2 Sheets--Sheet 1.

W. E. PRALL.

Pneumatic Railroad Signals.

No. 145,309. Patented Dec. 9, 1873.

Fig. 1.

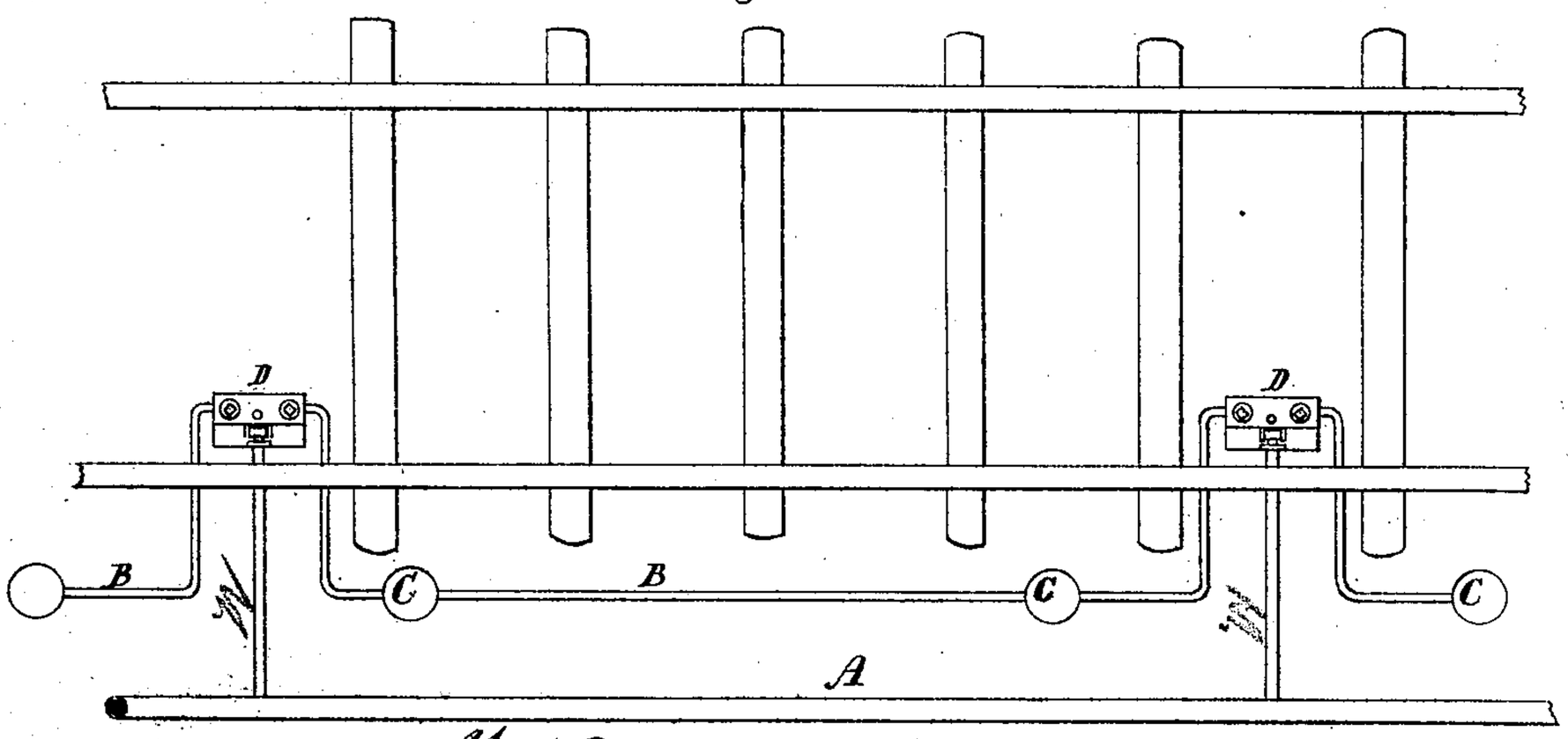


Fig. 3

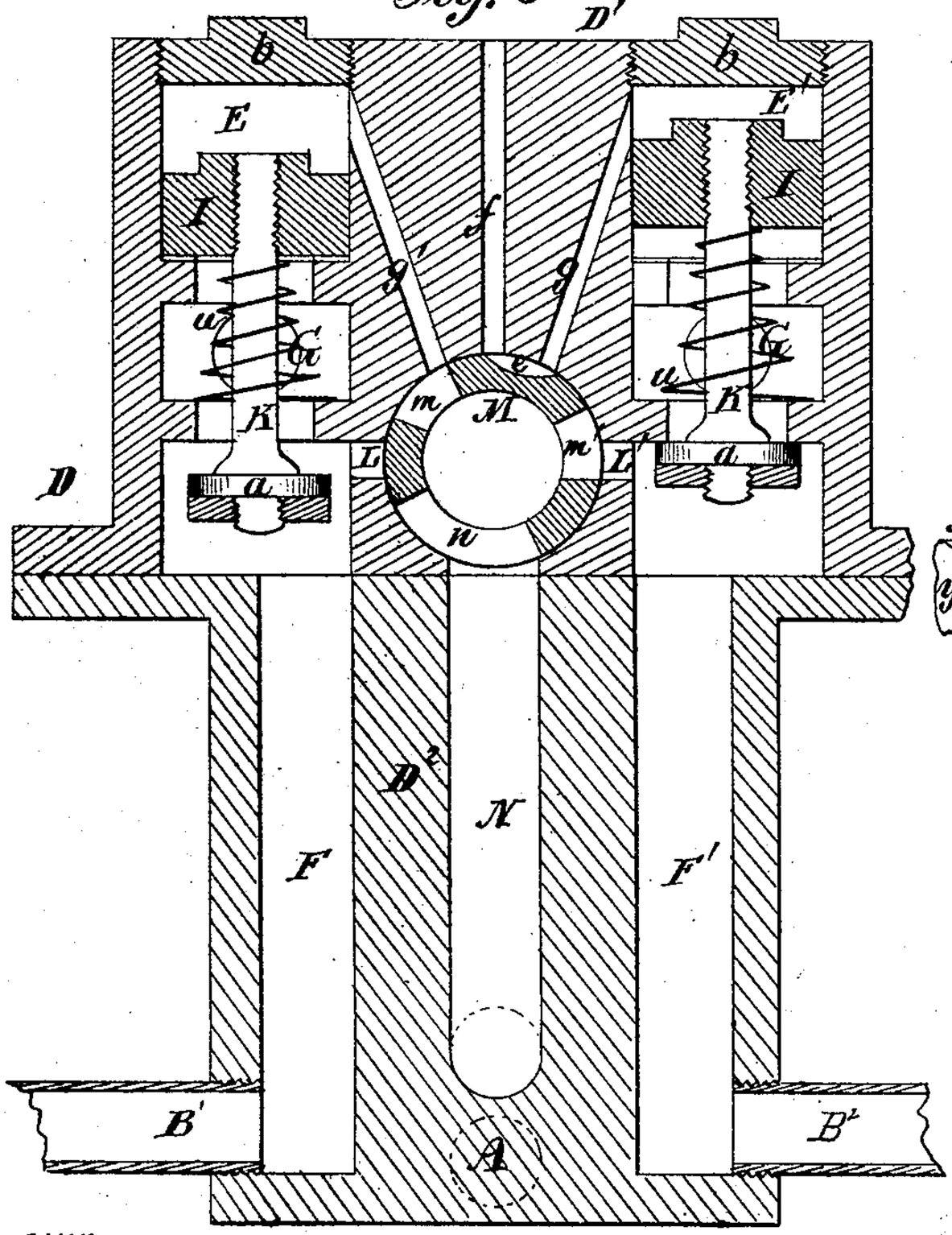
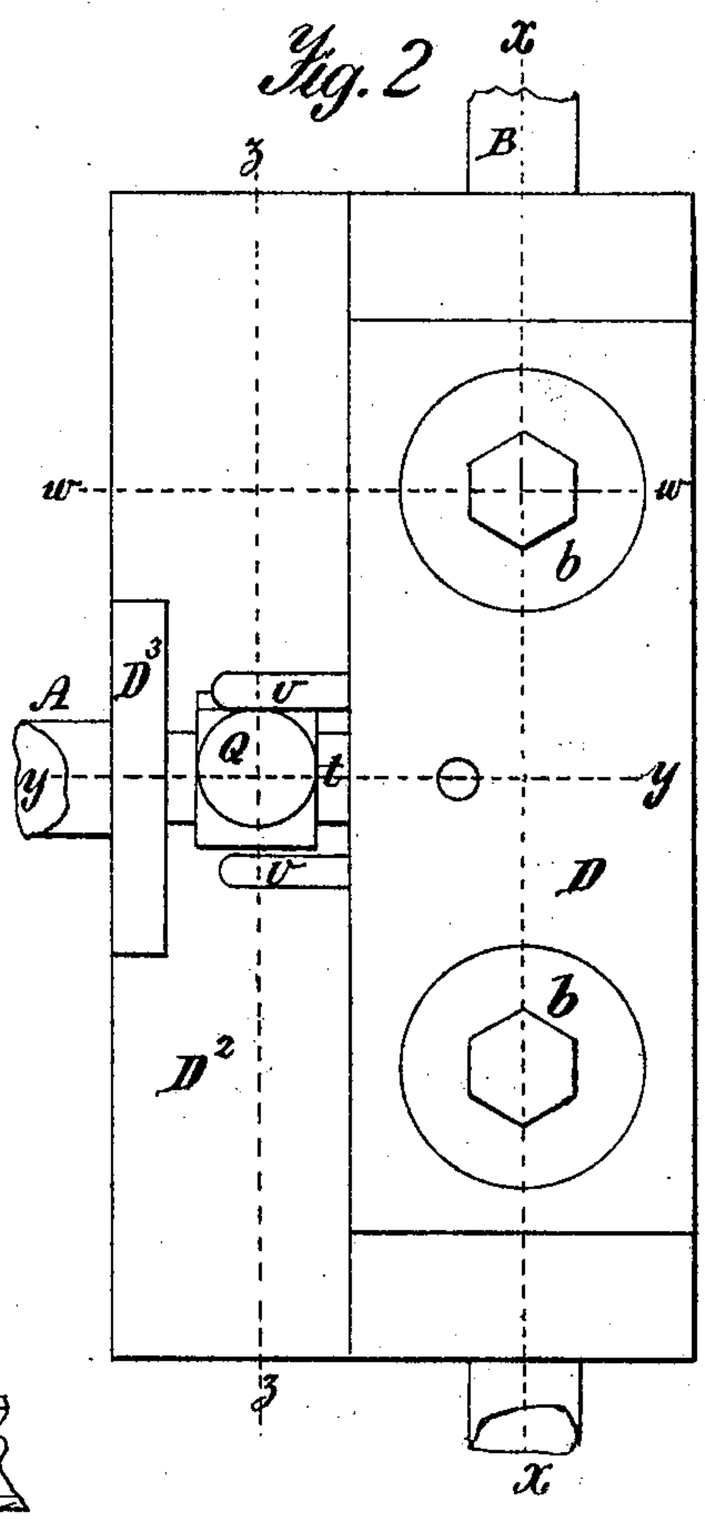


Fig. 2



Witnesses,
A. Ruppert,
D. F. Holloway

Inventor
W. E. Prall

A.M. PHOTO-LITHOGRAPHIC Co. N.Y. (OSBORNE'S PROCESS)

2 Sheets--Sheet 2.

W. E. PRALL.

Pneumatic Railroad Signals.

No. 145,309. Patented Dec. 9, 1873.

Fig. 5.

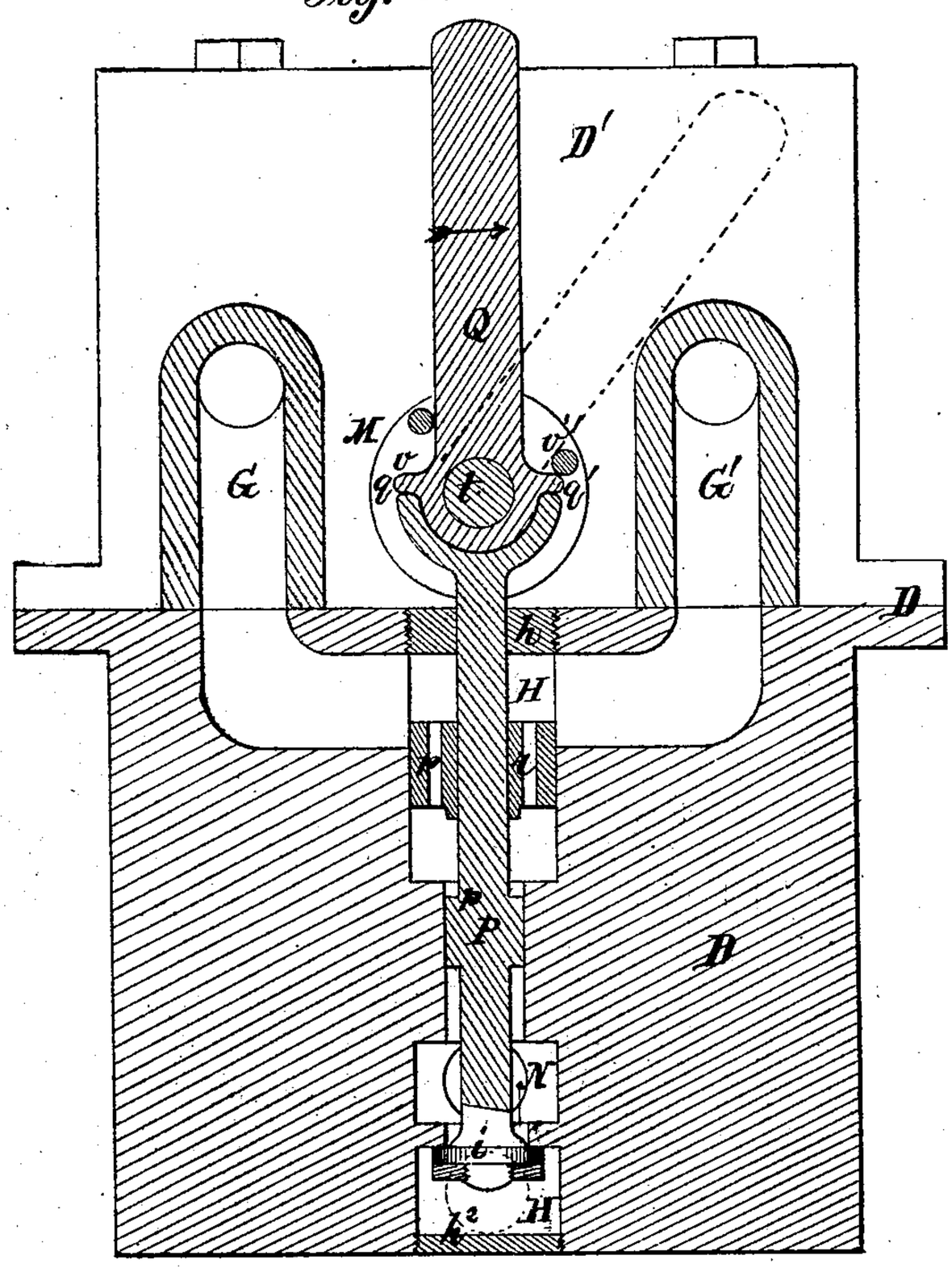


Fig. 4.

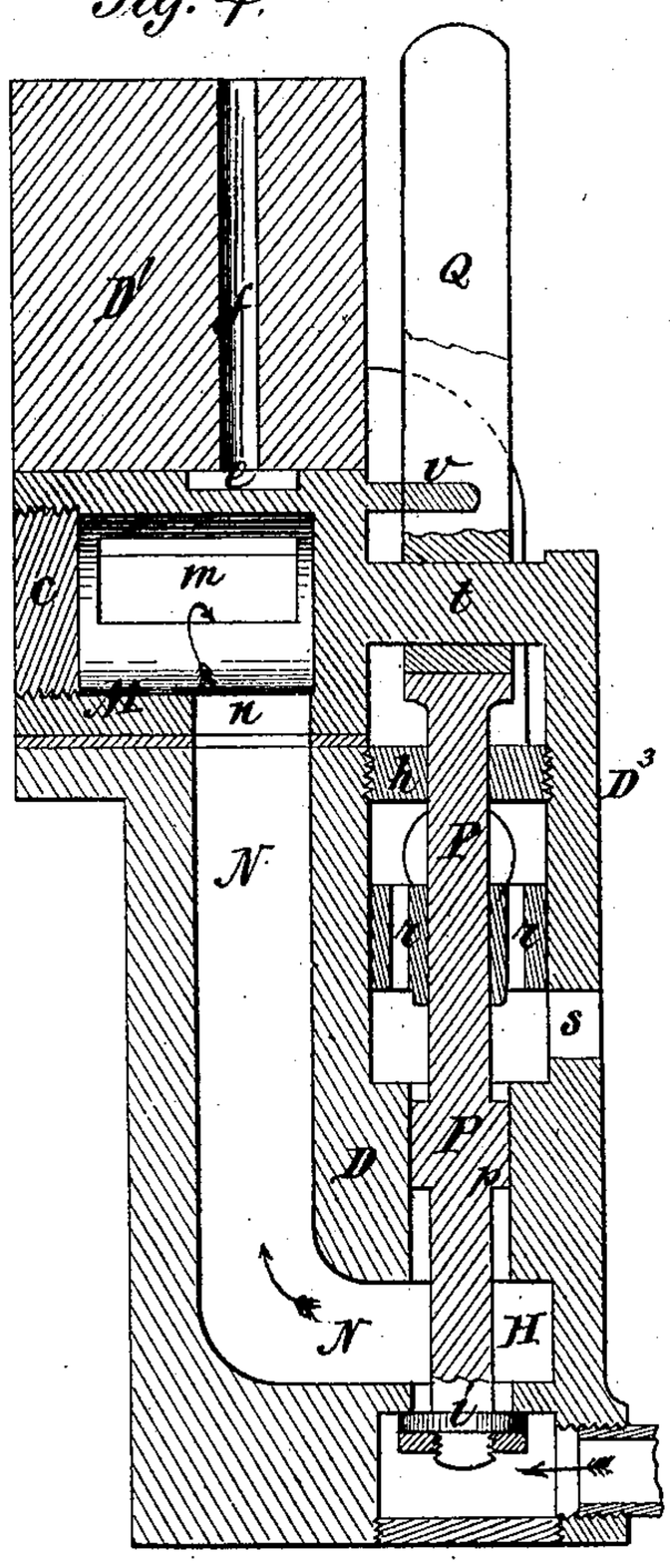
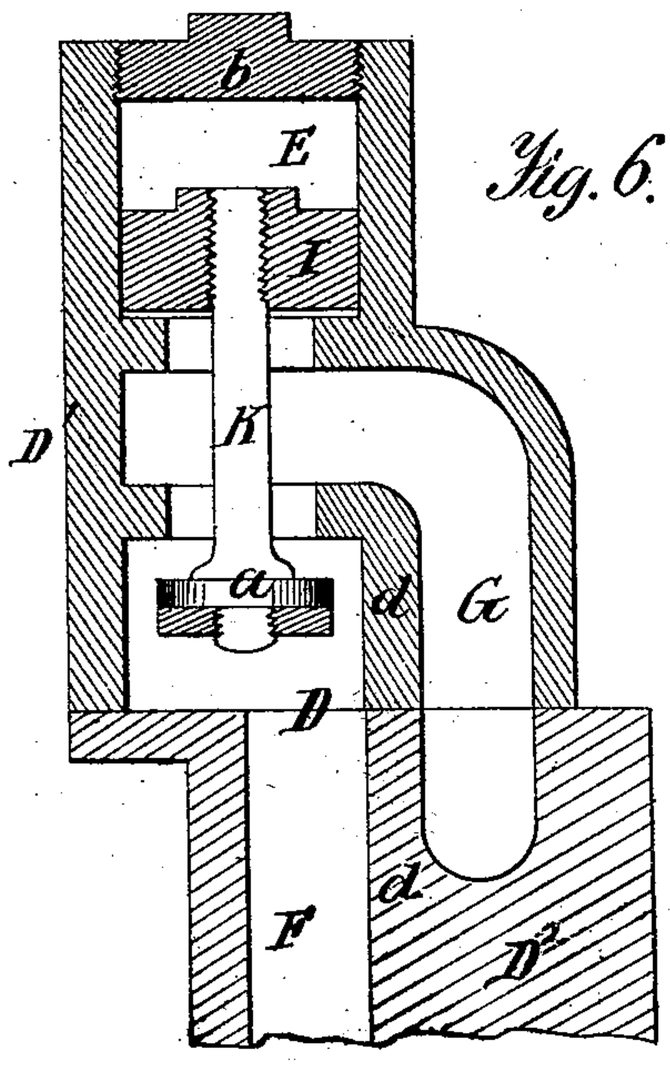


Fig. 6.



Witnesses.
A. Ruppert.
D. P. Holloway

Inventor.
W. E. Prall

AM. PHOTO-LITHOGRAPHIC Co. N.Y. (OSBORNE'S PROCESS.)

UNITED STATES PATENT OFFICE.

WILLIAM E. PRALL, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN PNEUMATIC RAILROAD-SIGNALS.

Specification forming part of Letters Patent No. **145,309**, dated December 9, 1873; application filed October 31, 1873.

To all whom it may concern:

Be it known that I, WILLIAM E. PRALL, of Washington city, in the District of Columbia, have invented an Improved Apparatus for Operating Railway-Signals by means of Compressed Air, of which the following is a specification:

My invention relates to an improved method of signaling the approach and passage of trains upon a railroad by means of compressed air; and it consists, first, in the use of a supply-pipe connected with a suitable air-pump, engine, and reservoir, so as that it shall be kept constantly filled with air under a proper degree of compression, and extending the entire distance along which signals may be required, and in the combination therewith of a secondary separate line of service-pipes, each connected with a series of signals arranged to be sounded or displayed by the introduction of air into said service-pipes, and to cease or be concealed by the escape or exhaustion of the air. It consists, secondly, in the arrangement and construction of an air-commutator, or device by means whereof the passage of a locomotive over the road will operate to throw up or sound the series of signals in advance as far as the next commutator, by admitting compressed air from the supply-pipe to the service-pipe connected with said advance signals, and simultaneously to cause the signals in the rear to cease or be concealed by permitting an escape of the air from the service-pipe connected with said rear signals.

In the accompanying drawings, Figure 1 is a plan view of a railroad-track, illustrating the relative arrangement and connection of the supply-pipe, service-pipes, commutators, and signals. Fig. 2 is a top view of a commutator of full size; Fig. 3, a vertical section in line *x x* of Fig. 2; Figs. 4, 5, and 6, respectively, similar sections in the lines *y y*, *z z*, and *w w* of said Fig. 1.

A is a supply-pipe connected with one or more reservoirs of air, compressed thereinto by suitable machinery, at any desired station upon a railroad. This pipe may extend the entire length of the road, and is to be kept constantly charged with compressed air, for use, as hereinafter described, in maintaining automatically a constant system of signals along the road, or at such points as may be deemed important, to indicate the presence of a locomotive or train of cars upon the track for any desired distance in advance or in the rear thereof. The air from this pipe can be also utilized in elevating water at the water-stations, and in driving machinery for sawing wood, &c., and, upon many roads, may be obtained at a low cost by utilizing the power of water-falls for its compression. B B are service-pipes extending from one commutator to the other, these commutators being placed at suitable intervals—say, of a mile—apart, or at the extreme ends of curves or bridges, the series of signals on any one section between any two of the commutators being all sounded and displayed or silenced and concealed simultaneously. C C are suitable signals, which may consist of whistles, to be sounded by an escape of air through them, and of vanes and lights, to be displayed by a pressure of air upon a piston or diaphragm connected therewith, compressed air for the purpose being automatically admitted at the proper moment by the action of the commutators, as hereinafter described. D are the commutators, (illustrated in detail of natural size in Figs. 2 to 6,) and W W are branch pipes connecting the commutators, and through said commutators the service-pipes B B, with the main supply or reservoir pipe A. The commutator D is, for convenience of construction, made in two divisions, D^1 and D^2, which are bolted together, as illustrated in Figs. 3 to 6, the lower division projecting beyond the front face of the upper division to form an offset, as shown in Figs. 2 and 6. In the upper division, D^1, at either end thereof, and extending longitudinally through the same, cylinders or cylindrical spaces E E′ are formed, as shown in Figs. 3 and 6. The lower end of each cylinder communicates with a passage, F, extending down through the lower division, through which it is connected with a service-pipe, B, operating the series of signals on that side of the commutator. About midway in the length of each cylinder E, an opening is pierced, connecting, by means of a suitable passage, G, with a central passage, H, in the lower division D^2, as hereinafter explained. Communication between the passages F and G, through the cylinder E, is closed, as required, by means of a rubber valve, *a*, closing against an annular

seat formed by means of an offset projecting into the cylinder immediately below the opening into the passage G, as shown in Figs. 3 and 6. A similar offset above said opening forms a seat for a plunger, I, working closely in the upper end of the cylinder E. The valve *a* and the plunger I are secured to opposite ends of a connecting-rod, K, whose length is so proportioned as that when the plunger I is down upon its bearing the valve *a* shall be open, and communication thereby established between the passages F and G, as shown in Fig. 6. A spring, *u*, encircles each rod K, and, being secured thereto at one end, bears upon the offsets of the valve-seat at the other, so as to keep said valve closed when free. The upper end of each cylinder E is closed by a plug, *b*. Near the lower end of the upper division, D^1, of the commutator, and centrally between the cylinders E E′, an enlarged cylindrical or slightly-conical opening is pierced transversely to receive a cock, M. Between this cock-opening and the cylinders E E′, on either side, apertures L L′ are formed below the valve *a*, as shown in Fig. 3. The cock M turns freely in its seat, and is made hollow, its rear end being closed by a plug, *c*, as shown in Fig. 4. In the sides of the cock, openings *m m′* are made, in such relative positions as that, when one opening, *m′*, is in register with the aperture L′ into the cylinder E′ on one side, the aperture L into the cylinder E on the other will be closed, and vice versa, as shown in Fig. 3. A notch or recess, *e*, is also cut in the upper side of the cock, of such a width and depth as that, whether the cock is turned to close either the aperture L or the aperture L′, said recess shall be in register with a small central vent-passage, *f*, pierced outward therefrom through the upper division D^1 of the commutator, and with one or other of two secondary passages, *g* and *g′*, pierced obliquely through said section from the cock to the upper end of each cylinder E and E′, respectively, said notch *e* thus serving to establish communication between the central outward vent or passage *f* and the upper end of that cylinder, E or E′, which at the time is in communication with the central opening in the cock through the aperture L or L′. A third opening, *n*, is made from the hollow center of the cock outwardly, of such width as that, whether the cock be turned to uncover either aperture L or L′, it shall always be in register with a passage-way, N, extending below it down through the lower division D^2 of the commutator nearly to the bottom thereof, (see Fig. 3,) where it communicates with a parallel, central, cylindrical opening, H, in the lower section. (See Fig. 4.) To the lower end of this cylindrical opening H the main air-supply pipe A is connected, and communication between said pipe A and the passage N, through H, is controlled by means of a valve, *i*, Figs. 4 and 5, closing upward against an annular bearing formed by an offset in the passage H, just below the opening N thereinto, as shown in Fig. 4. This valve is secured upon a rod, P, extending thence upward through the cylinder H, and outwardly through a bearing in a plug, *h*, closing the upper end of said passage. The lower end of H is closed by a second plug, h^2. Immediately above the opening N the cylinder H is contracted to form a long bearing for a plunger, E, formed or secured upon the rod P to work closely therein. Between said plunger and the upper plug *h* the cylindrical aperture H is again enlarged intermediate the two, and a second plunger, *r*, is secured on the rod P, to partially close, by its downward movement, a vent, *s*, opening outwardly from the cylinder H immediately below said perforated plunger *r*. The passage-ways G and G′ from the cylinders E and E′ open, respectively, from opposite sides into the cylinder H above the plunger *r*, and said plunger is perforated longitudinally to permit an escape of the air entering from said passages G and G′ outwardly through the vent *s* when the plunger is elevated sufficiently to uncover said vent. A stem, *t*, projects outwardly from the face of the cock M, as shown in Fig. 4, in a right line with the projecting valve-rod P, and is encircled by the lower end of a lever, Q, which turns freely thereon, and whose upper end projects above the commutator D, so as to be struck by a slight arm arranged upon each locomotive upon the railroad. The upper end of the valve-rod P terminates in a yoke, which, when the rod is elevated, closely encircles the lower end of the lever Q, as shown in Fig. 5. The ends of the yoke bear closely against ears or lugs *q q*, projecting from each side of the lever, so that when the rod P and its yoke is elevated the lever is thrown and sustained in an upright position, as shown in Fig. 5, and when the lever is thrown over to one side or the other it will bear down the rod P. Pins or lugs *v v′* project from the face of the cock on either side of the lever Q, in such position relative thereto as that the lug on the side nearest the passage L from the center of the cock into the side cylinder E, which is closed, shall, when the lever is upright, be in contact therewith, the other lug being so far removed therefrom as not to come into contact until the cock has been so far turned as to open the said closed passage, and close that until then open.

With a commutator thus constructed and its main supply-pipe A properly charged with compressed air, the pressure of the air against the valve *i* will tend to keep it tightly closed, (see Fig. 4,) and also to force up the rod P and its yoke against the lugs *q q* on the lever Q, so as to maintain the latter in an upright position, as shown in Fig. 5. If, now, the lever be struck by a train (passing, for instance, in the direction of the arrow on said lever, Fig. 5) and thrown into the position indicated by the dotted lines, Fig. 5, the lever in its movement will bear against the pin *v′*, projecting from the cock M, and turn said cock so as to establish communication through it between the air-supply passage N and the cyl-

inder E′, as shown in Fig. 3, and simultaneously, by the pressure of its lug q' upon the corresponding side of the yoke, will force down the rod P, and thereby open the valve i and admit a volume of compressed air into the air-passage N, as indicated by the arrows in Fig. 4. So soon as the lever Q is released and the pressure of air in the passage N and service-pipe B, connected therewith, is sufficiently great to elevate or throw out the signals, this pressure exerted upon the plunger p will force up the rod P, throw the lever back to its upright position, and close the valve i. It will be observed, however, that the return of the lever to its upright position will not turn or move the cock M, and that the communications established through it will consequently remain unchanged until the lever is thrown in the opposite direction. Hence, if a second locomotive follow the first in the same direction, and the lever is, therefore, thrown over in the same direction as before, the effect will only be to admit a second charge of compressed air to follow the same course as that before admitted. The charge of compressed air admitted to the common supply-passage N, following the communication established through the cock M by means of the openings n and m' therein, will pass (see Fig. 3) into the lower end of the cylinder E, and thence, through the open passage F′, to the service-pipe B^2, and operate to throw up all the signals connected with said pipe, the escape of the air from said pipe being prevented by the automatic closing of the valve E (see dotted lines in Fig. 3) in the commutator at its opposite end. The primary effect, therefore, of a movement of the lever Q in either direction is to throw up all the signals in front of the commutator in that direction as far as the pipe B^2 extends; but, simultaneously, the same movement effects a second end, viz., it permits all the signals connected with the service-pipe over which the train has passed before reaching the commutator to drop, by providing for the escape of the air otherwise confined therein to sustain them. This second end is accomplished by the passage of a portion of the compressed air admitted by the supply-passage N in the cock M, up from said cock, through the channel g', into the upper end of the cylinder E, which will force down the plunger I, as shown by positive lines in Fig. 3, and thereby open the valve a, and establish a vent for the pipe B^1 (connected with the signals which the train has passed) through the cylinder E to passage G, Fig. 3, and thence to the upper end of cylinder H, (see Fig. 5,) and through the perforated plunger r to vent s. (See Fig. 4.) This vent s, although not entirely closed by the descent of the plunger r when the air-supply valve i is thrown open, is nevertheless so far closed as that the air admitted to the cylinder H to be exhausted, as described, through said vent, will bear temporarily upon the upper side of the plunger p, and tend to keep the valve i open until its pressure is reduced below that in the pipe N, when the rod P, passing up, will wholly open the vent, and, by permitting a full, free exhaust, insure the prompt fall of the signals along the pipe B^1 thus exhausted. As the lever Q is thus automatically thrown up so soon as sufficient air has entered the service-pipes to throw up the signals, it is at once ready for operation, either to throw a second charge of air to the same signals, as described, or, if struck by a train coming from the opposite direction, to reverse the cock, and consequently admit air to the pipe B^1 and permit an exhaust of air from the pipe B^2.

An engine passing to or fro over the road will thus surely cause a display of the signals in advance by an admission of air to the section signal-pipe, and as surely cause those already displayed, and which it has passed by, to drop, by permitting an exhaust of air from the section signal-pipe operating them, the signals which are displayed in any one section remaining so until the train has passed the commutator and thrown up the signals for the next section.

I claim as my invention—

1. A continuous air-reservoir or supply-pipe, A, laid along any portion of a line of railway, in combination with a series of service-pipes, B B, connected therewith by branch pipes W W, so as to be automatically charged with air therefrom, as required, for the purpose of displaying or sounding a system of signals, substantially as herein set forth.

2. The cock M, constructed and operating substantially as described, in combination with the air-passages L, L′, N, f, g, and g'.

3. The cylindrical space E, in combination with the connected valve a and plunger I, and the air-passages F, L, G, and g, substantially as herein described.

4. The valve i, in combination with the air-supply pipe A and passage N, the rod P, lever Q, cock M, and plunger p, substantially as herein described.

5. The lever Q and its lugs q q, in combination with the cock M and its projecting pins v v', and with the forked end or yoke of the rod P, substantially as herein described.

6. In combination with the rod P, plunger p, and cylinder H, the exhaust-aperture s, perforated plunger r, and air-passages G and G^1, substantially as herein described.

7. The air-commutator D—a combination, substantially as herein set forth, of the several devices enumerated in the four preceding claims, to co-operate substantially as and for the purpose herein set forth.

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

WM. E. PRALL.

Witnesses:
A. RUPPERT,
EDM. F. BROWN.