2 Sheets—Sheet 1.

T. COOPER.

VACUUM BRAKES FOR CARS.

No. 184,507. Patented Nov. 21, 1876.

Fig 1.

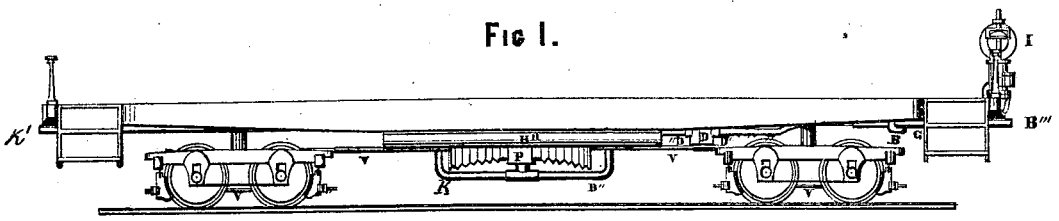

Fig 2.

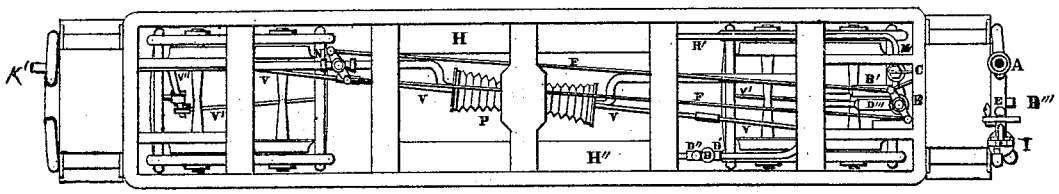

Fig 3.

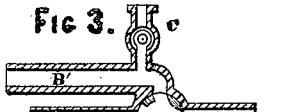

Fig 4.

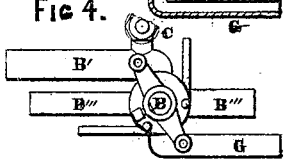

Fig 5.

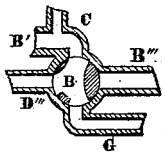

Fig 6.

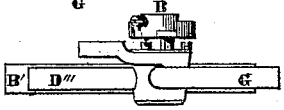

Fig 8.

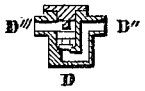

Fig. 9.

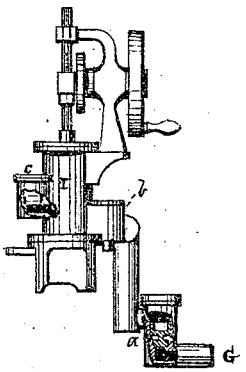

Fig 7.

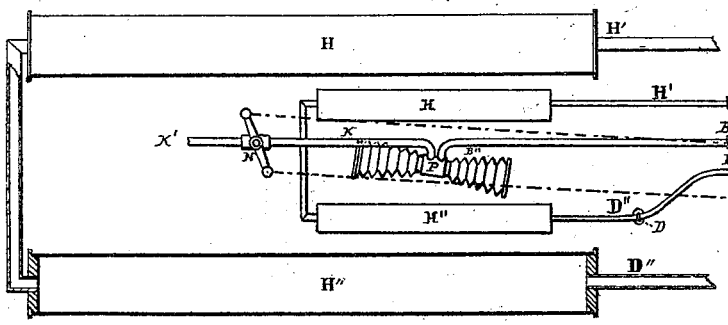

Fig 10.

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2 Sheets—Sheet 2.

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FIG 11.

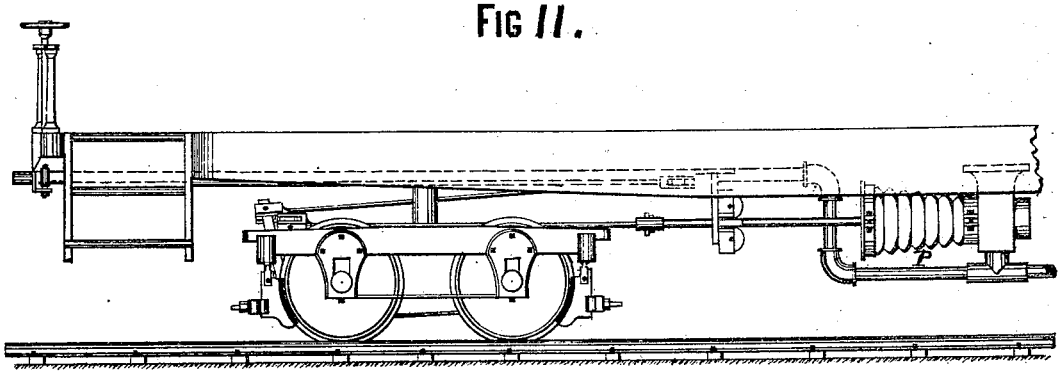


FIG 12.

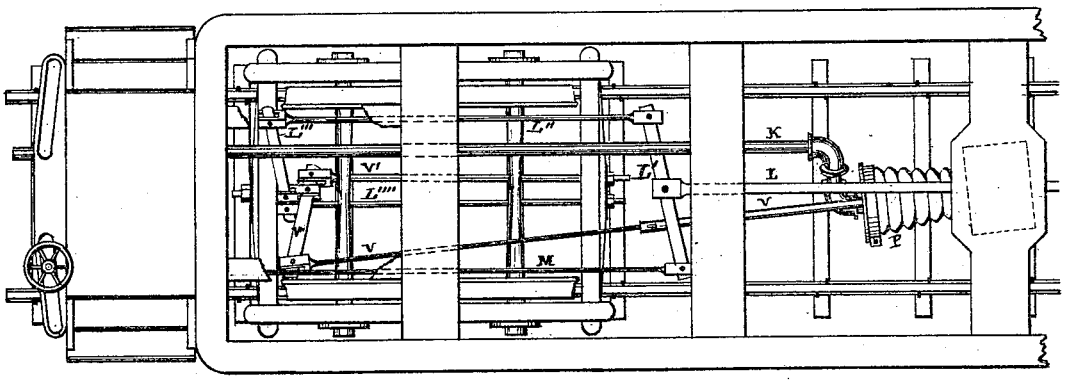
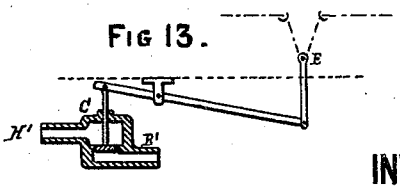


FIG 13.



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IMPROVEMENT IN VACUUM-BRAKES FOR CARS.

Specification forming part of Letters Patent No. **184,507**, dated November 21, 1876; application filed April 6, 1876.

To all whom it may concern:

Be it known that I, THEODORE COOPER, of Warwick, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Vacuum-Brakes for Railway-Cars, &c.; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a true, clear, and complete description of my said invention.

I seek and practically attain, by reason of my improvements, a vacuum-braking system which, while it embodies the advantages accruing from auxiliary vacuum-chambers combined for co-operating with the collapsible or working chambers on each car, requires but one main exhaust-pipe and but two sets of couplings, one set at the end of each car, instead of two exhaust-pipes and four sets of couplings, two at each end of the car, as heretofore proposed. Another object sought by me is the advantage accruing from the use of a complete vacuum apparatus on each car, embodying the collapsible and the auxiliary vacuum-chambers and local means for exhausting the air from all of the chambers. Still another object is such an arrangement of the collapsible chambers with relation to the brake-levers that no reorganization of the latter is requisite, which enables me to apply my vacuum apparatus to cars already provided with the present generally-adopted hand-brake mechanism without disturbing the same or lessening its efficiency in any manner.

My invention consists, mainly, in the combination, with braking mechanism on each car, of one or more auxiliary vacuum-chambers, a main exhaust-pipe, a collapsible vacuum-chamber connected therewith, and located midway between two cocks therein, one of which controls said pipe at its junction with a pipe which connects it with an auxiliary chamber, also check-valves for each auxiliary chamber, and external means for opening one of said valves, whereby, for operating the brakes, the air is exhausted by apparatus on the locomotive from all of said chambers through connections made at either end of said exhaust-pipe, or exhausted from the collapsible chamber into the auxiliary chamber, and also whereby, for releasing the brakes, air may be admitted to the collapsible chambers, by way of said exhaust-pipe, without affecting the vacuum in either of the auxiliary chambers.

My invention also consists in the combination, in a railway-car, of a local air-exhausting apparatus, a collapsible vacuum-chamber, an auxiliary vacuum-chamber, and a check-valve externally controllable, whereby air may be exhausted from all of said chambers, and the brakes operated independently of the main exhausting apparatus on the locomotive, and also whereby the collapsible chamber and the brakes may be operated by exhausting air from said chamber into the auxiliary chamber.

My invention further consists in the combination of a collapsible vacuum-chamber, having air-pipes connected therewith, and mounted diagonally beneath the car, and connected by rods with pendent brake-beams, as hereafter fully described, whereby a direct connection of the working-chamber and brake-lever is effected, and also whereby the vacuum apparatus may be applied to cars without any reorganization or rearrangement of the braking mechanism. I will state in this connection that I am well aware that pressure-chambers for containing steam and air under pressure have been heretofore arranged diagonally beneath a car, and connected with brake-levers of various kinds by means of chains or cords attached to movable pipes or rods, and also that similar chambers have been arranged longitudinally beneath the car and connected with brake-levers.

To more particularly describe my invention, I will refer to the accompanying drawings, in which—

Figure 1 represents, in side view, a car-frame and trucks with my improvements attached. Fig. 2 represents the same in top view. Fig. 3 represents, in section, the junction of the requisite air-pipes and a cock for placing either the main exhausting apparatus or the local or hand-pump exhausting apparatus into working relation with the several vacuum-chambers, and illustrates the position of the cock when set for operation of the main apparatus, carried usually on the locomotive.

Fig. 4 represents the same in top view, with the lever by which the cock is actuated. Fig. 5 represents, in section, the same as in Fig. 3, with the cock set for operation with the local exhausting apparatus. Fig. 6 represents, in side view, the same cock and pipes as in Fig. 4. Fig. 7 represents two auxiliary vacuum-chambers with communicating pipes, partly in side view and partly in section. Fig. 8 represents, in section, a check-valve, which prevents the induction of air to the auxiliary vacuum-chambers. Fig. 9 represents, partly in side view and section, an exhaust-pump arranged to be operated by a hand wheel or crank. Fig. 10 represents, on a small scale, a plan of the several vacuum-chambers and their communicating pipes. Figs. 11 and 12 represent, respectively, in side and top view, a portion of a car-frame and a truck with my vacuum-brake mechanism combined with well-known hand-brake mechanism. Fig. 13 illustrates a controlling check-valve for opening communication between the storing-chamber with the collapsible chamber.

I will first describe that portion of the apparatus which relates exclusively to my improved vacuum system. P denotes a pair of longitudinally-collapsible vacuum-chambers, which interiorly communicate by way of a central metallic chamber, and which therefore operate as one chamber, with a working head at each end. The chambers, as shown, embody certain novel features, which constitute subjects for special claims, in another application for patent.

It is to be understood that although the collapsible chambers invented by me are deemed preferable to any others heretofore known, I do not limit the several features of my invention as herein described to any particular type of working-chamber, because any of the several kinds heretofore proposed which have the requisite operative capacity may be employed, as herein described, with approximately valuable results.

H and H″ denote auxiliary chambers, preferably cylindrical in form, and arranged parallel with each other, the collapsible chamber being located between them, preferably midway between the ends of the car. These two auxiliary chambers are connected by a pipe at one end, as shown in Fig. 7. They are also connected, as shown in Fig. 10, at their opposite ends, by pipes H′ and D″ D‴, which are formed into a union in connection with the pipe B′, which communicates directly with the collapsible vacuum-chamber P. With this same union the main exhaust-pipe B‴ is connected for communication with the automatic exhaust apparatus on the locomotive; and, still further, with this union there is connected a pipe, G, which communicates with a local exhaust apparatus on each car, which may be a hand-pump, as shown at I, and also at Fig. 9, or any other suitable local exhausting mechanism capable of operation independently of aid from the locomotive. The four pipes at the union are suitably controlled by a four-way cock, B, as clearly shown in Figs. 3 to 6, inclusive, for purposes hereafter to be described. At D, between the auxiliary chamber H″ and the union-cock B, is a chamber provided with a check-valve, (clearly shown in Fig. 8,) for preventing the entrance of air to that chamber by way of pipe D‴. The collapsible chamber P has a pipe, as at K, connected therewith, which extends in the opposite direction from that previously described, toward the opposite end of the car, with which, at K′, connection is made with other cars in the same train. Although certain lengths f exhaust-pipe are designated by letters K′, B‴, and B′, it will be understood that these three lengths of pipe constitute, as a whole, the main exhaust-pipe of each car. A cock, as at N, is located in the length K of the main exhaust-pipe, and it is provided with a lever like that on cock B, before described, and these two levers are connected by long rods F, so that both may be opened or closed simultaneously. These cocks are actuated by a rod and a lever connected to a vertical shaft having a hand-wheel at its upper end, as at A, located at the end of the platform. At the junction of the auxiliary-chamber pipe H′ with the main exhaust-pipe there is, at C, a spindle check-valve, which, while it admits of air being drawn from the chamber H, will prevent air from entering the same, except when it is specially opened for that purpose by means of a lever and rod accessible from the platform at E, as will be hereafter described.

The brake mechanism proper embraces the two well-known pendent brake-beams at each truck, connected by means of a rod, v', and an inclined lever, v'', this latter being pivoted to the front or outer brake-beam, and it is to the upper end of this lever that the adjacent working-head of the collapsible chamber is connected by means of the rod v.

This type of brake mechanism is in general favor; and, as before stated, one feature of my invention consists in diagonally arranging the collapsible chambers, so that a proper draft-line is secured between the centers of their working-heads and the upper ends of the inclined levers v'', which are, respectively, located at diagonally-opposite corners of the car. So far as my knowledge extends, this result has never been attained with a vacuum-brake prior to my present invention. Moreover, by reason of this feature of my invention, I can profitably combine my vacuum-braking mechanism with the hand-brake mechanism of the class referred to, and yet have each wholly independent of the other, so far as operation is concerned. This I have illustrated in Figs. 11 and 12. Therein the vacuum-braking mechanism is all shown complete, with the several parts adjacent to one truck, as previously designated. The hand-brake, as usual, has the long central rod at L, which is located above the vacuum-chamber P, and between it and the bottom of the

car. At each end of this rod (one end only of which is shown in Fig. 12) there is a cross-lever at L′, with its fulcrum-pivot on rod L. To one end of the cross-lever L′ is attached the rod L″, which, in turn, is connected with the usual inclined lever L‴, which is pivoted for a fulcrum to the front brake-beam, and connected at its lower end, by rod L⁗, to the rear or inner brake-beam of the truck. The opposite end of lever L′ is connected with the hand brake-wheel by the usual brake-rod and chain at M.

It will be seen that either braking mechanism may be separately relied upon; that, although each is operatively independent of the other, they are capable of co-operating with each other in an emergency; and, also, that my vacuum mechanism may be applied without any reorganization and rearrangement of braking mechanism well known and largely in use.

The movement of the brake-beams incident to their operation by the hand-brake will, of course, move the working-head of the collapsible chambers rearward; but even this may be avoided, if desirable, by employing a rod constructed in two parts, with a telescopic-joint connection between the parts, so that while the rod, as a whole, could not be lengthened, it would, by reason of the joint described, be capable of a partial longitudinal movement of one part thereof without moving the head of the collapsible chamber.

Having thus explained how, by the rearward movement of the heads of the collapsible vacuum-chamber, the brakes may be set through the rods and levers, it now only remains for me to describe the modes of operation of the vacuum apparatus involved in my improvements.

In its simplest form each car is provided with the duplicate collapsible vacuum-chambers, diagonally located, and pipes leading therefrom in opposite directions to the ends of the car, and at each end thereof there is a coupling and flexible connection for uniting with the corresponding pipe of other cars. The several chambers communicate through these pipes with the exhausting apparatus on the locomotive, thereby placing the braking mechanism under the control of the engineer.

It is desirable, on cars which have with the vacuum-brake no auxiliary or co-operative hand-brake mechanism, to have the vacuum-brakes controllable independently of the locomotive and the main exhausting apparatus thereon, and therefore I combine with each car a local exhausting apparatus, which may be a vacuum hand-pump, as shown in the drawings, either with or without means for automatic operation through connection with the wheels or axles of a moving car. With the simplest form of my brake, as described, the hand-pump, located on a platform of the car, is placed in communication with the exhaust-pipe, which communicates with the collapsible vacuum-chamber, whereby the air may at will be exhausted from the vacuum-chamber and the brakes operated. After being thus used the cocks between the vacuum-chamber and the ends of the exhaust-pipe are opened to afford free ingress of air to said chamber when the brakes are to be released.

The exhaust-pump shown is provided with several check-valves, (indicated at *a*, *b*, and *c* in Fig. 9.)

I will next describe the operation of my vacuum-brake system when it embodies, with the collapsible chambers, the auxiliary or so-called "storing" vacuum-chambers, which are not collapsible.

In Fig. 10 the chambers, pipes, &c., are shown in their proper relative positions.

It will be supposed that the cock B is set as shown in Fig. 3, so that the hand-pump pipe G is closed and the main pipe B‴ opened through to the engine, and communicating rearward with the two storing-chambers H and H″, and also the collapsible chambers P. When communication is thus opened the engineer may operate the brakes by putting the main air-exhausting apparatus into operation.

As before described, at C there is a spindle-valve, which is opened by a vertical rod at E on the front platform, near the pump, and to this valve-rod a rope may be so attached that the conductor or engineer may open simultaneously the several valves C on the train. Each valve C is so weighted that it is normally closed against the free induction of air to the vacuum storing-chamber H, but is susceptible of being opened by the operation of the exhausting apparatus, so as to admit of the withdrawal of air from said chamber and its counterpart H″. This valve and its operating lever and rod are illustrated in Fig. 13. Now, assuming the train to have been stopped, the engineer then releases all the brakes by admitting air into the main pipe at the locomotive, and thereby promptly allowing the several collapsed chambers to expand.

It will be seen that the check-valve at D and the controllable check-valve at C both prevent the air, when thus entered for releasing the brakes, from entering the storing-chambers H″ and H, respectively, thus maintaining in both of them the vacuum which had been attained therein at the stoppage of the train. Next let it be supposed that the train under way again is to be again stopped. The engineer may, before putting the main exhausting apparatus into operation, pull the cord which controls the several valves at C, and thereby open communication between the storing-chambers H H″ and the collapsible chamber, the air passing from the latter into the former until equilibrium of vacuum is effected, the brakes being thereby more or less powerfully actuated. If the brakes be thereby insufficiently actuated, the engineer, with the main exhaust apparatus, perfects the vacuum and stops the train; or, if the emergency does not require it, the valve-cord may be un-

molested and the collapsible chambers operated solely by the main exhausting apparatus. If, while the train is in motion, the couplings should break and the cars commence to separate, the cord controlling the several valves C would so open said valves that the several collapsible chambers would be operated before the pipe-couplings were drawn asunder, and the train would be thereby checked to a greater or lesser extent.

I will next explain how each car is controllable independently of the exhausting apparatus on the locomotive.

After making a run there is always a partial vacuum in the storing-chambers, which will afford the pressure requisite for further operating the brakes. The cars being uncoupled and ready for making up a new train, the cock B is so turned that it closes the adjacent opening at main pipe B‴, and places the collapsible chamber in communication with the local exhausting apparatus or hand-pump at I. The cock N, operated simultaneously with B by the same rods, closes the main pipe K beyond the collapsible chamber. For stopping from ordinary speed, the brakeman may rely solely upon the valve at C, which, being opened, allows the auxiliary chambers to receive the air from the working-chamber; or he may first bring the shoes into good bearing by working the hand-pump, and then finally set the brakes by means of the valve at C through its lever E, placed conveniently near the hand-pump. For releasing brakes, the cocks B and N are then opened, permitting air to enter the collapsible chamber at both ends by way of the main pipes. The check-valves C and D prevent the air at such times from entering the auxiliary chambers, and therefore the vacuum therein is only affected so far as relates to the reception therein of such air as was contained in the collapsible chamber and pipes at the time the check-valve C was opened.

Having thus described my invention, I claim as new and desire to secure by these Letters Patent—

1. The combination, with suitable braking mechanism, of one or more auxiliary vacuum-chambers, a main exhaust-pipe, a collapsible vacuum-chamber, connected therewith and located between two cocks therein, one of which controls said pipe at its junction with a pipe connecting with one or more auxiliary chambers, a check-valve for each auxiliary chamber, and external means for opening one of said valves, substantially as described, whereby, for operating the brakes, air is either drawn from all of the vacuum-chambers through the exhaust-pipe from either of its ends, or exhausted into the auxiliary from the collapsible chamber, and also whereby, for releasing the brakes, air is admitted through the main pipe into the collapsible chamber without affecting the vacuum in the auxiliary chambers, as set forth.

2. The combination, with suitable braking mechanism on a railway-car, of a local air-exhausting apparatus, a collapsible vacuum-chamber, and an auxiliary chamber, having a check-valve externally controllable, substantially as described, whereby the air may be exhausted from said chambers independently of aid from the locomotive exhausting apparatus, and the brakes operated by the local exhausting apparatus, with or without aid from the auxiliary chamber, as set forth.

3. A collapsible vacuum-chamber, having air-pipes connected therewith, and mounted diagonally beneath a car, in combination with a pendent brake-beam, an inclined lever, and a rod which connects a working-head of the vacuum-chamber with the inclined lever, substantially as described.

4. A collapsible vacuum-chamber, having two working-heads diagonally mounted beneath a car, in combination with duplicate sets of pendent brake-beams and inclined levers, connected directly, by rods, with the working-heads of the vacuum-chamber, substantially as described.

THEODORE COOPER.

Witnesses:
J. C. B. WOODS,
THOMAS F. COSGROVE.