(No Model.) 2 Sheets—Sheet 1.

R. G. COATES.

AIR BRAKE.

No. 467,920. Patented Feb. 2, 1892.

Fig. 1.

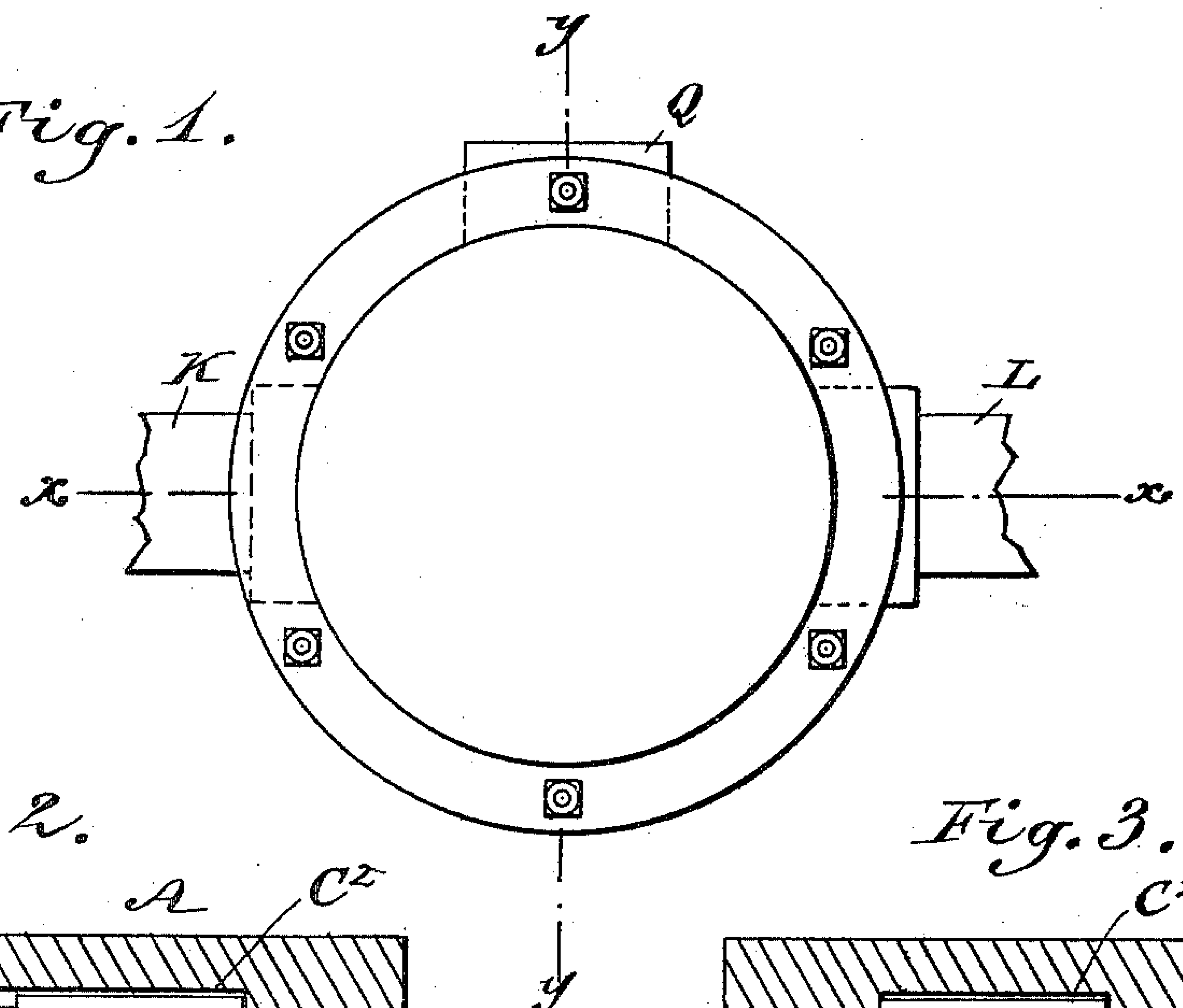


Fig. 2.

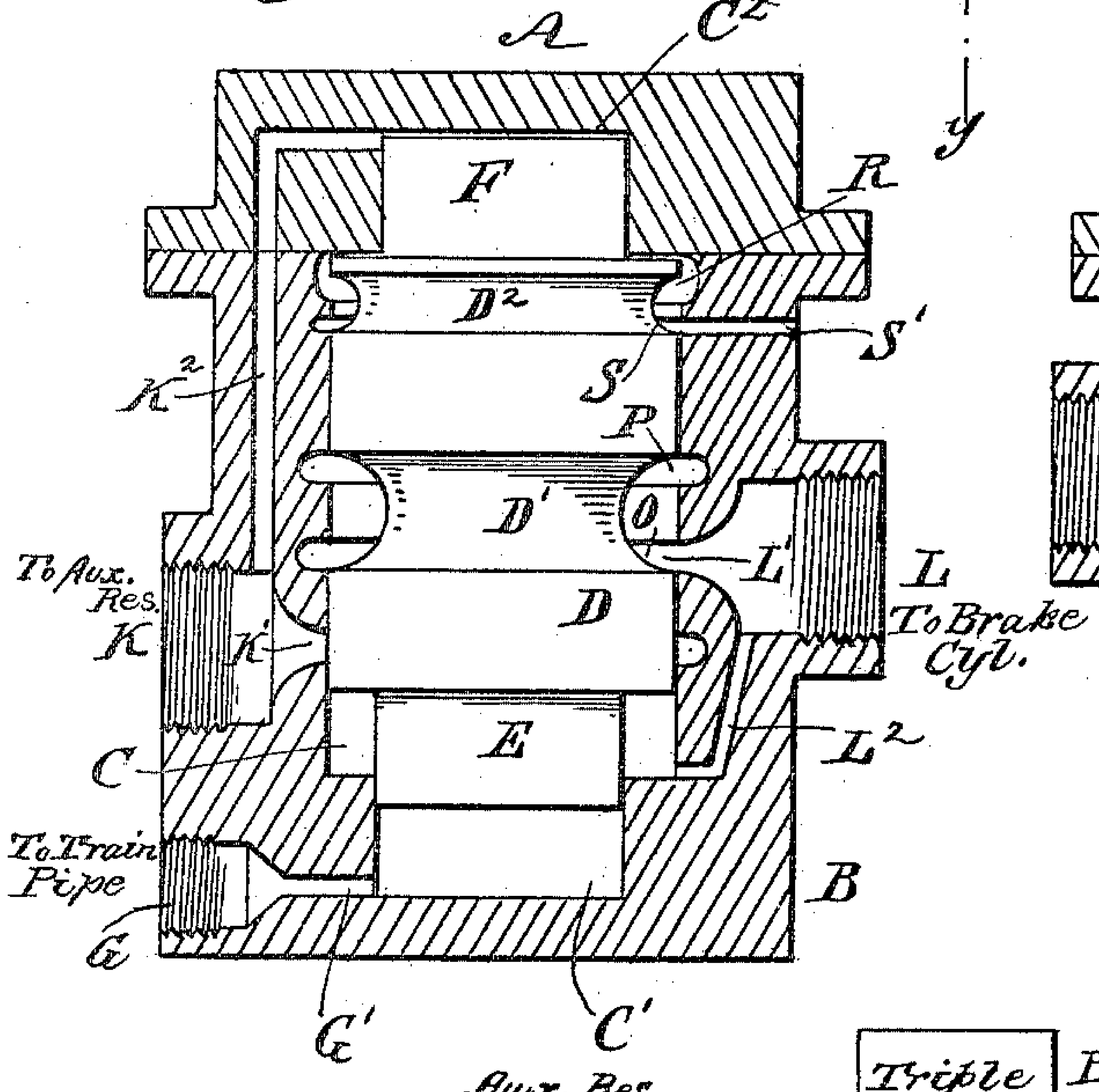


Fig. 3.

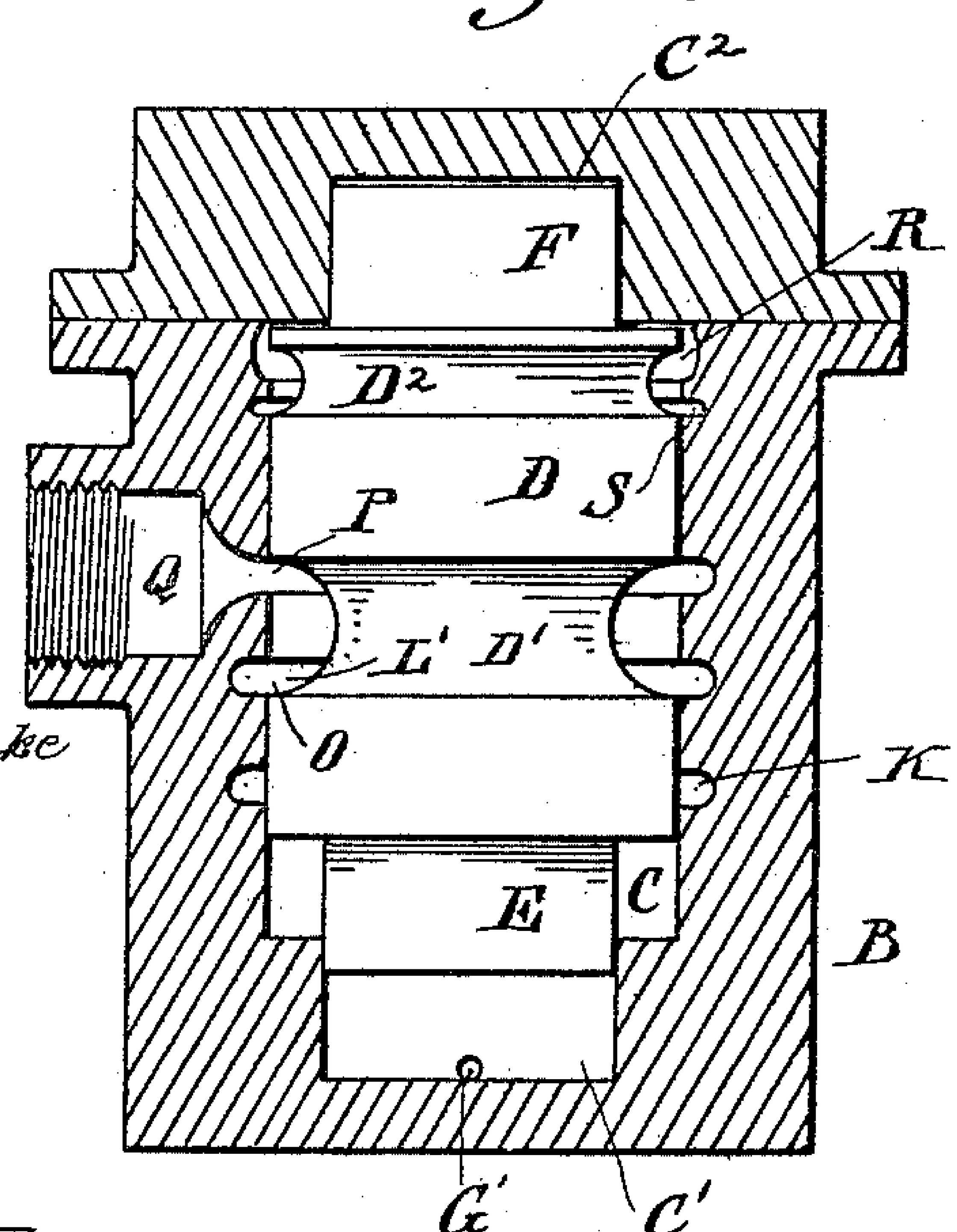
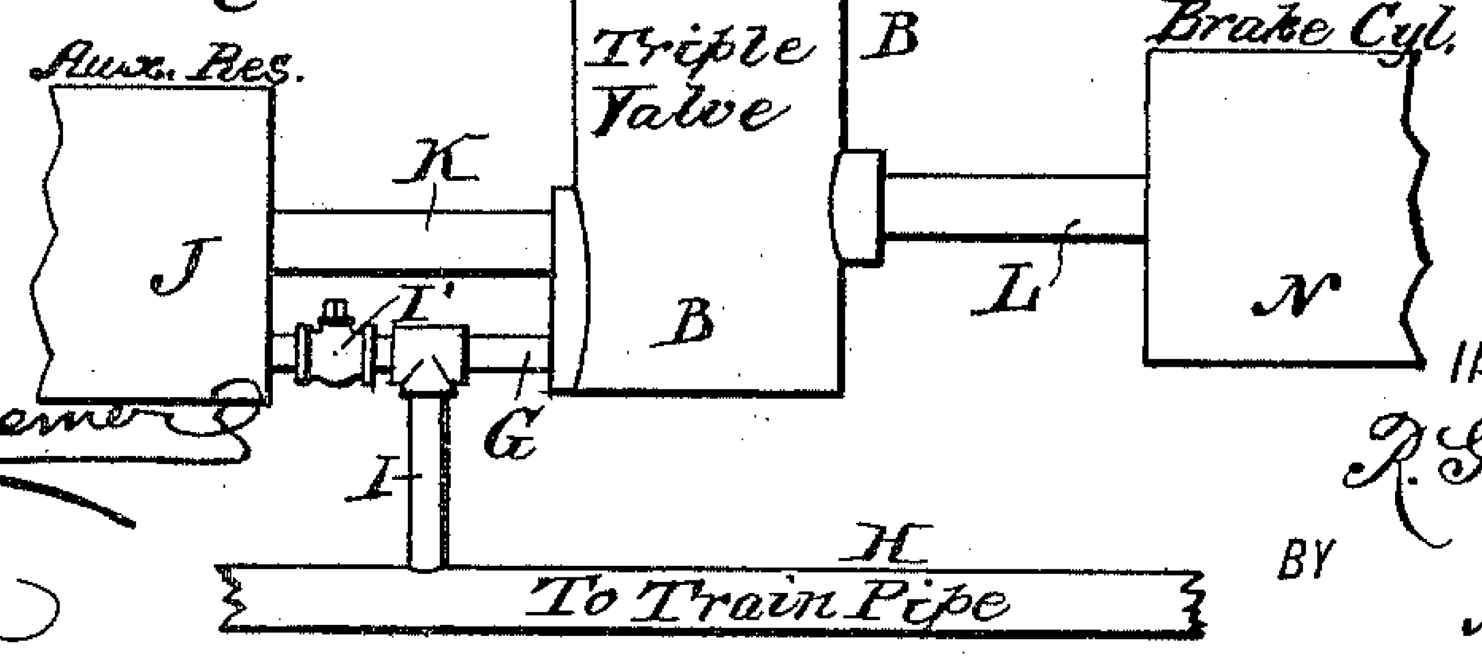


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

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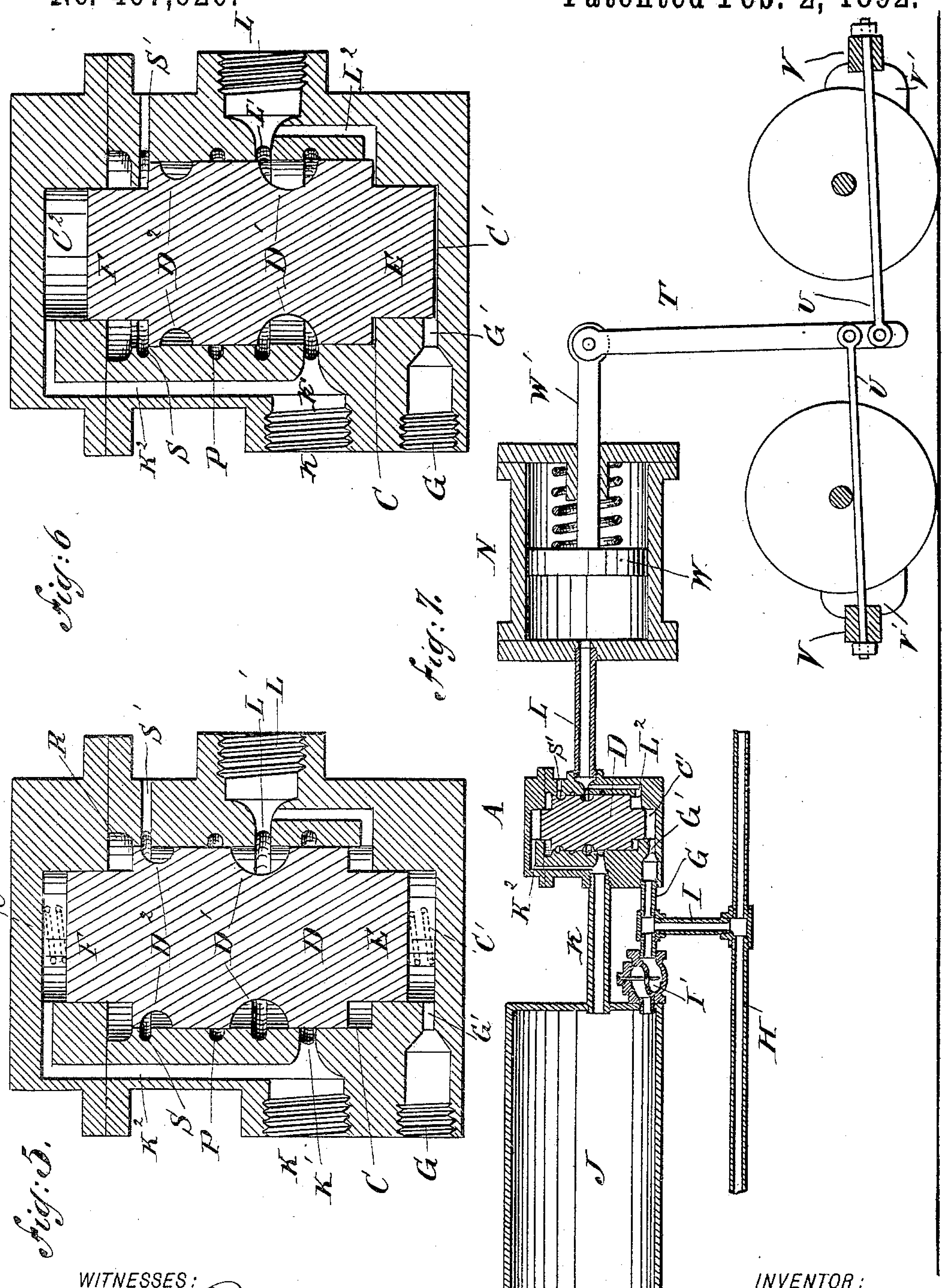

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UNITED STATES PATENT OFFICE.

RAY G. COATES, OF PUNTA ARENAS, COSTA RICA.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 467,920, dated February 2, 1892.

Application filed June 9, 1890. Serial No. 354,728. (No model.)

To all whom it may concern:

Be it known that I, RAY G. COATES, a citizen of the United States, at present residing in Punta Arenas, Costa Rica, Central America, have invented new and useful Improvements in Air-Brakes, of which the following is a full, clear, and exact description.

My invention relates to automatic air-brakes, being that class in which the brakes are set by a reduction of the pressure in the train-pipe.

The object of my invention is to furnish an improved triple valve by which the brake-cylinder may be supplied with air at the full auxiliary-reservoir pressure or at any part of that pressure less than the maximum, by which when the brakes are set any loss in the brake-cylinder pressure due to leakage will be restored from the auxiliary-reservoir-pressure, and which may be used in connection with an auxiliary reservoir of such a size that the pressure in the latter does not noticeably fall by the loss of one charge of air to the brake-cylinder. This I accomplish, mainly, by adding to a triple valve an auxiliary governing-piston, which latter is connected to and moves with the main governing-piston of the triple valve. I connect the cylinder of this auxiliary piston by proper ports with the brake-cylinder, so that any pressure that may be in the said brake-cylinder will tend to move the auxiliary piston, and consequently the main governing piston, to which it is attached.

The method of applying the invention is clearly shown in the accompanying drawings, in which similar letters refer to similar parts in all the figures.

Figure 1 is a plan view of my improvement. Fig. 2 is a sectional view of the valve-casing on the line X X of Fig. 1, with a side elevation of the piston-valve. Fig. 3 is a sectional view of the valve-casing on the line Y Y of Fig. 1 and a side elevation of the valve; Fig. 4, a diagram of the train-pipe, auxiliary reservoir, triple valve, and the brake-cylinder; Fig. 5, a sectional view of the valve and casing on the line X X of Fig. 1, the valve here being shown at half-stroke; Fig. 6, a similar view to the above, but with the valve in position to admit air to the brake-cylinder; Fig. 7, a general sectional view showing my improved valve and the necessary accessories for a complete working brake, the position being that in which the brakes are not set at the maximum pressure.

Referring to the drawings, the improved governing or triple valve A is provided with a casing B, in which casing is formed a cylindrical cavity C. At each end of the cavity C and on the same axis are formed cylindrical recesses C′ and C^2, of less diameter than the main cavity C. In the main cavity C is fitted to slide a piston D, provided with two circumferential grooves D′ and D^2 and with cylindrical offsets E and F, fitting into the recesses C′ and C^2. Into the recess C′ opens a port G′, connected with a branch I of the train-pipe H. A check-valve I′ is interposed between such branch I and the auxiliary reservoir J to prevent return of air from the latter into the train-pipe. The auxiliary reservoir J is connected by the pipe K to the casing B and opens into an annular groove K′, formed on the surface of the cavity C around the piston-valve D. The pipe K also opens into a passage or port K^2, leading to the cylindrical recess C^2, as is plainly shown in Fig. 2. The casing B is also connected by a pipe L with the brake-cylinder N, the said pipe L leading into an annular groove L′, formed on the surface of cavity C around the piston-valve D. A passage L^2 is formed leading from the pipe L to the lower end of the cavity C. In the cavity C is also formed a circumferential groove P, adapted to be connected with the groove L′ by means of the groove D′ in the piston-valve D, as shown in Fig. 2. D′ also connects groove L′ to groove K′, as shown in Fig. 6, but not at the same time that it connects L′ to P. The groove P opens into an exhaust-port Q. (Clearly shown in Fig. 3.) The cavity C contains, also, at the upper end two additional annular grooves—S vented to the atmosphere by an opening S′ and R not vented to the atmosphere by a special opening. The circumferential groove D^2 in the valve D connects R and S in certain positions of D, as in Fig. 2. Neither the port G′, connecting the train-pipe H to the recess C′, nor the port K^2, connecting the auxiliary reservoir J to the recess C^2, nor the port L^2, connecting the brake-cylinder N to the lower end of cavity

C, are ever to be entirely closed by the movements of the piston-valve D. Consequently the parts C′ C^2 and the lower end of C are always subject to whatever pressure may be in the parts of the brake apparatus to which they are respectively connected. The pipe L connects with the brake-cylinder N, containing the piston W and rod W′, which latter is connected by the lever T, rods U U, brake-beams V V to the brake-shoes V′ V′, by which the pressure is applied to the wheels. The piston W is retracted for releasing the brakes by the spring shown in Fig. 7. Upon pressure passing into the train-pipe the auxiliary reservoir J fills through I and is retained by I′. C′ also fills through the port G′. Valve D moves upward, owing to the pressure upon the lower end of E. The pressure in J passes through K to K′ and also by the port K^2 to the recess C^2. Upon the equalization of pressure between the train-pipe H and auxiliary reservoir J the pressure in C^2 will equal that in C′. If the axis of the valve is vertical and the diameter of E is slightly greater than that of F, the piston D will remain in the position shown in Fig. 2. If the axis of D is horizontal, no increase in the diameter of E over F is necessary to keep D in the position shown in Fig. 2. In this position the groove K′ is separated from the groove L′ by the piston D. L′ is connected to P by the groove D′ in the piston-valve D. The brake-cylinder pressure consequently is relieved by the pipe L, groove L′, groove D′, groove P, and port Q to the atmosphere. (Shown clearly in Figs. 2 and 3.) If the train-pipe pressure is now partially relieved, recess C′ likewise loses an equal pressure through G′; but C^2 still is subject to the full auxiliary-reservoir pressure through the port K^2. Therefore the piston D moves down to the lower end of cavity C, the air in the lower end of said cavity C finding an outlet through L^2 into L. In this position (shown in Fig. 6) the groove D′ connects the grooves K′ and L′, and consequently the pressure in the auxiliary reservoir has a passage through pipe K, groove K′, groove D′, groove L′, pipe L to the brake-cylinder N, thereby moving the piston W, and, through the connections, setting the brake-shoes against the wheels, as is clearly shown in Fig. 7. If the piston D remained in this position any considerable time, the pressure in the brake-cylinder N would equal that in the auxiliary reservoir J. Therefore it is desirable to move D sufficiently toward C^2 to close the connection between K′ and L′, and thus cut off the air-supply from the auxiliary reservoir J. The port L^2 accomplishes this, for while the pressure has been passing to N through L it has also been passing through L^2 and acting upon the annular under area of D, tending to move it (the piston D) in the direction of C^2. This movement of D will not begin until the pressure on the annular under end of D, admitted by L^2, equals the amount of pressure lost by E through C′, G′, and G upon the reduction of the train-pipe pressure. By this means the pressure rising in the brake-cylinder upon the admission of the auxiliary-reservoir pressure prevents an increase of the brake-cylinder pressure beyond a point determined by the reduction in the train-pipe pressure. If the annular under area of D is equal to the area of offset E, the rise in the brake-cylinder pressure before the valve D begins to move will equal the loss of pressure in the train-pipe. Unless checked the piston D, having cut off the communication between the brake-cylinder and the auxiliary reservoir, would not stop short of the exhaustion of a portion of the pressure in L through D′, P, and Q. The annular grooves R S and vent S′ are for the purpose of forming a temporary resistance when the groove D′ is approaching the exhaust-groove P. This is shown in Fig. 5. The upper end of the piston D having passed the groove S and vent S′ has confined the air in its advance. A resistance is thus formed, which continues until the groove D^2 connects R and S, when the air in advance of D passes out through R, D^2, S, and S′ to the atmosphere. The connection between the groove D^2 and groove R should occur slightly before the groove D′ reaches the exhaust-groove P. This resistance is to be adjusted so that it is sufficient merely to check the momentum of the valve D. The piston D remains in this position (shown in Fig. 5) until there is a change in the pressure of either the train-pipe, auxiliary reservoir, or brake-cylinder. If the brake-cylinder leaks air and the pressure falls, the equilibrium of the piston D is disturbed by the loss of pressure through the passage L^2. The piston D then moves down, connecting K′ and L′ by the groove D′, and the pressure in the brake-cylinder is restored by a sufficient supply from the auxiliary reservoir J, the cut-off occurring as in the first instance. If the train-pipe pressure is further relieved, the piston D falls and admits enough air to the brake-cylinder to again raise D and cause the cut-off. If the train-pipe pressure is increased, the piston D rises against the resistance caused by the air in the groove R until this resistance is eliminated by the connection of R and S by D^2 and consequent relief through S′, and the groove L′ and P are then connected by D′. The brake-pressure then exhausts through L, L′, D′, P, and Q to the atmosphere and the lower end of C through L^2, L, L′, D′, P, and Q. If the train-pipe pressure is raised, but not sufficiently to equal the pressure in the auxiliary reservoir J, the piston D permits only so much loss of pressure in the brake-cylinder as will again restore the equilibrium of D. When the piston D moves toward C′, the groove D^2 closes the connection between R and S immediately after the groove D′ has closed that between L′ and P. The air in R then becomes rarefied and the resistance to the movement of the piston D is one of suction instead of compression, as when going toward C^2. If the train-pipe pressure is fully restored, the piston D rises to its original position and the brakes are released, and whatever loss of pressure has been suffered by the auxiliary reservoir is supplied by the train-pipe. Practically the auxiliary-reservoir pressure will always fall to a certain extent; but with this form of valve such a fall is not essential for the regulation of the brake-cylinder pressure, and therefore the auxiliary-reservoir capacity can be increased to any extent.

In using a piston-valve, as shown, its inertia should be as small as possible, since this will reduce the amount of resistance necessarily furnished by R and S. To this end the piston D may be partially bored lengthwise in order to reduce its weight. The boring had best be done from the end F, as this does not increase the capacity of the recess C′ and consequently the amount of air to be discharged from the train-pipe. The boring is not to pass clear through D.

The figures show the method of construction that I prefer, since in it there is but one moving part.

When the train-pipe pressure equals the auxiliary-reservoir pressure, any pressure in the brake-cylinder will operate upon the piston D through the port L^2, moving said piston toward the end C^2, and thereby relieving the brake-cylinder of pressure, upon which the spring in C^2 presses the piston D back to the middle position, the piston D having been relieved at the same time as the brake-cylinder from pressure. If the train-pipe pressure is lowered below that of the auxiliary reservoir, the auxiliary-reservoir pressure moves D toward C′, thereby admitting pressure to the brake-cylinder and also, through L^2, to the under area of D. When the pressure accumulating on D through L^2 equals the loss of E due to the fall of the train-pipe pressure, the piston D will be in equilibrium as to the pressure governing it and the spring in C′ will move said piston to its middle position. The pressure in the brake-cylinder remains at this point so long as there is no change in the train-pipe pressure. In case of a leakage of pressure from the brake-cylinder the equilibrium of the piston D would be disturbed, and the piston D would consequently, owing to the loss of pressure from D through L^2, move toward C′, thereby again opening the connection between the auxiliary reservoir and the brake-cylinder and the pressure lost would be restored, the cut-off occurring as in the first instance.

In proportioning the areas of the piston-surfaces of this triple valve it is not necessary that they be all of equal area. If the area of E is equal to the lower annular area of D, then the brake-cylinder pressure upon the opening of the valve will equal the loss of pressure in the train-pipe. If the area of E is twice as great as the under annular area of D, then the brake-cylinder pressure will equal twice the loss in the train-pipe.

By properly proportioning the above-mentioned areas the pressure permitted to rise in the brake-cylinder may be made any multiple of the pressure lost in the train-pipe.

I am aware that triple valves governed by the opposition of the train-pipe and auxiliary-reservoir pressures, springs to hold triple valves in any desired position, piston triple valves, and slide-valves combined with the piston of a triple valve are all old devices at the present day. These I do not claim.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an automatic air-brake system, the combination of the train-pipe, auxiliary reservoir, and brake-cylinder with a triple-valve casing having ports admitting pressure to and exhausting the same from the brake-cylinder, also provided with recesses in its ends, which are of less diameter than the intermediate portion of said casing, a compound governing-piston of three areas, one of said areas being fitted to one of said end recesses, another area to the intermediate portion of the said casing, and the third of the said areas to the other of the said recesses, the connections or passages K, G, and L leading, respectively, to the auxiliary reservoir, the train-pipe, and the brake-cylinder and to the said end recesses and intermediate portion of said valve-casing, substantially as shown, whereby one area of said governing-piston is exposed solely to the pressure of the train-pipe and another area solely to the pressure of the brake-cylinder, the combined pressures on these two areas jointly opposing the pressure applied to the third area by the auxiliary reservoir, as and for the purpose specified.

2. In an automatic air-brake mechanism, the combination of the piston E, its cylinder C′, and port G′, leading to said cylinder C′ from the train-pipe, the piston D, its cylinder C, and port L^2, leading from the brake-cylinder to said cylinder C, and the piston F, its cylinder C^2, and port K^2, leading from the auxiliary reservoir to the said cylinder C^2, whereby the joint pressures of the train-pipe and brake-cylinder operate upon the governing-piston in opposition to the pressure of the auxiliary reservoir, for the purpose specified.

The foregoing specification of my new and improved air-brake signed by me, this 28th day of April, 1890, in the presence of the below-subscribed witnesses.

RAY G. COATES.

Witnesses:

FRANCO. CLAVEROFF,
INOFRE XATNICH.