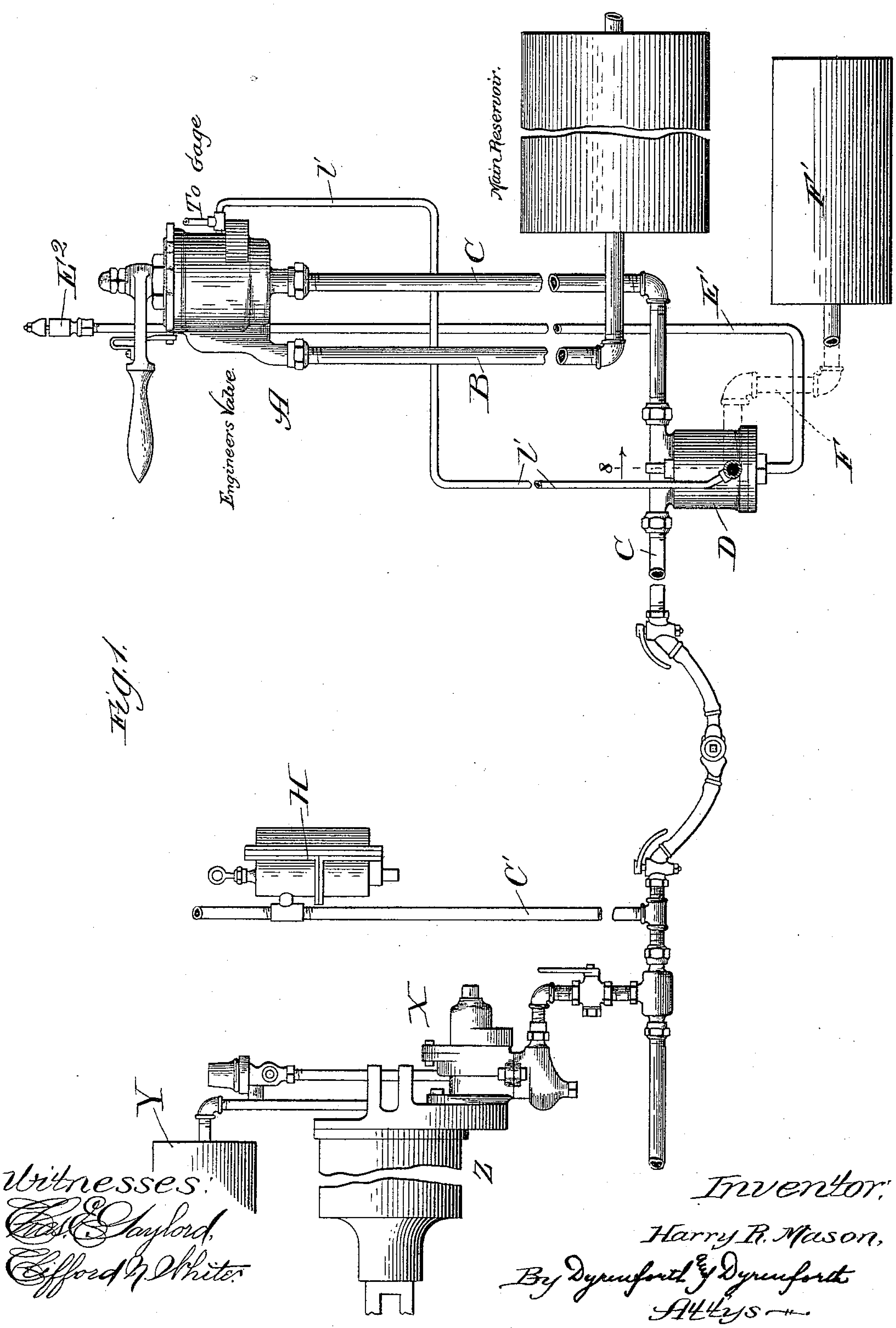
(No Model.) 3 Sheets—Sheet 1.

H. R. MASON.

TRAIN SIGNALING APPARATUS.

No. 450,334. Patented Apr. 14, 1891.



Witnesses:
Chas. E. Gaylord,
Clifford N. White.

Inventor:
Harry R. Mason,
By Dyrenforth & Dyrenforth
Att'ys.

(No Model.) 3 Sheets—Sheet 2.

H. R. MASON.

TRAIN SIGNALING APPARATUS.

No. 450,334. Patented Apr. 14, 1891.

Fig. 2.

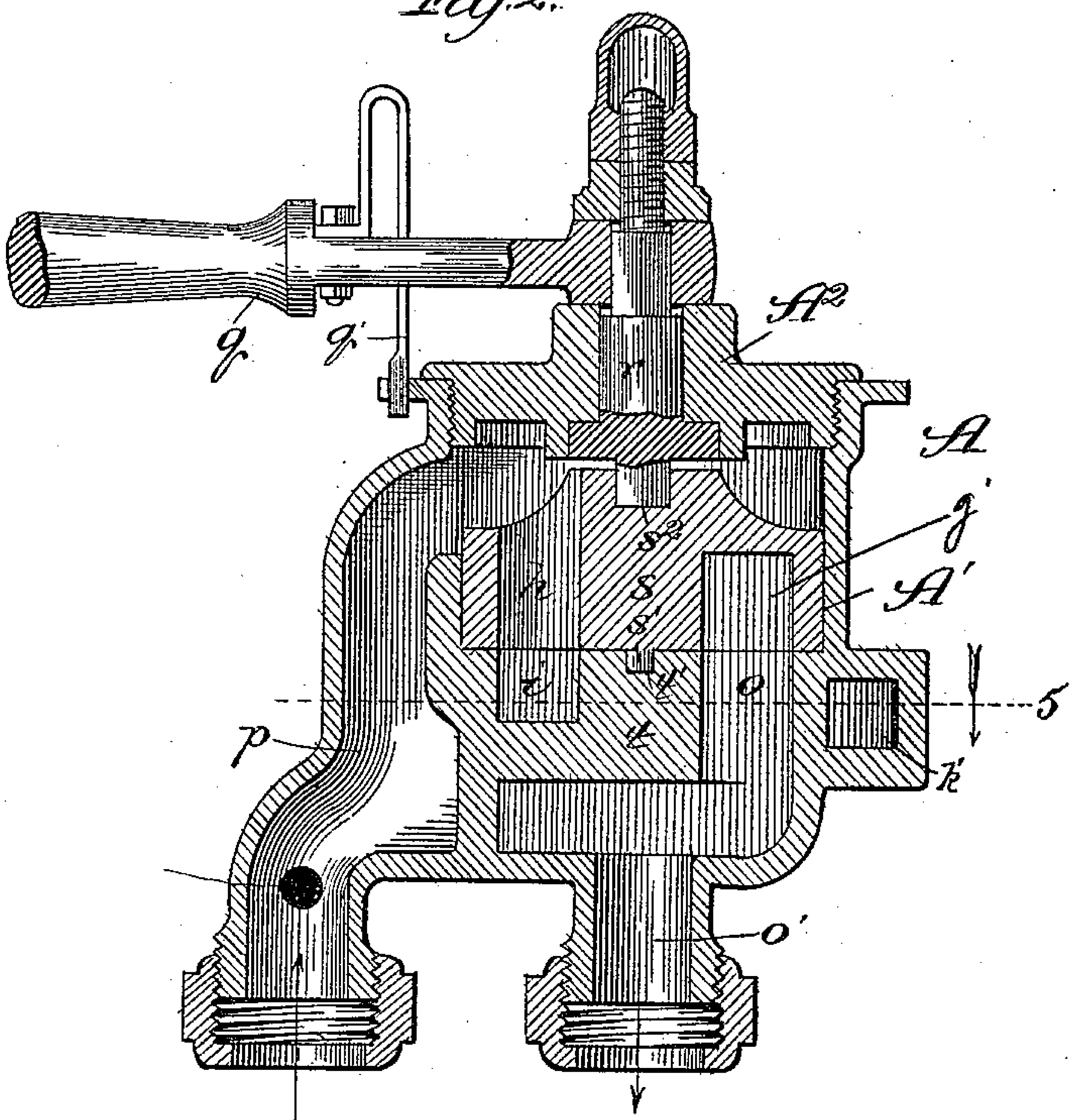


Fig. 3.

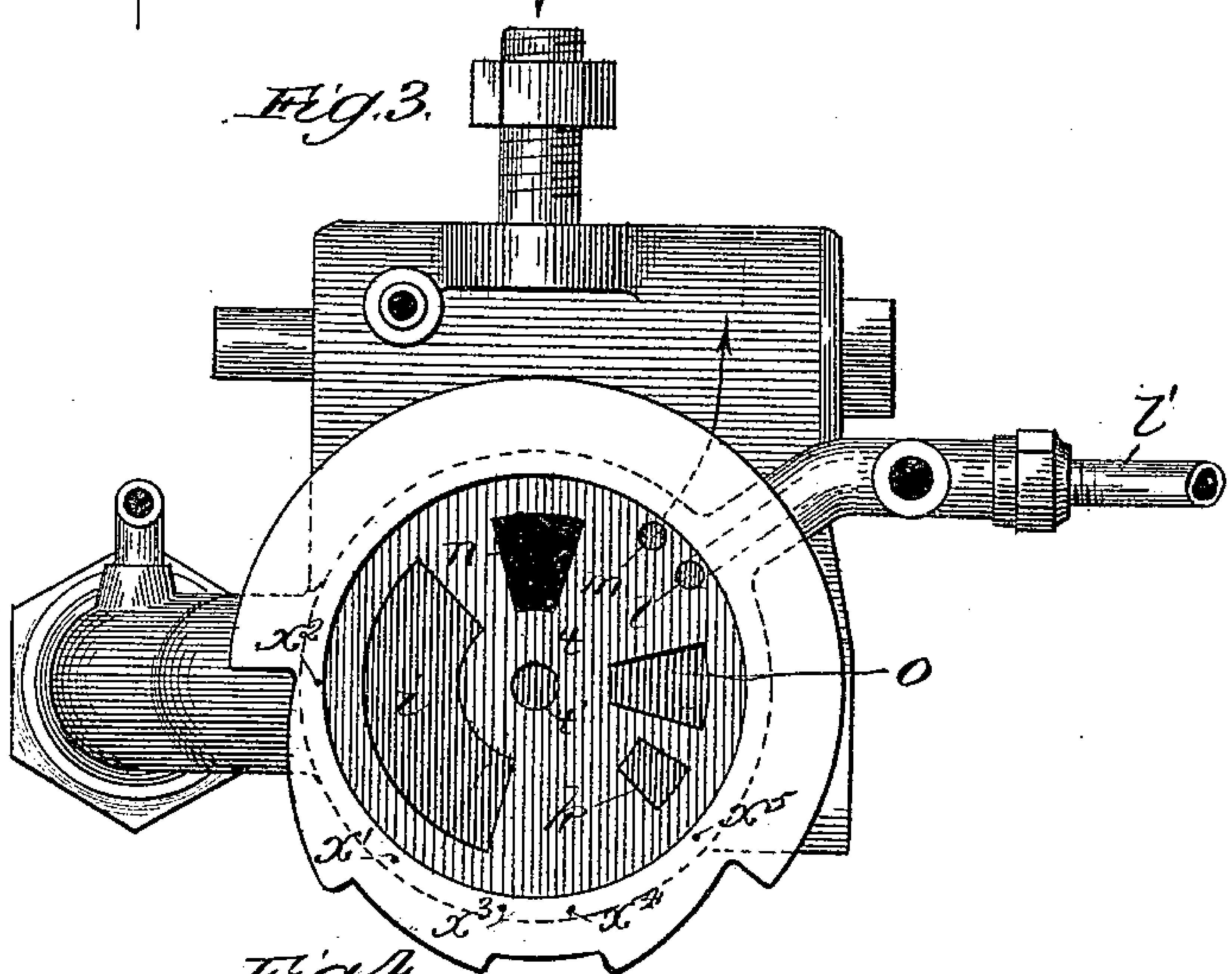
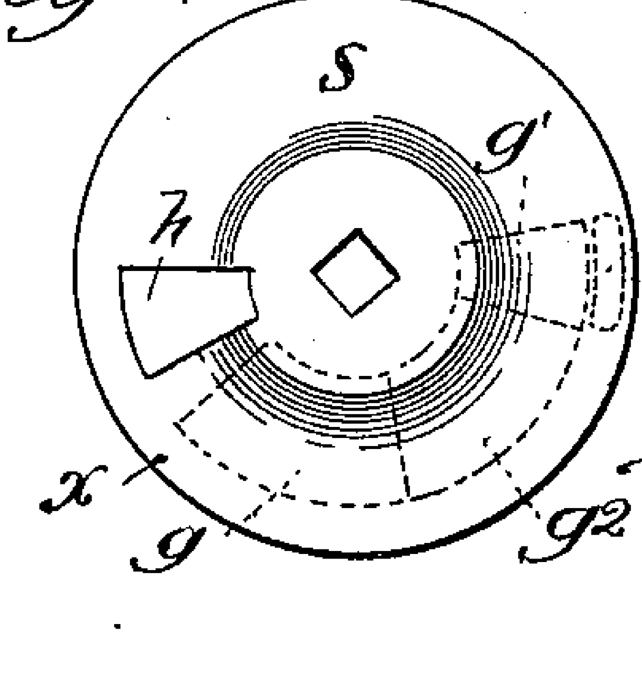


Fig. 4.



Witnesses:

C. E. Gaylord,

J. W. Dyrenforth

Inventor:

Harry R. Mason,

By Dyrenforth & Dyrenforth

Att'ys.

(No Model.) 3 Sheets—Sheet 3.

H. R. MASON.

TRAIN SIGNALING APPARATUS.

No. 450,334. Patented Apr. 14, 1891.

Fig. 5.

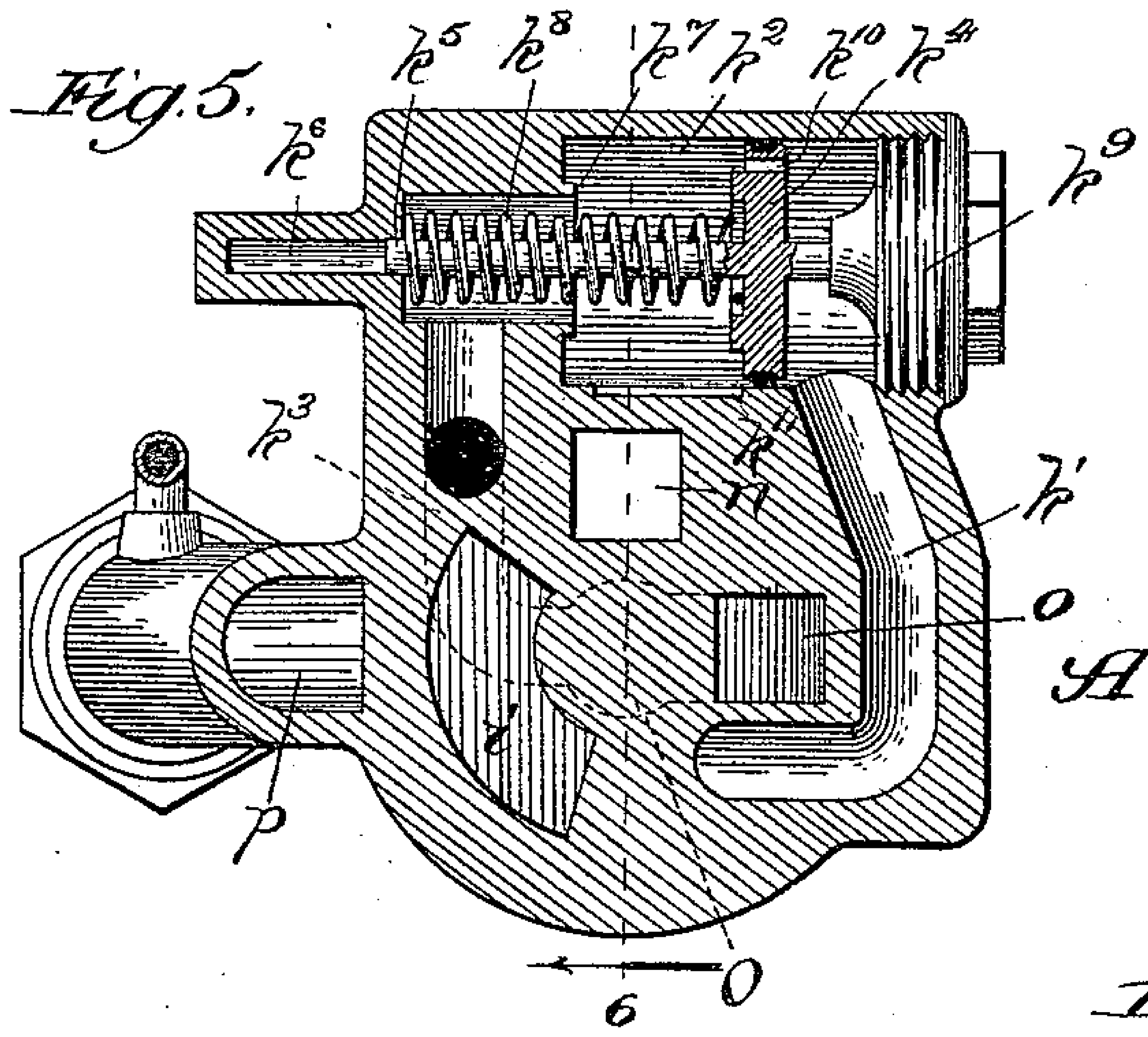


Fig. 7.

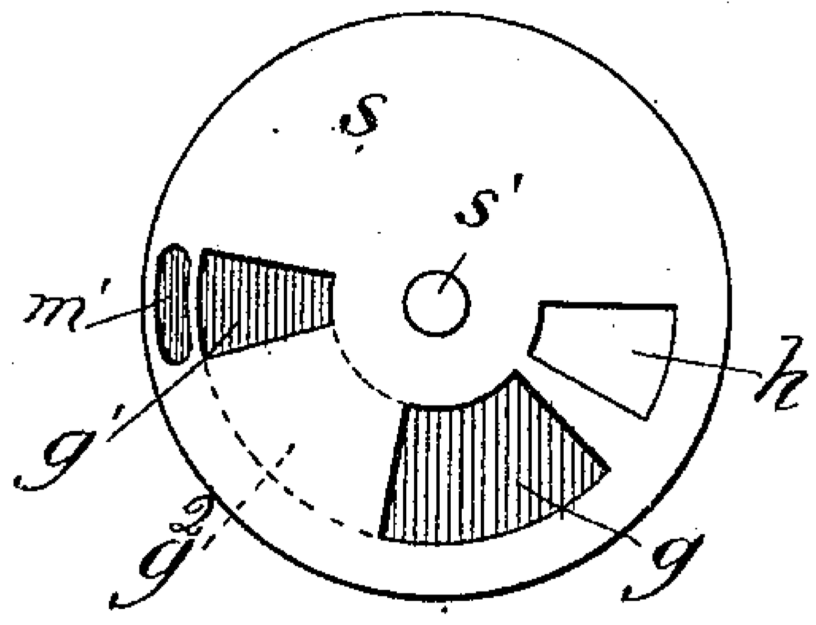


Fig. 6.

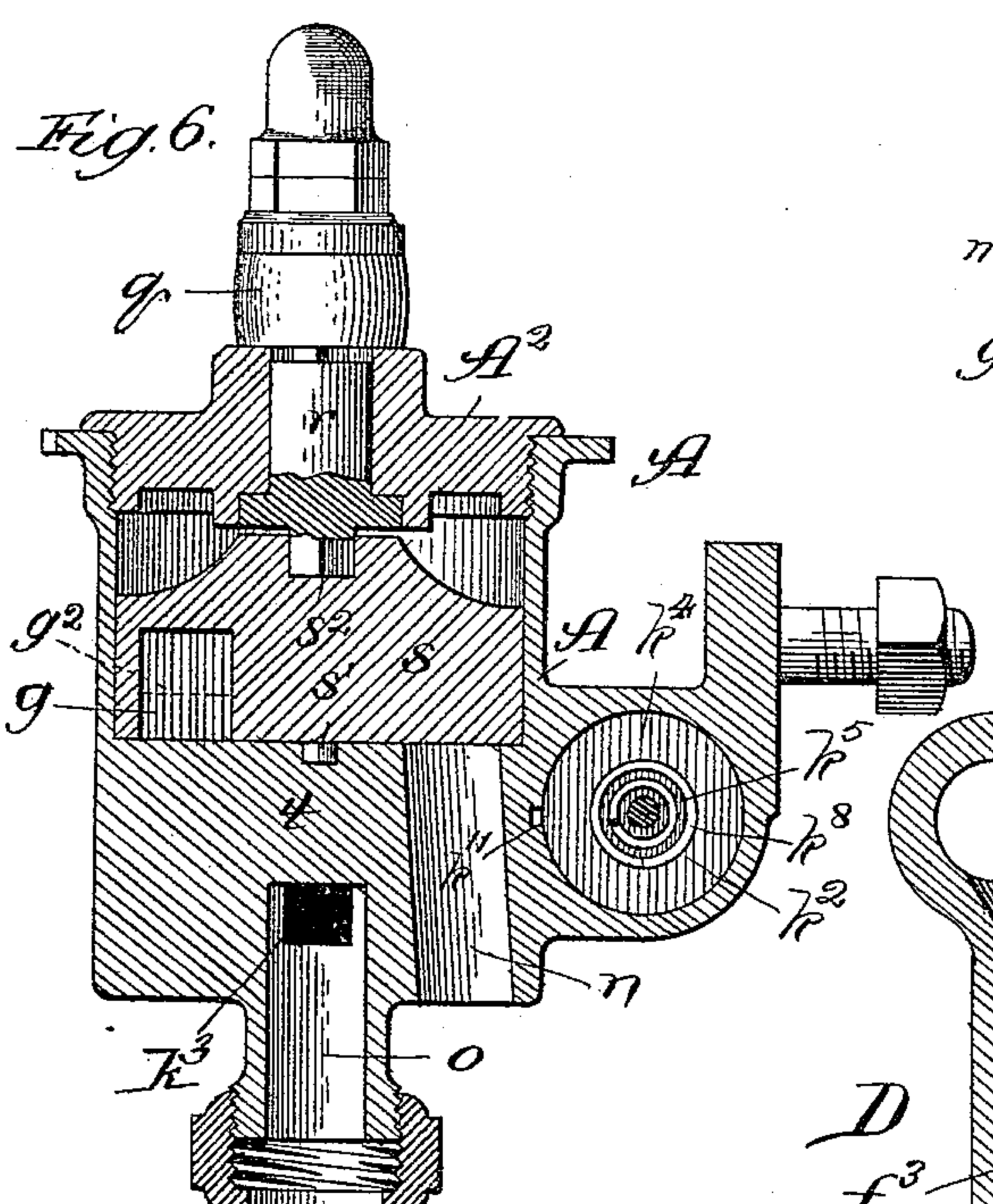
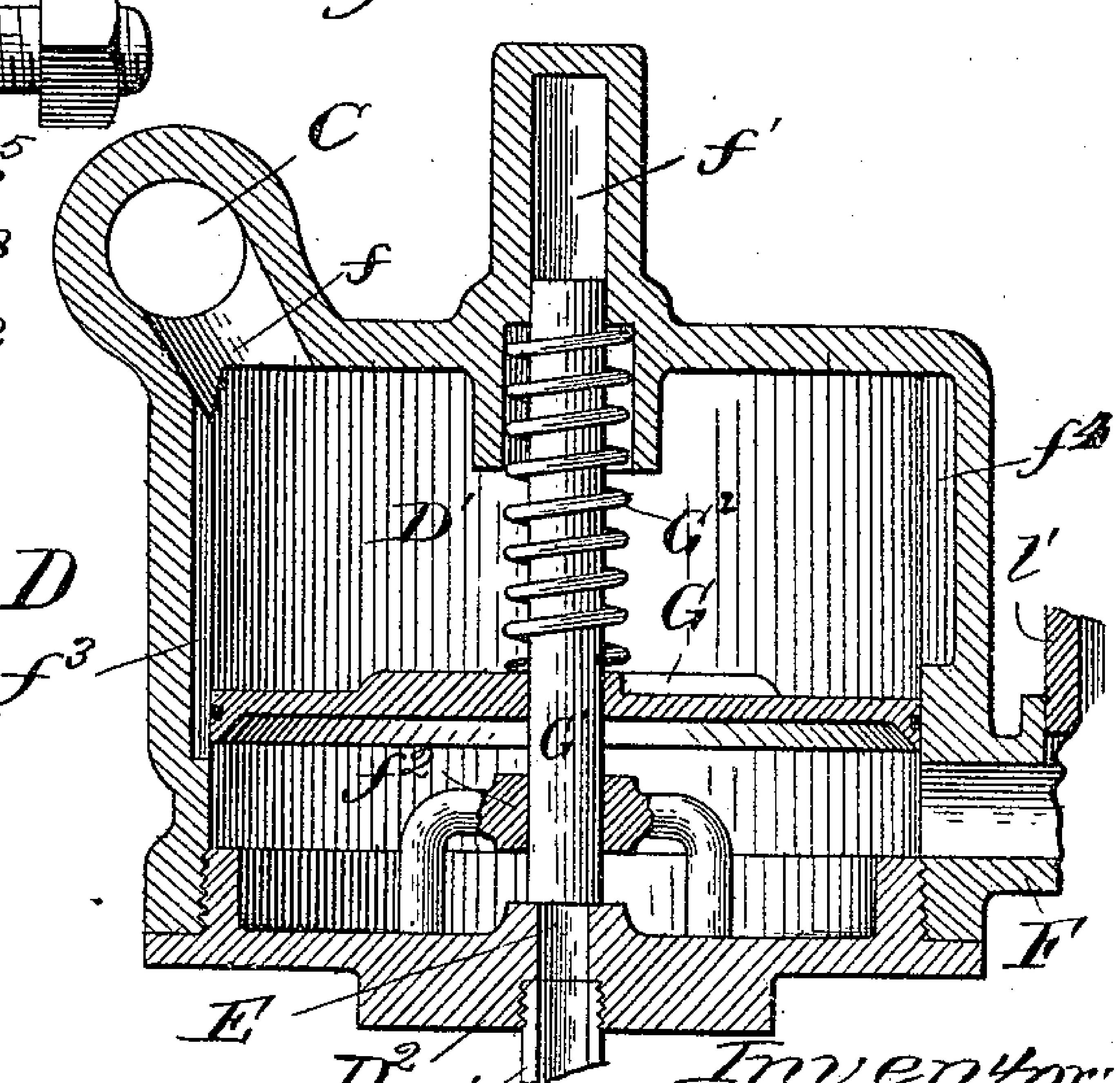


Fig. 8.



Witnesses:

Chas. E. Gaylord.

Clifford N. White.

Inventor:

Harry R. Mason,

By Dyrenforth & Dyrenforth

Att'ys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HARRY R. MASON, OF CHICAGO, ILLINOIS.

TRAIN-SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 450,334, dated April 14, 1891.

Application filed February 9, 1891. Serial No. 380,708. (No model.)

To all whom it may concern:

Be it known that I, HARRY R. MASON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Train-Signaling Apparatus, of which the following is a specification.

My invention relates to improvements in signaling apparatus for use upon railway-trains which employ air-brakes of the class wherein the brakes are applied by causing a reduction of the air-pressure to take place in the train-pipe and released by raising the air-pressure therein.

My present invention is in the nature of an improvement upon certain train-signaling apparatus forming the subject of a separate concurrent application for Letters Patent, which was filed by me in the United States Patent Office on the 2d day of December, 1890, and bears Serial No. 373,360.

The object of my present improvement is to provide for certain changes in the construction of the apparatus described in the application referred to and to supply certain features not employed in that construction, to the end that the apparatus may be better adapted for all possible requirements thereof. The present apparatus, like the other mentioned, is operated by the variations of air-pressure in the main train-pipe and dispenses with the use of the separate or supplemental train-pipe now generally employed for signaling purposes.

In the drawings, Figure 1 shows by a broken diagrammatic view my improvements applied to an air-brake system, the features to the right of the drawings being upon the locomotive and those to the left upon each of the cars, if a passenger-train, or upon the caboose, if a freight-train. Fig. 2 is an enlarged vertical central section, partly broken, of the engineer's valve, which is of the "flat-valve" type; Fig. 3, a broken top plan view of the lower stationary part or valve-seat of the engineer's valve, the upper movable part being removed; Fig. 4, a top plan view of the upper movable part of the valve, which is within the valve-casing and is directly upon and in contact with the part shown in Fig. 3; Fig. 5, a section taken on line 5 of Fig. 2 and viewed in the direction of the arrow; Fig. 6, a section taken on line 6 of Fig. 5 and viewed in the direction of the arrow; Fig. 7, a bottom plan view of the feature shown in Fig. 4; and Fig. 8, a section taken on line 8 of Fig. 1, enlarged and viewed in the direction of the arrow.

The engineer's valve A shown is formed with a shell or casing in two separable sections A′ and A^2, the lower section A′ affording the valve-chamber and the upper section A^2 a screw-cap therefor. In the lower section is a valve face or seat *t*, and fitted upon the latter is a rotary regulating-valve *s*, which is held in place by the pressure which is exerted against it by the air from the main reservoir. At the center of the seat *t* is a circular shallow socket *t′*, and at the center of the valve *s* is a circular lug *s′*, which fits the socket *t′* and rotates therein. In the center of the upper side of the valve *s* is a squared socket s^2 to receive the squared end portion of a valve-stem *r*, which extends through an opening in the cap A^2 and beyond the upper side thereof, where it is also squared and carries a lever-handle *q*. The stem *r* is suitably packed in the opening through the cap to prevent leakage and admit of its being easily turned by the handle *q*, whereby it moves the valve *s* axially upon the valve-seat *t*. Cored in the valve-shell is a passage *p*, which enters the valve-chamber above the valve *s* and communicates at its other end with the main reservoir-pipe B.

In the valve-seat *t* are a port *o*, leading to a passage *o′*, which communicates with the train-pipe C, a large exhaust-port *n* and a small exhaust *m*, both communicating with the outside air, a small inlet-port *l*, communicating with a pipe *l′*, and a port *k*, which communicates through a passage *k′* with an auxiliary valve-chamber k^2 on the side of the valve-shell. The ports described are located upon one side of a line drawn across the center of the valve-seat. At the opposite side in the face of the valve-seat is a segmental recess or cavity *i*. Extending through the valve *s* is a passage *h*. In the lower face of the valve *s* are two recesses or cavities *g* and *g′*, which communicate with each other through a passage g^2, (indicated by dotted lines,) cored in the valve, and a recess or cavity *m′*. The ports and cavities in the valve *s* and valve-seat should be substantially of the relative dimensions shown in the figures and should also be located in the relative positions shown. The passage k' enters the auxiliary valve-chamber k^2 at one end of the latter and at its opposite end the chamber communicates with the train-pipe through a passage k^3.

In the chamber k^2 is a check-valve k^4, which may be in the form of a piston-valve fitting and sliding against the inner wall of the casing. The piston is upon a stem k^5, which extends at one end a short distance beyond the face of the piston and at its opposite end moves in a guide-socket k^6, formed in the end portion of the shell. The seat of the valve k^4 is at k^7, which is in the direction of the passage k^3. The piston is held normally away from its seat by a spring k^8, and is prevented from advancing as far as the passage k' by the contact of the forward end of the valve-stem with the screw-plug k^9, which closes that end of the chamber. Near its circumference the piston is provided with a passage through it k^{10}, and in the side of the chamber-wall is a longitudinal groove k^{11}.

D is a signal-valve comprising a shell or casing affording a circular valve-chamber D′, which is closed at its lower end by a screw-cap D^2. Through the center of the screw-cap D^2 is an opening E, from which extends a pipe E′ to the signal, which may be a whistle E^2, as shown.

At the upper part of the valve-chamber D′ is a port f, which communicates directly with the train-pipe C, and extending from an opening at the lower end of the chamber D′ is a pipe F, which leads to an air-reservoir F′. The small pipe l', before mentioned, connects with the pipe F, as shown.

In the chamber D′ is a movable diaphragm or piston-valve G on a stem G′. The piston G fits closely against the wall of the chamber D′ to prevent leakage at its circumference, and it moves freely. The stem G′ above the piston moves in a guide-socket f', formed in the shell, and below the piston the stem G′ passes through a guide f^2 on the cap D^2. A spring G^2 operates to press the piston down, so that the end of the stem G′ normally closes the port E.

In the face of the inner wall of the valve-casing, and extending from the upper part thereof to a point a little below the normal or lowest position of the piston G, is a narrow and shallow groove f^3, which thus at all times affords communication between the upper and lower parts of the chamber D′. A groove f^4, of greater width and depth than the groove f^3, and also in the wall of the chamber D′, extends from the upper part of the chamber down to a point somewhat above the normal or lowest position of the piston G.

Upon each car of the train and connected with the train-pipe are the triple valve X, auxiliary reservoir Y, and brake-cylinder Z, which perform well-known functions and require no detailed description. Also upon each car, if a passenger-train, or upon the caboose, if a freight-train, is a branch pipe C′ of the train-pipe C, which carries a conductor's signaling-valve H. The valve H is described at length in my above-mentioned concurrent application. It comprises, broadly stated, a shell divided internally into two chambers by a stationary diaphragm. One of the chambers communicates constantly with the train-pipe through the branch C′, and the other or expansion chamber communicates through a port with the outer air. An opening through the diaphragm affords communication between the two chambers. A slide-valve in the device upon a stem which extends to the outside of the shell operates normally to close the passage between the chambers and open the passage from the expansion-chamber to the outside air. Connected with the valve-stem is a cord, which may extend the length of the car after the manner of a bell-cord. A pull upon the cord causes the valve in the device H to open the passage between the two chambers and at the same time close the outlet from the expansion-chamber, whereby air from the train-pipe expands into that chamber and reduces the pressure in the train-pipe to a degree limited by the capacity of the expansion-chamber.

Upon the operating-handle q of the engineer's valve is the usual spring-indicator q', which slides against the upper circumference of the shell A′, the latter being provided with shallow notches, with which the spring q' engages in the different positions of the valve to hold the handle in adjusted position and at the same time indicate the axial position of the valve s with relation to its seat t.

To explain the operation of the engineer's valve shown, I have indicated upon the circumference of the regulating-valve s in Fig. 4 a point x, and at the circumference of the valve-seat t in Fig. 3 points x', x^2, x^3, x^4, and x^5, with which the point x is to be turned coincident to produce certain results. When the valve s is turned to the position which brings the point x to x', the passage h and cavity g are at the cavity i, the cavity g' is at the port o, and the ports k, l, m, and n are closed. This is the "direct-feeding" position, in which pressure from the main reservoir, through its pipe B and the passages p, flows through the opening h to the cavity i, and thence through the channel g g^2 g' and port o to the train-pipe, whereby the latter is rapidly charged to the maximum degree of pressure and the brakes are released. When the point x is turned to x^2, the valve is at the "service-feed" or "running" position, wherein the pressure from the main reservoir is directed through the passage h to the cavity i and thence through the channel g g^2 g', port k, passage k', opening k^{10}, (in the valve k^4,) chamber k^2, and passage k^7 k^3 to the train-pipe, the ports o, l, m, and n being closed. While in this position any reduction of pressure due to slight leakages in the system will be overcome, the spring k^8 being sufficiently stiff to prevent the slight excess of pressure behind the valve k^4, while the effect of such leakage is being counteracted, from causing any apparent movement of the valve. The opening of a conductor's signaling-valve H, which, as described, produces a more decided though limited venting of the train-pipe, may cause the valve k^4 to receive a slight impulse in the direction of its seat; but an impulse from such a cause will never be sufficient to drive that valve to its seat. A breakage of the train-pipe or any of its connections, the parting of a coupling between cars, or the opening of a conductor's brake-valve will cause such a material venting of the train-pipe that the pressure behind the valve k^4 in excess of what escapes through the opening k^{10} will be greater than the spring k^8 can withstand, and the valve will therefore be quickly driven to its seat, thus shutting off the escape of air from the main reservoir. When the point x is turned to x^3, the valve is "on lap"—that is to say, the pressure from the main reservoir through the passages p and h can go no farther than the cavity i, the channel $g\ g^2\ g'$ being cut off from the latter. Thus all the ports are closed and the train-pipe is therefore cut off from all supply of pressure from the main reservoir, while at the same time the pressure in the train-pipe is held. When the point x is turned to x^4, the valve is in the position called "service stop," wherein the cavity m' is coincident with the ports l and m, all the other ports being closed. In this position pressure from the train-pipe passes through the port f into the valve D, and through the small passage afforded by the groove f^3 around the piston G, and through the pipe F and pipe l' to the port l, and through the cavity m' to the port m, and thence to the open air. This is the position to which the valve is turned to produce a slow venting of the train-pipe and a consequent gradual application of the brakes, as when the train nears a station. When the point x is turned to x^5, the cavity g takes in both the ports k and o, and the cavity g' is at the exhaust-port n, whereby a rapid venting of the train-pipe is effected, and the brakes are applied with great force and rapidity. This position is called the "emergency stop," and the valve is turned to this position only in case of emergency, as the name implies.

When the train-pipe is charged with pressure, it fills the reservoir F′ with the same pressure through the channel f, f^3, and F. In practice this pressure would be maintained at about seventy pounds. Any slight variations in pressure due to ordinary leakage in the system, and which would be overcome, as described, by the passage of pressure through the valve k^4, would not materially affect the pressure in the reservoir F′, and would not at least at any time produce such sudden exhausting as to cause the pressure from the reservoir F′ to move the valve G.

When a conductor's signaling-valve is operated while the engineer's valve is in the service-feed or running position, the sudden but limited venting of the train-pipe thereby effected will produce a sufficient reduction of pressure to cause the pressure from the reservoir F′ to move the valve G against the resistance of its spring G′ before the standard pressure can be again established through the valve k^4. This variation in pressure between the train-pipe and reservoir F′ is of course only momentary; but the upward impulse given to the piston G raises the valve-stem G′ from its seat at E and permits the escape of air into the pipe E′ to actuate the signal E^2.

If the conductor's signaling-valve H is operated while the engineer's valve is on lap, the pressure from the reservoir F′ may drive the piston G upward until it passes the lower end of the groove f^4, whereby the expansion of pressure from the reservoir F′ into the train-pipe to bring about an equilibrium of pressure between the two will be very rapid, so that the piston G will be returned by its spring and the escape of air to the signal cut off much more quickly than were the groove f^3 alone depended upon. The reservoir F′ should have capacity sufficient to cause the escape of air from it to supply a reduction of pressure in the train-pipe due to the actuating of a conductor's signal-valve to produce comparatively little reduction of pressure in the reservoir, and this even when the conductor's signaling-valve is actuated several times, and the rapidity with which the train-pipe may be supplied from the reservoir F′ through the groove f^3 will prevent such exhausting of the train-pipe as will reduce the pressure therein sufficiently to apply the brakes.

In practice the area of the groove f^3 would be about equal to that of a circle one-eighth of an inch in diameter, and the pipe l' and passage $l\,m'\,m$ about double that area. Thus when the engineer's valve is turned to service stop the escape of pressure from the reservoir F′ will be more rapid than that from the train-pipe. As a consequence, when the engineer's valve is turned from the service stop to "lap," the sudden shutting off of the escape of air through the pipe l' will cause no rebound or pressure in the train-pipe, for the reason that, the pressure in the reservoir F′ being lower at the time (due to its previous more rapid exhaust, as described) than that in the train-pipe, the rebound will be taken up by the reservoir.

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

1. In an air-brake system for railway-trains, the combination, with the main reservoir, engineer's valve, and train-pipe, of a supplemental air-reservoir near the engineer's valve in the line of the train-pipe, whereby when an exhaust-port in the engineer's valve is open pressure in the train-pipe and supplemental reservoir will be reduced simultaneously to prevent rebound of pressure in the train-pipe, substantially as described.

2. In an air-brake system for railway-trains, the combination, with the main reservoir, engineer's valve, and train-pipe, of a supplemental air-reservoir F′, communicating with the train-pipe through a small passage and with the engineer's valve through a larger passage l', and a valve in the engineer's valve for opening and closing communication between the passage l' and outside air, whereby when the valve is turned to vent the passage l' pressure is reduced more rapidly in the supplemental reservoir than in the train-pipe, and thereby prevents rebounding, substantially as described.

3. In an air-brake system for railway-trains, the combination, with the main air-reservoir, engineer's valve, and train-pipe, of a branch passage extending from the train-pipe to the service-stop inlet-port of the engineer's valve, a supplemental air-reservoir communicating with the train-pipe through the said branch passage to be supplied with pressure from the train-pipe, a valve device interposed in the branch passage between the train-pipe and supplemental reservoir and through which the pressure passes, and signal mechanism upon the said valve device actuated automatically by the said valve device when the pressure in the supplemental reservoir exceeds that in the train-pipe, substantially as described.

4. In an air-brake system for railway-trains, the combination, with the main air-reservoir, engineer's valve, and train-pipe, of a service-stop outlet-port and a service-stop inlet-port in the engineer's valve, a branch passage extending from the train-pipe to the service-stop inlet-port, through which air is vented from the train-pipe when the service-stop inlet and outlet ports are brought into communication, a signal-valve in the said branch passage, signal-actuating mechanism in the signal-valve, and a supplemental reservoir in the said branch passage between the service-stop inlet-port and the signal-actuating mechanism and receiving its pressure from the train-pipe, the signal-actuating mechanism being operated by the retrogression of pressure from the said supplemental reservoir to the train-pipe, substantially as described.

5. In an air-brake system for railway-trains, the combination, with the main air-reservoir, engineer's valve, and train-pipe, of a supplemental air-reservoir communicating with the train-pipe to be supplied with pressure therefrom, a valve device located between the train-pipe and supplemental reservoir and through which the pressure passes, a movable diaphragm in the said valve device only partly closing communication between the train-pipe and supplemental reservoir and to be moved from its normal position by pressure against it from the supplemental reservoir in excess of the pressure in the train-pipe, and signal mechanism upon the said valve device actuated by movement of the diaphragm, substantially as described.

6. In an air-brake system for railway-trains, the combination, with the main air-reservoir, engineer's valve, and train-pipe, of a supplemental air-reservoir communicating with the train-pipe to be supplied with pressure therefrom, a valve device located between the train-pipe and supplemental reservoir and through which the pressure passes, a port in the said valve device communicating with a signal, and a movable diaphragm in the said valve device normally closing the said port and partly closing communication between the train-pipe and supplemental reservoir and to be moved from its normal position by pressure against it from the supplemental reservoir in excess of the pressure in the train-pipe, whereby the said port is opened and air escapes to the signal to actuate the same, substantially as described.

7. In an air-brake system for railway-trains, the combination, with the main air-reservoir, engineer's valve, and train-pipe, of a supplemental air-reservoir communicating with the train-pipe to be supplied with pressure therefrom, a valve device located between the train-pipe and supplemental reservoir and through which the pressure passes, a passage f^3 in the valve device affording constant communication between the train-pipe and supplemental reservoir, a passage f^4 in the valve device to supplement the passage f^3, a movable diaphragm in the valve device normally closing the passage f^4 and to be moved from its normal position by pressure against it from the supplemental reservoir in excess of the pressure in the train-pipe to open the passage f^4 and permit the retrogression of pressure from the supplemental reservoir to the train-pipe through the passage f^4, as well as the passage f^3, and signal mechanism upon the said valve device actuated by movement of the diaphragm, substantially as described.

8. In an air-brake system for railway-trains, the combination, with the main air-reservoir and train-pipe, of a direct passage and an auxiliary passage between the main reservoir and train-pipe, an engineer's valve operative at will to direct pressure from the main air-reservoir to the train-pipe through either the said direct or auxiliary passage, a check-valve in the auxiliary passage seating in the direction of the train-pipe and exposed to back-pressure therefrom to be moved toward its seat by abnormal reduction of back-pressure in the train-pipe, a supplemental air-reservoir connected with the train-pipe, and a signal-valve interposed in the passage between the said supplemental reservoir and train-pipe and operative to actuate the signal when the pressure in the train-pipe is reduced below that in the supplemental reservoir, substantially as described.

9. In an air-brake system for railway-trains, the combination, with the main air-reservoir and train-pipe, of a direct air-passage and an auxiliary passage between the main reservoir and train-pipe, an engineer's valve device op-

erative at will to direct the air-pressure from the main reservoir through either the direct passage or auxiliary passage at will, a valve in the auxiliary passage normally held away from its seat and seating in the direction of the train-pipe and exposed to back-pressure therefrom, a normally-open feed-passage from one side of the said valve to the other, and a passage supplementing said feed-passage arranged to be opened by movement of the said valve toward its seat, whereby a limited reduction of back-pressure in the train-pipe will cause the said valve to be moved in the direction of its seat to open the supplemental passage, and thereby increase the feed of air from the main reservoir to the train-pipe, and whereby a sudden great reduction of back-pressure in the train-pipe will cause the said valve to be forced to its seat to shut off communication between the main reservoir and train-pipe, substantially as described.

HARRY R. MASON.

In presence of—
J. W. DYRENFORTH,
M. J. FROST.