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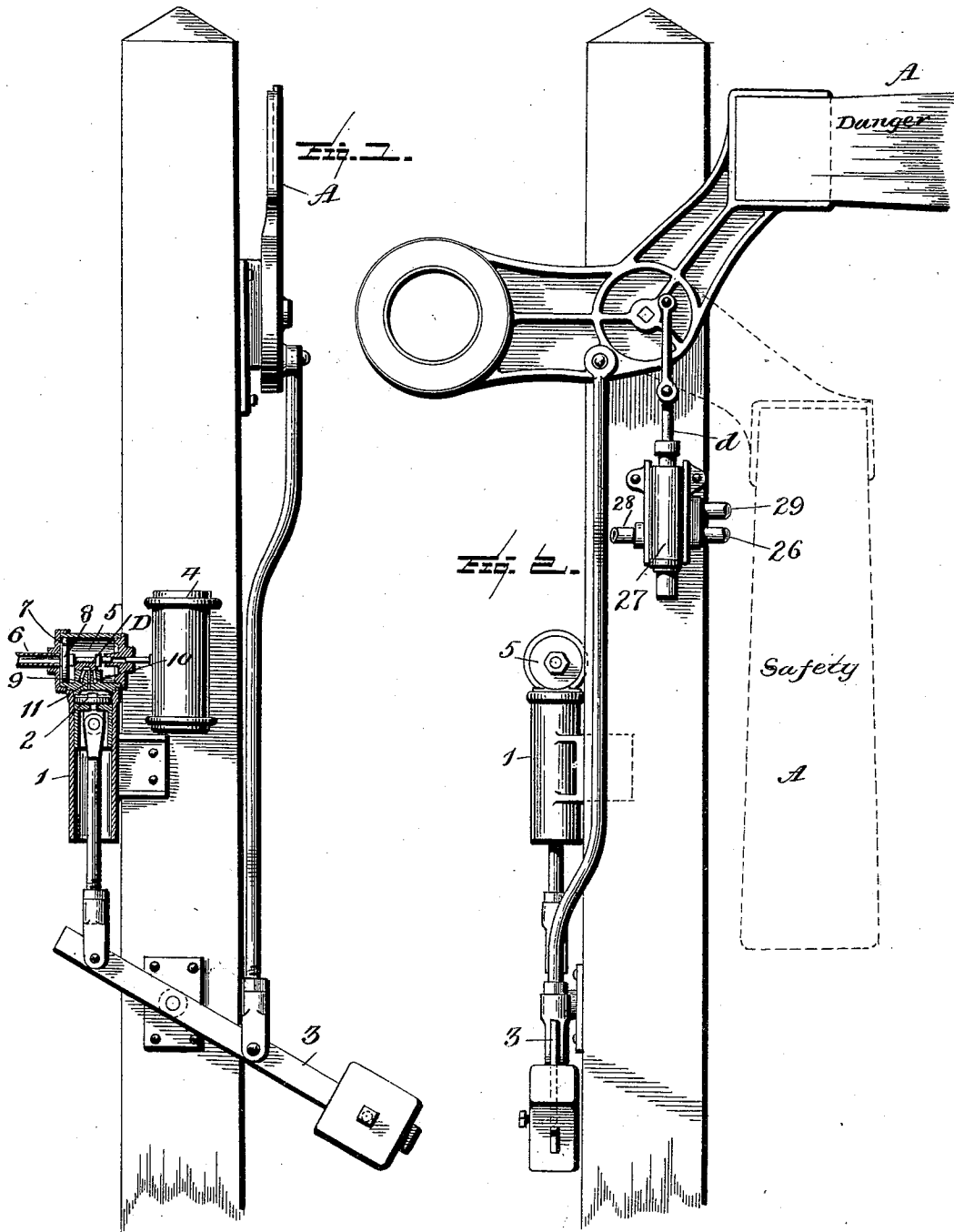
5 Sheets—Sheet 1.

J. W. THOMAS, Jr.

PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY SIGNALS.

No. 520,813.

Patented June 5, 1894.



Witnesses

L. C. Hills.
Edw. A. Dick

Inventor:

John W. Thomas, Jr.,
by *Marcellus Bailey*
his Attorney

(No Model.)

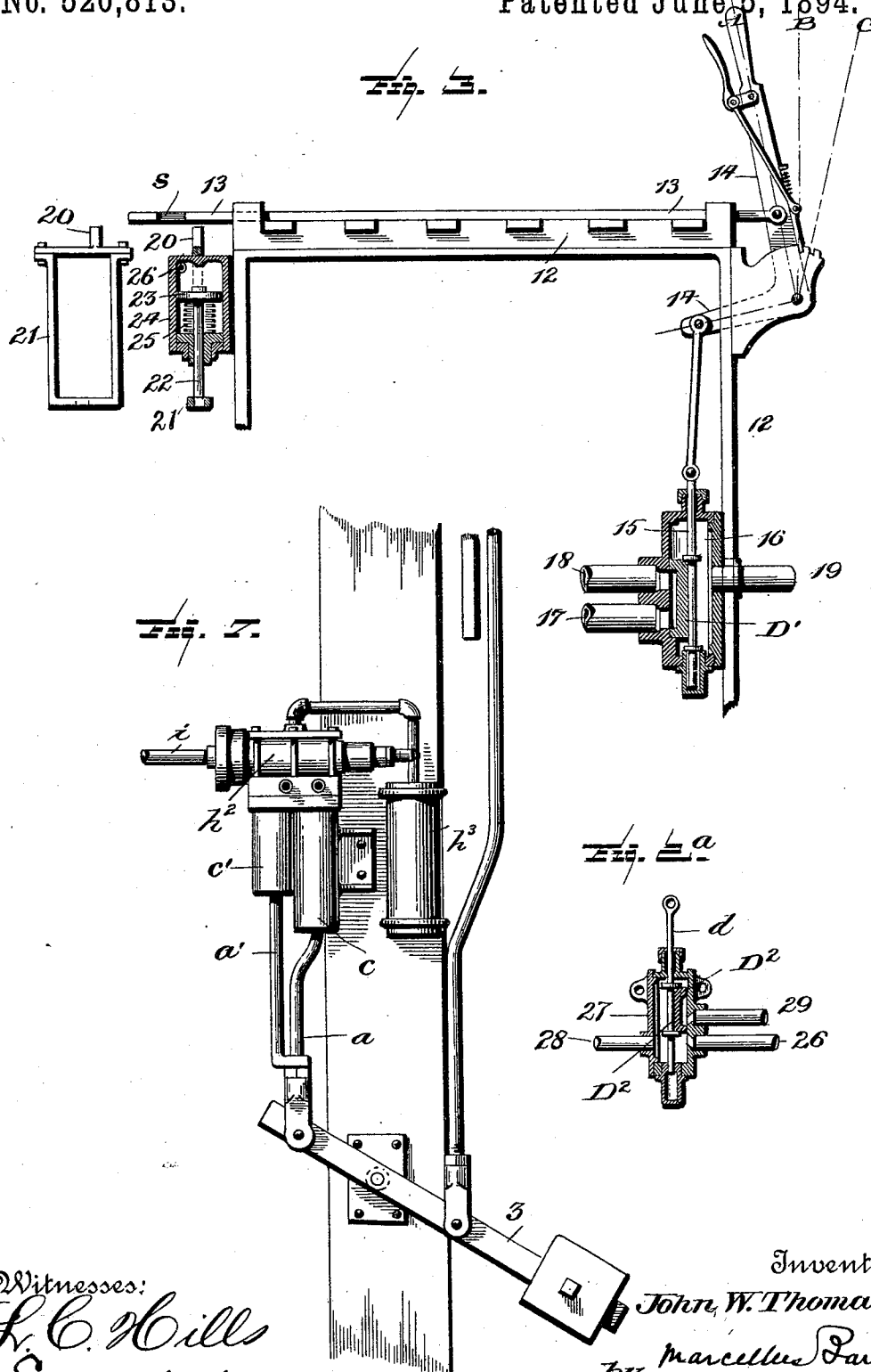
5 Sheets—Sheet 2.

J. W. THOMAS, Jr.

PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY SIGNALS.

No. 520,813.

Patented June 5, 1894.



Witnesses:
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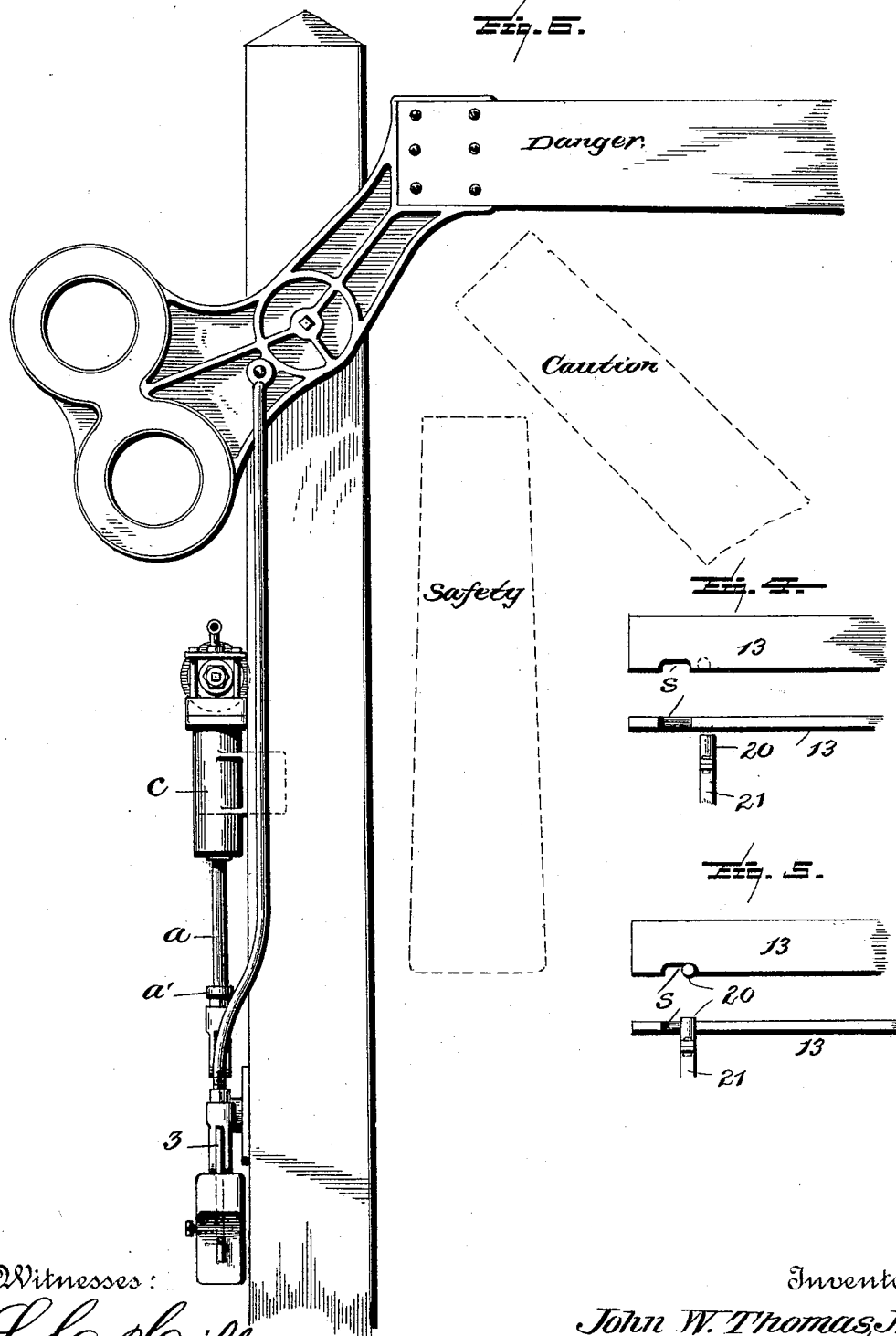
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5 Sheets—Sheet 3.

J. W. THOMAS, Jr.
PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY
SIGNALS.

No. 520,813.

Patented June 5, 1894.



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(No Model.)

5 Sheets—Sheet 4.

J. W. THOMAS, Jr.

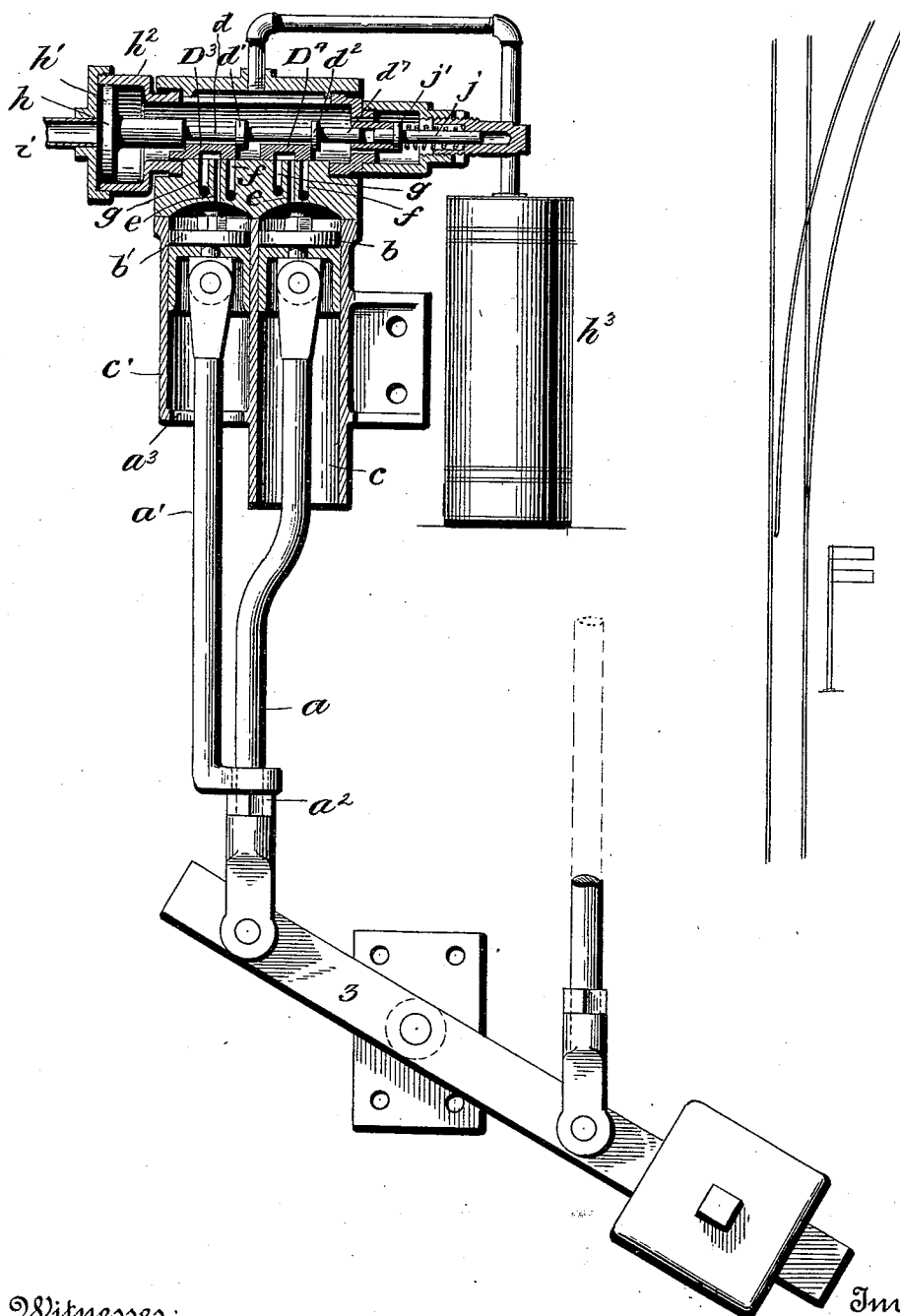
PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY SIGNALS.

No. 520,813.

Patented June 5, 1894.

Fig. 2.

Fig. 10.



Witnesses:

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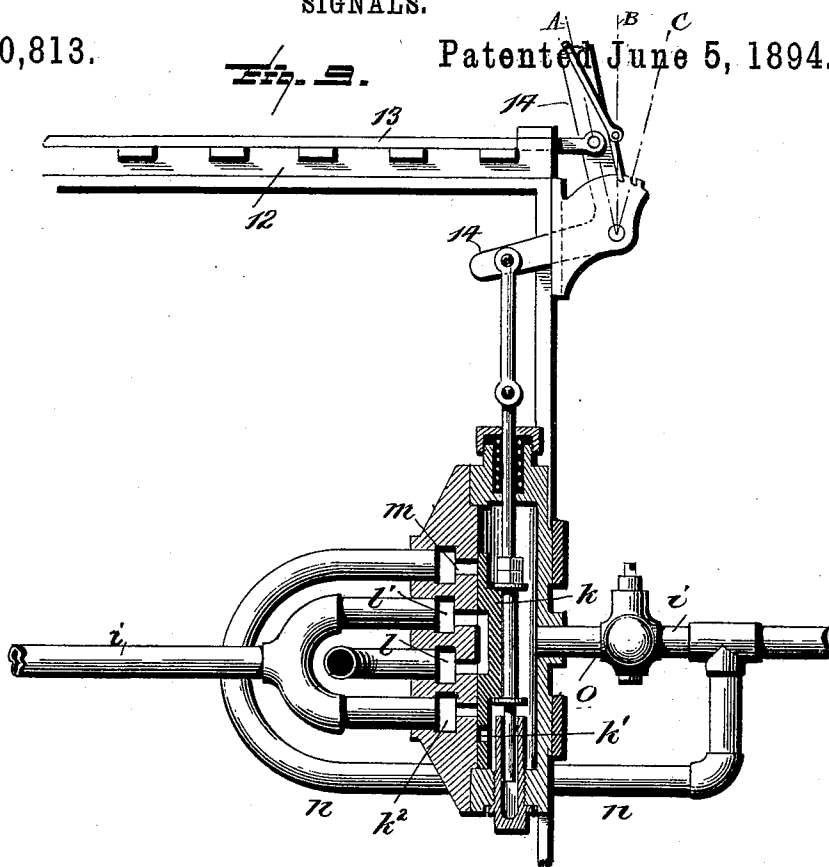
(No Model.)

5 Sheets—Sheet 5.

J. W. THOMAS, Jr.
PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY
SIGNALS.

No. 520,813.

Patented June 5, 1894.



UNITED STATES PATENT OFFICE.

JOHN W. THOMAS, JR., OF NASHVILLE, TENNESSEE.

PNEUMATIC SYSTEM OF AND APPARATUS FOR HANDLING RAILWAY-SIGNALS.

SPECIFICATION forming part of Letters Patent No. 520,813, dated June 5, 1894.

Application filed February 24, 1894. Serial No. 501,400. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. THOMAS, JR., of Nashville, in the State of Tennessee, have invented a certain new and useful Pneumatic System of and Apparatus for Handling Railway-Signals, of which the following is a specification.

The fundamental feature of my invention resides in the fact that the valve for admitting air to and exhausting it from the working cylinder of a signal is manipulated by means of a single controlling pipe containing air at more than atmospheric pressure at all times—the pressure of this air being variable within defined limits and being exerted upon a valve shifting piston which on the other side is subjected to continued air pressure, which also is variable with respect to the opposed pressure exerted by the air in the controlling pipe—the two pressures being equalized after the shifting of the piston in either direction by means of one or more equalizing ports or passages leading from one side of the piston to the other, through which air from the side on which preponderance of pressure for the time being exists gradually passes to the other side until the pressures are equalized.

Other features of the invention reside in the pneumatically operated appliances for handling two position signals and three position signals respectively; in a device which may be termed a pneumatic selector, whereby one or the other of two signals is put in condition to be operated according as the switch to which the same pertain, is either normal or reversed; and in other details which will be developed in the course of this specification.

I find that it is only by maintaining at all times more than atmospheric pressure in the controlling pipe, that the signal or signals can be worked efficiently and at the requisite speed. I prefer for this purpose to use compressed air in the controlling pipe between limits of sixty pounds to the square inch for maximum pressure, and fifty pounds to the square inch for minimum pressure; with this variation of pressure it is feasible to handle the signal expeditiously and effectively. The pressure in the main supply from which the air in the controlling pipe is drawn, I prefer

to maintain at say eighty pounds to the square inch, for the reason that after pressure in the controlling pipe has been reduced to the minimum of fifty pounds I find it much easier to restore the pressure in that pipe to the maximum of sixty pounds when the pressure in the main is over that figure, than when it is the same as the maximum in the controlling pipe. The reduction from eighty pounds in the main to the maximum of sixty pounds in the controlling pipe is effected by any suitable reducing valve interposed in the communication between the controlling pipe and the main from which it draws its supply. The reduction from the maximum of sixty pounds to the minimum of fifty pounds in the controlling pipe is effected by providing the exhaust for the controlling pipe with a pop or relief valve of any suitable construction, which is set or adjusted to open at pressures above fifty pounds.

By having a pressure in the main superior to the maximum in the controlling pipe I am also enabled to provide in a simple and efficient way for operating a three position signal.

To enable others skilled in the art to understand and use my invention, I will now proceed to describe the manner in which the same is or may be carried into effect by reference to the accompanying drawings, in which—

Figure 1 is a side elevation; and Fig. 2 is a front elevation of the upper part of a signal mast carrying apparatus embodying my invention as applied to a two position signal. Fig. 1 omits the valve which is shown in Fig. 2 for controlling the indicator in the tower; and Fig. 2 omits the air reservoir which in Fig. 1 is in communication with the interior of the valve chest. Fig. 2^a is a vertical central section of the indicator controlling valve in Fig. 2. Fig. 3 is a sectional side elevation of the signal operating lever (supposed to be located in the tower) and its appurtenances. Figs. 4 and 5 are diagrammatic views showing each in plan and side elevation, the tappet connected to the lever and the indicator pin which works in conjunction with the tappet, in the different positions which they assume when the operating lever is moved to set the signal from danger to safety. Figs. 6 and 7 are respectively a front elevation and a side elevation of the upper portion of a signal mast

provided with a three position signal and pneumatically controlled appliances for operating the same. Fig. 8 is a vertical section on enlarged scale of the appliances last mentioned. Fig. 9 is a sectional side elevation of the signal lever and valve mechanism and pneumatic appliances for operating in connection with the three position signal. Fig. 10 is a diagrammatic view illustrative of a main line, and branch or siding and a signal mast with two signals one for the siding and one for the main line. Fig. 11 is a longitudinal vertical section of a pneumatic selector operated by the switch connecting the main line and siding, and acting to determine which of the two signals shall be actuated according as the switch is normal or reversed.

In Figs. 1 and 2, A is an ordinary counterbalanced pivoted semaphore blade, which normally is held at danger by a pivoted counter weighted lever 3, joined to the shorter arm of the blade by a connecting rod as usual. Lever 3 at its shorter end is jointed by a connecting rod to a piston 2 which can move up and down in the working cylinder 1, into the top of which, at a point above the piston, leads the central port 11, from a valve chest 5. This port 11 is located between two ports 9, 10, in the same chest—all of these ports being formed in a valve seat upon which plays the slide valve D, by which the central port 11 is thrown alternately into communication with port 10 and port 9. Port 10 is the supply port and through it compressed air, taken from the main supply through a suitable communication, is supplied to the working cylinder 1 for the purpose of forcing down piston 2 against the resistance of the counterweight 3 and thus bringing the signal from danger down to safety. Port 9 is the exhaust port and through it air is exhausted from the working cylinder with the effect of allowing the counterweighted lever 3 to raise the signal to danger—this being the normal position of the signal.

The slide valve D is held between collars on a stem, which is fast to the piston 8 seated and adapted to move back and forth in the case 5. In the head of this case opposite the outer face of the piston is a pipe 6—hereinbefore referred to as the controlling pipe—which contains at all times air at more than atmospheric pressure. Under the conditions preferred by me, the maximum pressure in the pipe should be sixty pounds to the square inch and the minimum pressure should be fifty pounds to the square inch.

The piston—which I term an equalizing piston—has in it an equalizing port or passage 7, through which air can feed gradually from one side of the piston to the other. In the position of parts shown in Fig. 1, pressure in the controlling pipe is supposed to be reduced to fifty pounds; and by means of the equalizing port 7 air has passed through to the opposite side of the piston so as to make the pressure from that side also fifty pounds.

Now if the pressure in the controlling pipe be suddenly raised (the appliances for this purpose will be presently described) to say sixty pounds then as this increased pressure on the controlling pipe side of the piston, takes place more rapidly than it can feed through to the other side of the piston, it will have the effect of forcing the valve over to the right, thus shutting the working cylinder off from the exhaust 10 and putting it in communication with the supply 9. After the valve has shifted, the gradual feed of air through the port 7 will equalize the pressures and the valve will again be balanced; so that when pressure is suddenly reduced on the side of pipe 6 to fifty pounds the valve by the stored pressure on the other side of the piston, will be thrown over to the left to reassume the position shown in Fig. 1. For the purpose of giving increased capacity to the chest or case 5 on the side of the equalizing piston opposite to the controlling pipe—and thus providing for increased compressed air storage on that side—I connect to the latter an auxiliary reservoir or case 4 (Fig. 1). The foregoing will suffice to explain the operation of the equalizing piston.

I proceed now to a description of the means for varying the air pressure in the controlling pipe for the purpose of handling the signal. These means are shown in Fig. 3.

The parts about to be described are mounted on or secured to a suitable table or frame 12 in the tower. The signal operating lever is designated 14. It is capable of assuming successively the positions marked A. B. C. and is provided as customary in this class of appliances with a spring latch to engage a notched quadrant. The lever, as also is customary is suitably jointed to a sliding tappet 13 mounted on the table and intended for interlocking purposes, by which all conflicting levers are locked up at the proper time. The signal lever 14 is an elbow lever and its shorter arm is by a connecting rod linked to a valve stem 15, adapted to reciprocate in the valve case or chest 16. This stem actuates the slide valve D' which is held between collars on the stem and plays back and forth over ports 17, 18, formed in a seat on the chest. Opening into the chest is a pipe 19 communicating with the main air supply—this communication being provided with a suitable reducing valve by which the eighty pounds pressure in the main is reduced to say sixty pounds. The port 17 communicates with the controlling pipe 6 in Fig. 1; the port 18 is the exhaust port, to be armed with a pop or relief valve set to fifty pounds pressure.

In Fig. 3 the valve D' bridges the ports 17, 18—which is the position it occupies when the parts shown in Fig. 1 are in the position represented in that figure. When the operating lever 14 (Fig. 3) moves from A to C position, the valve D' will thereby be shifted to uncover the port 17 thereby putting the latter in communication with the supply 19, and

consequently raising the pressure in the controlling pipe 6 from fifty to sixty pounds. In this movement of the lever 14 it is desirable, before the valve D' is shifted, that all conflicting levers should be locked. This result is obtained by permitting a certain movement to the lever at the outset, independent of the valve D', to which end (as shown in Fig. 3) I place the collars on the stem 15 farther apart than the length of the slide valve D' which lies between them, thus permitting the lever 14 independent movement at the outset before the valve will be moved. The tappet 13 partakes of this initial movement of the lever and in so moving locks (by interlocking mechanism not necessary here to describe) all conflicting tappets and consequently all conflicting levers. The movement of the lever from A to C, will have the effect of setting the signal to safety. On the other hand the movement back from C to A will have the effect, by reducing the pressure in the controlling pipe, of restoring the signal from safety to danger—the unlocking of conflicting tappets taking place only during the concluding part of this return movement of the tappet attached to the lever. It is important that, in this return movement, it should be impossible for the operating lever to move far enough to cause its tappet to unlock conflicting levers or to do any mechanical locking unless its signal has certainly returned to danger. That signal for example might stick at safety, and in that event if the lever were free to return far enough for its tappet to unlock conflicting levers, conflicting signals might be given. To guard against any such contingency I provide a pneumatically actuated indicator connected to and controlled in its action by the signal, and operating as a stop or detent to arrest the lever before the completion of its return movement, unless the signal has actually gone from safety to danger. This device with its connections is shown in Figs. 2, 2^a and 3. It consists of an indicator pin 20 attached to and projecting from the top of a rectangular oblong frame 21, (shown detached and in front elevation on the left of Fig. 3,) which embraces and can move up and down in guides on the cylinder 24 attached to the lever and tappet carrying frame in Fig. 3 and arranged beneath the tappet 13 to bring the pin 20 in proper relation to a slot *s* in said tappet. The frame 21 is attached to the projecting lower and outer end of a rod 22 which extends up into the cylinder 24 and is fast to and moves with a piston 23. This piston is upwardly pressed by a spring 25 or any other suitable means, and when so moved will act to elevate the pin 20 to engage and lock the tappet; it is depressed against the force of the spring, by compressed air admitted into the cylinder above the piston by the pipe 26, and when thus depressed will act to lower the pin 20 out of the path of the tappet. The pipe 26 leads to and communicates with a port in

a valve chest or case 27 (Figs. 2 and 2^a) on the signal mast. This chest also has an exhaust port 29, which if desired may be controlled by a pop or relief valve set to open at a pressure so low as to be overcome by the force of the spring 25 (Fig. 3). These ports are controlled by a slide valve D² provided with a stem *d* which is linked to the semaphore signal, the adjustment being such that when the semaphore stands at danger the valve D² will uncover the port 26. Into the chest 27 leads a pipe 28 communicating with a source of compressed air supply having sufficient pressure or head to overcome the resistance of spring 25 (Fig. 3). Consequently when the parts are in the position shown in Figs. 2, 2^a and 3, the port 26 will be open, compressed air will be admitted to the indicator cylinder 24 over the piston and the indicator pin 20 will be held down out of the path of the tappet. The position in which the pin 20 stands in relation to the tappet at this time is indicated in Fig. 4—the depressed pin being beyond the right of slot *s* and under the solid part of the tappet.

In moving the operating lever from A to C position, the moment the semaphore blade leaves its danger position, pipe 26 will by the consequent movement of valve D² be put in communication with exhaust port 29; this will reduce the air pressure above the piston in the indicator cylinder and the pin 20 will therefore be forced up to engage the slot *s* which by this time has been brought over the pin. The operating lever can then be carried to its C position—the pin 20 at the conclusion of the movement of the tappet being at the left hand end of the slot *s*. Upon the return movement the signal should go to danger by the time the lever passes from its C to its B position, at the conclusion of which movement the elevated pin will engage the right hand end of the slot *s* in the tappet as seen in Fig. 5. If the signal responds properly and actually goes to danger, then the valve D² will shift so as to open the indicator pipe 26 to the compressed air supply, the pin 20 consequently will be drawn down out of engagement, and the lever will be free to accomplish the concluding portion of its movement from B to A—in the course of which, as hereinbefore stated, the tappet unlocks all conflicting tappets. But if the signal instead of responding properly should stick at safety then the valve D² would not be shifted, pressure in the indicator pipe 26 would not be restored and consequently the pin 20 would remain up in engagement with the tappet thus locking the lever from further movement toward its A position, and preventing that movement of the tappet requisite to unlock conflicting tappets.

The apparatus thus far described is one intended for a two position signal—that is to say a signal which has only "danger" and "safety" positions. When however it is required to handle a three position signal—or

one which has between its two extreme positions of "safety" and "danger" a third and intermediate position indicative of "caution"—the apparatus shown in Figs. 6, 7 and 8 can efficiently be used. I use as before an equalizing piston for controlling the valve mechanism; but instead of one working cylinder I have two, the one for "caution" and the other for "safety;" I employ two air controlling valves one for the "caution" and the other for the "safety" cylinder, the one being arranged to work at a lower pressure than the other; and I provide for obtaining these varying pressures in the controlling pipe by the movement of the signal operating lever, which is connected to and operates what may be termed a three position valve—a valve which in one position opens the controlling pipe to the exhaust or minimum pressure outlet, in another position opens that pipe to a pressure inlet, supplying air at a pressure (say sixty pounds) sufficient to operate the "caution" valve, and in still another position opens that pipe to an inlet supplying air at increased pressure (say eighty pounds) sufficient to operate the "safety" valve. The details of the apparatus by which this result is attained are illustrated in Figs. 6, 7, 8 and 9.

The counterbalanced semaphore blade is pivoted on the signal mast, and is joined by a connecting rod to a pivoted counterweighted lever, as in the apparatus hereinbefore described. The other end of this counterweighted lever is jointed to a rod a which at the other end is jointed to a piston b working in a cylinder c . This cylinder is the "safety" cylinder; the permitted throw of its piston is sufficient to carry the signal from danger to safety. Adjoining the "safety" cylinder is a second but shorter cylinder c' —the "caution" cylinder—containing a piston b' which has pinned to it a rod a' that at the other end is formed to encircle and slide on the rod a —this rod a' when the signal is in normal or danger position abutting at its lower end against a shoulder a^2 on rod a . The downward movement of the rod a' is limited by an internal stop or shoulder a^3 with which the cylinder c' is provided. The downward movement of rod a' will by the bearing of that rod upon the shoulder a^2 of the main rod a pull down the semaphore blade, and the stop a^3 is so arranged as to arrest this movement when the blade has reached the "caution" position represented in Fig. 6. Thus the force applied from above to the "caution" piston b' alone will suffice to bring the signal from "danger" to "caution;" to move it farther from "caution" to "safety" the rod a' is no longer available, but by applying force from above to the "safety" piston b , the signal can readily be still further lowered to "safety," the rod a sliding freely through the end of the rod a' by which it is loosely encircled. Thus by applying a force, such as compressed air, from above the pistons b, b' , successively, the signal can be moved successively from

"danger" to "caution" and from "caution" to "safety," or by moving the signal operating lever its full stroke so as to supply the "safety" cylinder immediately with compressed air the signal can move at once from "danger" to "safety" without any intermediate stop. For the purpose of regulating the supply and exhaust of compressed air needed for this purpose, I provide in the head which closes the upper ends of the two cylinders two sets of ports e, f, g , one for each cylinder— e in each case being the inlet to the cylinder, f , the port through which air is supplied from the main, and g the exhaust port opening to the atmosphere. These two sets of ports are in a seat on which are placed two slide valves $D^3 D^4$ one for each set of ports. These two slide valves have a stem d to which they are held by collars or flanges, the distance between the collars d', d^2 , between which the "safety" valve D^4 is included, being sufficiently greater than the length of that valve, to permit the stem a movement to the right sufficient to shift the valve D^3 before the valve D^4 is moved. This is illustrated in Fig. 8, in which the parts are shown as they stand when the signal is at danger. In shifting the valves so as to supply compressed air to the cylinders, it will be noted that the stem will move far enough to shift valve D^3 , before collar d' meets valve D^4 , further movement of the stem in the same direction after that, will of course have the effect of shifting valve D^4 also. The stem is connected to an equalizing piston h having an equalizing port h' , similar to the equalizing piston already described and combined in like manner with a chest h^2 and storage chamber or reservoir h^3 . Into the head of the chest opens the controlling pipe i containing at all times air above atmospheric pressure—but having that pressure varied at proper times by mechanism located in the tower and controlled by the signal operating lever. Within the chest h^2 , and beyond but in axial alignment with the valve stem d , is a spring pressed rod j which at the end contiguous to the stem enters the bearing in which the stem at that end slides, and is prevented from entering that bearing to more than a predetermined extent by a collar j' with which it is provided. In the normal position of the parts represented in Fig. 8 the adjoining ends of the valve stem d and the rod j are separated from each other by an interval sufficient to permit the stem to move far enough to shift the "caution" valve D^3 far enough to the right to open the air supply to its cylinder, before said stem abuts or brings up against the rod j . If therefore only sufficient force be applied to the stem to shift the valve D^3 this force manifestly will not suffice to still further move the stem against the added resistance of the spring pressed rod j the distance needed to shift the valve D^4 also. Consequently if the air pressure needed to shift the "caution" valve to the right be sixty pounds then that pressure

might be increased say to eighty pounds in order to shift the "safety" valve D^4 . Provision for this, is made by the apparatus represented in Fig. 9, which, as far as it goes resembles that shown in Fig. 3, save that the slide valve is a three position valve opening the controlling pipe not only to the exhaust and the usual sixty pounds pressure inlet as in the figure last named, but also to a further and higher pressure inlet—supplying a pressure of say eighty pounds.

In Fig. 9 the operating lever, table and tappet are the same as in Fig. 3; and the lever in like manner is linked to the slide valve. The valve (marked k) has however, in addition to its D cavity, an opening k' beyond that cavity, which is intended at stated periods to open communication between the port k^2 and the interior of the valve chest. The chest is also provided with three other ports, l , l' , and m . l' communicating with the controlling pipe i , l being the exhaust closed by a pop or relief valve set to close at any predetermined minimum pressure—say fifty pounds—and the remaining port m being in communication with the main supply through a pipe or communication n which delivers the air at the full head of eighty pounds. A branch pipe o from the supply enters the valve chest, but this pipe is provided with a reducing valve which reduces the pressure of air entering the chest to sixty pounds.

In the position of parts shown in Fig. 9 both supply ports are closed and the controlling pipe is open to the exhaust as it should be when the signal actuating mechanism is in the position shown in Fig. 8 with the signal at danger. Air stands at the minimum pressure of fifty pounds in the controlling pipe. If now the operating lever be moved from A to B position, the valve k will be shifted to bring its opening k' over the supply port k^2 thus closing the exhaust and admitting air at sixty pounds pressure from the valve chest into controlling pipe i , with the result of moving the equalizing piston far enough to shift the "caution" valve D^3 , and thus bringing the signal from "danger" to "caution"—the valve stem d at this time abutting against the spring pressed rod j . If now the valve k be still further moved by throwing the lever from B to C position, the port k^2 will be closed while the valve will bridge the ports l' and m , thus increasing the pressure in the controlling pipe to eighty pounds. By this increase of pressure, the spring pressed rod is forced to the right. As the pressures on both sides of the equalizing piston approach equality, the now superior power of the spring will assert itself and the rod j will be returned to its original position. In so doing it will also move the valve stem d correspondingly, but at the conclusion of the movement of the stem d to the right the collar d^2 was separated from the adjoining end of the valve D^4 by a distance equal to the return movement of the rod j , so that the latter in returning will have moved

the valve stem only the distance required to bring the collar d^2 up against valve D^4 ; and consequently the latter will remain undisturbed, until the after reduction of pressure in the controlling pipe—upon which both valves will return to their original position.

Where the switch of a junction or siding is handled from the tower, it is customary to guard that point by a signal mast carrying two blades—the top blade for the main line and the bottom blade for the siding. These blades are usually handled by one lever, through the agency of a "selector," connected to and actuated by the switch, and acting to determine which blade shall be lowered when the signal lever in the tower is reversed. To meet this requirement in my system I have devised what may be termed a pneumatic selector, the construction and mode of operation of which can best be explained and understood by reference to Figs. 10 and 11.

Fig. 10 is a diagrammatic representation of the switch between the main line and siding, together with a signal mast having two blades thereon. Each of these blades will have its own independent equalizing piston and appliances connected therewith such as represented in Fig. 1. In other words the apparatus shown in Fig. 1 will be duplicated. Instead, however, of the supply or controlling pipe 6 (Fig. 1) leading directly from the signal valve in the tower to the equalizing cylinder (or either of them on the mast) that pipe leads from the signal valve to the central port p of the group of ports p , p' , p^2 , at the right hand end of the valve chest F, Fig. 11, over which plays a slide valve D^5 , held between collars on a valve stem r the ends of which project out through the opposite ends of the valve chest in position to be operated on by knockers s on a reciprocatory rod G attached to the stem of the piston of the working cylinder for actuating the switch. The rod G slides back and forth beneath the valve case or chest F and is connected to appliances, which need not be shown, for throwing the switch. At or near the conclusion of its movement in either direction, and after the switch has been fully thrown, one or the other of the knockers s strikes and moves the valve stem with the effect of shifting valve D^5 . To the left of valve D^5 and the group of ports controlled by it, are two other groups of ports and valves for controlling the same. These parts, which are not distinguished by any reference letters or numerals, form part of a pneumatic switch operating apparatus, and require no description here. They will be found fully described and illustrated in my application of even date herewith for Letters Patent for a pneumatic system of and apparatus for handling railway switches. It will suffice for present purposes to say that the interior of the chest is supplied constantly with compressed air drawn from a suitable source, so as to counterbalance the valves.

As above said, the pipe 6 from the signal

valve in the tower (Fig. 3) should in this arrangement lead to the central port p . Port p' communicates with the controlling pipe of the equalizing piston arrangement of one of the two blades on the mast in Fig. 10 (in this instance the top blade) and port p^2 in like manner communicates with the controlling pipe of the equalizing piston arrangement of the other of the two blades. It will thus be seen that by shifting valve D^5 to one or the other of its two positions the controlling pipe of either one or the other of the equalizing cylinders on the mast will be thrown into connection with the pipe 6 of the signal valve in the tower; and as this shifting of the valve D^5 is due to the movement of the switch, it follows that one or the other of the signal blades on the mast can be operated according as the switch is normal or reversed. In Figs. 10, and 11, the switch is supposed to be in normal position (for main track) and under these conditions the selector valve D^5 will stand as shown in Fig. 11, bringing the signal valve in the tower in communication (through port p') with the controlling pipe for the top blade, which now can be lowered to safety whenever desired. On the other hand, with switch in reversed position the valve D^5 will have thereby been shifted to the left so as to open communication between the signal valve in the tower and the port p^2 leading to the controlling pipe of the second or bottom blade. In this way I provide a pneumatic "selector" by which the appropriate one of two signals can expeditiously and with certainty be brought into communication with the one signal valve in the tower.

It will of course be understood that the pneumatic selector just described can in a similar way be interposed between the signal valve and the equalizing piston mechanisms of the three position signal system illustrated in Figs. 6 to 9 inclusive.

In lieu of making an equalizing passage through the piston, manifestly it can be formed in that portion of the walls of the cylinder traversed by the piston.

I remark also that in lieu of using the spring in the indicator cylinder to act on the indicator piston, I may use compressed air, a weight, or any other suitable appliance for the purpose.

Having described my invention and the best way now known to me of carrying the same into effect, what I claim herein as new, and desire to secure by Letters Patent, is as follows:

1. In combination, a controlling pipe communicating with a source of compressed air supply, means for reducing and restoring air

pressure in said pipe; an equalizing piston and cylinder—the latter connected to said pipe; a working cylinder and piston and a signal connected thereto so as to be operated by the movement of the piston; and a valve mechanism controlled by the equalizing piston for admitting compressed air to and exhausting it from the working cylinder, the combination being and acting substantially as hereinbefore set forth.

2. The signal operating lever, its tappet and the pneumatic indicator mechanism, in combination with the signal, and valve mechanism for admitting air to and exhausting it from the indicator cylinder, connected to and operated by the signal at the times and in the manner substantially as hereinbefore set forth.

3. The pneumatic selector, comprising a valve connected to and operated by the switch or some part moving therewith, and three ports controlled by said valve communicating, one with the supply port of the signal valve in the tower, and the other two with controlling pipes leading to the cylinders of two valve shifting piston mechanisms, for operating each in connection with a distinct and separate signal, under the arrangement and for operation substantially as hereinbefore set forth.

4. The mechanism for operating a three position signal comprising a three position signal valve in the tower adapted to deliver and graduate air pressures; a single controlling pipe through which said pressures are delivered; an equalizing piston and cylinder—the latter connected to the controlling pipe; two working cylinders, one for "caution" and the other for "safety;" working pistons one for each cylinder whereby the signal may through suitable intermediaries be actuated; a set of admission and exhaust ports for each cylinder; two valves connected to and operated by the equalizing piston in such manner that the "caution" valve will move far enough to open its cylinder to the admission of compressed air, before the "safety" valve is moved to admit air into its cylinder; and a graduated spring or yielding resistance which opposes such movement of the "safety" valve—the combination being and acting substantially as hereinbefore set forth.

In testimony whereof I have hereunto set my hand, before two subscribing witnesses, this 16th day of February, 1894.

JOHN W. THOMAS, JR.

Witnesses:

EWELL A. DICK,
ROBT. W. COX.