

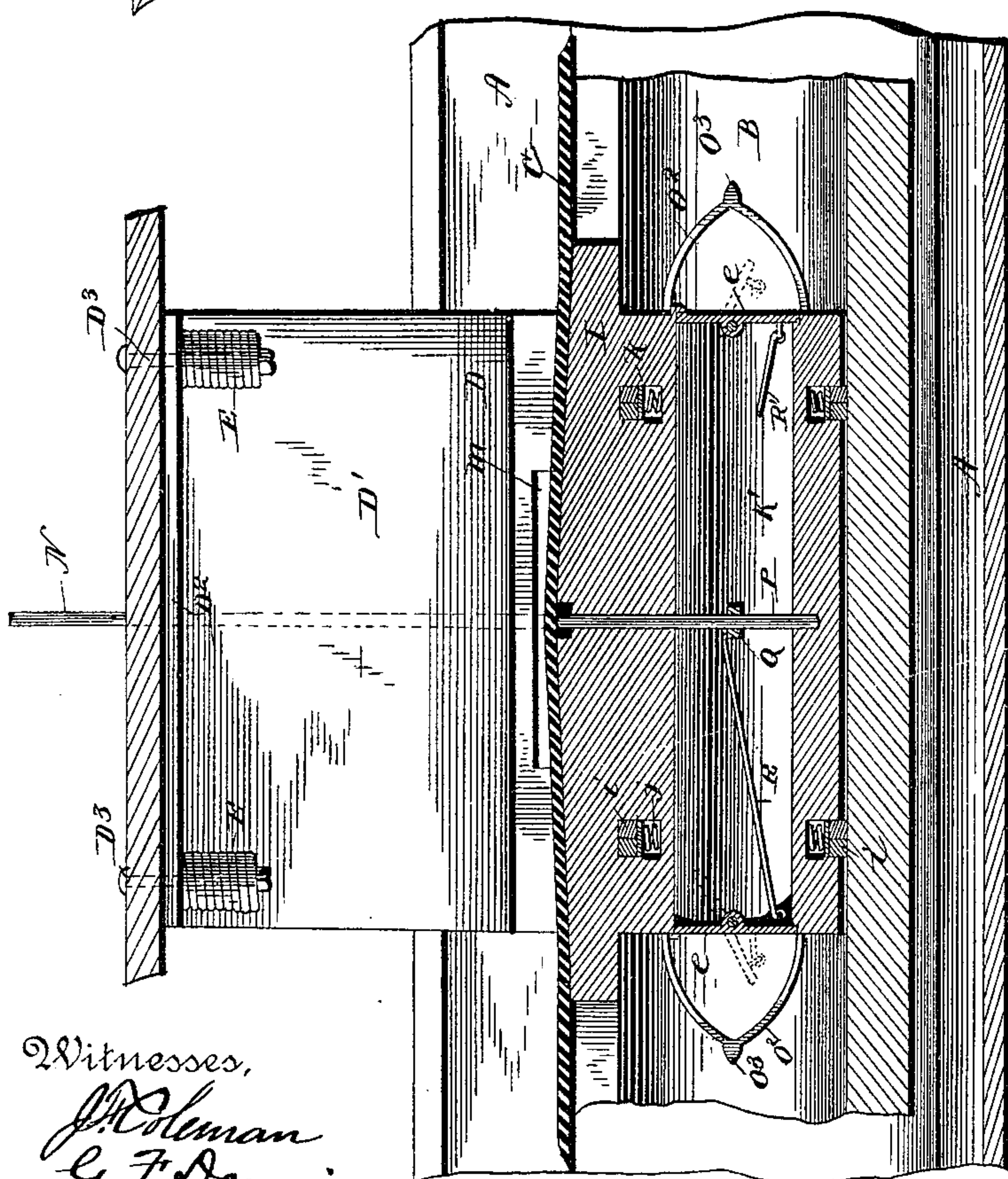
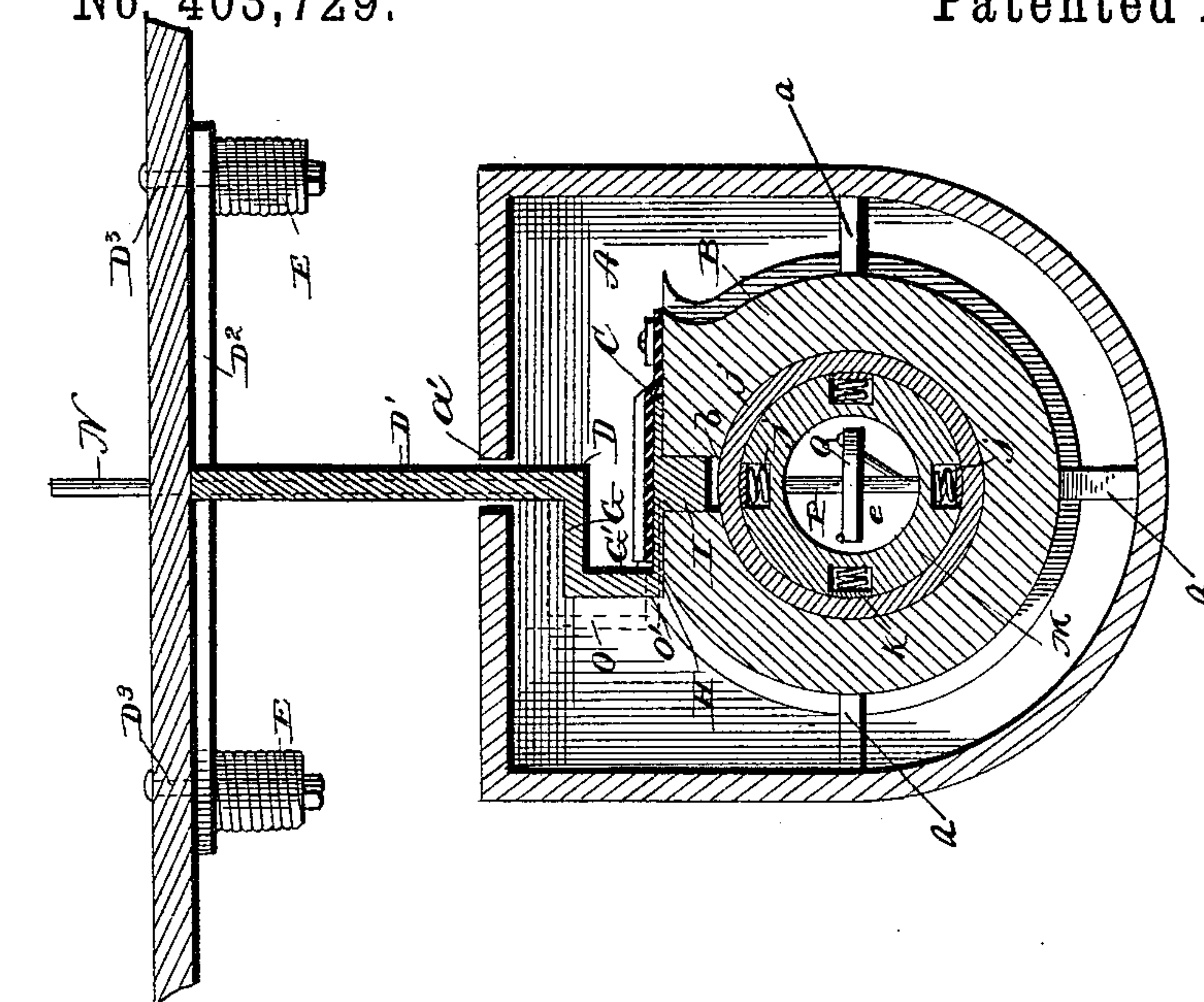
(No Model.)

3 Sheets—Sheet 1.

M. BODEFELD.  
PNEUMATIC RAILWAY.

No. 403,729.

Patented May 21 1889.



Witnesses,

J. Coleman  
G. F. Downing.

Inventor  
M Bodefeld.

By his Attorney  
H. A. Szymann.

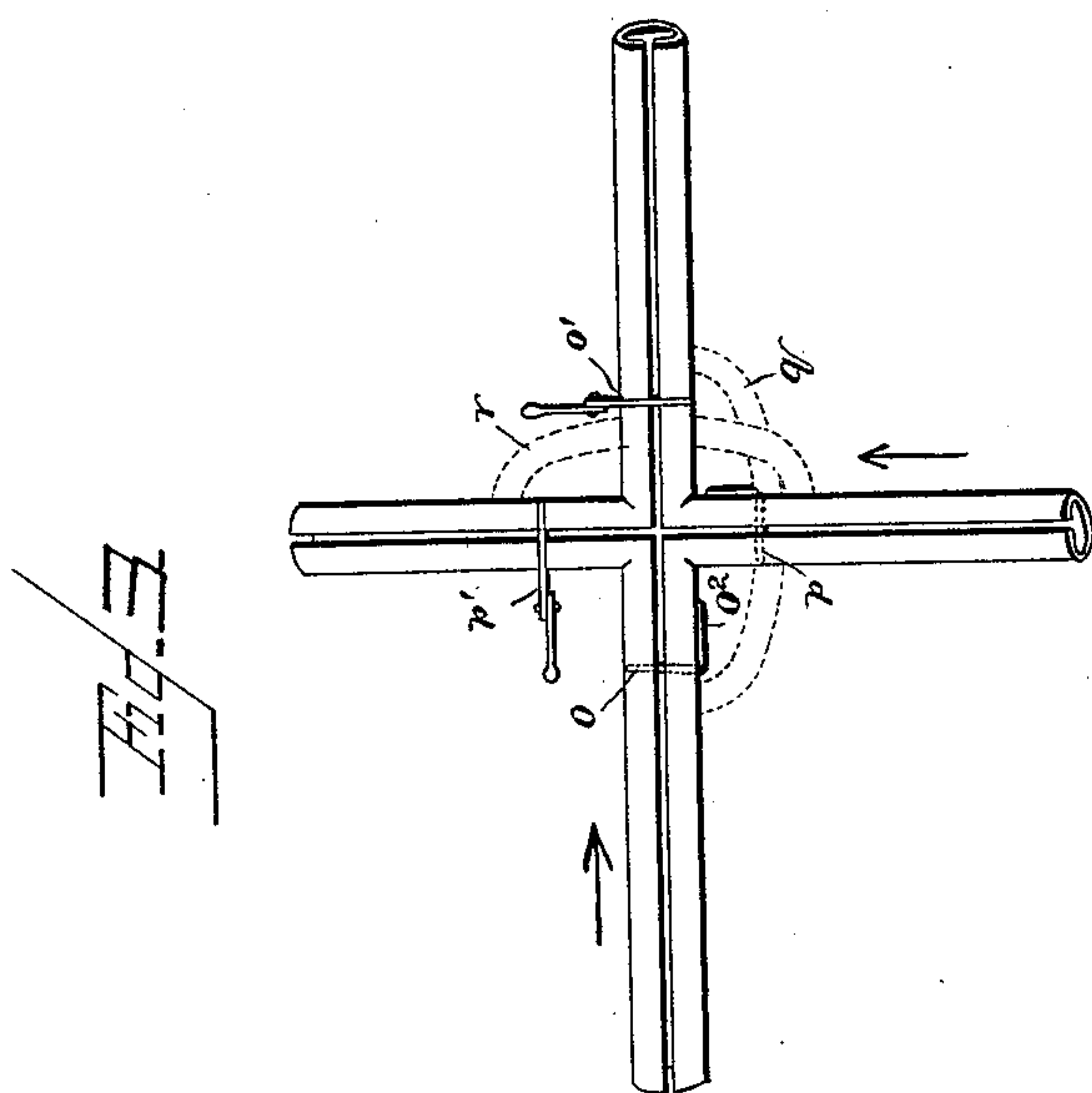
(No Model.)

3 Sheets—Sheet 2.

M. BODEFELD.  
PNEUMATIC RAILWAY.

No. 403,729.

Patented May 21 1889.



Witnesses,

*J. Coleman*  
*G. F. Downing.*

Inventor,  
*M. Bodefied.*

his Attorney  
*H. A. S. S. S. S.*



(No Model.)

3 Sheets—Sheet 3.

M. BODEFELD.  
PNEUMATIC RAILWAY.

No. 403,729.

Patented May 21 1889.

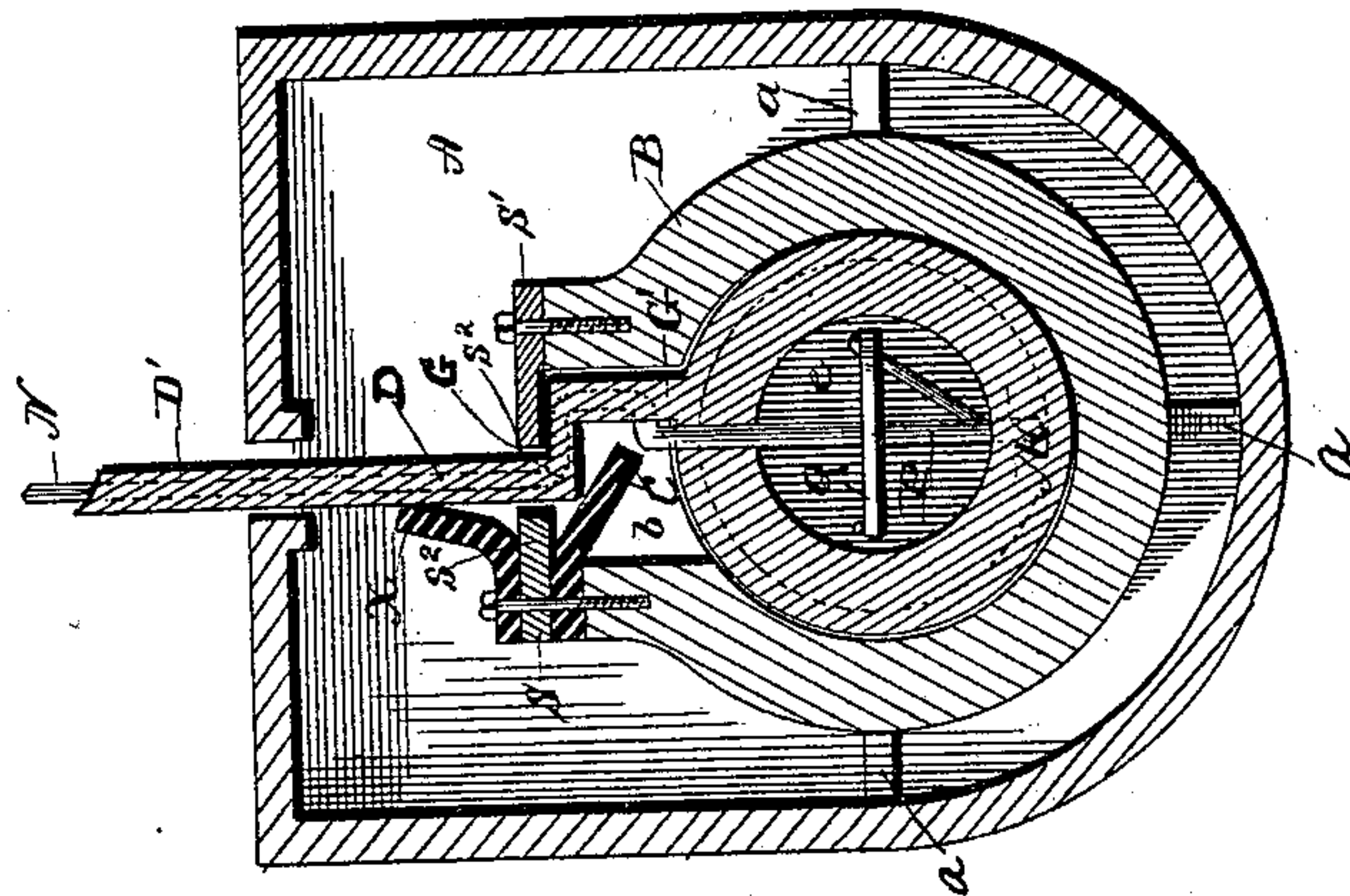


Fig. 5.

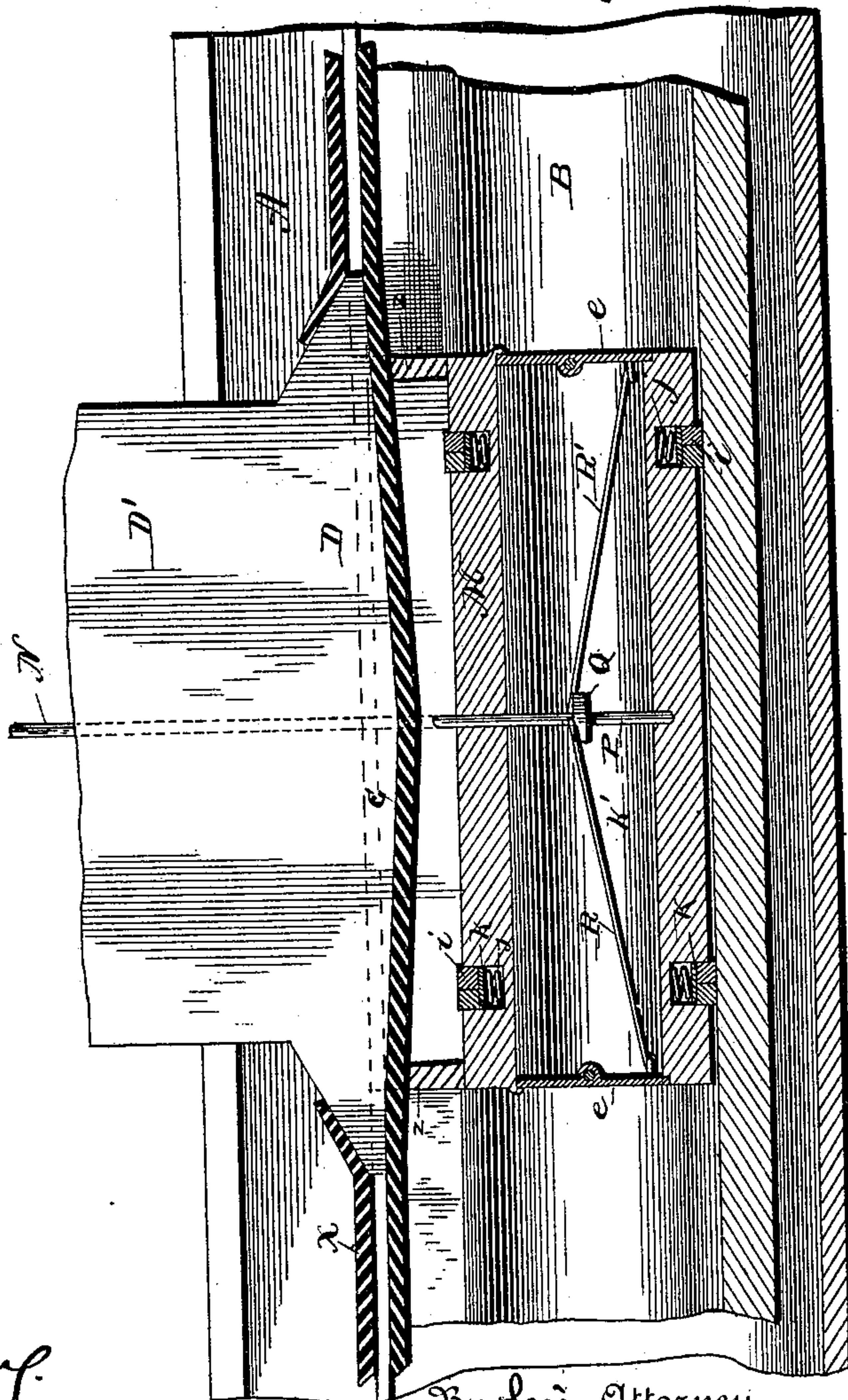


Fig. 4.

Witnesses  
*J. Coleman*  
*L. F. Downing*

Inventor  
*M. Bodefled.*

By his Attorney  
*H. A. Symmes*



# UNITED STATES PATENT OFFICE.

MEINOLPH BODEFELD, OF ST. LOUIS, MISSOURI.

## PNEUMATIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 403,729, dated May 21, 1889.

Application filed November 23, 1887. Serial No. 255,985. (No model.)

*To all whom it may concern:*

Be it known that I, MEINOLPH BODEFELD, of St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Pneumatic Railways; 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.

My invention relates to an improvement in pneumatic railways.

Prior to my invention in the construction of pneumatic railways the car has been provided with a depending portion to enter a tube and has been there connected with a piston. With such arrangements a flap was necessary to cover the opening in the tube and prevent the escape of the compressed air contained therein for propelling the piston, or to prevent the admission of air when exhaust-air devices were employed, and to retain this flap to its seat various devices have been employed which have rendered the system of such railways unnecessarily complicated and expensive, owing to the large number of parts used.

It is the object of my present invention to simplify and cheapen the construction of pneumatic railways, and at the same time render the same effective in operation.

A further object is to provide a tube from which the air is exhausted with a flap of elastic material to cover a longitudinal opening in the tube, and that will be held firmly to its seat by suction produced by a partial vacuum in the tube.

A further object is to so construct the bracket attached to the car and which passes through the opening in the tube that it shall raise the above-mentioned flap to permit its passage, and in such a manner that little or no air will find its way into the tube.

A further object is to furnish the hollow piston which passes through the tube with mechanism whereby both ends may be simultaneously opened when it is desired to stop the car.

With these objects in view my invention consists in the novel construction and peculiar combination and arrangement of parts, as will be hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is

a longitudinal sectional view of a conduit embodying my invention. Fig. 2 is a cross-section of the same. Fig. 3 is a view illustrating the arrangement of conduits at a crossing. Fig. 4 is a longitudinal sectional view of a modification. Fig. 5 is a cross-section of the same.

A indicates a conduit similar in construction to those commonly used for cable railways, but preferably somewhat larger, for the reception of a tube, B. This tube B is made of iron or other suitable material and supported in the conduit A by means of rods or braces *a*, thus leaving a space beneath the tube B for the reception of drainage, which may be carried off through suitable drain-pipes to a sewer or other place.

The tube B is provided at its top and throughout its length with an opening, *b*, and is flattened slightly on each side of said opening for the reception of a sealing-strip, C, as shown. This sealing-strip is preferably made of india-rubber or other elastic material, and secured by one edge to the flattened portion of the tube, so as to cover the opening *b* and be held firmly thereon by pressure of air brought to bear upon it, there being a partial vacuum produced in the tube by any suitable means. The space between the top of the tube B and the top of the conduit A will preferably be sufficient to admit a man, so that repairs may be made when required. Tracks are laid in the usual manner parallel with the conduit A at each side, upon which a car is adapted to run.

Each car is provided at its bottom with a depending bracket, D, the arm D' of which is secured at its upper end to a frame, D<sup>2</sup>, which latter is attached to the truck of the car by means of bolts D<sup>3</sup>, strong springs E being made to encircle these bolts and bear upon a nut screwed upon their lower ends. By this construction jolting of the car in passing over an obstruction is compensated for.

Secured to the lower end of the arm D' is a laterally-extending arm, G, and fixed to the free end of this arm is a downwardly-extending arm, G'. The arm G' is secured to a plate, H, which extends therefrom in a direction parallel with the arm G, and is adapted to slide upon the top of the tube B. As shown in Fig. 2, this bracket, with the exception of



the arm D', is inclosed within the conduit A, said arm D' extending through the opening a' of the conduit and connected to the truck of the car, as above explained. The plate H is beveled on its upper face from the center to each end to enter beneath the flap C, for a purpose which will be hereinafter described.

To the under side of the plate H is secured a web or flange, I, adapted to slide in the opening b of the tube and project somewhat beyond the ends of the plate H, as shown in Fig. 1. The bracket D and web I may be made in a single piece, if desired.

A piston, M, of cast-steel or other suitable material, and preferably about the same length as the plate H, is firmly secured to the bottom edge of the web I, or, if desired, may be made integral with said web. The piston M is provided around its periphery with two or more grooves for the reception of packing-strips i, which are placed in these grooves, so that they shall be capable of a slight expansion outwardly, and thus cause the piston to fit snugly within the tube A.

In order to insure such expansion of the packing strips or rings, each is made of two or more pieces of suitable material, which have their ends overlapped. Behind these packing-rings and fitted in sockets made in the base of the grooves are a series of spiral springs, j, furnished at their outer extremities with small plates or washers k, which bear against the under faces of the packing-rings i, and thus these rings are normally forced outwardly against the inner surface of the tube B. The packing-rings should be furnished with rabbets on one face to enter beneath a plate secured to the piston, and thus prevent said packing-rings from moving too far when the piston is out of the tube.

The piston M is made with a passage, k', which extends from end to end thereof, as shown in Figs. 1 and 5. Pivoted at each end of this passage is a disk-valve, e, which disks are furnished on their peripheries with suitable packing material to produce air-tight joints when the valves are closed.

Mounted upon the car, preferably the front platform, is a rod, N, provided at its upper end with a crank arm or wheel by which to operate it. The rod N extends downwardly through the bottom of the platform of the car into the conduit A, being set into a recess made in the arm D. This rod is then bent outwardly some distance beyond the bracket D, then downwardly, and then inwardly, thus producing a crank-arm, O. The lower inwardly-extending arm, O', of this crank-arm is adapted to enter an elongated or V-shaped slot or recess, m, made in one edge of plate H, in which slot said arm has a sliding movement, the lower portion of the arm G' being sufficiently cut away to permit the entrance of arm O' into the slot or recess m. The arm O' is connected at its free inner end within the slot m to a vertical rod, P, pivoted at its

upper end in the plate H and at its lower end in the bottom of the piston M.

Fixed to the rod P within the piston M is a short cross-bar, Q, extending an equal distance on each side of said rod and provided at or near its ends with perforations for the reception of one end of rods R R'. The opposite ends of these rods are extended outwardly toward the ends of the piston and connected to an eye or loop fixed to the upper or lower portions of the disk-valves e, as shown in Fig. 2. By this construction it will be seen than when the rod N is turned one way it will operate to open the valves e and when turned in the opposite direction will operate to close them.

The apparatus being constructed as above set forth, the air is exhausted from the tube B by means of a suitable engine at a central station. The air in the tube being thus exhausted and the valves e of the piston closed air-tight, the piston will move through the tube B, and thus the car attached to it is moved upon its tracks. While the car is moving, the projecting end of the web or flange I will serve to lift the flap C slightly, said flap being further lifted by the plate H, which moves beneath it. This plate being beveled from the center toward each end, the raising of the flap will be gradual, and after the car has passed will close down behind it by means of suction.

From this construction it will be seen that there is always a tendency of the flap C to retain its seat over the opening in the tube B, and that the raising and lowering of it by the plate H will cause little or no air to be admitted into the tube, and if outside air should find its way into the tube it is immediately exhausted by the engine at the central station. When it is desired to stop a car, it is simply necessary to operate the rod N, as above explained, to open the disk-valves e and permit the circuit to pass through the piston, and therefore exert no pulling force thereto. If the car is to be stopped immediately, its momentum may be arrested by the ordinary brakes applied to the car-wheels. When it is desired to use compressed air to propel the piston M in climbing heavy grades, the arrangement of apparatus illustrated in Figs. 4 and 5 will preferably be used.

If the flap C were used as shown in Fig. 2, the compressed air would tend to force the same away from its seat, and to retain said flap in position and render the tube air-tight two strips or plates, S S', to project over the flap and limit its upward movement, are preferably secured to the flattened top of the tube B, as shown in Fig. 5. With this arrangement the web I and plate H will be dispensed with and the arm G' secured directly to the piston, the opening b in the tube B being of sufficient width to receive the flap C and arm G'. The arm G' therefore occupies the same position in this form of the invention as the web I in



the previously-described arrangement, and, in fact, takes the place of said web I and serves to connect the piston with the bracket which protrudes from the car. The under face of arm G of bracket D will be so arranged relatively to the piston that the flap C shall pass between them without permitting escape of air. The under face of the arm G is beveled from the center toward each end to enter between the plates S S' and the flap to force it down to permit the passage of the bracket D. In order to prevent a current of air passing around the piston M through the opening b, said opening will be closed by projections z, fixed to or made integral with the piston M and adapted to bear against or form a bearing for the under face of the flap C.

When the above-described arrangement of bracket is used, the crank-arm of the rod N will be made to work in a recess made in the back of the arm G. A flap, X, of rubber or other suitable material, is secured to the plate S and adapted to extend over the opening b of the tube B to exclude dirt, &c. This strip is raised by the beveled end of the arm D' in its passage through the opening b, as shown in Figs. 4 and 5. Where two tubes or conduits cross, the arrangement shown in Fig. 3 will be adopted. The two tubes will be made to communicate in a manner similar to the joining of two gas or water pipes, and the tubes will be furnished at each side of the point of crossing with valves  $o o' p p'$ . These valves remain normally closed, so that the currents in the respective tubes will not conflict with each other. The current will be made continuous past these valves by means of by-passes  $q$  and  $r$ , these by-passes communicating with the tubes at points beyond the valves. When a car is passing a crossing in the direction indicated by the arrows, the valve  $o$  is so arranged that when the piston M strikes it, it

will be opened down in a suitable recess,  $o^2$ , made in the tube to receive it, and the piston M is then allowed to pass; but when the piston reaches the valve  $o'$  this valve, which is preferably adapted to slide, will have to be operated manually.

It is preferable that the piston be provided with a curved rod,  $O^2$ , at each end, said rod being so arranged as not to conflict with the valves  $e$ , and furnished with a knob,  $o^3$ , to strike the valves in the tubes to open them. The valves  $p p'$  of the cross-tube will of course be constructed and operated in the same manner as the valves  $o o'$ .

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

1. In a pneumatic railway system, the combination, with two pneumatic tubes which cross, of by-passes communicating with the tubes to bridge the point of crossing, an automatically-operated valve in each tube at one side of the point of crossing, and a manually-operated valve at the opposite side of the point of crossing, substantially as set forth.

2. In a pneumatic system, the combination, with a tube having a longitudinal opening, of an elastic flap to close said opening, a web adapted to slide in the opening, a bevel-plate secured to the top of the web to move the flap, a bracket connecting the bevel-plate, and a frame attached to the car-truck, and a piston secured to the bottom of said web and adapted to slide in the tube, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

MEINOLPH BODEFELD.

Witnesses:

R. S. FERGUSON,  
S. G. NOTTINGHAM.