(No Model.)

2 Sheets—Sheet 1.

C. W. LANPHER.

VACUUM CAR BRAKE.

No. 250,823.

Patented Dec. 13, 1881.

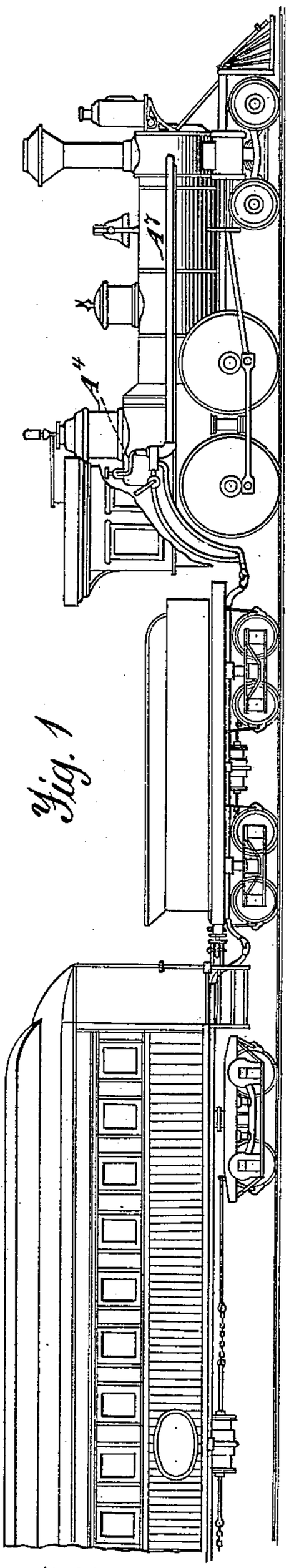

Fig. 1

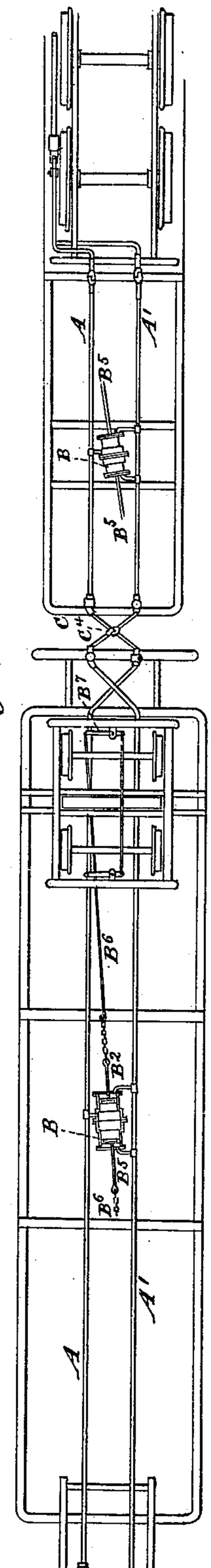

Fig. 2.

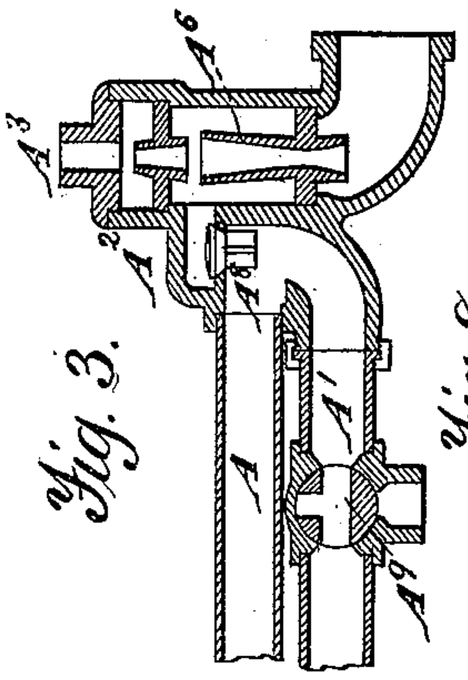

Fig. 3.

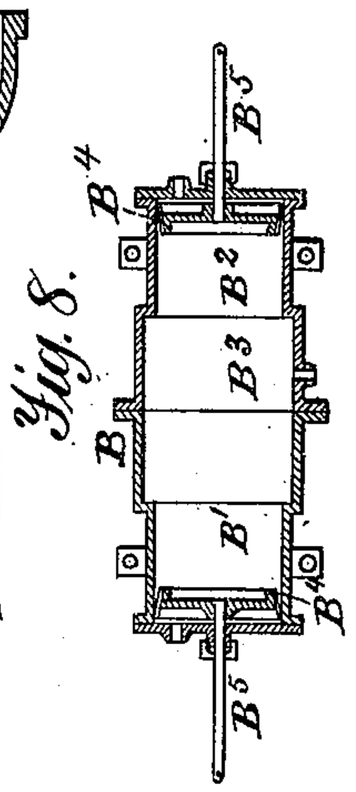

Fig. 8.

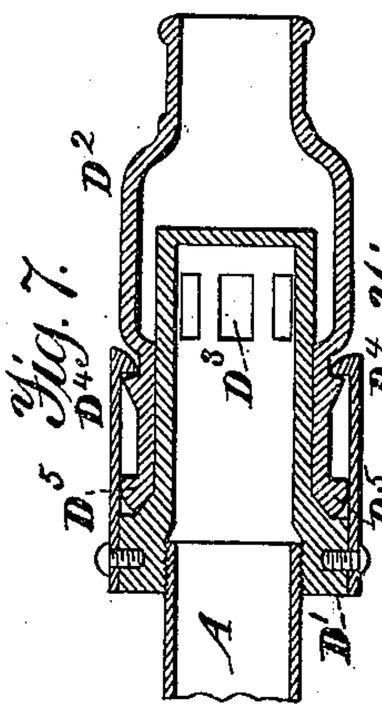

Fig. 7.

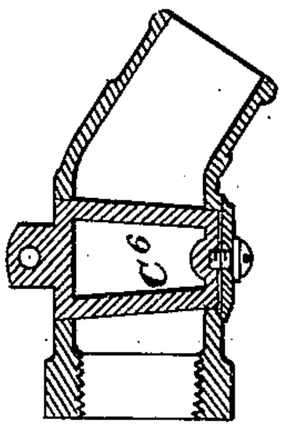

Fig. 6.

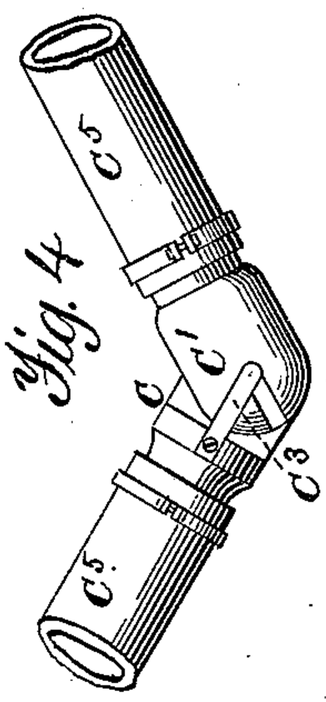

Fig. 4

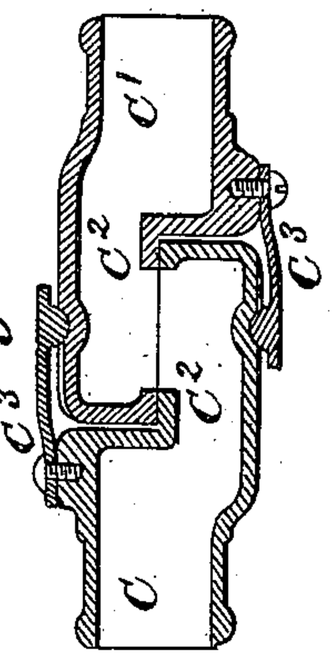

Fig. 5.

Witnesses.
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(No Model.)

2 Sheets—Sheet 2.

C. W. LANPHER.

VACUUM CAR BRAKE.

No. 250,823. Patented Dec. 13, 1881.

Fig. 9.

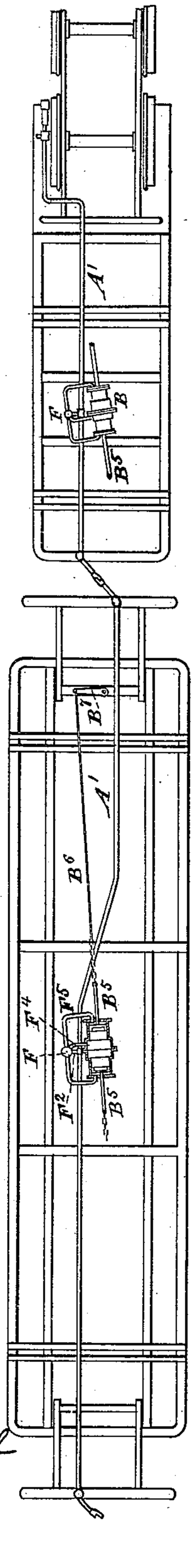


Fig. 12.

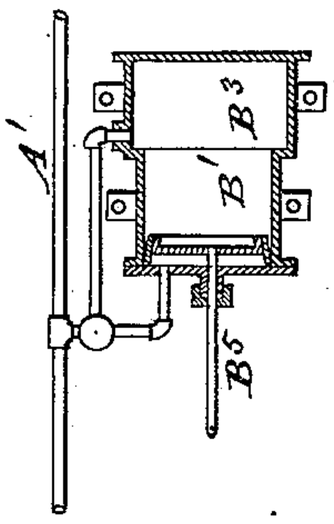


Fig. 11

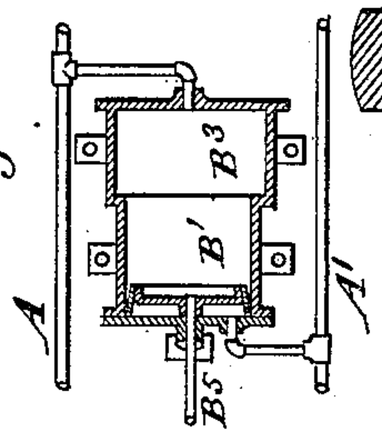


Fig. 10.

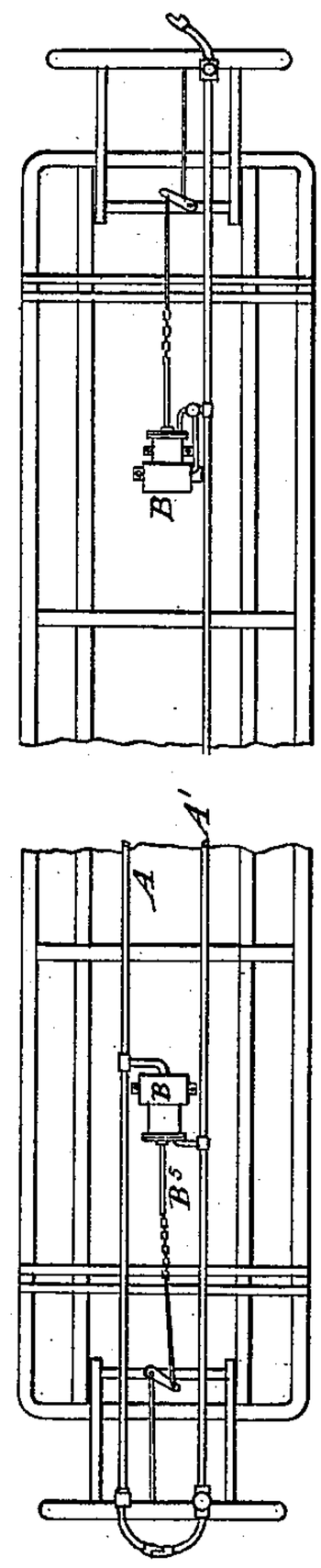


Fig. 15.

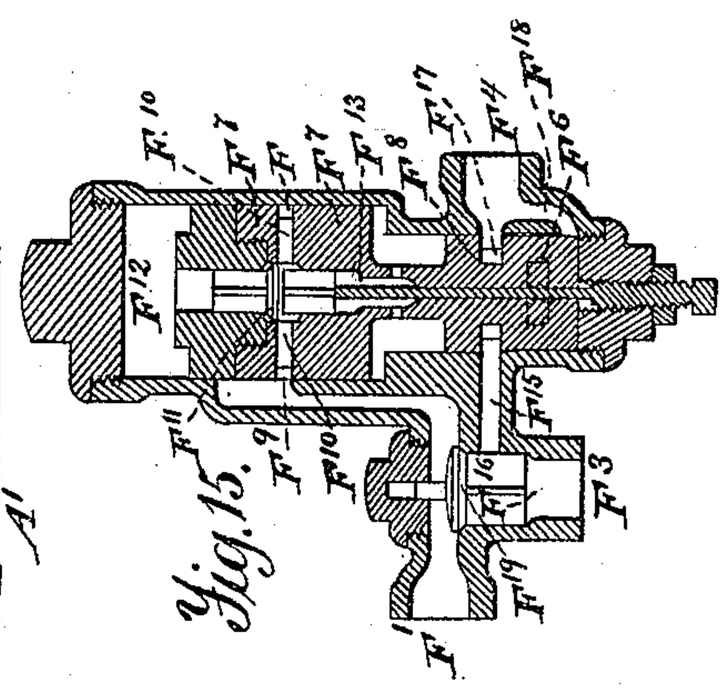


Fig. 14.

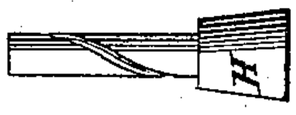
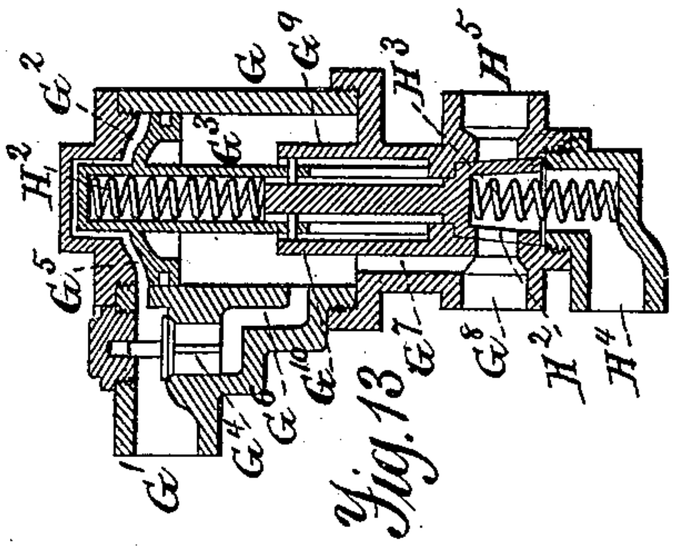


Fig. 13



Witnesses.
A. Ruppert.
C. M. Connell

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Holloway & Blanchard
Attys

UNITED STATES PATENT OFFICE.

CHARLES W. LANPHER, OF NORWICH, NEW YORK.

VACUUM CAR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 250,823, dated December 13, 1881.

Application filed April 12, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. LANPHER, a citizen of the United States, residing at Norwich, in the county of Chenango and State of New York, have invented certain new and useful Improvements in Automatic Constant-Vacuum Car-Brakes; 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, reference being had to the accompanying drawings, and to the letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in automatic constant-vacuum brakes; and the objects of my improvements are, first, to provide a brake for railroad-cars which shall be automatically applicable when the train remains intact and is running in either direction, and also when the train is separated by accident or otherwise; second, to provide novel means for coupling the parts of the vacuum-producing and air-conducting devices together; and third, to provide novel combinations of the parts of which the mechanism is composed, as will be more fully explained hereinafter. I attain these objects by the mechanism and combinations illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a locomotive, its tender, and a portion of a car, showing the air-exhausting device placed on the engine, pipes for the admission and exhaustion of air to and from the brake-cylinder, such cylinders placed upon the tender and car, and the rods for connecting the pistons to the brake-levers. Fig. 2 is a bottom view of a portion of the engine, tender, and car, showing the brake-cylinders, the air-pipes, and the method of arranging them, and the brake-beams and their connections. Fig. 3 is a sectional elevation of the air-exhausting apparatus, showing a portion of the air-pipes, a valve and a three-way cock for regulating the passage of the air, and the body of the air-ejector and the internal arrangement of its parts. Fig. 4 is a plan view of the couplings for the hose used between the cars, showing the method of uniting the portions thereof and of attaching the hose thereto, and Fig. 5 is a sectional elevation thereof. Fig. 6 is a sectional elevation of a cock to be attached to the ends of each one of the air-induction pipes. Fig. 7 is a sectional elevation of a sliding or extensible valve to be placed at the extreme ends of air-eduction pipes, the method of uniting the parts being shown. Fig. 8 is a sectional elevation of one of the brake-cylinders, showing the three chambers thereof, the pistons, and portions of their rods. Fig. 9 of Sheet 2 shows a portion of a locomotive, tender, and car, it being a bottom view thereof, and showing the same form of brake-cylinders as is shown in Figs. 1, 2, and 8 of Sheet 1, but with a single row of pipe, and the method of applying it so as to cause it to perform the functions performed by the two rows shown in Fig. 2, Sheet 1. Fig. 10 is also a bottom view of a car having attached to it a modified form of brake-cylinder, showing its arrangement with reference to the air-pipes and to the brake-lever, and also how it may be used in connection with two lines of pipes. Fig. 11 is a central sectional elevation, showing the modified form of brake-cylinder shown in Fig. 10, and the manner of connecting therewith two lines of pipes. Fig. 12 is a sectional elevation of a brake-cylinder and its piston, showing how they may be used in connection with a single line of pipe; and Figs. 13, 14, and 15 are elevations (13 and 15 being in section) of different forms of valves for use in the air-pipes when only one line is employed.

Similar letters refer to similar parts throughout the several views.

This type of braking mechanism may be applied to any form of locomotive, tender, and car, it consisting, primarily, of an air-exhauster of the construction shown, or of any others that will readily produce the required vacuum, a pipe or pipes for conducting the air contained therein, and in the brake-cylinders to the exhausting apparatus, and thence to the atmosphere; brake-cylinders, having in them chambers for the reception of air and the movement of the pistons, rods, or chains for connecting the pistons to the brake-levers, and suitable couplings for connecting the air-pipes between the cars or between them and the tender and engine, the parts being constructed, combined, and arranged substantially as hereinafter described, as a consequence of which they are caused to perform the functions ascribed to them.

In constructing and applying my brake mechanism I first provide any suitable air-exhausting device, by preference such an one as is shown in detail in Fig. 5, it being adapted to the reception of two lines of air-pipes, A and A′, which are secured to the case A^2 of the instrument, the upper portion of which is provided with a nozzle, A^3, for the reception of a steam-pipe, A^4, which connects it with the steam-generator, as shown in Fig. 1.

Within the case A^2, a short distance below where the steam enters, there is placed a disk, A^5, having in it a tapering pipe or aperture, A^6, through which the steam passes, it being directed through a curved neck of the case to a pipe, A^7, by which it is conducted to the smoke-box of the generator, or it may be into the atmosphere at such a height as to cause it to pass over the train when running; or it may be conducted back into the water-tank of the engine for the purpose of being utilized to heat the water.

In that portion of the case of the exhauster to which the pipes A and A′ are attached there is placed a valve, A^8, which opens upward, and in the pipe A′, at some convenient point, there is placed a three-way cock, A^9. The exhauster is to be attached to the generator at some convenient point, it being so located as to be conveniently manipulated by the engineer, there being between it and said generator a cock or valve for controlling the admission of steam thereto. The two lines of pipes A and A′ extend from the exhauster, passing under the tender and each of the cars of the train, they being connected between each of the cars and between the cars and the tender by flexible hose, which are supplied with suitable couplings, soon to be described, and made to cross each other between the cars, as shown in Fig. 2. This crossing of the hose obviates the necessity of using male and female couplings, and makes them capable of universal application without reference to the relative positions or heights of the cars.

Under each of the cars, and under the tender, if desired, there is placed a cylinder, B, the construction of which is clearly shown by Fig. 8, it being composed of three chambers, B′, B^2, and B^3, the one, B^3, being in the center and of larger dimensions than the end ones, in each of which there is placed a piston, B^4, which may be made of cast-iron or of any other metal, their peripheries being provided with a packing of leather, rubber, or other suitable substance.

To the outer ends of the parts B′ and B^2 of the cylinders, heads are attached, which are provided with proper packing-boxes for the purpose of preventing the passage of air around the piston-rods B^5 B^5, to the outer ends of which chains or rods or chains and rods B^6 are attached, the opposite ends of which are connected directly to the levers B^7 of the brakes, so that as a vacuum is formed between the pistons and air is admitted to the ends of the cylinders the application of the brakes will be accomplished.

For the purpose of permitting the air to be exhausted from and admitted to the cylinders the two lines of pipes are connected thereto as follows: The pipe A is connected to the center chamber of the cylinders and the pipe A′ with the end chambers. These pipes, when connected by the hose, as above described, form a continuous line from the rear end of the train to the exhauster on the engine, the one A′ being supplied near said exhauster with a three-way cock, A^4, as previously stated.

The couplings to be used between the cars are shown in Figs. 4 and 5, they consisting of two parts, C and C′, each of which is provided upon its outer end with a projection which extends beyond the body of the part, and is designed to hold the flexible hose securely thereon, when it has been passed over the projection and properly clamped, as shown, or secured in any other suitable manner. Each of the parts of this coupling is provided with a seat, C^2, upon which the opposite part rests, as shown in Fig. 5, the seats being nicely fitted and ground together, or having rubber gaskets fitted thereon, so that no air can escape or enter between them. They are held in their relative positions by means of springs C^3 C^3, which are bolted upon, or otherwise secured to the parts C and C′ of the coupling, each of the parts being provided with a recess or groove, into which projections upon the inner surfaces of the springs enter, and the parts are held together by the combined action of these springs and the pressure of the atmosphere. The hose, in the centers of which the couplings are placed, are shown at C^5 C^5, there being one in each of them. This coupling is regarded as being novel in its construction, and its use is preferred; but so far as the combination of the parts is concerned any other of suitable form may be adopted, or metallic couplings may be dispensed with and the hose and pipes united by means of a cock, C^6, such as is shown in Fig. 6, and a plain piece of hose, the cock in such case being screwed upon the end of the pipes A A′ and having upon its outer end a curved part, for the reception of the hose, it being provided with an annular projection, over which the end of the hose is slipped for the purpose of causing it to be retained in position. These cocks, when used, must all be open with the exception of the one at the rear end of the line, which must be closed.

To one or both ends of the connecting-hose C^5 C^5 there is secured a valve, D, the construction of which is shown in Fig. 7, its office being to close the ends of the pipes in the event of the cars of the train being separated while running, such a valve being placed at the extremities of A under each car. This valve consists of two parts, D′ and D^2, the former sliding telescope-like in the latter, its inner end being closed, and its periphery near its closed end being provided with a series of air-pas-

sages, D^3, so that the air passing through it may enter the chamber in the portion D^2, or be shut off therefrom, owing to the position of the part D′ therein. In practice the hose is attached to the neck formed on part D^2, and springs D^4 may be provided for preventing the separation of the parts in ordinary use, they being arranged as shown, so that projections upon their ends may enter grooves formed in the part D^2 for that purpose. Should the train become separated while running, the strain upon the hose would cause the part D′ to be drawn outward until stopped by the springs falling into the recesses formed in the surface of the part D^2, and coming in contact with the shoulders D^5 D^5, at which time the air-passages D^3 will have been drawn out of the chamber, and will be covered by the wall of D^2 in such a manner as to prevent the entrance of any air to the pipe A.

The operation of the air-exhauster and the three-way cock will be as follows: Steam is admitted through the nozzle A^3, and passes through the chamber beneath it, and enters the funnel-shaped pipe A^6, carrying with it the air in the vicinity, and a vacuum is formed in the chamber surrounding said pipe, which causes the valve A^8 to rise, when the continued action of the steam entering the exhauster causes a vacuum to be produced in the pipe A. The air is also, by the same operation, withdrawn from the pipe A′ when the three-way cock A^9 in said pipe is in the position shown in Fig. 3. This efflux of air is continued until a vacuum is formed in the pipes and the chambers connected with them, and so long as the cock A^9 remains in the position shown a vacuum will be maintained; but if the plug in said cock is turned one-quarter around, so as to cause the air-passages in it to register with the pipe and the induction-opening on its under side, the pipe A′ will be cut off from communication with the exhauster and put in communication with the atmosphere, which will result in filling the end chambers of the brake-cylinders and applying the brakes.

In operating this brake mechanism, steam, as before stated, is admitted to the air-exhauster when the train starts on its trip, and is not shut off until it has reached its final destination. As above stated, a vacuum is formed in the pipes A and A′, the air passing out through pipe A′, causing a vacuum to be formed in the end chambers, B′ and B^2, of the cylinders, and that passing out through pipe A causing a vacuum in the center chamber thereof. In applying the brakes, after the vacuum has been produced, the engineer has only to turn the plug of the three-way cock to the position above described, thereby closing the communication between the pipe A′ and the exhauster, and allowing the atmosphere to enter the end chambers of the cylinders attached to the different cars of the train. The pistons in the cylinders, on account of the pressure applied to their outer surfaces by the inflowing air, move toward each other and apply the brakes by acting directly upon the levers attached thereto. For releasing the brakes, the plug of the three-way cock is turned back into its original position, as shown in Fig. 3, when communication will be re-established between the pipe A′ and the exhauster, and thus a restoration of the vacuum in said pipe A′ and in the ends of the cylinders will be effected, it having been maintained in the pipe A and in the central part of the cylinders during all of the time that the brakes have been applied.

In the event of the parting of the train while running the portion D′ of the valve shown in Fig. 7 will be drawn out by the action of the flexible couplings of the pipes until its air-passages D^3 are covered by the wall of the outer part, D^2, which will have the effect to prevent the air from entering the pipe A, and thus the vacuum will be preserved in the central chamber of the cylinders; but at the same time the separation of the hose-coupling on pipe A′ would admit the passage of air to said pipe and the end chambers of the brake-cylinders, thereby applying the brakes to the detached portion of the train.

The modifications of this brake and of the parts of which it is composed are shown by the figures constituting Sheet 2 of the drawings, Fig. 9 thereof showing a modification by which one of the lines of pipe may be dispensed with without interfering with the functions of the mechanism as to its operation upon the brakes. In this modification one cylinder is used upon each car, having in it two pistons, as in the plan previously described, their connection with the brake-levers being the same as in that description. In this modification only one line of iron or other suitable pipe is used, which corresponds with the line A′ shown in Figs. 2 and 3 of Sheet 1, it being supplied with suitable valves, cocks, and couplings, as there shown, an exhauster, and a three-way cock, the location of the exhauster on the generator being the same as in the first-described plan, and also the hose-couplings between the cars and the cocks at the ends of the pipes, each one of which is to be open, with the exception of the one at the rear end of the train, which is to be kept closed. Near the brake-cylinder under each car there is placed a valve to regulate the communication between the pipe A′ and the chambers or parts of the cylinders. Two valves for this purpose are shown, one in Fig. 13 and the other in Fig. 15, either one of which will perform the functions required.

In Fig. 15 there is shown a valve of positive action, and in Fig. 13 a valve which admits of a partial application of the brakes in addition to its performing all of the functions of the valve shown in Fig. 15. The valve represented in Fig. 15 has four pipe-connections, it being designated as a whole by the letter F, F′ designating the point where the air-pipe F^2, Fig. 9, which connects the central chamber of the cylinder to the pipe A′, and the valve is located. At F^3 there is attached a pipe, F^4, Fig.

9, which communicates with the central chamber of the cylinder. At F^4 there are connected pipes F^5 F^5, which establish communication between the valve-case and the two end chambers of the cylinders. At F^6 there is connected a pipe which leads to the atmosphere, through which the air escapes.

F^7 F^7 represent a piston moving in a chamber of the valve-case F, said piston having a greater sectional area than that of the piston F^8, which moves in a chamber in the lower portion of said valve-case, it being rigidly connected with piston F^7. In the piston F^7 there is formed an annular groove, F^9, from which there extend passages F^{10} F^{10}, which lead to the valve-chamber F^{13} in said piston, in which there is placed a double-seated wing-valve, F^{11}. This chamber communicates directly with chamber F^{12} above the piston F^7 by means of the passages F^{10}. In the side of the case of valve F there is formed a passage, F^{14}, which permits a constant communication to be kept up between the pipe A′, through F′, and the groove F^9 throughout the whole range of the movements of the pistons F^7 and F^8.

F^{15} is a port leading from a valve-chamber, F^{16}, to a groove, F^{17}, formed in the piston F^8, and thence leading to the pipe at F^4.

At F^{18} there is shown a passage leading from the passage F^4 to the under side of piston F^8. Passing through the pistons there is a rod, the lower end of which rests upon a set-screw, which passes through the lower head of the valve-case F, and is provided with a set-nut for holding it in its adjusted position, said rod sustaining in its position the valve F^{11}.

The operation of the parts last described is as follows: Steam is admitted to the exhauster, which exhausts the air from the pipe A′ and the ports, passages, and chambers of the valve-case F, which operation causes the valve F^{19} to rise and the air to be withdrawn from the end chambers of the brake-cylinders, and at the same time from beneath the piston F^8. A vacuum is maintained in all of the spaces alluded to so long as the exhauster is kept in operation and the three-way cock is left in the position shown in Fig. 3 of Sheet 1. To apply the brakes the three-way cock is turned so as to cause its openings to communicate with the atmosphere, when the valve F^{19} will fall to its seat, and the vacuum in the central chamber of the cylinders will be maintained, and the air will enter the valve-chamber through the passage F^{14}, and pass through the groove F^9 and passages F^{10}, and lift the valve F^{11} to its upper seat in the piston F^7, thereby preventing the entrance of air into the chamber F^{12}, at which time air will be permitted to enter a chamber between the two pistons, which will cause a greater force to be exerted upon piston F^7 than is exerted upon piston F^8, by reason of the greater area of the former than of the latter, and hence the pistons will be forced upward; but as they rise the groove F^{17} no longer registers with the passage leading from the valve-chamber F^{16}, and as the lower end of piston F^8 rises above said passage the air enters the chamber below said piston and passes through the pipe F^6 and out of the case F at F^4, into the pipe A′, and through it to the end chambers of the brake-cylinders.

Experience has shown that with every precaution for securing tightness in the pistons and joints of an intermittent vacuum-brake, the force applied is maintained but a short time without a re-formation of the vacuum in the chambers of the brake-cylinders. In the present case the moment the brakes have been applied the three-way cock is turned to its normal position, and any air that may have entered the central chamber or the pipe A′ is again ejected, and the valve F^{11} at once falls to its seat, and at the same time the valve F^{19} is caused to rise, thus causing a vacuum to be maintained in the central chamber of the cylinders, at which time air has free access to the end chambers of the brake-cylinders, which applies the brakes with the full force due to the pressure of the atmosphere. In releasing the brakes according to this plan, the three-way cock is returned to its normal position, when the valve F^{19} falls to its seat and prevents the entrance of air to the central chamber of the brake-cylinders. Should the train become parted while running, the atmosphere will enter the pipe A′, and the action of the valve just described, and consequently of the brakes, will be the same as if the three-way cock upon the engine had been turned to admit air thereto; or, in other words, the brakes will be applied to both sections of the train.

The valve represented in Fig. 13, when used in connection with the single line of pipe and the other devices shown in Fig. 9, does not require any change to be made in the apparatus, either in the construction or arrangement of the parts, and its operation is the same, with the one exception that it possesses the advantage of permitting a partial application of the brakes without applying their full force, it being placed in the same position as that described for the one shown in Fig. 15. In this description, G represents a valve-case, which corresponds to the one designated by F in Fig. 15, and is of similar construction, it having the necessary nozzles to which to attach the necessary pipes. Leading from the induction-nozzle G′ to the interior of the case there is a passage for air which leads to a chamber above a piston, G^2, said piston moving in a cylinder or chamber, G^3, formed in the case G. G^4 in this figure is a wing-valve. G^5 is the passage above referred to, which leads from the nozzle to the chamber above the piston G^2. G^6 is a passage by which air may be caused to pass into the chamber G^3 below the piston G^2. G^7 is a port leading from the chamber G^3 to a pipe, G^8. The piston of this valve has a hollow stem fitting into and moving in a cylinder, G^9, to which pins G^{10} are secured opposite to each other, which move in slots formed in the cylinder.

H is a plug, having a stem which runs up

through the cylinder G^9, and enters the hollow stem of piston G^2. This plug is open at the bottom, and has a port or passage, H′, formed in it for the passage of air. In the stem of the plug are two straight slots directly opposite to each other and of equal, or nearly equal, length with the stem of the piston. There are also two helical slots formed in the stem of plug H, as shown in Fig. 14, one running from the top of each of the straight slots to the bottom of the other. The pins G^{10}, which move in the guiding-slots in the cylinder G^9, project to the inside of the hollow stem of piston G^2 and enter the slots in the stem of plug H. Between the top of the stem of the plug and the inner upper end surface of the piston G^2 there is placed a spiral spring, H^2, which holds the piston in its elevated position, as shown in Fig. 13. For the purpose of holding the plug H in its proper position there is placed beneath it a spring, H^3, as shown, the tension of which always keeps the plug up to its seat, but does not prevent it from turning when necessary.

The operation of the valve is as follows: The exhauster in taking the air from the main pipe also take it from the chamber G^5 above the piston G^2, which causes the valve G^4 to rise and permit the air to pass out of chamber G^3 through port or passage G^7, and also through port G^7 from the pipe G^8, and from the center chamber of the brake-cylinder. A vacuum is thus established in each compartment of the brake-cylinder and above and below the piston G^2 of the valve.

To apply the brakes, air is admitted to the main pipe through the three-way cock, as before described, and the valve G^4 closes, preserving the vacuum in the center chamber of the brake-cylinder, and as the air enters the chamber above the piston G^2 of the valve at this instant there is a vacuum in each compartment of the brake-cylinder and in chamber G^3 below piston G^2, while above it there is an air-pressure which causes the piston to descend, which has the effect to turn the plug half round. As a consequence of this movement the port or air-passage H′ in the plug no longer permits communication between the passages or pipes H^4 and H^5, but establishes a communication between the passages G^8 and H^5, and the chambers in the ends of the brake-cylinders. The air being again exhausted from the train-pipe at G′, and the chamber above the piston G^2 through port G^5, the spring H^2 forces the piston back to its most elevated position, and at the same time the valve G^4 is raised and the vacuum in the center chamber of the brake-cylinders is maintained so long as these conditions remain unchanged.

In applying the brakes when the last-above described form of valve is used air is admitted to the main pipe, and the valve G^4 closes and prevents the entrance of air below it, when the piston G^2 descends and turns the plug H half round, and the pipes G^8 and H^4 are brought into communication through the port H′, and the pressure in the different compartments of the brake-cylinders is equalized and the brakes are at once applied. Should the train become parted while running, the brakes will be applied, as previously described, when the valve shown in Fig. 15 is used.

In partially applying the brakes by the use of the last-described valve, air is continuously admitted to the main pipe by the engineer, and when the piston G^2 has descended far enough to bring the port H′ in the plug but slightly open to the pipe at H^5 the air will slowly enter through said opening and pass through H′ and H^4 to the end chambers of the brake-cylinders. When sufficient power, at the discretion of the engineer, has been applied to the brakes, the three-way cock formerly alluded to is turned so as to permit the withdrawal of a portion of the air from the main pipe, and thus allow the piston G^2 to be raised by the spring H^2 far enough to allow the plug H to be moved so as to cut off the supply of air through H^5 to the end chambers of the brake-cylinders. The plug of the three-way cock is then turned to a position intermediate between the two heretofore described, by which means the port in plug H is made to stand between its two extreme positions, which will prevent it from communicating with any of the passages, while the position of the three-way cock neither allows air to enter into nor be withdrawn from the main pipe, at which time a vacuum exists in the center chamber of the brake-cylinders and a partial air-pressure in their end chambers, which has the effect to apply the brakes, but with less force than when the full atmospheric pressure is admitted to the end chambers. The brakes are relieved from this partial pressure in the same way as when the full atmospheric pressure is used.

The plan shown in Figs. 10 and 11 differs from that shown in Fig. 9 only in that two cylinders, each with one piston in them, are shown in the former, instead of one cylinder with two chambers containing pistons, as in the latter, said cylinders being placed near the ends of the car, and the one shown in Fig. 12 differs from that shown in Fig. 9 only in that in the former two cylinders are supposed to be used, each of which are connected with a single line of pipe; but instead of using the two cylinders with one piston in them, one cylinder with a capacity equal to both may be used by adopting the proper arrangement of levers for applying the brakes.

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

1. In a brake-operating mechanism in which a constant vacuum is maintained, substantially as hereinbefore described, the combination of an air-exhauster, two independent lines of air-conducting pipes, one of which is supplied with a three-way cock for controlling the ingress of air to the brake-cylinders when the brakes are to be applied, said pipes being arranged and connected to the cylinders sub-

stantially as described, whereby they are both made to act as eduction-pipes when air is to be exhausted from said cylinders, and a cylinder placed under each car having in it two pistons arranged to operate substantially as described, and for the purpose set forth.

2. In a brake-operating mechanism in which a constant vacuum is maintained, the combination of an air-exhauster, two independent lines of pipes for the passage of air, one of which is provided with a three-way cock for controlling the admission of air thereto, brake-cylinders placed under each of the cars, and a valve constructed and arranged substantially as described, whereby the operator can admit air to said cylinders in such regulated quantities as to cause the brakes to be applied with any required amount of force, up to the full amount derived from the atmospheric pressure, substantially as described.

3. In a brake-operating mechanism, the combination of an air-exhauster, two lines of pipes, one of which is provided with a three-way cock for regulating the amount of air admitted thereto, and a brake-cylinder having centrally arranged in it a vacuum-chamber of greater diameter than are the chambers or parts in which the pistons work, substantially as set forth.

4. The herein-described valve for controlling the admission of air to the brake-cylinders in regulated quantity, whereby the brake may be applied with greater or less force, as described, it consisting of a suitable case having the required nozzles to which to attach the different pipes, a piston, a partially-rotating plug, and springs for controlling the ingress to and the egress from the brake-cylinders of the air used in operating the brakes, the parts being constructed substantially as and for the purposes set forth.

5. The sliding or telescopic valve, consisting of the parts D D′, the latter moving in the former and being provided with openings for the passage of air, which, when the part D′ is drawn outward, will be covered by the unbroken wall of the part D, and the passage of air prevented as described, the movements of the parts being controlled by springs D^4 D^4, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES W. LANPHER.

Witnesses:
ROBT. A. PARKE,
HOLDRIDGE OWEN.