(No Model.)

4 Sheets—Sheet 1.

B. B. MORGAN.

BLOCK SIGNAL.

No. 572,267. Patented Dec. 1, 1896.

Fig. 1.

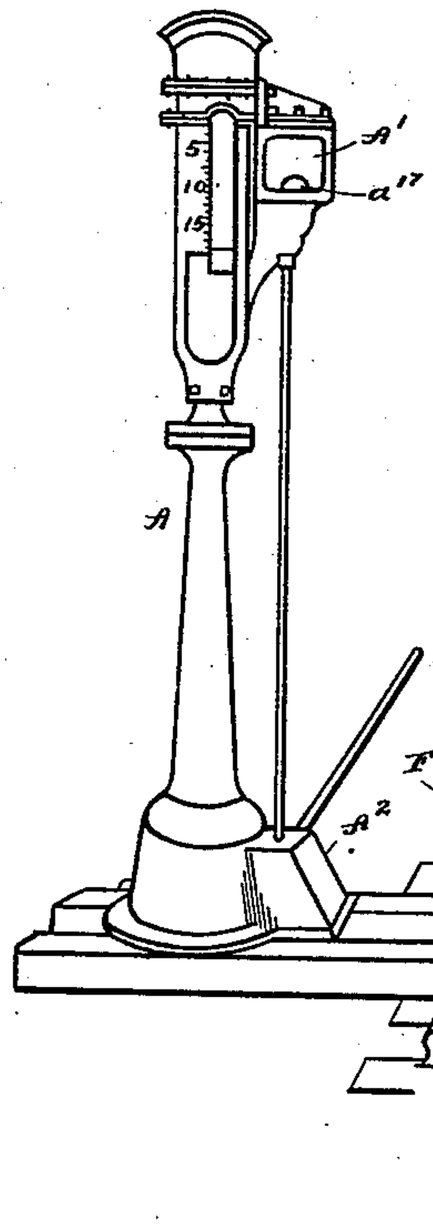


Fig. 2.

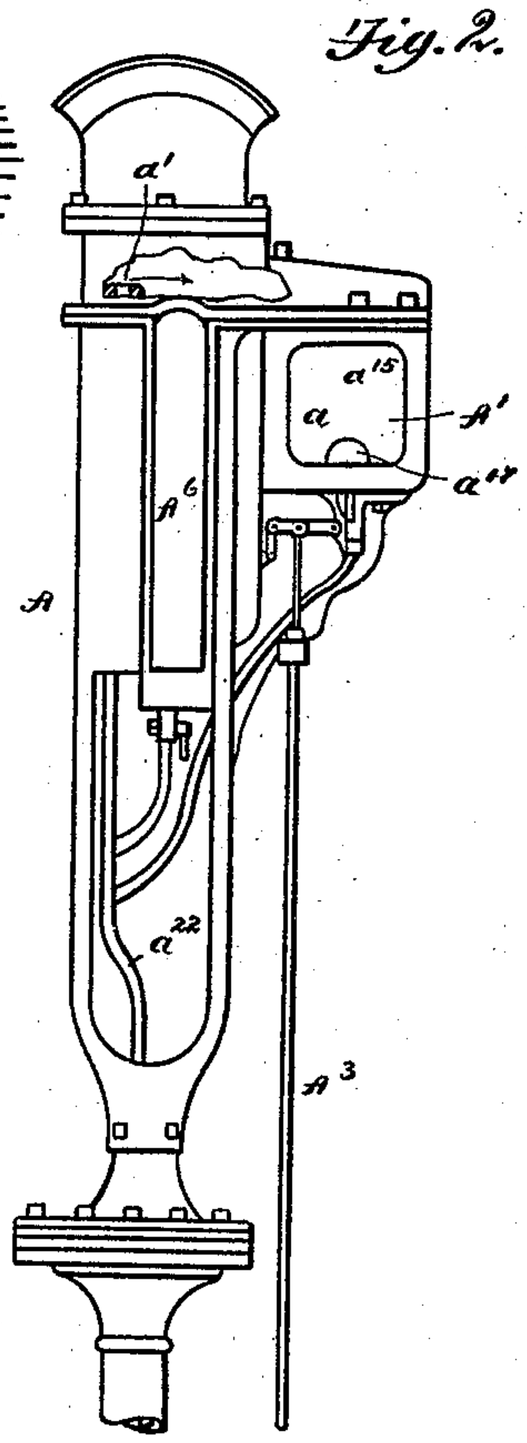
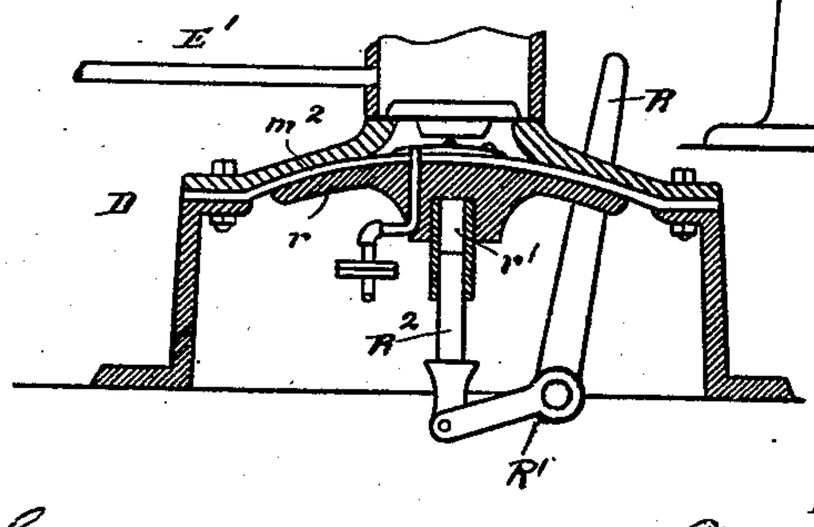
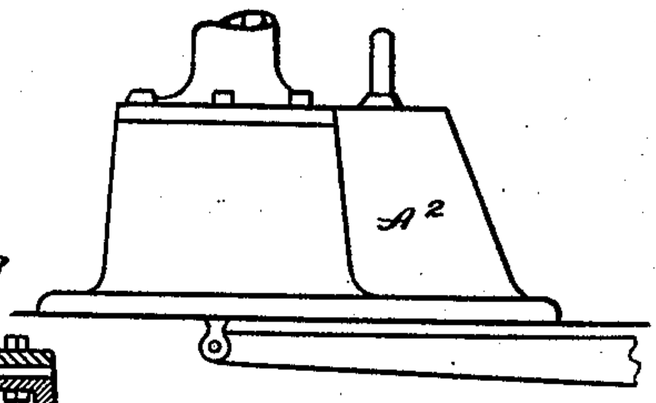


Fig. 7.





WITNESSES

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(No Model.) 4 Sheets—Sheet 2.

B. B. MORGAN.

BLOCK SIGNAL.

No. 572,267. Patented Dec. 1, 1896.

Fig. 10.

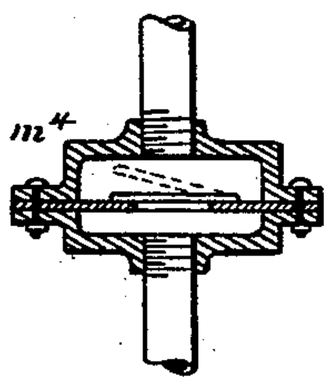


Fig. 3.

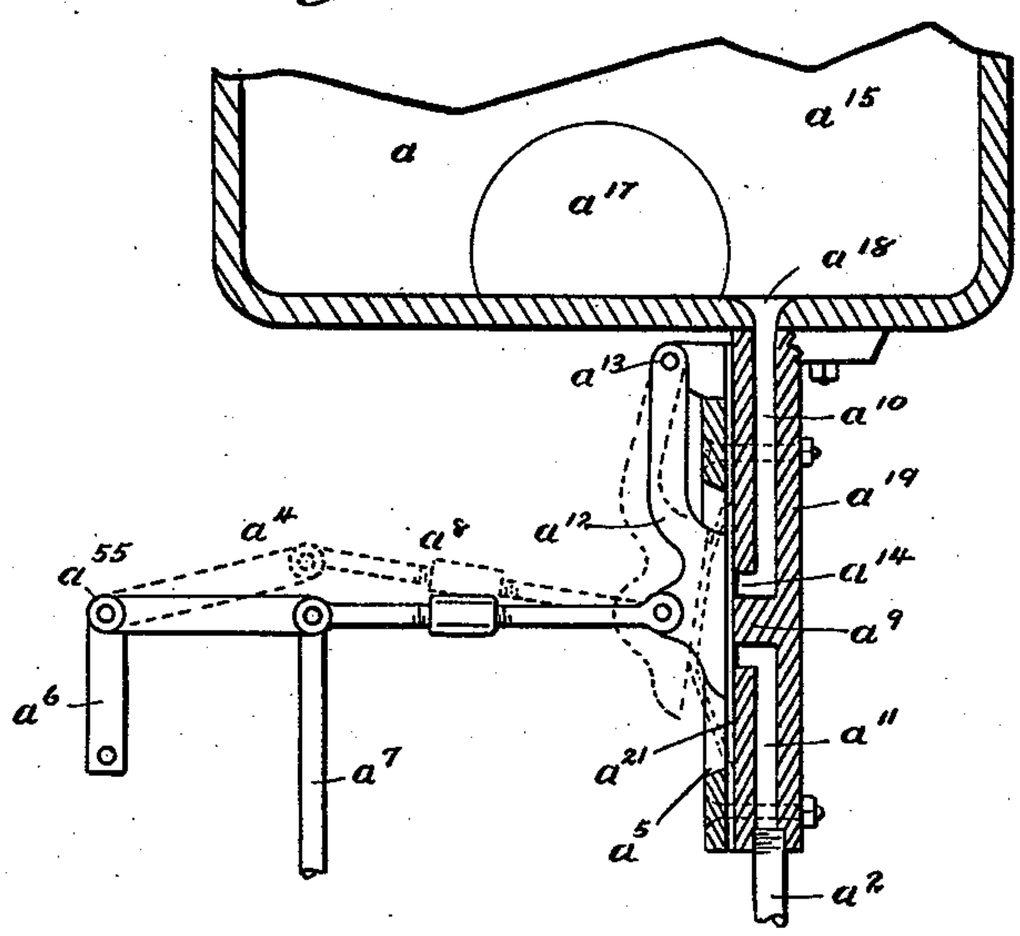
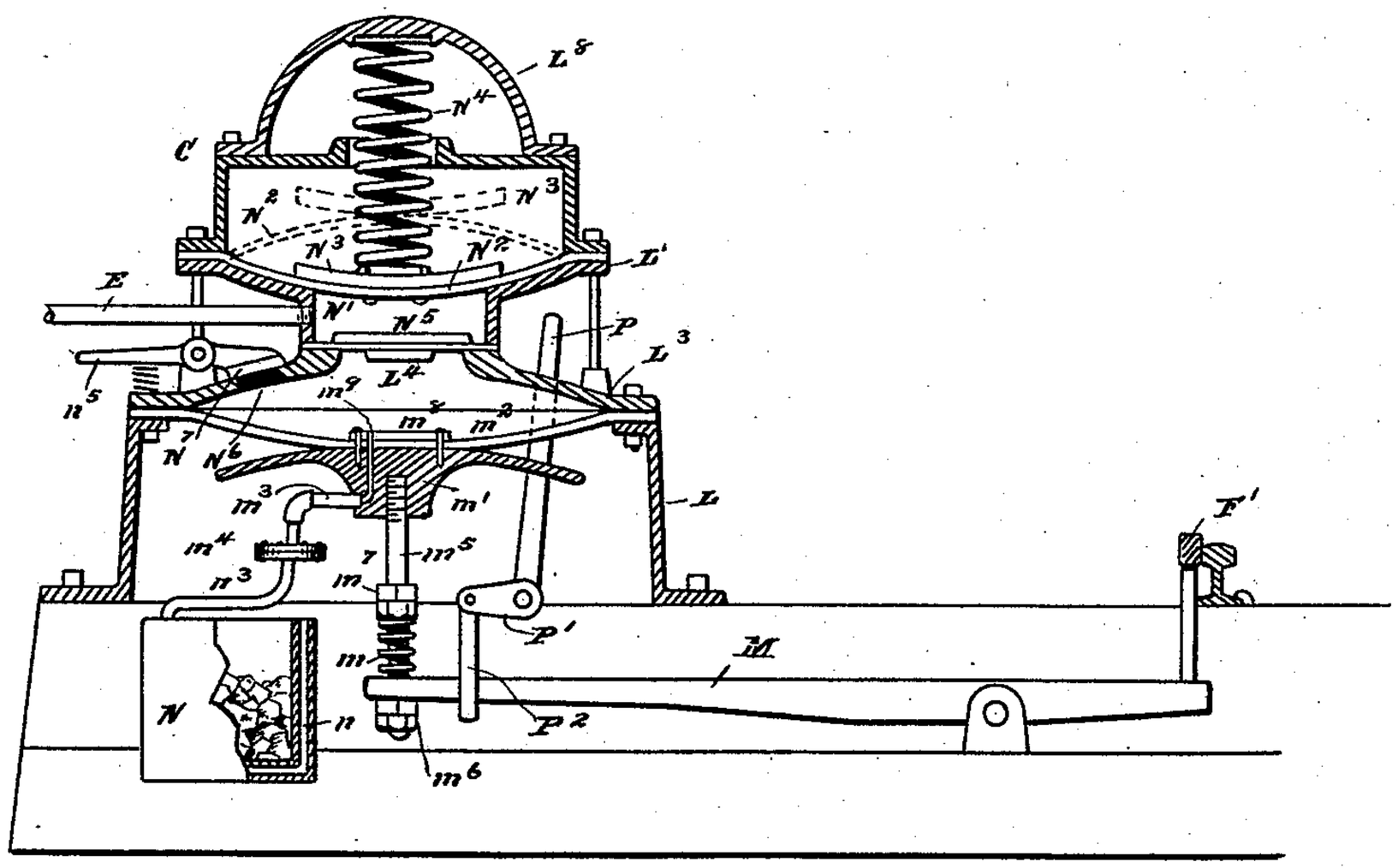


Fig. 6.



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BLOCK SIGNAL.

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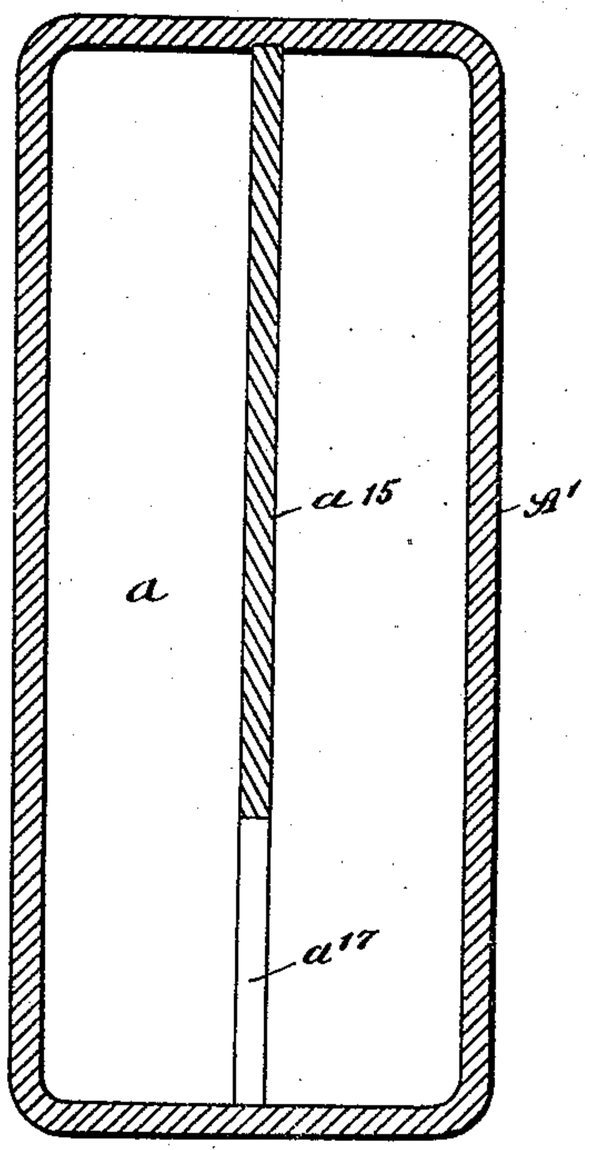

Fig. 11.

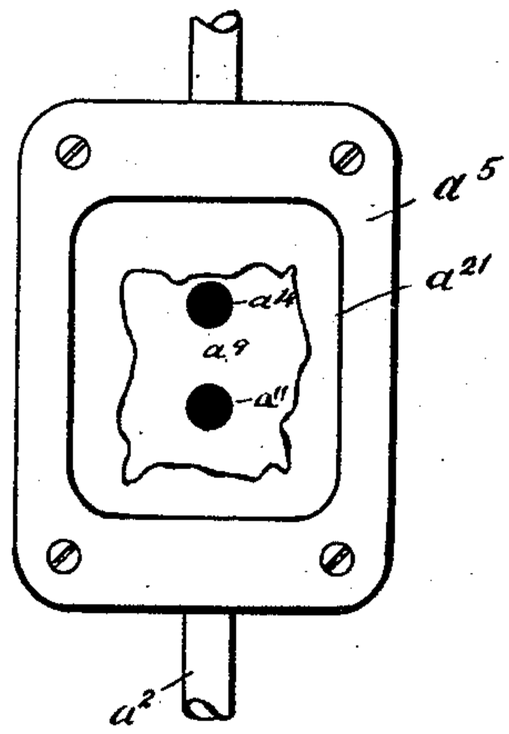

Fig. 4.

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BLOCK SIGNAL.

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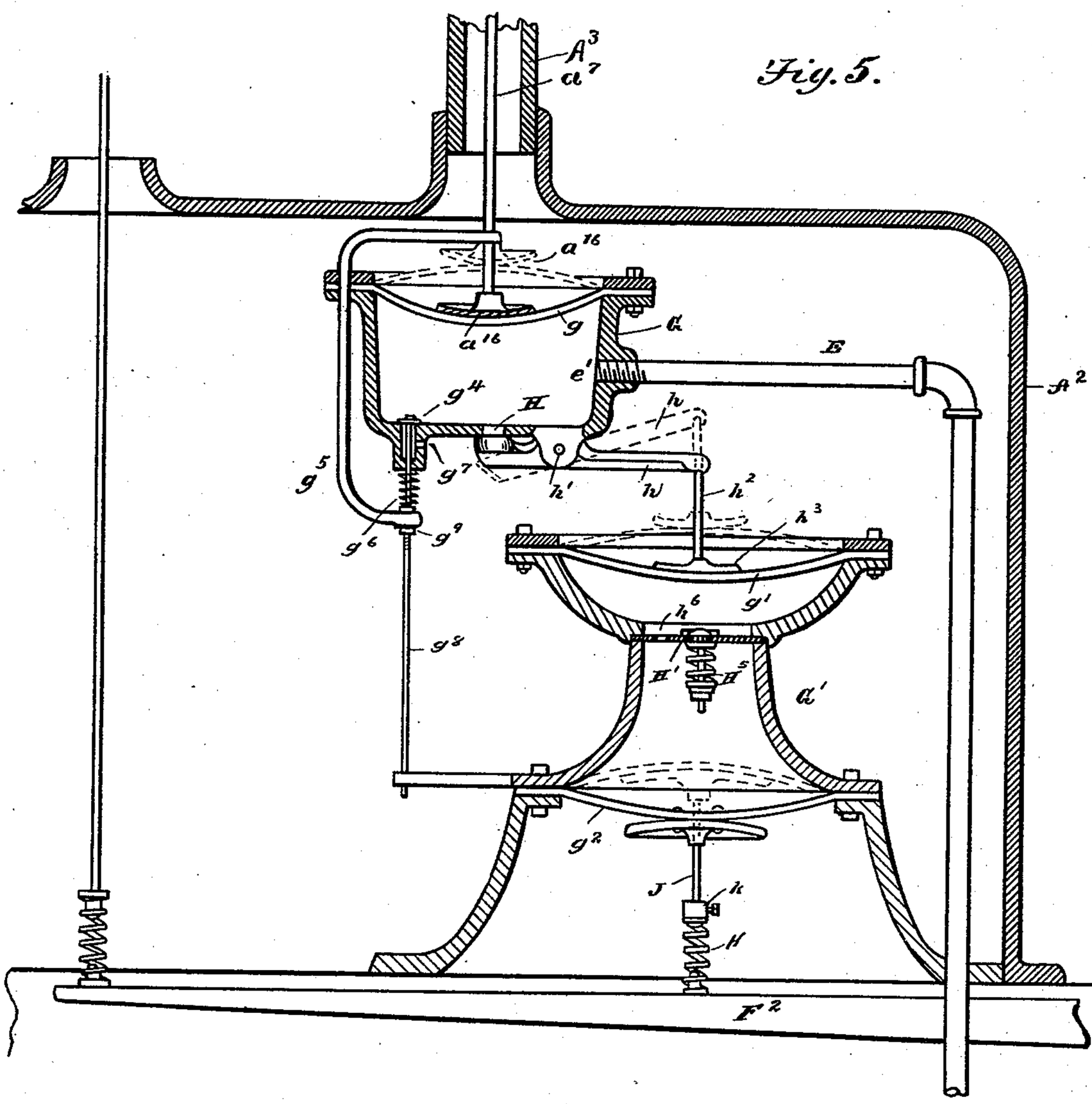


Fig. 5.

Fig. 8.

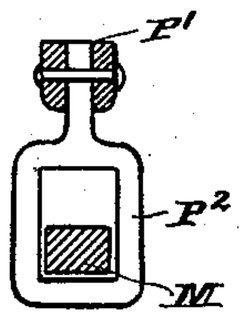
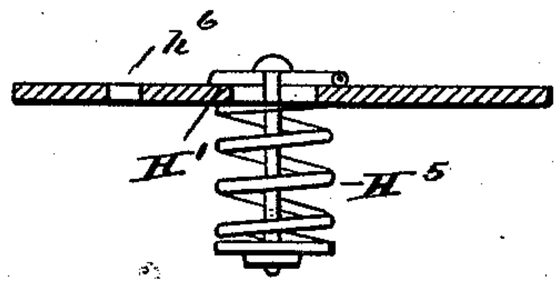


Fig. 9.



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UNITED STATES PATENT OFFICE.

BENJAMIN B. MORGAN, OF YPSILANTI, MICHIGAN, ASSIGNOR TO THE MORGAN SIGNAL COMPANY, OF SAME PLACE.

BLOCK-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 572,267, dated December 1, 1896.

Application filed December 1, 1893. Serial No. 492,472. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN B. MORGAN, a citizen of the United States, residing at Ypsilanti, county of Washtenaw, State of Michigan, have invented a certain new and useful Improvement in Block-Signals; and I 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 pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to block-signals for railways; and it consists in the mechanism and combinations hereinafter described and claimed.

In the drawings, Figure 1 is a perspective view of a block-signal constructed according to my system, showing its relation to a railway as an appliance therefor. Fig. 2 is an elevation showing the details of a signal-post, time and block signals elevated thereon. Fig. 3 is a sectional view of the releasing mechanism of a block-signal. Fig. 4 is a plan view of the same. Fig. 5 is a sectional view of the transmitting and air-releasing apparatus for operating the signal. Fig. 6 is a sectional view of the tripping apparatus. Fig. 7 is a sectional view of a hand tripping apparatus. Fig. 8 is a detailed view of a portion of Fig. 6. Fig. 9 is a detail figure showing the diaphragm and valve with its small perforation, as shown in Fig. 5. Fig. 10 is a detail sectional view of the valve in the flexible pipe illustrated in Fig. 6. Fig. 11 is a perpendicular central sectional view of the signal-case, showing the central diaphragm.

Similar letters refer to similar parts.

In the drawings, A represents a signal-post containing time-signals such as are described and illustrated by me in certain Letters Patent of the United States issued to me March 28, 1893, No. 494,509, and hence they will need no further description. To the side of the signal-post A, and preferably constructed integral therewith, is a block-signal bracket-chamber A′, which is operated by mechanism inclosed in the case A^2. Both the time-signal and the block-signal are actuated simultaneously by a single spring-rail connection F, the constructions and connections preferably being substantially such as are shown in an application heretofore filed by me on December 27, 1892, Serial No. 456,519, or they may be those shown in the patent or any other suitable track connection.

B represents the main line of rails of a railway. B′ represents a switch and siding leading therefrom. It is usual in block-signals, as is well known, to divide the main line into sections, each of which is blocked successively by the signal until an advancing train passes the block at the beginning of the next section, and so on continuously. The main object of this device is to make the operation of setting and releasing signals automatic as the train advances from block to block.

In Fig. 1, therefore, C would represent the trip or release point, which is supposed to be at the farther end of the block of which the signal-post A is the commencement. This latter trip is also actuated, preferably, by a spring-rail connection F′, exactly like that which sets the signal and which therefore needs no further description. A train under motion first striking the spring-rail F not only sets the time-signal in the signal-post A, but also sets the block-signal in A′. As it advances, the time-signal commences to run down, showing the length of time since the train passed the post A, as stated in the patent hereinbefore named. The block A′ remains fixed in position, showing a danger-signal to any train proceeding in the same direction and following the one in question, until the advancing train has reached the connection at F′, when it releases the block-signal by means of the mechanism hereinafter described, and it is at once withdrawn, showing that the block from the post A to the point F′ is clear.

In Fig. 2, A is the case containing the mechanism of the time-signal, and containing in A^5 the operating mechanism therefor, which, as stated, may be the same precisely as that prescribed in the Letters Patent before issued to me, No. 494,509. A portion of the case is broken away to show the discharge-pipes and also to show the reservoir *a* in the case A′ for the block-signal. The reservoir in the case A′ is adjacent to the reservoir A^6 of the time-signal, the capacity of the propelling-chamber at A^5 and the amount of liquid being sufficient

to supply both the time-signal A^6 and the reservoir a for the block-signal. A passage-way at a', leading from the overflow-pipe from the top of time-chamber A^6, leading to the open top of the block-signal chamber a, enables both to be filled simultaneously by means of the propelling mechanism in the chamber A^5, connected with track connections, as described in the former patent or as illustrated also in the application hereinbefore named. The case A', which surrounds the reservoir-chamber a, is cut out upon either side thereof, and as the chamber a is made of transparent glass the colored liquid thrown therein, as before described, is exhibited to observation precisely the same as that shown in chamber A^6 for the time-signal. Situated in the case A' is a perpendicular central diaphragm a^{15}. This diaphragm is preferably made of opaque white-colored glass, to form a background for the colored liquid, which is permitted to flow on either side thereof. In the lower portion of the diaphragm is a semicircular perforation a^{17}, the object of which is to permit rays of light to pass entirely through from side to side of the case A' and the reservoir for purposes of illumination.

In Fig. 3, which is a sectional view of the reservoir and a face view of the diaphragm a^{15}, with the perforation a^{17} described, and also a sectional view of the mechanism for discharging the liquid and means for controlling the same, the construction is shown to better advantage than in Fig. 2. In the bottom of the reservoir a is a perforation a^{18}. Communicating with this perforation is a depending plate a^{19}, having passage-ways shaped therein, a^{10} a^{11}, the perforation a^{10} in this plate coinciding with the perforation a^{18} in the bottom of the reservoir. The perforation a^{10} is brought to the surface of the plate at a^{14}. The perforation a^{11} is also brought to the surface of the plate a short distance below that of a^{14}, so that there is a short intervening portion of the plate or bridge a^9 between the two.

Fig. 4 is a plan view of the face of the plate a^{19}, with the hereinafter-described valve omitted, the irregular outlines representing a perforation in the rubber plate a^{21} and the dark spots a^{14} a^{11} representing the openings of the perforations in the face of the plate. A thin plate of soft pure rubber a^{21} is firmly fastened to the perforated face of the plate a^{19} by means of a perforated metal plate a^5, with appropriate bolts or screws passing through the corners thereof. It is obvious that so long as the rubber plate a^{21} is in close contact with the face of the plate a^{19} all communication between the two apertures a^{14} and that leading into the perforation a^{11} is closed by the contact of the rubber plate upon the face a^9 of the plate between the two perforations. It is also obvious that if the rubber plate be permitted to spring away from the face of the perforated plate a^{19} communication will be opened between the perforations a^{10} and a^{11}, over the bridge a^9, and between the rubber plate and the perforated plate. To provide means for this springing away, and also for closing the face of the rubber plate a^{21} against the face of the perforated plate a^{19}, I have devised the apparatus further shown in Fig. 3, in which a^{12} is a hanging and swinging arm pivoted at a^{13} from a lug formed on the perforated holding-plate a^5. The side of the arm toward the perforated plate a^{19} is formed with a flat surface in a plane corresponding to that of the rubber plate a^{21} when the arm is swung in the position shown in Fig. 3. It is adapted to be swung backward therefrom, taking the position shown in the dotted lines, thereby removing any pressure which it may have theretofore exerted against the rubber plate a^{21}. Obviously, if the chamber a be filled with the colored liquid, the liquid will permeate through the aperture a^{18}, the perforation in the plate a^{19}, and impinge against the rubber plate at a^{14}. On the removal of the face of the swinging arm a^{12} from behind the rubber plate that pressure will overcome, if the parts are properly adjusted, the resistance of the rubber plate a^{21} and cause it to bulge outwardly, thereby opening communication over the bridge a^9 with the lower aperture a^{11}, which communicates with an eduction-pipe a^2, and which in turn communicates with the overflow-pipe, as shown in Fig. 2, at a^{22}. By this means the colored indicating liquid which has occupied the block-signal chamber a is returned to the chamber A^5 in readiness to be again thrown over by the operation of the mechanism contained in the latter chamber, and thus refill the block-signal chamber.

The mechanism for controlling the operation of the swinging arm a^{12} consists of a toggle-joint composed of two bars a^4 and a^8, one end of the arm a^8 being pivoted to the swinging block a^{12} and the other end being pivoted to its fellow arm a^4. The opposite end of the arm a^4 is pivoted to an adjustably-swinging block a^6 at a^{55}. The object of this is that the pivotal point a^{55} may be slightly moved toward or from the perforated plate a^{19}, so as to make the pressure against the rubber plate a^{21} adjustable.

At the junction of the arms a^4 and a^8 is pivoted a connecting-rod a^7. This descends through but is disconnected from a pipe A^3, which pipe forms a case for it, the upper end of which pipe is attached to the case A' for the block-signal and the lower end attached to the case A^2, which contains the tripping mechanism. The connecting-rod a^7 enters the lower case A^2 and is therein connected to the tripping mechanism hereinafter described and which is more particularly shown in Fig. 5.

I do not desire to confine myself to the form of release mechanism hereinbefore described, and more particularly illustrated in said Fig. 3, although I prefer that shown and believe the same to be original with me; but in the

general combination I desire to be understood as intending to cover any and all forms of mechanism whereby the indicating liquid in the block-signal chamber A′ may be permitted to escape therefrom at the proper time, and such escape will be effected by means of the mechanism hereinafter described. Said mechanism is adapted to operate longitudinally the reach-rod a^7, and, as it is obvious that the upper end of said rod a^7, having the motion shown in Fig. 3, might be made to operate any one of a number of common valves or devices which would permit the release of the liquid from the reservoir of the block-signal, any one of which devices would be an equivalent for the one shown, I do not wish to confine myself to that form, although I deem that the best for the purpose under the circumstances specified.

As the releasing apparatus must not be operated until after the moving train which set the signal has arrived at the extremity of the block which the signal guards, a portion of the mechanism by which the releasing apparatus is operated must be so located that it cannot be set in operation to release the signal until the train has reached the distant point, and therefore some means must be provided at the distant point by which the releasing mechanism at the signal-post is operated to shift the signal; also, some means of communication between the distant mechanism and the immediate releasing mechanism must be had. I attain both of these objects by the mechanism shown in Figs. 1 and 6 in conjunction with mechanism located at the signal-post in Fig. 5.

In Fig. 6, F′ represents a spring-rail adapted to operate a lever M. This spring-track connection is precisely the same as that shown in the application hereinbefore referred to and need not therefore be fully described. It will be understood, however, that any track connection adapted to operate the lever M would be within the scope of the invention herein described and claimed, and I do not desire to limit myself to the special form of track connection mentioned, although I prefer it. The location of this rail and its relation to the signal-post is shown in perspective in Fig. 1.

Adjacent to the track connection F′ and inclosing the outer end of the lever M is a strong cast-iron case L. The upper portion of this case is preferably round and is closed by a cover L^8, which cover has a central perforation at L^4. The under portion of the cover is concave, and firmly clamped between the cover and a flange surrounding the upper edge of the case L is an elastic diaphragm m^2. Attached to the center of this circular elastic diaphragm m^2 is a convex plunger-head m', from which depends a stem m^5. The lower end of this stem passes loosely through a hole in the lever M and is held therein by means of nuts at the extreme threaded end at m^6. The shank of the projection m^5 is threaded, and upon it is run the adjusting-nut m^7. Between this and the lever M is interposed a release spiral spring m. It is obvious that upon the head m' meeting a resistance, as, for instance, the upper concave portion of the cover L^3, any further motion of the lever M would be taken up by the spiral spring m, the spring, however, being stiff enough, and in this respect being adjustable by means of the nut m^7 to compel the movement of the head m' against the resistance above the attached elastic diaphragm m^2.

Upon the opposite and upper side of the diaphragm m^2, concentrically located, is a round plate m^8. This plate is fastened by appropriate fastenings to the plunger-head m', firmly holding the elastic diaphragm m^2 between the plunger-head and the plate. At m^9 the plate, diaphragm, and plunger-head are perforated to the exterior of the plunger-head. Coinciding with this perforation is a tube m^3. This communicates with a valve-chest m^4, containing an ordinary flap-valve adapted to open inwardly. The lower side of the valve-chest is perforated and a flexible tube n^3 continued therefrom. This tube communicates with the interior of a chest N. The tube n^3, by its flexibility, permits the movement of the plunger-head m' throughout the range of its motion without disturbing its connection with the chest N. As shown in section at n, one side of the chest is perforated, forming a tube which permits the air to enter and pass to the bottom of the chest N before it is permitted to enter into the chest. The chest N is partially or wholly filled with lumps of caustic lime or any other anhydrous deliquescent material.

It is obvious that the reciprocations of the plunger-head m', acting upon the elastic diaphragm m^2, in conjunction with a flap-valve located above at N^5 and closing off the central opening located in the apex of the cover L^3, would operate to draw air through the valve m^4 and connecting-tubes from the chest N, and the object of the anhydrous material located therein is for the purpose of absorbing any moisture that might be present in the air drawn through the chest in the manner specified.

I have deemed it best to show a means of extracting residual moisture from the air used to operate the device, as the moisture contained in the air might freeze and affect the operation of the device at critical points. It will be understood, however, that I do not confine myself to any specified means nor to any means for extracting such moisture, for the reason that it is not essential to the operation of the device, except under extraordinary and exceptional circumstances. I deem it preferable, however, that the moisture should be preliminarily extracted before using air, for the purpose hereinafter stated.

As hereinbefore stated, the central opening in the apex of the cover L^3 is closed off by a flap-valve N^5 opening upwardly. This

valve is preferably weighted, so as to insure its closing under proper circumstances. It is obvious that upon forcing the elastic diaphragm m^2 upwardly the air confined between the flap-valve in the valve-chamber m^4 and in the space above the diaphragm would be compressed, and as its only mode of egress is through the flap-valve N^5 it raises this valve and escapes into a chamber located above it, (marked N',) and in a casting of peculiar shape L', which forms, preferably, an annular continuation surrounding the central open portion of the concave head L^3. Connected with this chamber is an air-pipe E, through which the air can flow freely until it reaches the apparatus shown in Fig. 5. This pipe E is illustrated upon Fig. 1 as extending from the trip mechanism at C to the releasing mechanism in the casing A^2 at the block-signal, the mechanism in said casing A^2 being illustrated in Fig. 5. As the diaphragm m^2 would be forced upwardly very quickly on the passage of a train, thereby opening the valve N^5 quickly and forcing the air into the chamber contained in the annular casting L' and from thence into the pipe E, and as the valve N^5 would also close quickly on the release of the upward pressure and the consequent descent of the plunger-head m' and the diaphragm m^2, I have provided means for continuing the pressure upon the air contained in the chamber L', which means consists in placing above the chamber L' another elastic diaphragm N^2, which diaphragm is controlled by a plunger-head N^3. Located centrally in this plunger-head and between it and the cap L^3 of the casing is a spiral spring N^4. This spring gives a definite pressure upon the diaphragm N^2, tending to force it into the position as shown in the drawings. The pumping of the air, however, past the flap-valve N^5 forces the diaphragm N^2 upwardly against the pressure of the spring N^4, compelling it and the head N^3 to take the position shown in dotted lines. The closing of the valve N^5 fills the chamber between it and the diaphragm N^2 with air compressed by the pressure of the spring N^4, and this gives a constant pressure for a short time through the pipe E.

It will be noted that the essential feature of this apparatus is an air-pump worked by a track connection forcing the air into an elastic chamber past a flap-valve closing off its return, whereby the air in the elastic chamber, by virtue of the elasticity of the chamber, is compelled to do work at the extremity of the open tube E, no matter to what distance that tube may be carried; but owing to the peculiar difficulties in handling compressed air under such circumstances I prefer the apparatus as a means of handling thereof over any others that might be used in common use.

I do not deem the air-compressing apparatus hereinbefore described to be essential in the operation of this device. It, however, is a convenience, and it avoids the necessity of rapid oscillations by the diaphragm m^2 and also prevents excessive pressures in the chamber contained in the casting L'. In order to provide for a release of the air in the chamber above diaphragm m^2, the perforation is made in the head L^3 at N^6, which is closed by an air-tight pad upon a lever N^7. A handle n^5, which is capable of being depressed, permits of the opening of the valve at N^6 by hand. It is obvious that in such case the air would be permitted to escape instead of being compressed into the chamber above the valve N^5, and therefore that a train would be permitted to pass over the track connection F' without operating the trip to release the block-signal at the beginning of a block. This would be frequently desirable in case two or more trains should happen to be located within the block, as the release of the block-signal would not be desired until the rearmost train had passed out from the block.

Provision for operating this device by hand is also made by means of the lever P. As shown in the drawings, this is bell-cranked upon a pivot, and an arm P' is pivotally connected to a yoke P^2, which encircles and engages the lever M. By throwing the lever P down the lever M would be raised by means of the yoke connection, carrying with it the plunger-head m', the attached diaphragm m^2, and thereby forcing the air into the chamber above in the same manner as though it had been done by means of the track connection F'.

Fig. 8 shows an elevation of the yoke and a sectional one of the arm P' and lever M. When the lever P is thrown into the position shown in the drawings, the yoke permits the free oscillation of the lever M.

In Fig. 7 is shown a trip mechanism communicating with the pipe E and located, as shown in Fig. 1, at a switch D. The construction of this mechanism is in all respects essentially the same as that of Fig. 6, and therefore the similar details are entirely omitted. The pipe E', however, simply communicates as a branch pipe with the pipe E, so that an impulse of air sent through the pipe E' trips the block-signal in the same manner as an impulse sent by means of the train to the pipe E by means of the mechanism shown in Fig. 6. The mechanism shown in Fig. 7 is modified to the extent that the lever R, instead of being connected to a yoke like P^2, carries beyond its pivotal point and on its shorter end R' a plunger-rod R^2. The plunger-head in this device r is in all respects the same as that shown at m' in Fig. 6, except that its under side at r' is hollowed to receive the upper end of the plunger-rod R^2, the plunger-rod moving freely in the hollow. When the upper end of the plunger-rod comes in contact with the bottom of the hollow r', it compels the plunger-head r to rise, carrying with it the diaphragm m^2 in exactly the same manner as if it had been forced up by the lever M. As, however, the diaphragm m^2, car-

ried by the plunger-head r, descends comparatively slowly, so that, by means of the sliding connection at r', the lever R can be instantly returned to its original position and locked. As hereinbefore stated, all of the other parts of the apparatus are duplicates of that shown in Fig. 6, and therefore they are not shown in this figure. The impulse of air thus generated and forced through the pipe E is transmitted to the mechanism shown in Fig. 5 and passes into a chamber formed by a casing G at e'. The upper portion of this casing G is closed off by an elastic diaphragm g. The connecting-rod a^7, carrying upon its lower end a head a^{16}, is shown in its normal position when the signal-releasing mechanism is closed, as shown in Fig. 3. The impulse of air arriving in the chamber formed in casing G, underneath the elastic diaphragm g, forces it upward, carrying with it the head a^{16} and the connecting-rod a^7. This raises the toggle-joint at a^4, thereby withdrawing the swinging block a^{12} and permitting the liquid in the signal-chamber to descend through the pipes a^{10} a^{11}. In order to prevent an excessive pressure in the chamber in the casing G and thereby a rupture of the diaphragm g, there is provided a safety-valve g^4, through which the air may escape out of the passage-way g^7 when the plunger-head a^{16} arrives at the point shown in the dotted line. The safety-valve g^4 carries upon its under side a long valve-stem g^8. Upon this stem is an adjustable yoke g^5, made adjustable thereon by means of the nuts g^9. This yoke passes through a guide, is curved over the center, and loosely embraces the rod a^7 just over the head a^{16}. Between the lower face of the casing G and the jam-nuts g^9 is interposed a spiral spring. The motion of the head a^{16} upwardly engages the yoke g^5 and raises it, also compelling a raising of the valve-stem g^8 against the tension of the spring g^6, and also simultaneously raising a safety-valve g^4 and permitting the escape of the air contained in the chamber in the casing G.

As the compressed air in the chamber in the casing G, forced therein through the pipe E and aperture e', would remain therein and hold the aperture at a^{14} open, or at least permit the liquid that might be thrown into the block-signal chamber A′ to instantly flow through the escape passage-ways at a^{14}, there must be some means provided whereby the air from the chamber in the casing G can be permitted to escape at the time of or before the filling of the block-signal chamber A′. This is attained by means of the releasing mechanism further shown in Fig. 5.

As hereinbefore stated, the time-signal is set by means of a track connection F, connected with a lever F^2 and operated as described in the patent named. Intermediately placed between the time-signal and the track and inclosed in the casing A^2 is a subsidiary casing G′. The lower portion of this casing contains a diaphragm g^2. This diaphragm is operated by a plunger-head J, which is connected with a track through the means of the spring K and collar k, so that the lever F^2 operates the time-signal, fills the block-signal, and also simultaneously operates the air-releasing apparatus through the plunger J. Above the plunger J is an air-chamber, the upper portion of which contains a diaphragm and an upwardly-opening air-tight valve H′, controlled by a spiral spring upon its under side H^5. The operation of the air above the diaphragm g^2 forces this valve upwardly and permits it to fill the chamber above it. A second elastic diaphragm g' is located above the valve H′, closing off the upper portion of the chamber in the casing G′. This diaphragm carries a head h^3, the stem h^2 of the head operating a lever h. Upon the opposite end of this lever, it being pivoted at h', is a valve H. The movement upward of the head h^3, the stem h^2 operating the lever h, opens the valve H. The closing of the valve H′ would, except for the means hereinafter specified, prevent the diaphragm g', operating through intermediate connections or valve H, from descending, and thereby would keep the valve H entirely open. In order to permit its descent, a small perforation is made at h^6 through the rigid diaphragm, in which is seated the valve H′. This opening h^6 is so proportioned that it permits the escape of air somewhat slowly and thus retains the valve H in the open position for from half a minute to a minute, which insures the certainty of the descent of the head a^{16} and the locking of the valve at a^{14}.

The operation is obvious from the foregoing description. It is also obvious that an engineer of a following train, in approaching the combined time and block signal, would be informed of the length of time the train preceding his had passed the time-signal within its limits, and also whether it had passed beyond the block or not. If, for instance, the time-signal showed that it had passed at least fifteen minutes before and that the block was still shown it would appear that it was probable that some accident had happened or that the preceding train was detained on the block for an unusual time.

What I claim is—

1. In a block-signal for railways, the combination with a track, a signal-post and case carrying said signal, a time-signal in conjunction with the block-signal and the block-signal post, of transparent receptacles adapted to be filled with colored liquid, a valve adapted to close the outlet of one of said receptacles, means for automatically closing said valve by the passing of a train along the track, means whereby the time-signal is set and the block-signal displayed automatically and simultaneously with the closing of said valve and by the passage of said train, and means for automatically opening said valve

whereby the block-signal is withdrawn by said train passing out at the opposite end of the block, substantially as described.

2. In a block-signal for railways, the combination and arrangement of a transparent chamber exposed to view, a colored liquid adapted to be forced therein, means for automatically forcing said liquid therein by the passing of a train upon an adjacent track, an air-pump located at the opposite end of the block, means for automatically actuating the same by the passage of the train out from said block, a communicating pipe connecting said air-pump with means for automatically actuating a discharge-valve, whereby a passage-way is opened leading from said indicating-chamber and the liquid discharged therefrom, substantially as described.

3. In a block-signal for railways, the combination and arrangement of a transparent chamber exposed to view, a colored liquid adapted to be forced therein, means for automatically forcing said liquid therein by the passing of a train upon an adjacent track, an air-pump located at the opposite end of the block, means for automatically actuating the same by the passage of the train out from said block, a communicating pipe connecting said air-pump with means for automatically actuating a discharge-valve, whereby a passage-way is opened leading from said indicating-chamber and the liquid is discharged therefrom, and a relief-valve operating to automatically release the air from the receiving-chamber of said air-pump, whereby the air is continually being forced into the apparatus and discharged therefrom after doing its work, substantially as and for the purpose described.

4. In a block-signal for railways, the combination and arrangement of a transparent chamber exposed to view, a colored liquid adapted to be forced therein, means for automatically forcing said liquid therein by the passing of a train upon an adjacent track, an air-pump located at the opposite end of the block, means for automatically actuating the same by the passage of the train out from said block, a communicating pipe connecting said air-pump with means for automatically actuating a discharge-valve, whereby a passage-way is opened leading from said indicating-chamber and the liquid discharged therefrom, a relief-valve operating to automatically release the air from the receiving-chamber of said air-pump, whereby the air is continually being forced into the apparatus and discharged therefrom after doing its work, and means connected with the track whereby the air is positively discharged from the operating trip-chamber simultaneously with the setting of the signal, substantially as described.

5. In a block-signal for railways, the combination and arrangement of a transparent chamber exposed to view, a colored liquid adapted to be forced therein, means for automatically forcing said liquid therein by the passing of a train upon an adjacent track, an air-pump located at the opposite end of the block, means for automatically actuating the same by the passage of the train out from said block, a communicating pipe connecting said air-pump with means for automatically actuating a discharge-valve, whereby a passage-way is opened leading from said indicating-chamber and the liquid discharged therefrom, an intermediate air-pump connected with said communicating pipe and adapted to be operated by hand, whereby air may be forced into said pipe and withdraw said signal in the manner hereinbefore set forth, substantially as described.

6. The combination of a railway-track, a track connection, an air-pump suitably connected thereto and operated thereby, two compression-subchambers connected by communicating pipe E, one subchamber having a movable wall connected to and adapted to operate a signal apparatus, and containing means for discharging the air therefrom after performing work, substantially as described.

7. In an apparatus for actuating a signal, and analogous purposes in connection with railways, the combination of said railway, a track connection adapted to be actuated by the passage of a train, an air-compressing apparatus consisting of two elastic diaphragms g' g^2 inclosing a chamber having a centrally-fixed diaphragm H′, a check-valve located in an aperture in said fixed diaphragm to permit the rapid passage of air from one side thereof to the other, and means to permit the air to return slowly from the compression-chamber, an air-compression chamber located contiguous thereto, a valve located in the walls of said chamber, and means connecting the opposite diaphragm from that actuated by the track connection with the valve in said compression-chamber in such manner that the motion of the diaphragm upon the compression of the air behind it shall open said valve in the compression-chamber, and retain the same open during the time of the slow withdrawal of the air from behind the diaphragm operating said valve, substantially as described.

8. In a liquid block-signal for railways, the combination of a transparent chamber open to observation upon each side, a colored liquid adapted to be placed within said chamber, means leading from said chamber to the source of supply of said colored liquid whereby the same may be withdrawn, and means controlling the discharge of said colored liquid, consisting of a plate containing two apertures, one aperture connected with said signal-reservoir and opening out into the surface of said plate, the other aperture connecting with a discharge-pipe and also opening into the face of said discharge-plate contiguous to the opening of the first-named aper-

ture, an elastic diaphragm covering both apertures and rigidly secured at its edges to said plate, and means whereby the diaphragm is controlled and held or withdrawn against the pressure of the liquid in the indicating-signal chamber, substantially as described.

9. In a liquid block-signal for railways, the combination of a transparent chamber open to observation upon each side, a colored liquid adapted to be placed within said chamber, means leading from said chamber to the source of supply of said colored liquid whereby the same may be withdrawn, and means controlling the discharge of said colored liquid, consisting of a plate containing two apertures, one aperture connected with said signal-reservoir and opening out into the surface of said plate, the other aperture connecting with the discharge-pipe and also opening into the face of said discharge-plate contiguous to the opening of the first-named aperture, an elastic diaphragm covering both apertures and rigidly secured at its edges to said plate, means whereby the diaphragm is controlled and held or withdrawn against the pressure of the liquid in the indicating-signal chamber, consisting of a swinging block impinging against the outer face of said elastic diaphragm and controlled by a toggle-joint, and means for operating said toggle-joint upon the passage of a moving train, substantially as described.

10. In a liquid block-signal for railways, the combination with a transparent indicating-chamber, of a central opaque diaphragm located therein, the lower edge of said diaphragm being cut out to permit the transmission of light and the free communication between the liquid upon either side thereof, substantially as described.

11. In an apparatus for actuating a signal, and analogous purposes in connection with railways, the combination of a railway, a track connection adapted to be actuated by the passage of a train, an apparatus consisting of two elastic diaphragms inclosing a chamber having an interposed centrally-fixed diaphragm, a check-valve located in an aperture in said fixed diaphragm to permit the passage of air from one side thereof to the other, and means to permit the air to return slowly from the compression side of said diaphragm to the initial-pressure side, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

BENJAMIN B. MORGAN.

Witnesses:
WALTER P. BEACH,
HENRY W. GEER.