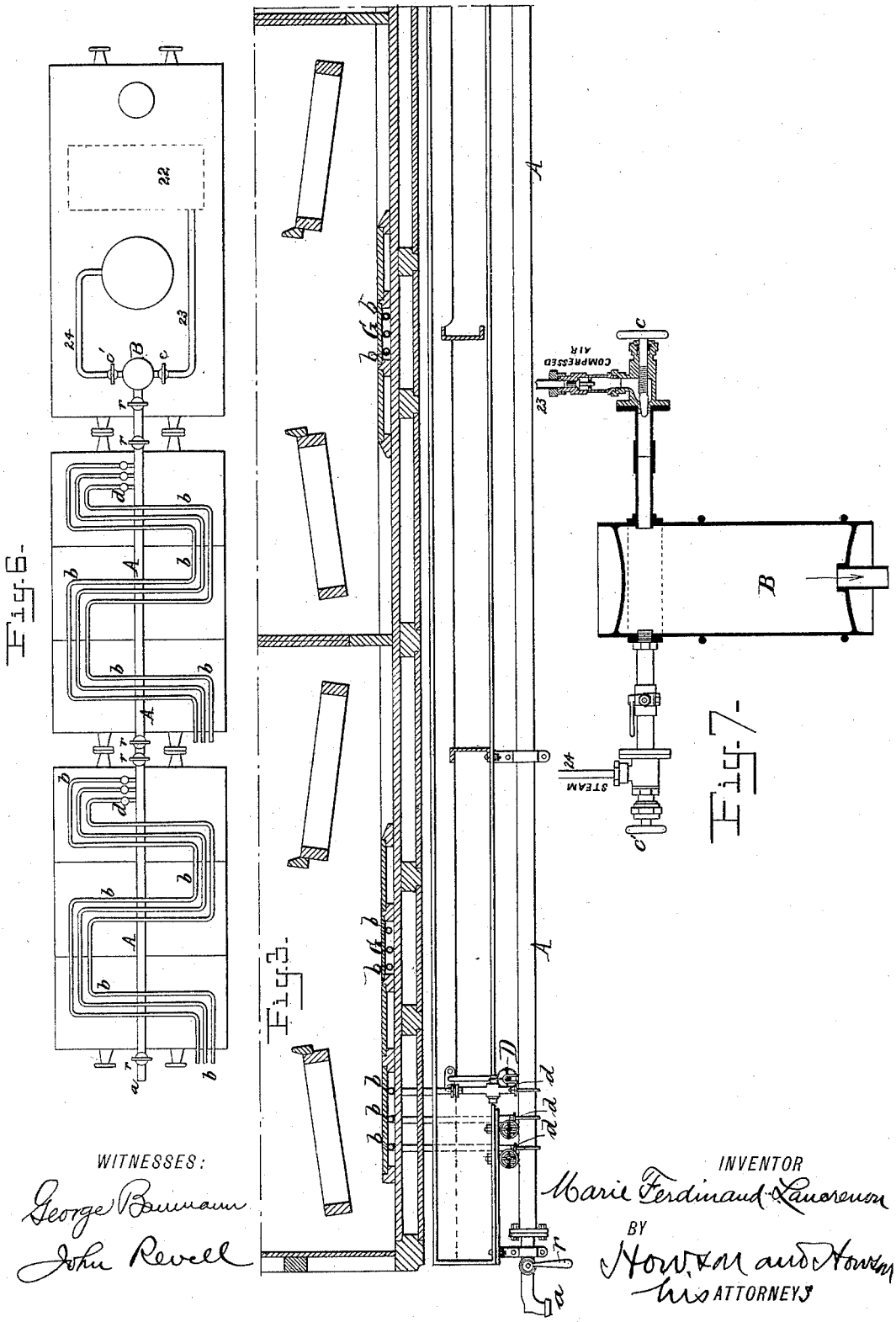
his ATTORNEYS

(No Model.) 4 Sheets—Sheet 3.

M. F. LANCRENON.

SYSTEM OF HEATING BY STEAM.

No. 489,748. Patented Jan. 10, 1893.



WITNESSES:

George Baumann

John Revell

INVENTOR

Marie Ferdinand Lancrenon

BY

Howson and Howson

his ATTORNEYS

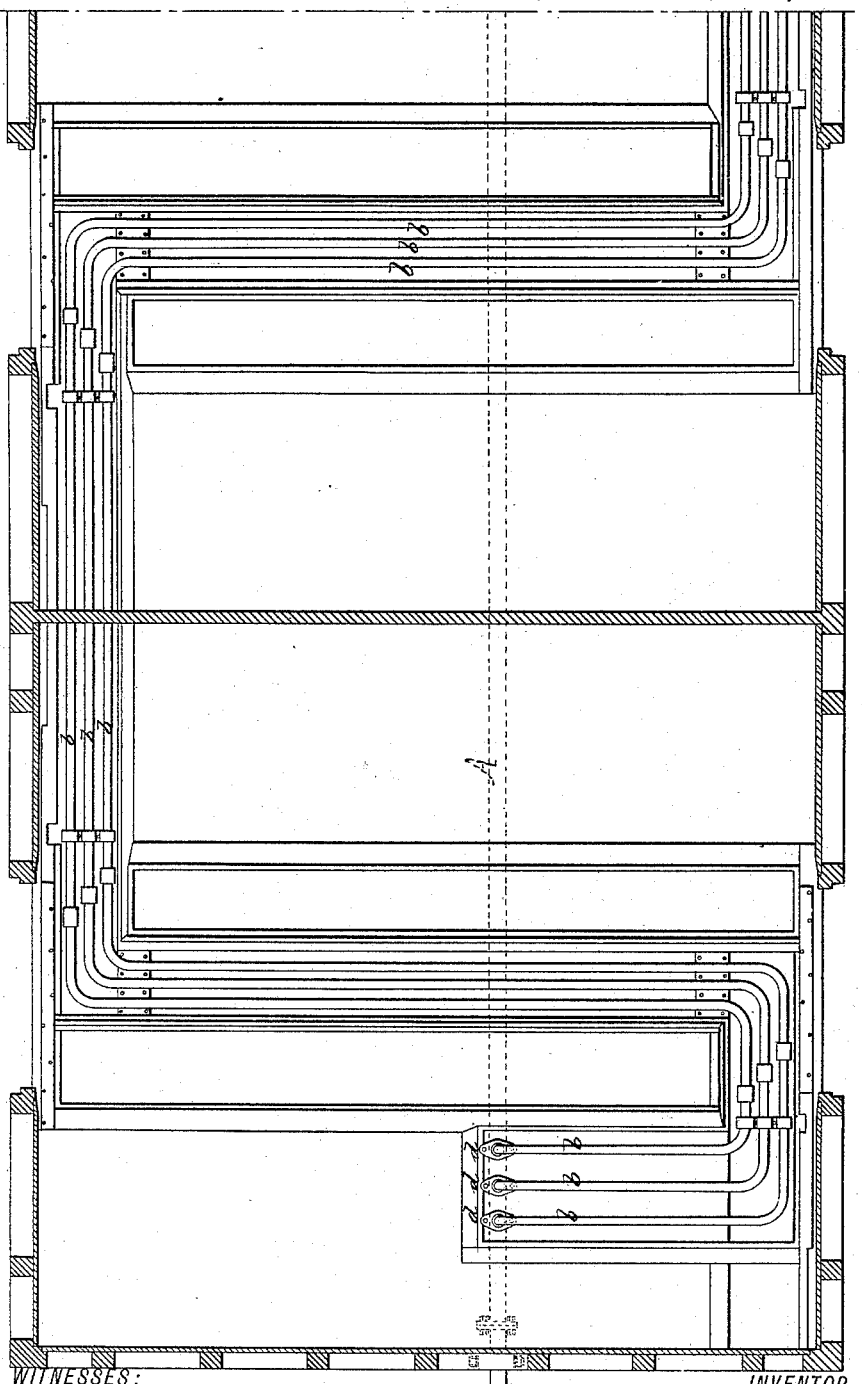
(No Model.) 4 Sheets—Sheet 4.

M. F. LANCRENON.

SYSTEM OF HEATING BY STEAM.

No. 489,748. Patented Jan. 10, 1893.

Fig. 4.



WITNESSES:

George Baumann

John Revell

INVENTOR

Marie Ferdinand Lancrenon

BY

Howson and Howson

his ATTORNEYS

UNITED STATES PATENT OFFICE.

MARIE FERDINAND LANCRENON, OF PARIS, FRANCE.

SYSTEM OF HEATING BY STEAM.

SPECIFICATION forming part of Letters Patent No. 489,748, dated January 10, 1893.

Application filed March 26, 1891. Serial No. 386,440. (No model.) Patented in France September 3, 1890, No. 208,016.

To all whom it may concern:

Be it known that I, MARIE FERDINAND LANCRENON, a citizen of the Republic of France, residing in Paris, France, have invented an Improved System of Heating by Steam, (for which I have obtained a French patent, dated September 3, 1890, No. 208,016,) of which the following is a specification.

The improved system of heating by steam forming the object of the present invention is more particularly designed for heating railway trains, boats and the like but it may be employed for heating hospitals, schools, offices, factories and any other fixed or movable structures or locality where artificial heat is required. This system of heating is distinguished by the combined employment of steam and compressed air, and has for its object the production of a more uniform or regular pressure in the heating pipes, and at the same time facilitating the regulation of the said pressure at the points where the heat is employed. The heat is also enabled to be conveyed to great distances from the generator with pipes of relatively small sectional area and relatively low initial pressure. The steam is supplied by any suitable generator and the compressed air is furnished by an air pump of any suitable construction. A mixture of these two fluids is forced into the heating pipes.

The annexed drawings illustrate an example of an arrangement employed in applying the invention to the heating of a railway train.

In the drawings, Figures 1 and 2 illustrate in longitudinal and end elevation respectively a locomotive with the connections for the supply of the compressed air and steam. Figs. 3, 4 and 5 illustrate in longitudinal section, in horizontal sectional plan and in transverse section respectively, a portion of a railway car heated according to my invention, Fig. 6 is a diagrammatic plan of the system; Fig. 7 is a sectional view of the mixing reservoir. Fig. 8 is a view of a form of controlling valve which may be used in connection with my invention.

In these drawings I have shown my invention as applied to the European style of compartment car for railways.

The principal parts of the apparatus for heating a railway train by means of a mixture of compressed air and steam consist of a main pipe A extending from one end of the train to the other with a suitable union *a* to each car and a number of heating pipes *b* communicating with the main and arranged in a zigzag form passing from one part of the car to another. In the particular style of car illustrated the zigzag piping is shown as passing from one compartment to another (Figs. 3 and 6). The main pipe A is connected to a suitable reservoir or chamber B arranged on the locomotive and in which the engineer produces the mixture of compressed air and steam by the manipulation of the admission cocks or valves *c* and *c'* for the compressed air and steam in accordance with the number of cars to be heated and the diameter of the pipes (Figs. 1 and 7). The farther extremity of this main pipe is closed by a cock such as at *r* and the said pipe is further provided with one of these cocks *r* and a union at each end of each car so as to enable the corresponding length or section of pipe to be closed in order to isolate each carriage during the operation of coupling. The compressed air delivered to the mixing reservoir B through the pipe 23 proceeds from the main reservoir 22 of compressed air provided for working the brakes (Figs. 1, 2, 6 and 7). The usual air pump and compressed air reservoir must of course be of sufficient capacity to supply the brakes as well as the heating apparatus. When not sufficient for this, they must be enlarged or duplicated. The steam supplied to the mixing reservoir through the pipe 24 may come from any convenient source, as for instance the exhaust of the air pump, but I have shown it in the drawings as receiving steam directly from the boiler.

The heating pipes *b* are each provided at the part where they are connected with the main pipe A with a valve *d* which can be worked from either side of the car by means of a horizontal shaft D (Figs. 3 and 5). The other extremity of the heating pipe *b* is open to the atmosphere, outside the compartment to be heated as indicated in the diagram Fig. 6. Over these pipes and in direct contact therewith may be a metal plate G forming a heating or radiating surface. When the car is constructed in compartments, these plates are arranged longitudinally in each

compartment and occupy a portion of the space beneath or between the seats (Fig. 3). When the valves *d* are closed the pipes *b* are cold but when these valves are open, the mixture of compressed air and steam contained in the main pipe A enters these heating pipes where the steam becomes condensed and communicates its heat to the pipes, the air contained in the mixture being allowed to escape freely into the atmosphere. The opening of the valve *d* placed at the head of each pipe *b* is so adjusted as to enable it to be heated to nearly 100° centigrade throughout its length. The temperature of the heating plate can be regulated by bringing a larger or smaller number of the pipes *b* into action. The water of condensation formed in the heating pipes is carried away by the current of steam from B and escapes into the atmosphere at the open ends of the pipes. The water resulting from condensation in the main pipe A is carried by the current of air and steam to a receptacle at the farther end of the train whence it is discharged by opening the last valve *r*, when desired or necessary.

The escape of the steam at the extremities of the pipes *b* communicating with the atmosphere is controlled by means of an automatic blow-off valve working by expansion, as illustrated in Fig. 8. This valve automatically closes the orifice when the steam escapes in excessive quantity from this orifice and thus prevents a needless waste of steam. This automatic blow-off valve, as shown in Fig. 8, consists of a metallic casing K screwed on to the extremity of the heating pipes *b*. In the interior of this casing is a hermetically closed envelope *k*, whose lower part *k'* is made of a bellows-like form capable of expanding and contracting to lengthen or shorten the envelope. This expansible lower end carries or controls a valve *m* which can find a seat in and controls the outlet tube *n*. The interior of the envelope *k* is filled with a suitable liquid. When the steam passing out of the pipe *b* enters the casing K it heats the liquid contained within the envelope so as to dilate it and consequently to close the valve *m* to its seat. On the other hand, when the casing becomes filled with the water of condensation or air, the liquid within the envelope cools off and contracts, so that the valve *n* opens to allow the water and air to escape until the steam can again act on the envelope and close the valve. I do not however desire to claim this special form of valve as part of my present invention.

When applied to other heating purposes, on board ship for example, or in public or private establishments, arrangements of a similar nature to that hereinbefore described are employed.

A steam generator and an air pump may be specially provided in order to supply the needful steam and compressed air.

The number of heating pipes connected with the main pipe and the capacity of either of these pipes must evidently be regulated according to the conditions under which the apparatus has to work.

The materials employed in the construction of the apparatus, the mode of securing, connecting or attaching the same, the nature and arrangement of several cocks or valves and the joints or connections between the main pipe and the sources of steam and compressed air may be modified or regulated in like manner.

I claim as my invention:—

1. In a heating system, the combination of a main distribution pipe and means for supplying compressed air and steam thereto with valved branch pipes leading from the main to the points to be heated and having controlled discharge outlets at their outer ends, outside the compartments to be heated.

2. In a train heating system, the combination of a steam supply and a compressed air supply with a main distribution pipe running to the cars, and valved branch pipes leading into the cars from the main pipe and having controlled discharge outlets at their outer ends, outside the compartments to be heated.

3. In a train heating system, the combination of a steam supply and the main air brake reservoir with a main distribution pipe with which said steam supply and air brake reservoir are connected, and valved branch pipes leading into the cars from the main distribution pipe for the steam and compressed air, substantially as described.

4. In a train heating system, the combination of the locomotive carrying the main air brake reservoir, and a main distribution pipe leading from the locomotive to the cars, valved pipes connecting the locomotive boiler and the said air brake reservoir with said main distribution pipe and valved branches from the latter to the cars, substantially as described.

5. In a train heating system, the combination of a steam supply and a compressed air reservoir with a mixing reservoir, with which the steam supply and air brake reservoir communicate, a main distribution pipe leading from said mixing reservoir and valved branch pipes leading into the cars from the main distribution pipe for the steam and compressed air, substantially as described.

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

MARIE FERDINAND LANCRENON.

Witnesses:
LÉON FRANCKEN,
EMIL REMELMANT.