4 Sheets--Sheet 1.

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Steam and Air Brake.

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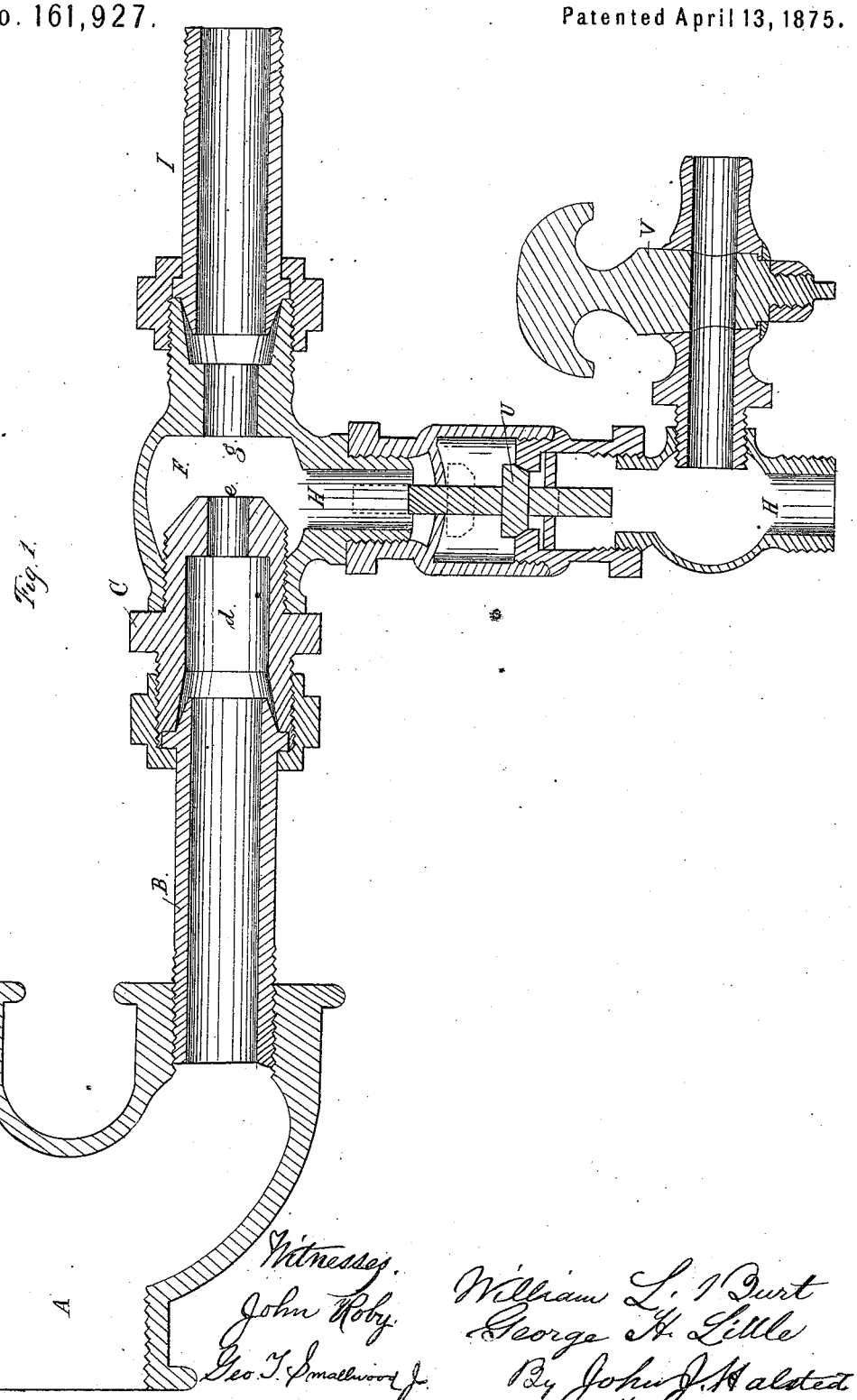

Fig. 1.

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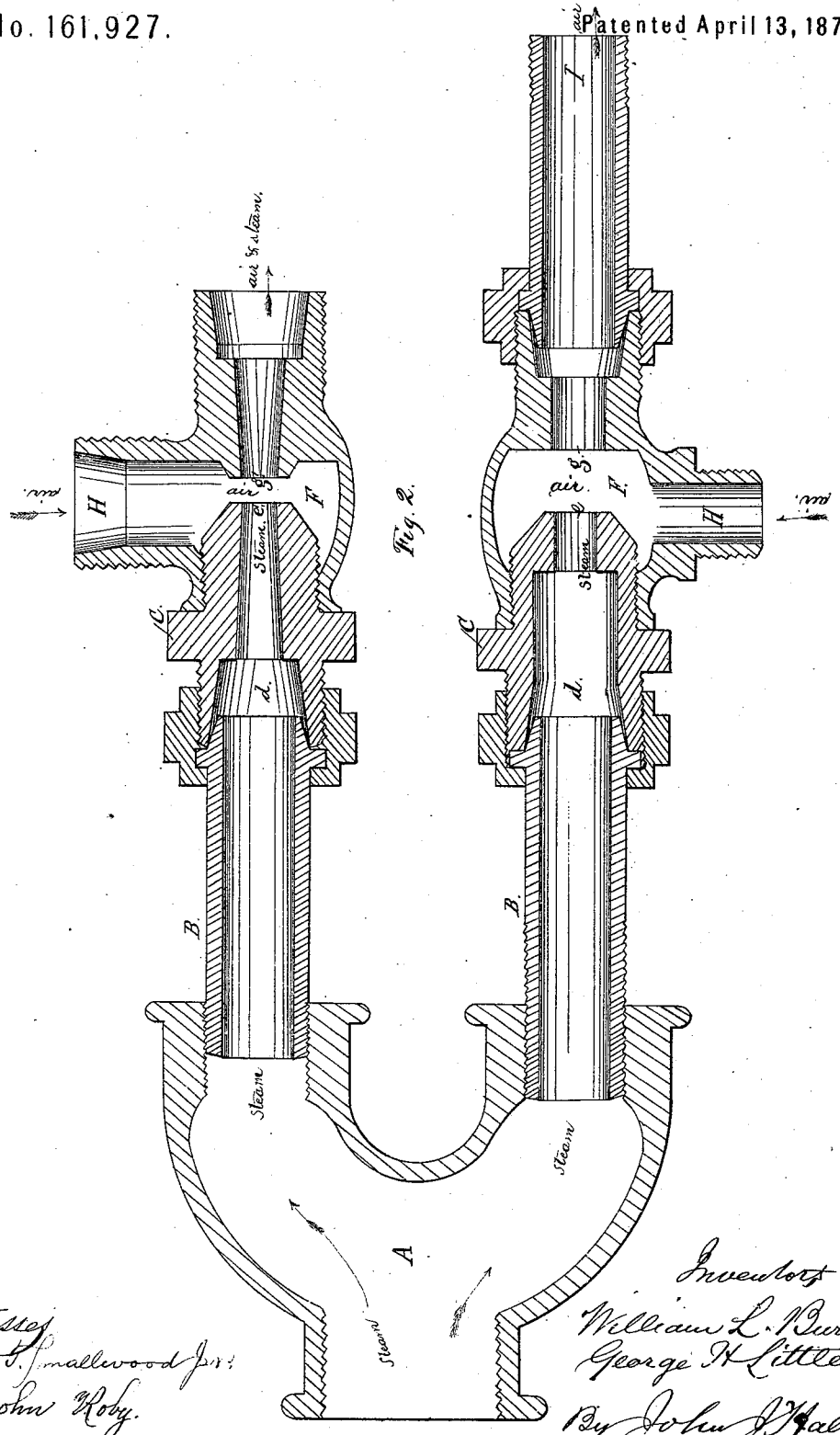

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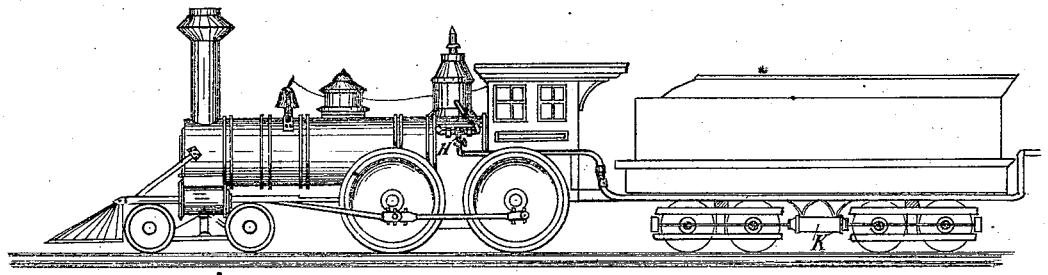

Fig. 3.

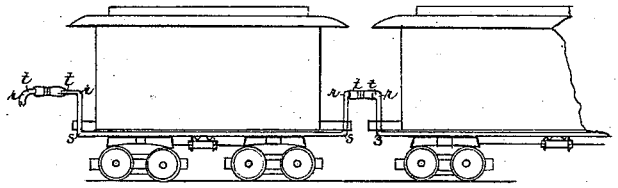

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Fig. 4.

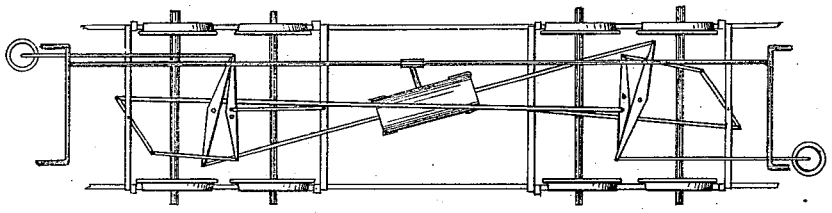
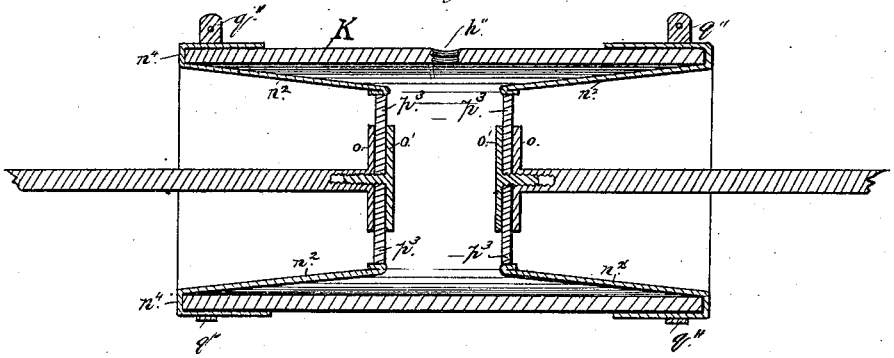


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM L. BURT, OF BOSTON, AND GEORGE H. LITTLE, OF PEABODY, MASSACHUSETTS.

IMPROVEMENT IN STEAM AND AIR BRAKES.

Specification forming part of Letters Patent No. **161,927**, dated April 13, 1875; application filed March 11, 1875.

To all whom it may concern:

Be it known that we, WILLIAM L. BURT, of Boston, Massachusetts, and GEORGE H. LITTLE, of Peabody, in the same State, have invented certain Improvements for Creating and Utilizing a Vacuum for Operating Brakes upon Railway-Cars; and we do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of our invention sufficient to enable those skilled in the art to practice it.

Our improvements consist in the combination, for operating a vacuum-brake mechanism, of a metallic cylinder, a flexible cylinder or cylinders within the same, and a solid piston or pistons; also, in the employment of a flexible cylinder within a metallic one, and connecting one end of the same to the metallic cylinder and its other end to the solid piston; also, in a special mode of securing the end of the flexible cylinder to the outer side of the metallic cylinder by means of a band or clasp; also, in combining, with the vacuum-cylinder, an air ejector or ejectors, operating as hereinafter set forth, for producing a vacuum for operating car-brakes; also, in combining, with the vacuum-cylinder and with the air-ejector, a special method of connecting the air or vacuum pipes from car to car, the connections operating self-closing valves.

Figure 1 represents a vacuum-creating mechanism in connection with the air-tube; Fig. 2, two vacuum-creating apparatus yoked together; Fig. 3, a locomotive-tender and cars having our improvement applied thereto; Fig. 4, an under-side view of a car, showing our brake-operating mechanism; and Fig. 5, the solid cylinder and flexible heads.

In the drawings, A, Fig. 1, is a yoke-tube for connecting the steam-pipe with two of the vacuum-producers or air-ejectors, as we prefer generally to use two or more, as being more powerful and efficient than one, this tube A being parallel with the connecting-tubes B, which unite A to the vacuum-producers or air-ejectors. This tube A, it will be seen, delivers steam to both tubes B in a direct line, in the same manner, at the same time, and with the same force, and without any back pressure at either, differing essentially in this respect from those cases where the steam-pipe running at right angles to two ejectors passes the inlet to the first before it reaches the second ejector, and consequently delivers steam more powerfully to the latter one, besides subjecting the former to back pressure.

Instead of the yoke A, a T-shaped or other equivalent coupling adapted to operate in the same manner as the yoke may be employed, or additional yokes or T-connections for additional ejectors.

C is a tube, having its inlet *d* much larger than its outlet *e*, and it may taper throughout. F is the vacuum-chamber, having its tube *g* considerably larger than the tube *e*, to preserve the full force of the steam, and so that air coming in at H and commingling with the steam from *e*, and being greatly expanded in volume by the heat, shall have ample space for exit, and not obstruct the rapid current of steam in quickly producing a vacuum in the cylinders. I is an outlet-tube to conduct the air and steam away after they have performed their duty; and it is made considerably larger than *g* to facilitate the exit.

The air-pipe H, which connects with the vacuum-cylinders on the cars, is furnished with a self-acting valve, U, to retain the vacuum upon the brake. Any appropriate valve will answer which will prevent the return of the air into the cylinder. The air-pipe H is also furnished with a cock, V, below the self-acting valve U, by means of which air is admitted to the cylinder and the pressure of the brakes released. When two inlet air-pipes, H, are used, they may be coupled together, so as to have a single inlet of the air, by means of a yoke like A, or any equivalent coupling.

The air-ejector may have its inlet and outlet taper toward each other, as shown at *g' e'*. In such case the smaller ends of those tapers are made of about the same size; but in such construction the action is less efficient than in the construction shown at *g e*. This air-ejector is found practically to be the most powerful and efficient in producing a vacuum,

and with two ejectors connected by the yoke the power for creating the vacuum is doubled and equal to any emergency demanded for operating car-brakes, and superior for that purpose to anything known to us. It will also be observed that all plugs or adjusting devices are dispensed with; the parts being once made and put together remain always fixed relatively to each other and ready for use; that there is no mere film, or sheet, or jet, or annular flow of steam passing into the tubes, but on the contrary a solid body of steam filling the entire tube, the passage being also carefully and designedly made of proper relative size to insure the best results, and without any need of after adjustment or variation.

We do not in this application claim the ejectors or vacuum-creating apparatus, but reserve the right to apply for a separate patent therefor, and also to apply for a separate patent for the self-closing valves described in this specification.

The mechanism to which we prefer to connect this vacuum apparatus to operate the car-brakes is constructed as follows: K is a tubular metal cylinder, (shown as a double-acting one, although it may be made single-acting,) and provided with a single opening, h'', to which we connect a pipe or hose leading to the pipe H above named, and through which the air is exhausted by means of the vacuum apparatus above described. This opening h'' also serves to return the air to the cylinder when the engineer wishes to remove the pressure and let the brakes off the wheels.

The springs, as ordinarily used to throw back the brake-beams of cars, will serve to draw the pistons back when the air is admitted at h'' and the brakes are let off from the wheels.

The piston-rod is connected to the part n^3 of the flexible cylinder by means of metal disks o o' in any appropriate manner, these disks being of considerably less diameter than the part n^3, leaving the flexible portion p^3 free to act. The piston rod or rods may be connected by chains, rods, or otherwise, and in any well-known manner to the brake mechanism of the car.

The operation is as follows: When the air is exhausted from the cylinder, leaving a vacuum or partial vacuum within it, the pistons (or the single piston, if one only be used) are forced inward by the pressure of the atmosphere, such pressure acting at the same time on the inner sides of the flexible cylinder, and causing the retroverted or doubled part n^4, which is turned over the edge of the end of the metallic cylinder, to hug and fit it closely, both upon its inside and outside, and thus to tend to tighten the joint when the strain is the greatest.

A solid cylinder, with our flexible internal cylinder, when the same is operated by the air-ejector, affords a more durable construction, and one less exposed to injury, than any mere elastic or collapsible folding contrivance having no piston and no exterior metal cylinder, and will wear much longer. Our piston-rods, as shown in Fig. 5, also have a freedom of action laterally, allowing them a sort of universal motion without affecting the action of the flexible cylinders.

The metal cylinder and the flexible cylinder are united by an outer band, q'', or otherwise by clamping the two together, so as to make a positively air-tight connection, substantially as shown in Fig. 5.

This flexible portion n^2 thus becomes a cylinder secured upon tne outside of, but located and working inside of, the metal cylinder K, being, as seen, bent over the edge of the end of this cylinder as it passes from its outer to its inner side. No holes need be made through this flexible part to secure it to its place, and the mode of securing it by an exterior band or clamp, q'', which encompasses the outside both of the flexible and metal cylinders, permits whatever strain may come upon the fastening to be exerted in a direction just the opposite of that which the cylinder receives within the metal one; and the action is, therefore, always to tighten the same on the metal cylinder, and cause it to hug more closely and air-tight, instead of to be strained or torn away from it. The flexible cylinder has also the advantages of allowing ample range of motion for the piston, of being protected within the metal cylinder from exposures to accidents from the outside, and also that, unlike other pistons, it needs no lubrication. The solid cylinder K may be made single-acting by attaching a flexible cylinder, n^2, to one end only, the orifice h'' being in such case located near one end of the metallic cylinder to exhaust the air in that direction.

When only one of the vacuum-exhausting apparatus or air-ejectors is used the yoke is, of course, not required. The air or vacuum pipe connecting the cars is turned upward and brought above the platform of the car, so that when two cars are to be coupled the pipes are easily accessible from the platform for coupling and uncoupling. When the cars are uncoupled by accident or otherwise a joint at r or s, permitting the horizontal part to be swung round parallel with the end of the platform and out of the way, also operates a self-closing valve in the pipe, preserving the apparatus in operative condition on the rest of the train. The necessary power to throw this joint around and close it may be by a spring self-acting when the pipes are disconnected.

We do not confine ourselves to any particular construction of vacuum apparatus, to be used in connection with our novel construction of cylinder and piston.

We claim—

1. In a vacuum car-brake, the combination of a metallic cylinder with flexible cylinders of nearly the same length of the metallic cyl-

inder, and a piston, substantially as and for the purposes set forth.

2. In a vacuum car-brake, the combination of a metallic cylinder with flexible cylinders of nearly the same length of the metallic cylinder, and a rigid piston having a yielding periphery, substantially as and for the purposes set forth.

3. The combination of the metal cylinder, the flexible cylinders, and the bands or clamps q'', for forming the joint and holding the cylinders together, substantially as and for the purposes set forth.

4. The combination of an air-ejector, the metallic cylinder, the flexible cylinder, the piston, and brake-levers, substantially as shown and described.

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