(No Model.) 5 Sheets—Sheet 1.

W. RAAB.

RAILWAY SIGNAL.

No. 454,767. Patented June 23, 1891.

Fig. 1.

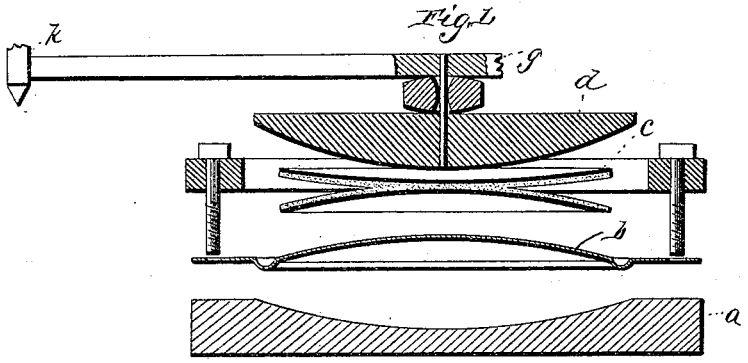


Fig. 2.

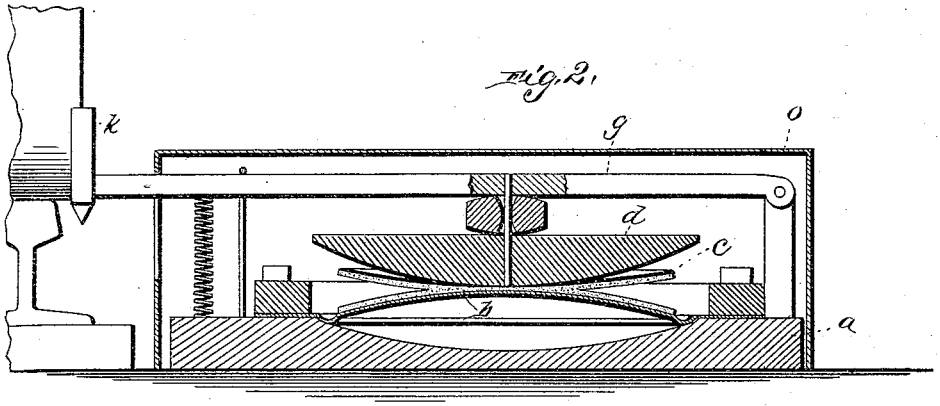
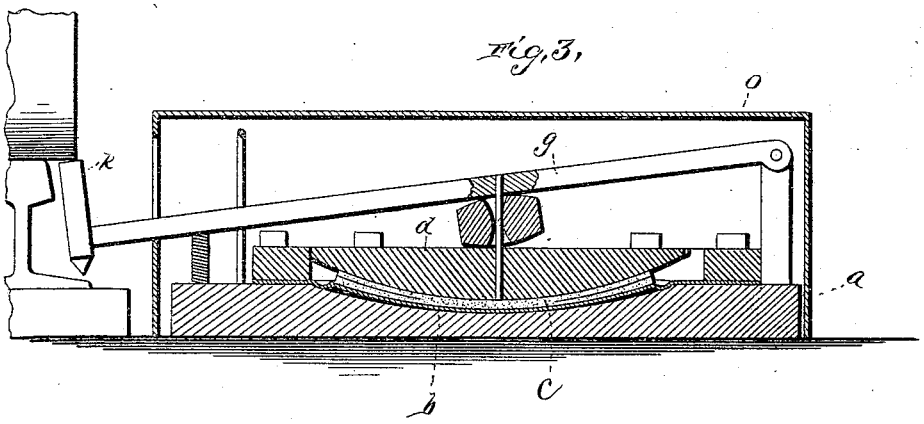


Fig. 3.



WITNESSES

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(No Model.) 5 Sheets—Sheet 2.

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RAILWAY SIGNAL.

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Fig. 4.

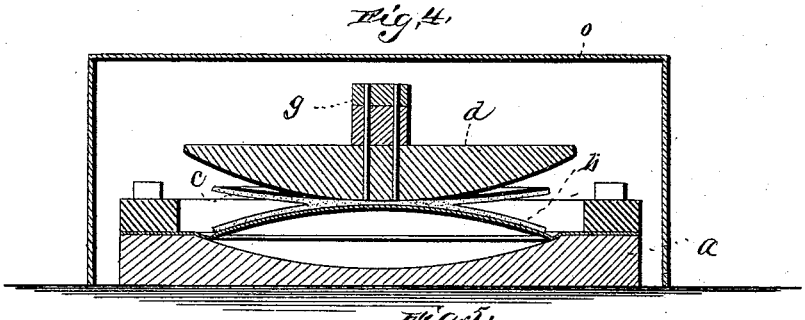

Fig. 5.

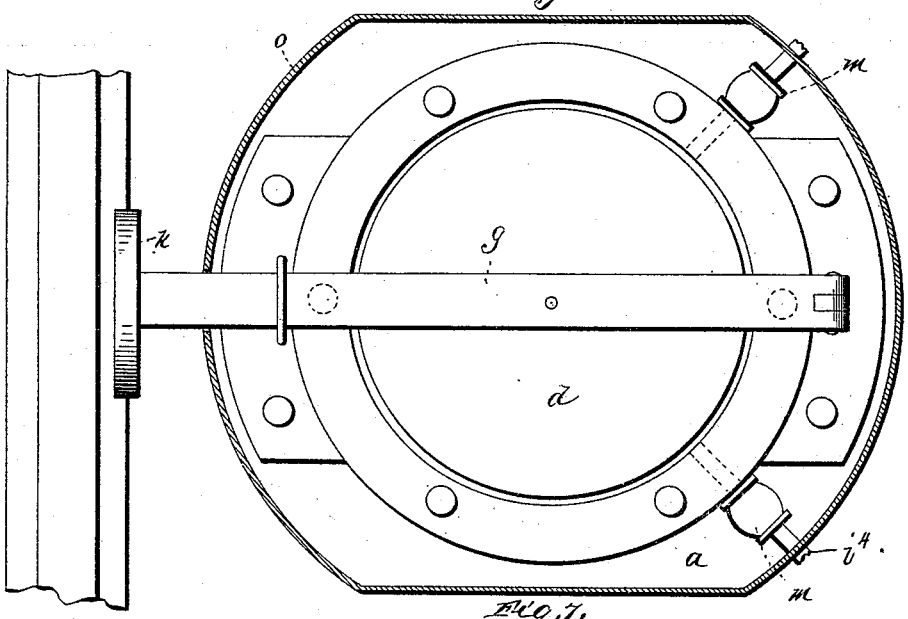

Fig. 7.

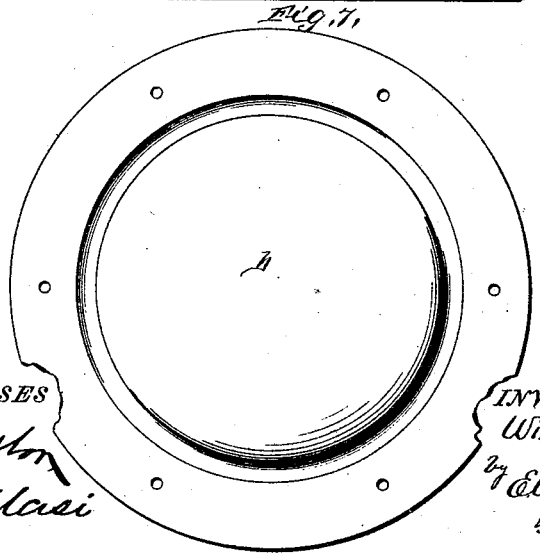

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Fig. 6.

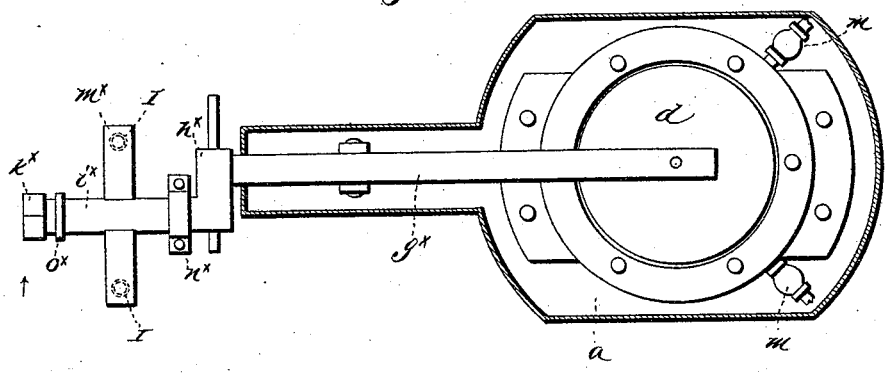


Fig. 12.

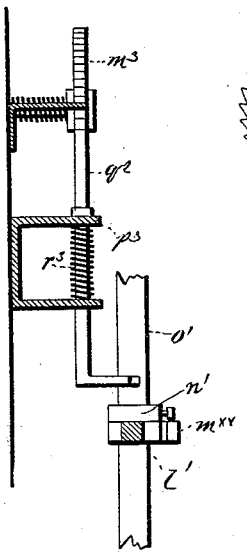


Fig. 11.

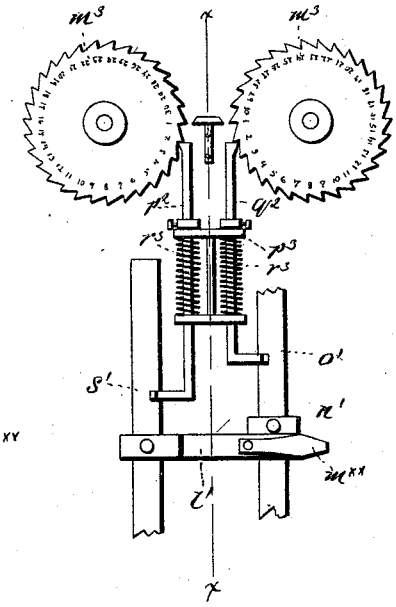
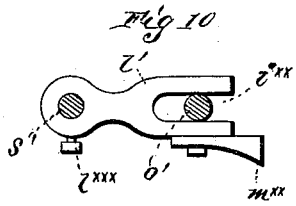


Fig. 10



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RAILWAY SIGNAL.

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Fig. 9.

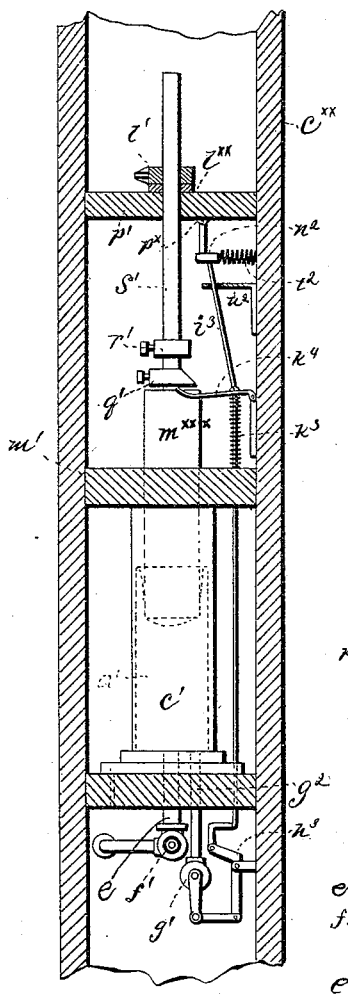

Fig. 8.

Fig. 13.

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RAILWAY SIGNAL.

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Fig. 14.

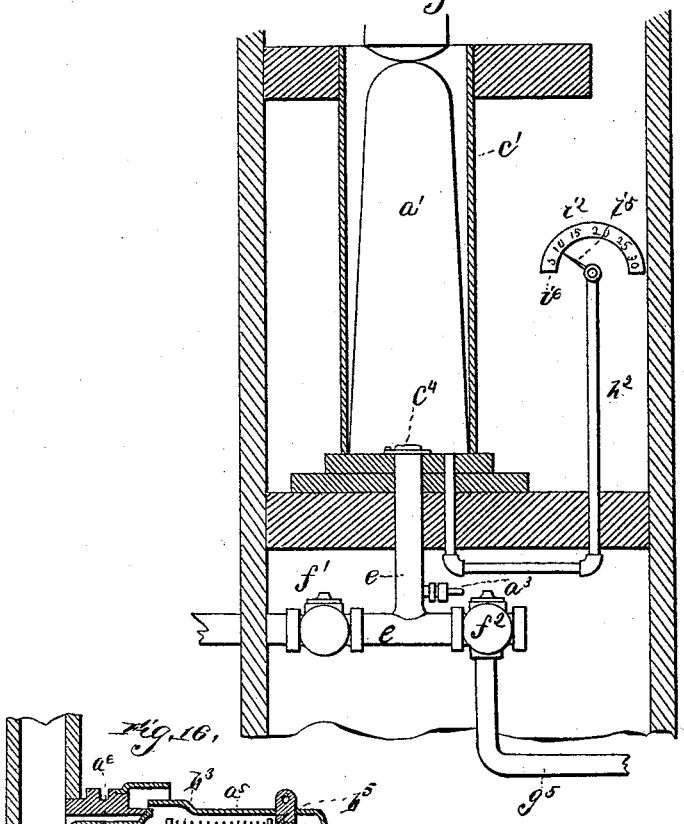


Fig. 15.

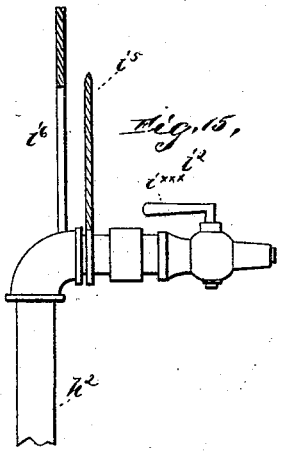


Fig. 16.

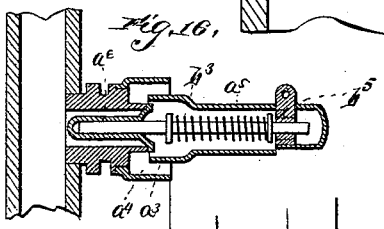
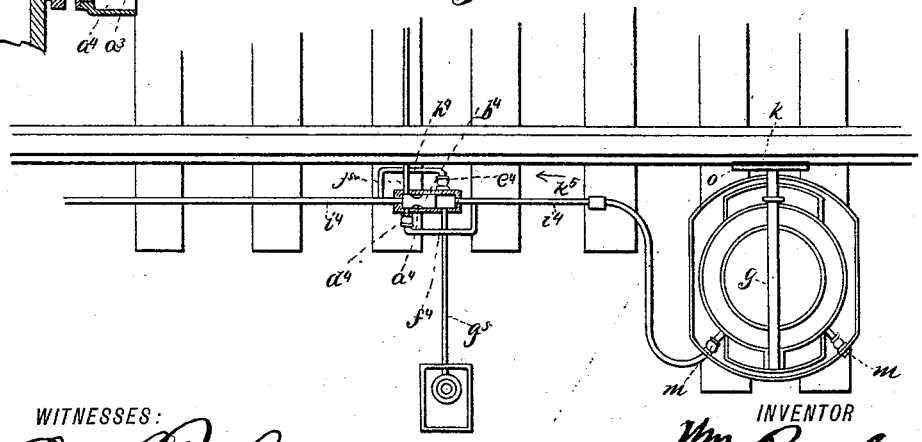


Fig. 17.



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UNITED STATES PATENT OFFICE.

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RAILWAY-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 454,767, dated June 23, 1891.

Application filed June 7, 1890. Serial No. 354,609. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM RAAB, a citizen of the United States, and a resident of Cedar Falls, in the county of Black Hawk and State of Iowa, have invented certain new and useful Improvements in Railway-Signals; and I do 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in railway signaling, in which a metallic bellows-pump is employed, which sucks in and forces out air and, working under the wheels of railway engines and cars, forces the air through suitable tubes into a rubber bag and, inflating it, causes signals to be shown and sounded, the rubber bag, collapsing by the escape of the air, allowing the signals to disappear.

The objects of my invention are, first, to secure an absolutely automatic signal; second, to cause engines and trains to announce their approach toward a certain point by means of a signal at that point; third, to provide a signal giving notice of a train's having passed a certain point for a definite period of time after the passage of the train, as for a block system. I attain these objects by the mechanism illustrated in the accompanying drawings and hereinafter explained.

Figure 1 is a sectional view of parts of the pump of my signal. Fig. 2 is a longitudinal section of a single downward-acting pump at rest. Fig. 3 is a longitudinal section of the same pump in action. Fig. 4 is a cross-section of pump at rest. Fig. 5 is a top view of same. Fig. 6 is a top view of the pump and shows the position of the disconnecting-bar which is to be used where it is not desired to set a signal behind the train. Fig. 7 is a plan view of the spring-disk. Fig. 8 is a sectional elevation of the invention in action. Fig. 9 is an enlarged detailed view of a portion of the signal mechanism. Fig. 10 is a plan view of the arm l' and its adjunctive parts. Fig. 11 is an enlarged detail view of the time-setting apparatus. Fig. 12 is a sectional view of same. Fig. 13 is a "current-switch." Fig. 14 is an enlarged detail sectional view showing more especially the cylinder with its inclosed air-bag and the air-supply pipe with its pop or relief valve and the time-valve, the cylinder j^2 being omitted. Fig. 15 is also an enlarged detail partly sectional and partly side view of the time-valve. Fig. 16 is an enlarged sectional view of the pop or relief valve, and Fig. 17 is an enlarged broken plan view of the current-switch.

The metallic bellows-pump in Fig. 1 has a bed-piece a of any suitable size and weight and of any desirable metal, flat underneath, and arranged for fastening to a railway-tie or other suitable support. On the upper side is a circular concave depression extending to within an inch or two of the outer edge, the edge not depressed being turned to a smooth flat surface. At the sides of the bed-piece and opening into the concave are fixed a suction-valve and an exhaust-valve m m. On the top of the bed-piece and attached to it in any desirable manner on the flat surface is a convex circular plate of spring metal b, having a corrugation near the outer edge. On top of the spring-plate is a circular double concave piece of rubber or other desirable material c to protect it from rain or other injurious agency, and above this is a circular plano-convex piece of metal d, of any desirable material, and attached at its upper center in such manner as to allow slight motion to a metal lever g, the lever g being attached in any desirable way, so as to allow free hinge movement to a projection above the bed-piece. At the other end of the lever is a segment of any desirable metal k, having its plane edge downward and beveled to a cutting-edge. Between the lever and the bed-piece is a coiled metal spring held in place in any suitable manner. Astride the lever g is a staple fastened in the bed-piece in any desirable way to check the rebound of the lever.

Over the pump, when in place, is a cover (see o, Fig. 2) of any desirable material. The pump is attached in any suitable manner on the railway-track with the segment end of the lever within one-half inch of the upper part of the rail. The outer edge of the wheel of a locomotive or car passes over the segment, bears down the lever with the disk d, which depresses the spring-plate b, and forces the

air under it out of the exhaust-valve m and into a pipe which connects with a cylinder in the signal-post, as at e, Fig. 8. The segment hugs the wheel and, rising, allows the spring-plate to rise, and air rushes in through the suction-valve, filling the pump ready for the next action.

Referring to Fig. 6, wherein the pump is set farther from the rail, the lever $g^{\times}$ is constructed with or without a segment at the end, and above this end rests one end of a rock-shaft $i^{\times}$, of any desirable shape, turning freely in boxes $n^{\times}$ $o^{\times}$, which are firmly attached to a tie or other suitable fixture. At the end next the pump is a short arm $h^{\times}$ at right angles to the shaft $i^{\times}$ and extending over the end of the lever $g^{\times}$, but not attached to it. At the end of the shaft $i^{\times}$ next to the rail is a half-oval-shaped arm $k^{\times}$, extending upward at right angles to the shaft $i^{\times}$. At any desirable point between the boxes $n^{\times}$ $o^{\times}$ and firmly attached to the shaft $i^{\times}$ is a cross-bar $m^{\times}$, and under the outer ends of this bar are coiled metal springs I I. A car-wheel moving in the direction of the arrow comes in contact with the left face of the oval arm, flexes it in the direction of its motion, turns the shaft $i^{\times}$, flexes downward the arm $h^{\times}$, which presses downward the lever $g^{\times}$, and produces the same action on the pump as when a car-wheel passes over the segment. A wheel moving in an opposite direction to the arrow flexes the oval arm $k^{\times}$ in the line of motion, turns the shaft $i^{\times}$ in the same direction, and lifts the arm $h^{\times}$. The lever $g^{\times}$ is not moved, and the pump remains at rest. The shaft $i^{\times}$ and the oval arm $k^{\times}$ are brought back to position by the springs I I. The disconnecting-bar is to be arranged so as to cause the pump to act when the train is moving toward the signal, and thus give notice of its approach.

The pump is connected at the exhaust-valve m with a tube of any desirable material, which extends to the signal-post, Fig. 8, (which may be at any desirable distance from the pump,) and connects with the air-bag a' through the tube e and valve f' (More fully shown in Figs. 8 and 14.)

The signal apparatus is inclosed in a hollow case of any form and material, designed to stand erect above or below a proper fastening, and is described as follows: At or near the lower part of the case is firmly fastened a hollow cylinder c', (referring to Fig. 8,) of any desirable material. Within the cylinder c' is a rubber bag a', firmly flanged to the bottom of it. The bag a' is closed at the upper end, where it is in contact with a circular plano-convex disk, which is attached at its upper center to a rod s'. Around the rod s' and extending upward from the outer edge of the disk is a drum $m^{\times\times\times}$, of any desirable material, working through a box m' and keeping the rubber bag from folding over the disk as the latter sinks down, as shown in Fig. 9. On the rod s' is a collar q', held in place by a set-screw and beveled on one side, as shown in Fig. 9. Above this is another collar r', held in place in the same manner. The rod s' works through another box $l^{\times\times}$ in the piece p' and carries an arm l', fastened to it by a set-screw. Parallel to the rod s' is another rod o', working at its lower end through the eye-pieces p' and i', these eye-pieces being made so as to allow a lateral motion to the upper part of the rod o'. The arm l' extends from the rod s' to the rod o', which latter works through it in a slot $i^{\times\times}$. (See Fig. 10.) The arm has at the slotted end a beveled piece $m^{\times\times}$. On the rod o', at a proper distance from the bottom, is a collar n', the upper end of the rod o' being attached to a bent arm attached to the signal-arm, Fig. 8, so as to allow free movement. The signal-arm $v\ v$ is made of any desirable material and made so as to turn on a pin $u\ u$. Extending back from the signal-arm is a short arm bearing a weight $t\ t$, which is sufficiently heavy to overbalance the signal-arm and raise it up, turning on the pin $u\ u$. On the signal-arm may be any desirable inscription. At the outer end of the arm is a concave reflector $w\ w$, made of any desirable material and arranged to be seen from either side of the arm, designed to reflect the head-light of a locomotive at night, thus showing that the signal is out and to be regarded.

Suspended near the upper end of the case at $c^{\times\times}$ is a pendulum k^2, the rod of which extends above the point of suspension and connects with a spiral spring y, which connects with a spring-clapper of a gong-bell z^2, fastened at the top of the post. Attached to the side of the signal-arm $v\ v$ next to the pendulum is a short projecting pin l^2, (see Fig. 8,) so arranged that when the signal-arm is thrown down the pin strikes the lower end of the pendulum-rod and carries the pendulum forward until it slips over the pin, when it vibrates a number of times.

At the side of the cylinder c' (referring again to Fig. 8) is placed a smaller cylinder j^2, constructed in the same manner as the former. The rod t' has a collar u' to prevent its rising higher than needed. The rod works through a box f''. Above the box f'' is a collar v', which prevents the rod from sinking too far. Above the collar v' is an arm w'. Above and near the rod t' is a trip-rod z^3, moving on a pin d', as shown by the dotted lines c^2. Attached to the rod z^3 is an arm b^2, which is drawn under the lower end of the rod o' by a spiral spring a^2.

h^2 is a tube opening into the rubber bag a' and connected with a time-valve i^2 and determines the time of the escape of air from the bag a' sufficient to allow the signal to drop back into the case.

g' in Fig. 9 (to which reference is now made) is a safety-valve connected with the rubber bag a' by a tube g^2, (shown by the dotted lines,) and works as follows: As the rod s' moves upward it carries the beveled collar

q' into contact with the spring-bolt n^2, the end of which is held in place by a short rod turning on a joint $p^\times$. The collar q' forces the bolt n^2 outward, compressing the spring t^2. The rod i^3 slips through a slot in the spring-bolt n^2, the rod i^3 being held in place by the slotted guide u^2, and is forced upward by the spring k^3, above which is a jointed lever k^4, attached to the rod i^3. This lever catches the upward pressure of the spring k^3, carries the rod i^3 up with it, and pulls on the movable elbows at h^3, pushing open the valve g' and allowing the air to escape. As the rod s' descends the collar q' bears down the lever k^4 above the spring k^3, depressing the spring, and, closing the valve g', draws the upper end of the rod i^3 out of the slot in the bolt n^2, which springs into place, catching the end of the rod i^3 under it and holding it in place.

The tube or pipe e is provided with a pop or relief valve a^3, consisting of the nozzle-section a^4, screwed to said pipe, and the cylinder or tube section a^5, projecting a certain distance into and held within the nozzle-section a^4. Fitting still farther in the nozzle-section a^4, but of smaller diameter than the latter, is a plug a^6, having its flange fitting against the inner edge of said nozzle-section and its stem encircled by a spring b^3, normally holding the plug a^6 in contact with its seat, the tension of said spring being regulated by the nut b^5.

The action of the valve a^3 is as follows: The air after inflating the bag a' to its fullest capacity, following the course of the least resistance, pushes out the plug a^6 in the pop or relief valve, and in so doing compresses the spring b^3 and then escapes through the opening thus provided between the plug and its seat, which will continue so long as air is forced into the tube or pipe e by the action of the pumps. Covering the inner end of the tube or pipe e is a downwardly-closing valve c^4, having its upper side weighted to aid its closing action. When air is first forced through the tube or pipe e, the valve c^4 will be lifted thereby and the air enter the bag a' until the latter is full, the course of the air then being diverted through the pop or relief valve. The time-valve i^2 is an ordinary air-cock having a handle $i^{\times\times\times}$, by turning which more or less to the right or left the escape of air is accordingly regulated. Upon the pipe or tube h^2 is fitted the index i^5 for movement or adjustment by hand to register with graduations on an arc i^6 indicating minutes.

The action of the valve is as follows: Suppose the valve be set so as to allow the air to escape from the bag a' in five minutes. The air is forced from the pumps by the action of the car-wheels through the tube or pipe e, past the valve c^4, and into and inflating the bag a', operating the signal. This, however, requires but very few actions of the pump, and as each car-wheel produces an action of the pump the air will be forced into the bag a' faster than it can escape, even after the latter is full, through the valve i^2. This air, following the course of least resistance, forces open the valve a^3 and thus escapes. It will therefore be seen that there is in the meantime a continuous escape through the time-valve i^2; but this escaping air is constantly replaced by the continual forcing of air from the tube e into the bag a' while there is any action of the pump. After the train has passed the pump, there being no further ingress of air, the pressure of the air in the bag a' forces down the drop-valve c^4, so that the only escape of air is through the time-valve i^2. The escape at this point continues, and in five minutes, the cock of the valve being so adjusted, sufficient air has escaped to permit the tripping of the spring-bolt, holding the signal up and allowing the signal to fall back into the box or post.

The action of the signal is as follows: The air from the pumps is impelled by their action through a tube, as above described, from the side of the signal-post on which the train is approaching, passes through the tube e and the valve f', Fig. 8, to which reference is now made, into the rubber bag a', inflating it, lifts the rod s', carries up the arm l', which comes in contact with the collar n', carries up the rod o', and throws out the signal $v.v$, which in falling strikes the pendulum k^2 and causes it to vibrate, the upper end of which trips the clapper of the gong and causes it to ring. As the signal-arm $v\,v$ falls out the short arm b^2 on the trip-rod z^3 is pulled under the end of the rod o' by the spiral spring a^2, and the signal is thus held in place. Where the signal is set "on time," the air in the bag a' escapes through the valve i^2 by the tube h^2, as above described, the bag a' collapses, the rod s' slips down, bringing the beveled piece $m^{\times\times}$ in contact with the trip-rod z^3, forcing out the upper end of the trip-rod, as shown by the dotted lines in Fig. 8, and releases the lower end of the rod o'. The weight $t\,t$, being thus allowed to fall, raises the signal-arm within the case.

Where so desired, the signal may be thrown back into the case as the train passes it by connecting a suitably-sized pump directly opposite the signal-post to the small cylinder j^2 through the pipe y. The air is then forced into the bag within this cylinder, inflating it and lifting the rod t', (referring to Fig. 8,) which carries the trip-arm w' under the trip-rod z^3, forces it out in the position of the dotted line shown in Fig. 8, releases the rod o', and allows it to drop, as above described.

The registering apparatus shown in Fig. 11 is the signal-post in connection with a "block system," and where the signal is set "on time." It consists of two notched metal wheels $m^3\,m^3$, having the notches numbered and arranged as shown in the figure. The wheels are turned by the upward pressure of the rods p^2 and q^2, the rods being held in place by a frame p^3 (detailed at left of the figure) in Fig. 12 and held down by the spiral springs $r^3\,r^3$.

The action is described as follows: When the signal-arm is thrown out by the upward movement of the rods s' and o', the arm l' and the collar n' press upward the rods p^2 and q^2, and both the notched wheels are turned outward. Immediately after the train has passed the pump the air escapes through the time-valve i^2, the rubber bag a' collapses, and the rod s' sinks down, allowing the registering-rod p^2 to sink out of the notch in the wheel and down to position for the next action; but the rod o' is held in place by the arm b^2 on the trip-rod z^3 until the air escapes sufficiently to allow the beveled piece $m^{\times\times}$ to push out the trip-rod and release the rod o'. Should sufficient time not be allowed for this before the second train runs over the pump, this second train will operate on the rod s' only, the rod p^2 will again be moved up, and the wheel on that side be turned. This would cause the numbers opposite each other on the two wheels to be dissimilar. The number of errors caused in this way would show how many trains were running ahead of time. The location of the register in the signal-post is shown in Fig. 8.

The current-switch in Fig. 13 is to be used on curves or elsewhere in order to avoid the necessity of a double line of pipe where signals are to be placed on each side of the track and to be thrown out by trains approaching from opposite directions and to enable several signals to be operated by one pump. The switch consists of a suitable metal cylinder a^4, fitted with a double-headed piston b^4, on the outside of the heads of which are rubber disks c^3 c^3. Fitted into the ends of the cylinder are pipes i^4 i^4, which are fitted to the pipe leading from the pump toward the signal-posts. Extending from the cylinder to the pipes i^4 i^4 are two pipes f^4 and h^4, each being closed with a valve shown at d^4 and e^4 by suitable mechanism. (Not shown.) From the cylinder are two other tubes g^5 and j^5, leading to the valve f^2 in two signal-posts on opposite sides of the track.

In the action of the current-switch the air is forced into the cylinder and from that through the pipe g^5 into the tube or pipe e and past the drop-valve c^4 into and inflating the bag a'. There then being compression or resistance it follows the line of least resistance, which is through the valve e^4, and so on past the switch into the line-pipe, carrying out the principle above involved—that of air following the direction of the least resistance. It might be supposed that the air would escape through the pop-valve a^3 rather than through the valve e^4. This difficulty is obviated by tightening the spring in the pop or relief valve a^3 and compressing it by means of its nut to such extent as to cause a greater resistance at the plug therein than occurs in the valve e^4 of the current-switch, it being understood that the valves e^4 and d^4 are spring-valves—that is, their plugs are seated or closed by means of a spring whose resistance is overcome by pressure.

A train moving in the direction of the arrow k^5 passing over a pump, forces the air in the same direction and into the cylinder, forcing the piston against the tube at the opposite end and closing the opening there. The air then follows the direction of the arrows through the tube g^5 into the cylinder of a signal-post at that point through a valve f^2, causing the signal to operate, and through the valve e^4 into the tube i^4, and on past the switch to the next post, and so on. A train moving in the opposite direction forces the piston in the line of its motion to the other end of the cylinder. The air then passes through the tube j^5 to the cylinder of a signal-post on the opposite side of the track, causing the signal to act, and through the valve d^4 and tube f^4 onto the next post, reversing the above-described process.

On the top of the signal-post, Fig. 8, is a whistle x^2 x^2. This is connected by means of a tube y^2 y^2 with the pipe carrying air into the cylinder-bag a' at a point between the valves f' f^2. When the bag a' is fully inflated, the surplus air passes through a valve f^5 into the tube y^2 y^2 and blows the whistle x^2 x^2.

Having described this invention, what I claim, and desire to secure by Letters Patent, is—

1. The single concave bed-piece, the double concave rubber piece, an exhaust, and a suction-valve coacting with said parts, said bed-piece having a turned rim around the concave depression, the movable spring-plate b, the circular plano-convex disk d, the lever g, having the segment k, the disconnecting-shaft $i^\times$, turning in the boxes $n^\times$ and $o^\times$, having the oval arm $k^\times$, the depressing-arm $h^\times$, and the cross-bar $m^\times$, supported by the springs I I, in combination with the signal, all substantially as described.

2. The combination of the cylinder c', containing the rubber bag a' for lifting the rod s', the disk above the rubber bag attached to the rod s' at its lower end, the drum $m^{\times\times\times}$, the rod s', adapted to work through the boxes m' and p', the beveled collar q', the collar r', the slotted arm l', the beveled piece $m^{\times\times}$, attached to the slotted arm, the trip-rod z^3, the rod o', adapted to work through the eyes p' and i' and attached at its upper end to the bent arm of the signal-board by a movable joint, the collar n', the signal-board v v, adapted to turn on the pin u u, the reflector w w on the signal-arm, the weight t t, adapted to bear the signal-arm into place, the projecting pin l^2, and the signal-arm adapted to push out the pendulum k^2, substantially as described.

3. The combination of the bell z^2 with pendulum k^2, the spiral wire y, the signal-board v v, provided with the stud or projection l^2 and the rod o', adapted to bear said signal-board, the trip-rod z^3, having the upper and lower ends bent, and the short projection b^2 on the trip-rod, the spiral spring a^3, holding the trip-rod in place, the cylinder j^2, containing the rubber bag j, the rod t', working

through the box f''' and having the collars v' and w', and the arm w' for moving the trip-rod, substantially as specified.

4. The registering apparatus having the notched and numbered wheels for registering the passage of trains, in combination with the rods p^2 and q^2, the spiral springs r^3 r^3, and the frame p^3, holding the rods p^2 and q^2 in position, and the actuating mechanism comprising the rods o' and s', the rod s' carrying the arm l', provided with the beveled piece $m^{\times\times}$, the rod o' carrying the collar n', and the air-bag, and pump for inflating said bag, substantially as set forth.

5. The combination of the signal with the current-switch consisting of a cylinder a^4, containing the double-headed piston b^4, the rubber disks c^3, the valves e^4 and d^4, opening into the pipes f^4 and h^4, the pipes f^4 and h^4, signal-post, and the tubes g^5 and j^5, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM RAAB.

Witnesses:
C. J. MORLEY,
JOHN B. ABBOTT.