

(No Model.)

2 Sheets—Sheet 1.

J. GRESHAM.

AUTOMATIC VACUUM BRAKE APPARATUS.

No. 332,653.

Patented Dec. 15, 1885.

Fig. 1

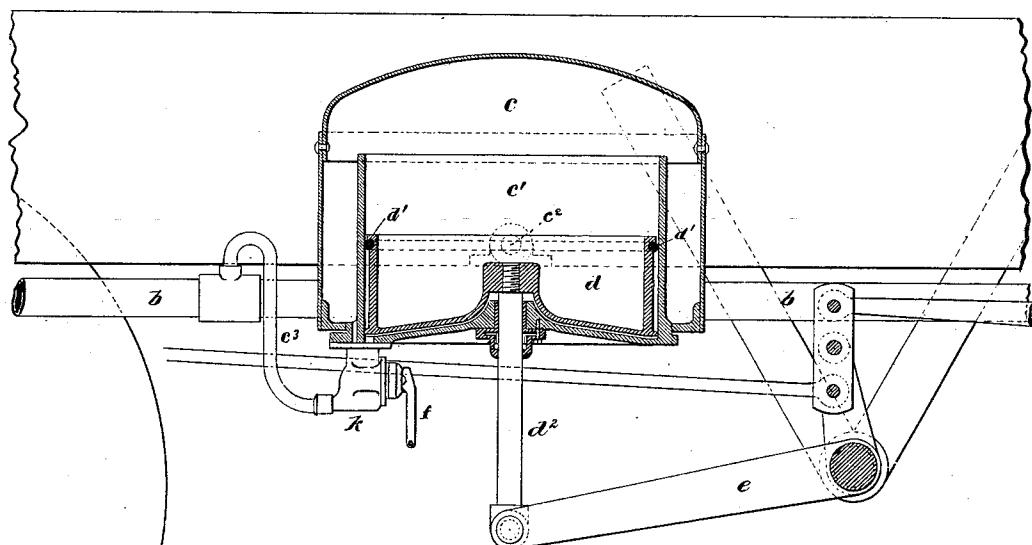
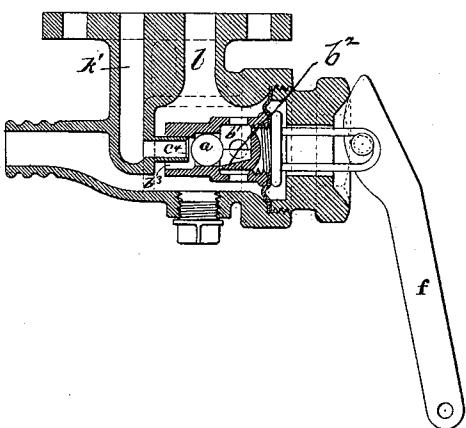


Fig. 2



Witnesses:

Charles R. Searle,  
M. A. Boyle.

Inventor:

James Gresham  
by his attorney  
James Drew Wilson

(No Model.)

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Fig. 3.

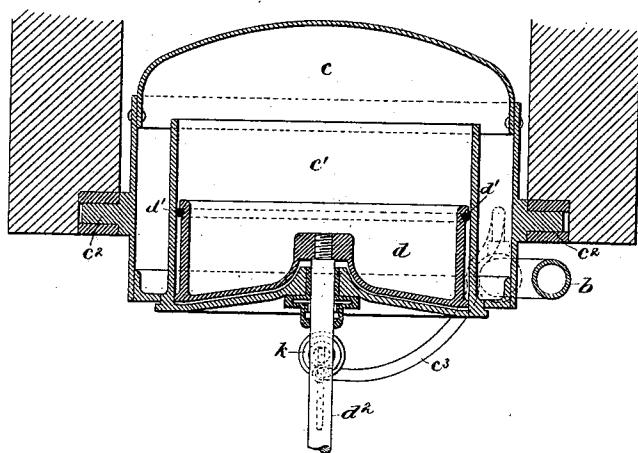
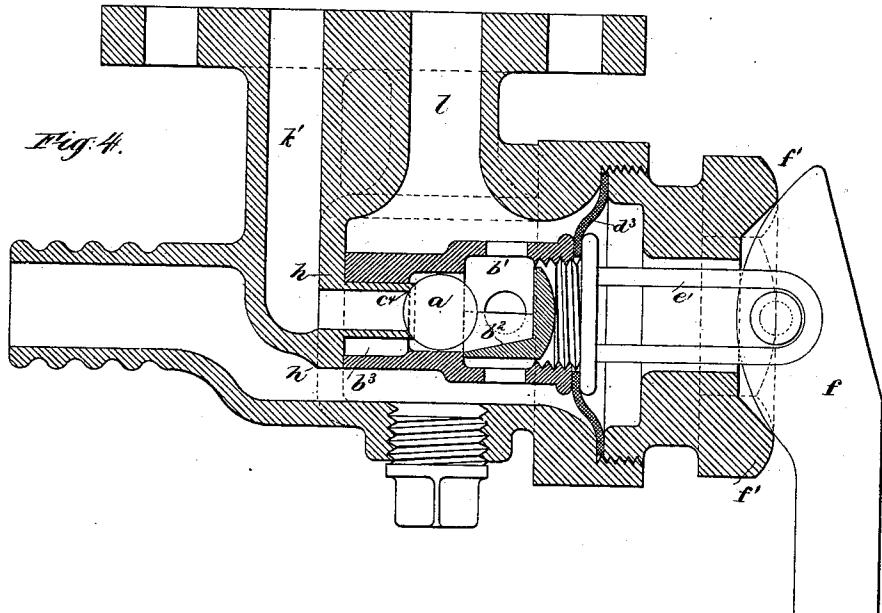


Fig. 4.



Witnesses:

Charles F. Searle,  
M. F. Boyle.

Inventor:

Jane Gresham  
by his attorney  
Thomas Drew Watson

# UNITED STATES PATENT OFFICE.

JAMES GRESHAM, OF SALFORD, COUNTY OF LANCASTER, ASSIGNOR TO THE VACUUM BRAKE COMPANY, (LIMITED,) OF 32 QUEEN VICTORIA STREET, COUNTY OF MIDDLESEX, ENGLAND.

## AUTOMATIC VACUUM-BRAKE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 332,653, dated December 15, 1885.

Application filed May 25, 1885. Serial No. 166,615. (No model.) Patented in England November 23, 1881, No. 5,109, and December 27, 1882, No. 6,171; in France March 6, 1883, No. 154,136; in Belgium March 7, 1883, No. 60,676; in Italy March 15, 1883, No. 15,231; in Austria-Hungary July 11, 1883, No. 9,791; in Victoria September 19, 1884, No. 3,846, and in New South Wales December 13, 1884, No. 1,539.

To all whom it may concern:

Be it known that I, JAMES GRESHAM, of the firm of Gresham & Craven, of Craven Iron-Works, Salford, in the county of Lancaster, England, have invented certain new and useful Improvements in or Applicable to Automatic Vacuum-Brake Apparatus, (patented to me in Great Britain, No. 5,109 of 1881, and No. 6,171 of December 27, 1882; 5 in France, No. 154,136, March 6, 1883; in Belgium, No. 60,676, March 7, 1883; in Italy, No. 15,231, March 15, 1883; in Austria-Hungary, No. 9,791, July 11, 1883; in Victoria, 10 No. 3,846, September 19, 1884, and in New South Wales, No. 1,539, December 13, 1884,) 15 of which the following is a specification.

My invention relates to an improved construction and combination of brake-cylinder, vacuum-chamber, and valve apparatus for 20 use in working automatic vacuum railway brakes.

Vacuum-brake apparatus constructed and arranged in accordance with my invention is represented in Figure 1 of the accompanying drawings, the valve apparatus appertaining thereto being shown to a large scale in the supplementary sectional view, Fig. 2. Fig. 3 is a cross-section taken at right angles to Fig. 1; Fig. 4, an enlarged view corresponding to 25 Fig. 2.

In Fig. 1, *c* is the vacuum-chamber; *c'*, the brake-cylinder. *d* is a piston furnished with a rolling packing-ring, *d'*. *d''* is a piston-rod communicating motion through the bell-crank 30 lever *e* to the brake-rods. The brake-cylinder may be considered a double one, having an outer part, *c*, closed and forming a vacuum-chamber, and an inner part, *c'*, for the piston *d* to work in. The part *c'* of the cylinder is 35 closed at its lower end and is open to the vacuum-chamber at its upper end. The cylinder *c* is mounted on trunnions *c''*, whereby it is enabled to adjust itself to the circular movement of the extremity of the vibrating lever 40 *e*. The piston-rod *d''* passes through a gland-packing, by preference of india-rubber composition. The valve-casing *k* is attached to the under side of the cylinder *c*, and commu-

nicates through a flexible tube, *c''*, with the train-pipe *b*, the connection being made 50 through a T-piece with ascending branch. There are two passages from the valve-casing *k*, one communicating with the cylinder *c'* on the under side of the piston *d*, and the other leading to the vacuum-chamber *c* and upper 55 side of the piston *d*.

In order that the construction and operation of the valve apparatus may be fully understood, I will proceed to describe the same with reference to Fig. 2.

The ball *a* is arranged in a passage or chamber, *b'*, having an inclined internal surface, so disposed as to induce the ball to roll toward its seating *c'*, where it arrives with its center approximately opposite the axis of the said seating, and against which it closes with little or no lift. The anterior portion of the passage *b'*, wherein the ball *a* rests when against the seating *c'*, is approximately of the same diameter as the ball, but sufficiently larger to allow 70 the ball to roll freely therein. The posterior portion of the passage is of considerably larger diameter than the ball, and is formed or fitted with an inclined internal surface, *b''*, whereon the ball rests, when forced, by the effect of 75 unequal pressure on its opposite sides, away from its seating. When the ball is in this enlarged portion of the chamber and upon the higher part of the incline, ample area of passage-way is presented for air to pass around 80 the ball. When the current of air ceases, the ball rolls down the incline and arrives in the narrow portion of the passage, ready to close against its seating on a very slight excess of pressure in the passage *b'* relatively to that 85 prevailing beyond the seating.

In ordinary working the brakes are released by restoring the vacuum on the train-pipe side of or below the piston in the brake-cylinder to that prevailing on the opposite side of the piston; but it is sometimes necessary to accomplish the same end by restoring equilibrium in another manner—that is, by destroying the vacuum on the reservoir side of or above the piston. For this purpose it is expedient to provide means whereby the ball-

valve may be unseated by hand. The chamber  $b'$ , inclosing the ball  $a$  as in a cage, is accordingly mounted to slide longitudinally. It is carried at one end on a tubular neck forming the valve-seating  $c^4$ , and is mounted at the other end in a flexible diaphragm,  $d^3$ , of leather or other suitable material. To a prolongation,  $e'$ , outside the diaphragm  $d^3$ , is attached a lever,  $f$ , which, bearing on the part  $f'$  as a fulcrum, serves, when operated either way, to draw the valve-carrier  $b'$  outward and to remove the ball from its seat  $c^4$ , the internal diameter of the carrier beyond the ball being smaller than that of the latter. The bearing-surface of the valve-carrier  $b'$ , sliding on the neck of the seating  $c^4$ , is grooved longitudinally, as shown at  $b^3$ , so that when the ball-carrier or cage is withdrawn a short distance and the ball lifted from its seat, air is enabled to enter from the train-pipe  $b$  between the extremity of the ball-carrier and the surface of the body  $h$ , and so by way of the passage  $b^3$  to the branch  $k'$  without having to pass the ball-valve  $a$ . By these means air may be rapidly admitted to the reservoirs, and without the necessity of actually holding the valve off its seat by means of the handle  $f$  until the vacuum is completely destroyed. On recreating vacuum in the train-pipe  $b$  the first effect is for the diaphragm  $d^3$  to be pressed inward and for the ball-valve carrier  $b'$  to be moved longitudinally until the inner extremity of the latter, seating against the surface of the body  $h$ , shuts off communication through the groove or grooves  $b^3$ , whereupon the apparatus is again in order for automatic working, ejection of air from one side of the brake-piston being effected by way of the passage  $l$  and ultimately from the opposite or vacuum chamber side of the brake-piston by way of the passage  $k'$  and past the ball-valve  $a$ .

Having fully described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The improved automatic vacuum-brake apparatus, constructed and working substantially as herein described, and consisting of a brake-cylinder open at one end to and inclosed within a vacuum-chamber, the piston packed as shown, and operated by means of ball-valve apparatus in connection with the train-pipe, and communicating directly with one end of the brake-cylinder and with the vacuum-chamber, respectively. 45

2. The use, in automatic vacuum-brake apparatus, of a ball-valve mounted in a movable carrier having chambers of three diameters, respectively smaller, slightly larger, and considerably larger than that of the ball-valve, the chamber having the largest diameter being 60 provided with an inclined surface for the purpose of causing the valve to roll toward its seating against which it closes with a very slight, if any, lift, substantially as described. 55

3. The lever  $f$  and connections, as described, 65 for manually releasing the valve from its seat, the same consisting of a tubular carrier having a part beyond the valve of contracted diameter, the said carrier being attached to a flexible diaphragm or equivalent device, 70 whereby the valve is enabled automatically to resume its working position on vacuum being recreated.

4. The improved means, substantially as described, for rapidly admitting air from the 75 train-pipe direct to the vacuum-chamber without passing around the ball-valve, such means consisting of the valve-carrier  $b$ , having longitudinal internal grooves,  $b^3$ , the open neck  $c^4$ , and pipe  $c^3$ , all arranged to serve with the 80 piston-cylinder and train-pipe  $b$ , as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES GRESHAM.

Witnesses:

PETER J. LINSEY,  
JAMES WOOD.