

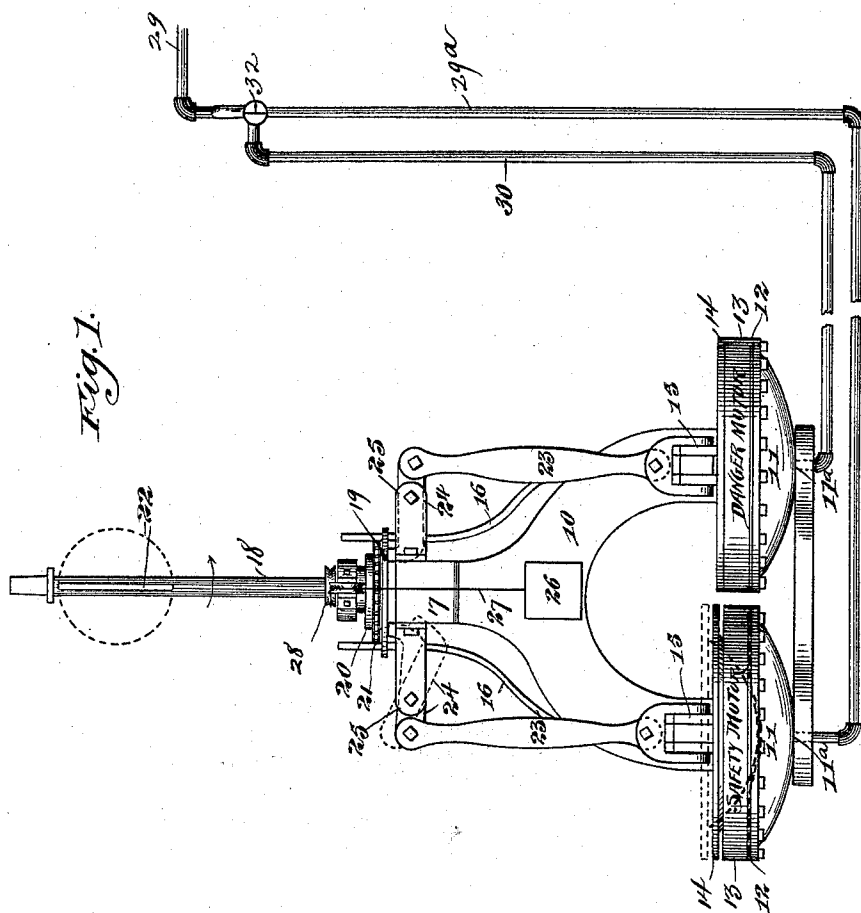
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5 Sheets—Sheet 1.

W. P. ELLIOTT.
PNEUMATIC SIGNAL.

No. 535,824.

Patented Mar. 19, 1895.



Witnesses,

F. M. Mamm
Frederick Goodrum

Inventor,

William P. Elliott
By Offield, Towle & Luthicrum
Attys.

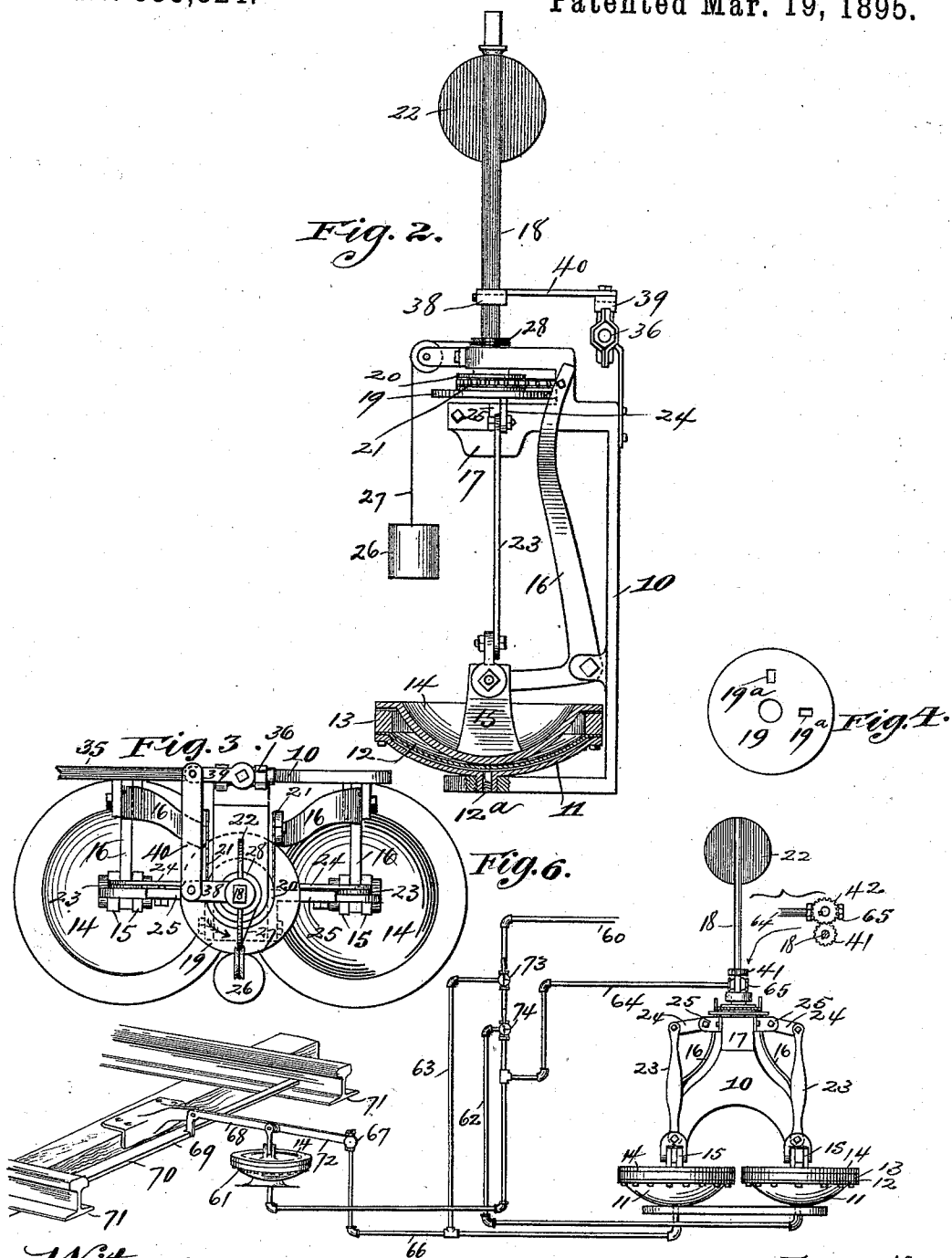
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5 Sheets—Sheet 3.

W. P. ELLIOTT.
PNEUMATIC SIGNAL.

No. 535,824.

Patented Mar. 19, 1895.



Witnesses,

J. M. Mann,
Frederick Goodrum

Inventor,

William P. Elliott
By *Field, Towle & Luthig*
Attys.

(No Model.)

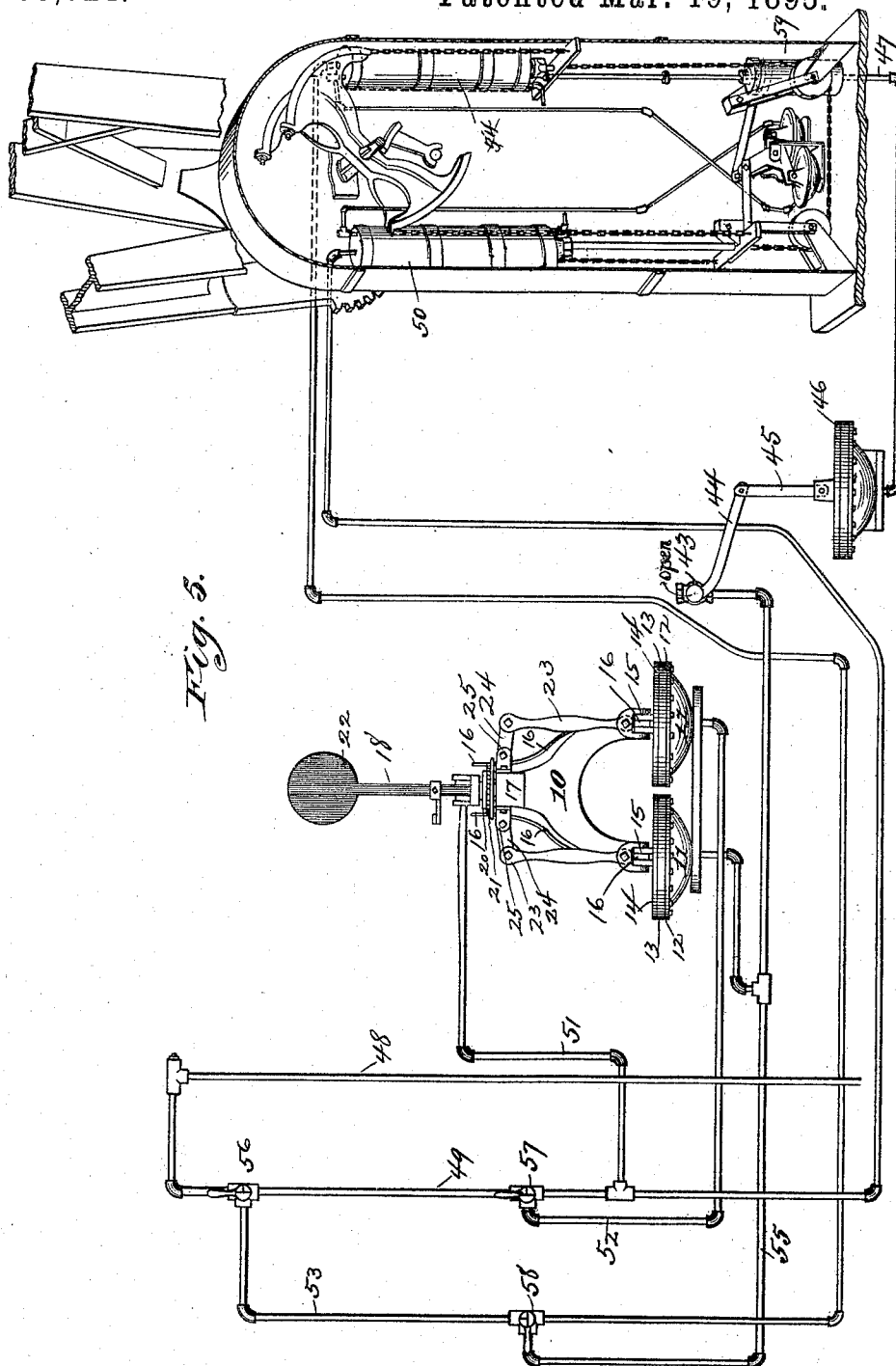
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W. P. ELLIOTT.
PNEUMATIC SIGNAL.

No. 535,824.

Patented Mar. 19, 1895.

Fig. 5.



Witnesses,
J. E. Mann,
Frederick Goodwin

Inventor,
William P. Elliott,
By *Offield, Tuck & Luntz*
Attys.

(No Model.)

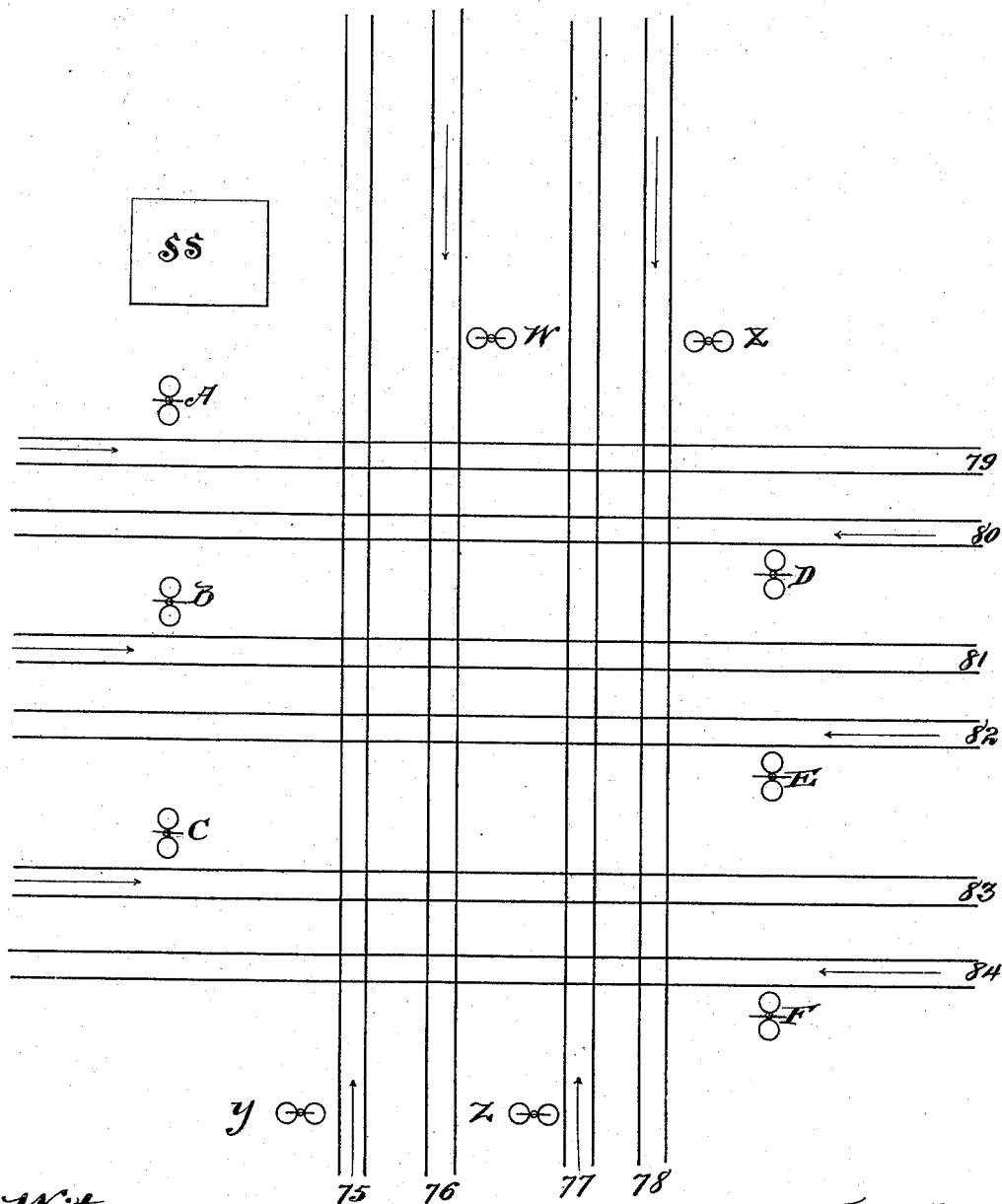
W. P. ELLIOTT.
PNEUMATIC SIGNAL.

5 Sheets—Sheet 5.

No. 535,824.

Patented Mar. 19, 1895.

Fig. 7.



Witnesses,

J. D. Mann

Frederick Goodrum

Inventor,

William P. Elliott

Ray Offield, Fowler & Luthicum

Atty.

UNITED STATES PATENT OFFICE.

WILLIAM P. ELLIOTT, OF CHICAGO, ILLINOIS.

PNEUMATIC SIGNAL.

SPECIFICATION forming part of Letters Patent No. 535,824, dated March 19, 1895.

Application filed June 15, 1894. Serial No. 514,698. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. ELLIOTT, of Chicago, Illinois, have invented certain new and useful Improvements in Pneumatic Signal Apparatus, of which the following is a specification.

This invention relates to that class of signaling apparatus in which compressed air or other motor fluid is employed to change the signals.

The invention in the simplest form is adaptable to the operation of a single signal—as, for example, a semaphore—and is capable, also, of being applied in couples or series so as to adapt one signal operating device to lock or unlock another, thus rendering two or more signals interlocking; or a single signal operating device may be so connected with other moving devices—as, for example, a railway crossing gate, a switch or a bridge—thus making the changing of the position of the gate, switch or bridge in the examples given dependent upon the proper adjustment or setting of the signal which is interlocked therewith.

In the accompanying drawings, Figure 1 is a view in side elevation, showing a signal with its operating mechanism, the connecting pipes being shown broken away to indicate that the signal is at a distance from the operator. Fig. 1^a is a view in side elevation, showing two interlocking signals with their operating mechanisms and indicating their relation to each other when connected, the connecting pipes however being shown broken away to indicate the separation of the signals. Fig. 1^b is a perspective view of a suitable valve for controlling the flow of the compressed fluid used. Fig. 2 is a view of one of the signal operating devices, partly in section and at right angles to the view shown in Fig. 1^a. Fig. 3 is a plan view of one of the signal operating devices. Fig. 4 is a detail of a locking plate forming a part thereof. Fig. 5 shows the application of my improvement in interlocking connection with a railway gate, the post of which is shown in section with the gate arms broken away. Fig. 6 shows the application of the invention to a switch locking mechanism. Fig. 7 indicates diagrammatically the application of my invention to the intersection of a series of railway tracks.

In carrying out my invention, I prefer to employ air under pressure as a motive fluid, whereby to operate the signals and locking devices, and the mechanical structure which I have described is adapted to the use of air as a motor fluid. The principal mechanism employed comprises, in the preferred construction, a suitable standard or frame work 10, the base of which is adapted to support compressed air engines which, in the present case, each comprise a concave cup 11, a flexible diaphragm 12 confined to the cup by the ring 13 and a cover weight 14, consisting of a concave disk with a straight flange and which is lifted by the admission of air under pressure below the diaphragm. The bottom of the cup 11 is perforated, as at 11^a, for the admission of air, and preferably threaded to adapt it for a pipe connection. The cover weight 14 has a central post 15 to which is pivotally connected one arm of a bell crank 16, the latter being pivoted at its apex to the frame. On a bracket 17 of the frame in the construction shown is rotatably supported the shaft or standard 18 having, in the present instance, a disk 19 with a hub 20 and to the hub a chain 21 is made fast between its ends, said ends being secured, respectively, to the upper ends of the bell cranks 16, which are rocked by the movements of the diaphragms of the engines respectively.

The upper end of the standard 18 may carry a signal—as, for example, the disk 22 of usual construction, or work a semaphore—and a lamp may be mounted on the top of the shaft. The disk 19 is provided, as shown in Fig. 4, with perforations 19^a, which serve as locking notches for a locking mechanism, comprising the arms 23 pivotally connected at their lower ends to the cover weights 14 and at their upper ends to the short end of the pivoted locking levers 24, the latter being pivoted to lugs 25 of the bracket 17. The points of the long ends of the locking levers 24 are adapted, respectively, to enter the locking notches 19^a.

As a safe-guard I have provided the weight 26 connected by the cable 27 with the sheave 28 on the standard in such manner that the signal will be moved to a position to indicate danger should the mechanism become inoperative.

As the means of operating the mechanism,

already described, are shown (Fig. 1) pipe 29 leading from some compressed fluid supply with a branch 29^a, leading to and communicating with the left hand motor, which for convenience of description I have designated the "safety motor," and another branch 30 leading to and communicating with the right hand motor, which I have designated the "danger motor." At the juncture of these pipes is the valve 32 which governs the flow of compressed fluid through the branch pipes 29^a and 30.

The valve 32, as is more fully shown in Fig. 1^b, has an inlet *s*, two outlets *t* and *u*, and two apertures *v* and *x* through its shell *y*; with a hollow plug *z*, having an opening which, in the position shown, communicates with *s*, another which communicates with *t*, and a third at right angles to the last two and which will communicate with *s* when plug *z* is turned ninety degrees to the left, the lines in the head of plug *z* indicating the direction of these openings. Plug *z* has also along its outside, next to the inside of the shell *y*, a recess *w* which in the position shown of the valve would permit compression in the pipes connected with the outlet *u* to escape through the aperture *x* to the open air, and when the valve plug *z* is turned ninety degrees to the left, will permit the compression in the pipes connected with the outlet *t* to escape through the aperture *v*; or, in more general language, the functions of this valve are such that when compression is lead through it into one of the outlet pipes, the compression that may be in the other outlet pipe will be released.

The operation of the mechanism described is briefly as follows: If air under compression is admitted through the pipe 29 to the valve 32, the turning of the valve plug ninety degrees to the left from the position shown will release any compression in pipe 29^a and the safety motor with which it communicates and lead compression into the pipe 30. The diaphragm 12 of the "danger motor" will be inflated, and during its inflation will lift its weight cover 14, the connecting rod 23, and the short end of the lock lever 24, causing the long end of the lock lever to disengage with the aperture 19^a of the disk 19, thus unlocking the disk. The inflation of this diaphragm 12 also raises the end of the bell crank 16, which is connected with the weight cover 14, and causes its other end to rock backward a distance sufficient to rotate the hub 20 of disk 19 to which it is chained, to the right ninety degrees of its circle, or far enough to permit the opposite or "safety motor's" lock lever 24 which is held against the lower surface of the disk 19 by the gravity of parts connected with its short end, to engage in the aperture 19^a of the disk 19 provided for it; but this motion of disk 19 will rotate the shaft 18 and the signal 22 ninety degrees to the right, as shown by the arrow, thus changing the signal from its shown position, which we will call "safety" to its other indicative position, which we will

call "danger," and the locking lever last named will retain it in that position wholly independent of the compression in the pipes which put it there.

It must be noted that in construction the proportions of the lengths of the different ends of the locking levers 24 and of the bell cranks 16, and the size of the disk 19 are such as to insure a prompt release of the points of the locking lever before any considerable rotation of the disk has taken place.

To reverse the position of the signal thus attained, compression will be admitted through pipe 29, through valve 32, to pipe 29^a which will be done by turning the valve plug handle to the right ninety degrees, that is, to its upright position. This position of the valve plug will also release the pressure which may be contained in pipe 30 at the aperture of said valve, corresponding to *x* Fig. 1^b. The diaphragm 12 of the "safety motor" will be inflated and during its inflation will raise the cover weight 14 of the motor, the connecting rod 23, the short end of the lock lever 24, and depress the long end of lock lever 24 from its engagement with aperture 19^a of the disk 19, thus releasing said disk 19. This inflation will also raise the end of the bell crank 16, to which the cover weight is attached, thus rocking the other end backward and rotating the disk 19, to whose hub 20 it is attached by chain 21, to the left ninety degrees, or far enough for lock lever 24 of the "danger motor" to engage with its aperture 19^a of the disk 19, leaving the signal locked in the position now shown which I call its safety position.

It is evident that by changing the connection of pipe 29^a to the right hand motor and pipe 30 to the left hand motor, the mechanism could be operated equally well.

Weight 26, attached to cable 27, which is fastened to and passes around sheave 28 from left to right, will tend to pull standard 18, to which sheave 28 is rigidly attached, and signal 22 to danger; and in case all other connections provided for moving the signal should become inoperative this weight would carry the signal to danger.

From the foregoing description it will be understood that my invention in its broader scope may be employed in the operation of a simple single signal of any desired form, and as such is a useful and novel improvement, the peculiar advantage of the mechanism being that the signal is locked in the set position and its position cannot be changed except by the person having control of the motor fluid. Of course it will be understood that instead of the diaphragm shown any other form of air motor may be employed and that other motor fluid than air may be used—as, for example, a working cylinder and piston might be substituted for the cups, diaphragm and weight cover shown.

In Fig. 1^a, I have shown two of these signal operating mechanisms and means whereby

the same are rendered interlocking, that is, they are so connected that the signal of one cannot be changed to the position of safety without first changing the signal of the other to the position of danger. In this adaptation of my invention I employ a more extended system of connected pipes and valves for controlling the motor fluid and, as in the single signal, have so arranged the pipes that the valves must be manually changed in order to put the signal device into a condition responsive to the motor fluid. This system includes air supply pipe 29 and branch pipe 29^b leading to the "safety motor" of the right hand signal, branch pipe 30^a leading to the "danger motor" of the left hand signal, branch pipe 31 leading to the "safety motor" of the left hand signal, branch pipe 31^a leading to the "danger motor" of the right hand signal, and valves 32^a, 33 and 33^a at the junctions of these pipes with each other, which valves are of similar construction to 32, (Fig. 1) before described; also a branch 34 leading from the pipe 29^b to the vicinity of the signal operating mechanism at the left of the view, and a branch pipe 35 leading from pipe 31 to the vicinity of the operating mechanism at the right of the view, branch pipe 35 having interposed in it near its end a suitable valve 36, and branch pipe 34 having interposed in it near its end a suitable valve 37, both of which valves may be ordinary stop cocks. The standards 18 are connected with the valves 36 and 37, respectively, by means of arms 38 and 39 and link 40 (Fig. 3) in such a manner that a partial rotation of the standards will operate to open or close the valves, and this connection is so arranged that when either signal is set to danger, the valve connected to it will be closed, and when either signal is set to safety the valve connected to it will be open to the atmosphere.

In order to change the right hand signal from danger, the position shown in which it is locked by the lock lever 24 of its "safety motor," it will be necessary to produce compression under diaphragm 12 of this motor. If the compressed fluid is directed through pipes 29 and 29^b, communicating with the chamber of this motor, which can be done by turning the plug of valve 33 to the right ninety degrees, such compression will escape to the open air through valve 37, which is open and connected with pipe 29^b by branch pipe 34 and no compression will be produced in the motor chamber while pipe 34 and valve 37 have a capacity sufficient to release the compression directed to pipe 29^b. This capacity is a matter of dimension and is provided for in construction. The valve 37 must be closed to render possible the necessary compression in the diaphragm chamber of this "safety motor," and this can be done only by turning the plug of valve 32^a to the left ninety degrees, thus admitting compression to pipe 30^a and to the "danger motor" of the left hand signal which will inflate its diaphragm 12,

causing its cover weight 14 to rise, disengaging its lock lever 24 from its aperture 19^a in the disk 19, rocking its bell crank 16, rotating the standard 18 to the right in the direction indicated by the arrow ninety degrees, or until the safety motor's locking lever 24 engages with its aperture 19^a in the disk 19, and also rotating the crank lever 38 and by means of the connecting bar 40 the crank lever 39 of valve 37 forward ninety degrees and thus closing valve 37. The process of closing the valve 37 will have also changed the left hand signal to danger and locked it in that position. When this process is completed we would have both signals at danger, a condition that can be attained directly at any time, and we can take our choice which one of the signals shall next be changed to safety. Choosing the right hand signal to change to safety, by turning the plug of valve 32^a back to its shown position compression will be lead into pipe 29^b and the "safety motor" of that signal, raising its weight cover 14, its connecting rod 23, disengaging its lock lever 24 from the aperture 19^a of the disk 19, rocking its bell crank 16 backward and rotating the shaft 18 and the signal 22 to the left in the direction of the arrow ninety degrees, or far enough for the lock lever 24 of the danger motor to engage in its aperture 19^a of the disk 19, thus moving this signal to safety and locking it in that position; and while in that position any attempt to move the left hand signal which is at "danger" to safety would be futile, for to do this, compression would have to be produced under the safety motor of that signal, and would have to be lead from valve 33, valve 33^a and pipe 31, but pipe 31 is connected by pipe 35 with valve 36 which I have just opened by turning the right hand signal to safety, and compression cannot be had in pipe 31, or the safety motor, until I have closed this valve 36. This can be done only by leading compression from pipe 29 through valves 33 and 33^a and pipe 31^a to the danger motor of the right hand signal, causing its standard to rotate from the last supposed position to the position shown, which is "danger" and locked. The rotation of this standard 18 will be by means of its arm 38, the connecting rod 40, and the arm 39 of the valve 36 rotate the valve plug ninety degrees and close it, and when this is done compression can be produced in pipe 31 and the safety motor of the left hand signal and the signal itself can be turned to safety, thus fulfilling in all its movements the requisites of an interlocking mechanism.

Instead of the means shown for operating the valves 36 and 37, I may substitute simple gearing as shown in Fig. 6, a spur gear 41 being mounted on the standard and enmeshed with a spur gear 42 secured on the valve plug, or the standard itself, if provided with a perforation or slot, may serve as the valve plug, and a suitable valve casing communicating with the pipe may be fitted thereto.

In Fig. 5, where the invention is shown as applied to a railway crossing gate, I have shown at the left of the view a pneumatically operated signal with a pipe system connected therewith; at the right of the view a gate post with its arms broken away and interposed between them an additional motor for operating a valve or stop-cock necessary to the system. The signal operating mechanism is the same as previously described, is in the position of danger illustrated by the right hand signal of Fig. 1^a, and is connected with a pipe system having a stop-cock adjacent to the standard of the signal and valves which are manually set in order to put the mechanism into operative condition.

The gates, which are pneumatically operated, are provided with cylinders 40^a and 41^a, a rocking section of a wheel 42^a, upon whose shaft there is pivoted a gate arm 43^a, chains 45^a and 46^a, securing the sections of the wheel 42^a to the cross head 44^a of the piston rod of the cylinder 40^a in such a way that when the cross head descends the section of the wheel rotates to the left; a chain 46^b securing the lower end of piston rod 47^a to the lower end of piston rod 48^a; chains 49^a and 50^a securing the opposite periphery of the section of the wheel 42^a to the cross head 51^a, sheaves 52^a and 53^a around which the chain 46^b passes, locks 54^a and 55^a, bell cranks 56^a and 57^a attached to these locks respectively and pivoted on stand 58^a, which also supports motor 59^a which actuates lock 54^a and motor 60^a which actuates lock 55^a by their connection with the lower end of the bell cranks 56^a and 57^a, respectively; pipe 61^a communicating between the top of the cylinder 40^a and motor 60^a, and pipe 62^a communicating between the top of cylinder 41^a and motor 59^a. The pipe system has a valve 43, valve lever 44, connecting rod 45 and a motor 46, said motor to be operated by compression generated in cylinder 59, placed within the gate post, through the pipe 47 communicating between them for the purpose of closing valve 43. The piston rod 59^b of cylinder 59 passes through an aperture in cross head 51^a large enough to permit the cross head to slide up and down the piston rod between shoulders 63^a and 64^a made at the proper points on the piston rod; a supply pipe 48 communicating with some supply of compressed fluid, with a branch 49 leading to and communicating with cylinder 40^a, another branch pipe 53 leading to and communicating with cylinder 41^a, a branch pipe 52 leading from the pipe 49 to and communicating with the danger motor of the signal, a branch pipe 55 leading to and communicating with the safety motor of the signal, and also in communication with the open air at valve 43 which is open in the shown position of the system, these pipes having valves 56, 57 and 58, similar to valve 32, Fig. 1, already described, at their junctures; branch pipe 51 leading from pipe 49 to valve 65^a, which is similar to and corresponds with valve 36,

(Fig. 1^a), already described. With this system of pipes and valves to operate the gate compression will be admitted through pipe 48, through valve 56, which by turning its plug to the left ninety degrees, will release all compression in pipe 49 and cylinder 40^a to the open air, and will lead compression into pipe 53, whence such compression can be taken through valve 58, by turning its plug to the right ninety degrees, to the top of cylinder 41^a. This compression in the top of that cylinder, by means of the pipe 62^a, will be communicated to the motor 59^a, which will lift one end of its bell crank 56^a, and by that means move to the right the other end, which being connected with lock 54^a, will draw it from engagement with cross head 44^a and unlock the gate mechanism. This compression will also force the piston of cylinder 41^a and its rod 48^a downward carrying the cross head 51^a to a point where it will engage with lock 55^a. The cross head 51^a being chained to the periphery of the section of the wheel 42^a will rotate that wheel to the right ninety degrees and bring the gate arm 43^a to its horizontal position, which I will call its position of danger. This motion of the cross head 51^a will also force down the piston rod 59^b and piston of cylinder 59 by means of the shoulder 64^a, thus compressing air in that cylinder, in pipe 47 and in the motor 46, raising the lever 44 and closing valve 43. The gates and the signal being then at danger, I can choose which of the two next to move to safety, but I cannot move both to that position.

To move the signal to safety compression would be necessary in its safety motor. Turning the plug of valve 56 to the right ninety degrees, thus releasing the compression that exists in pipe 53 and its communications and leading compression into pipe 49, this compression will not escape at valve 43, which the movement of the gate mechanism just described will have closed, but will set the safety motor of the signal in motion and move the signal to safety. This could not be done as long as the gate arm is in its vertical position because valve 43 would remain open and prevent compression in the safety motor of the signal.

To raise the gate arm to its vertical position it will be necessary to get compression in pipe 49 and cylinder 40^a with which it communicates. This can only be done after closing pipe 51 at valve 65^a, but it is necessary to danger the signal to close valve 65^a. Having done this by leading compression through valve 56, pipe 49, valve 57, pipe 52 to the danger motor, I can turn valve 57 back to the position shown, thereby releasing the compression that exists in pipe 52, and leading compression through pipe 49 to the top of cylinder 40^a. This compression will be communicated to motor 60^a by pipe 61^a and will cause this motor to withdraw the lock 55^a from engagement with the cross head 51^a, thus unlocking the gate mechanism. The compression

sion in the top of cylinder 40^a will also force the piston and rod of that cylinder and its cross head 44^a downward, causing the section of a wheel 42^a to rotate ninety degrees to the left and carry with it the gate arm 43^a to its vertical position, in which the lock 54^a by gravity of its parts will engage the cross-head 44^a, securely locking the gate mechanism. The rotation of the section of wheel 42^a by means of the chains 49^a and 50^a will draw upward the cross bar 51^a, and it by means of the shoulder 53^a will draw along with it the piston rod and piston head of cylinder 59 to the top of that cylinder. This movement of the piston head of cylinder 59 will neutralize, or let escape through an orifice in the wall of cylinder 59 near its upper end, provided for that purpose, the compression in that cylinder and in pipe 47 and motor 46 communicating with it, and thus permit the gravity of the weight cover of motor 46 to open the valve 43, thus rendering it impossible to move the signal to safety until the gate arm has again been moved to its horizontal or danger position to close this valve 43.

It will be understood that the valve 43 may also be closed and opened mechanically by suitable connection to the moving machinery in the post and thus accomplish the same purpose.

In Fig. 6 I have shown my invention applied in connection with the movable rails of a switch, the purpose being to so connect a signal with the movable switch rails that before the switch can be opened the signal must be set to danger. A signal operating device of the sort previously described is shown at the right of the view, the movable rails of the switch at the left and a pneumatically operated switch lock interposed between them, the locking or operating motor being connected with the signal motors by a pipe system. In this pipe system let 60 represent the air supply pipe which delivers air under pressure to a lock operating motor 61. Branch pipes 62, 63 lead from the supply pipe 60 to the motors of the signal operating mechanism and a branch 64 leads from the supply pipe to the vicinity of the signal standard and is there provided with a stop-cock 65 as in the previously described construction. The pipe 63 has a branch 66 provided with a stop-cock 67. The motor 61 is operatively connected with a bell crank locking bar 68, the short arm of which is adapted to engage a shoulder 69 in tie bar 70 which connects the movable switch rails 71. The stop-cock 67 is also connected by an arm or lever 72 with the motor 61, in such manner as to be operated by the motor when air under pressure is admitted thereto. Valves 73, 74, of similar construction to valve 32 (Fig. 1) already described, are placed at the junction of pipes 60 with 62 and 63. As the parts are shown the signal indicates safety to the engineer on the main track and the switch is locked so as to leave the main track clear. In order to move the switch it must

be unlocked, and as a prerequisite to unlocking it the signal must be turned to indicate danger to the engineer on the main track.

In the position of the parts above described the stop-cock 65 is open, and in order to operate the lock the valves 73 and 74 must be put in the position to admit air to the pipe 62, thus releasing any compression that has existed in pipe 63 and its communications and leading compression to the right hand or danger motor of the signal which by its motion unlocks and moves the signal to danger at the same time through the gears 41, 42, closing the stop-cock 65 in the pipe 64. Then if the valve 74 be turned back to the first position, releasing compression in pipe 62 and its communications, air will be admitted through pipe 60 to the motor 61, and the movement of the diaphragm thereof will rock the bell crank lever 68, releasing it from the shoulder 69 of the tie bar, and the movement of the switch rails will cause the tie bar 70 to engage the locking end of the lever 68, thus maintaining the long end of the bell crank in the raised position, and at the same time through the arm 72 hold the stop-cock 67 open. As long as the stop-cock 67 is open no compression can be had in the pipe 66, and hence the signal cannot be turned back to safety until the switch is again shifted and locked in the starting position. Interlocking systems of these signals can be obtained by properly continuing the air pipes from the system of valves and pipes shown in Fig. 1^a, and described in connection therewith, to the motor chambers and stop-cocks of any desirable number of like signals located as circumstances may require, and this may be done as follows: The pipes 30^a and 31^a (Fig. 1^a) may be extended and connected so as to communicate with the chamber of all the motors which operate, in the manner already described, to move the signals to danger, which motors will correspond with those at the right or danger motors of the signals shown in Fig. 1^a. The pipes 29^b and 31 may likewise be extended and connected so as to communicate with the chambers of all the motors which operate to move the signals to safety, which motors will correspond with those at the left or safety motors of the signals shown in Fig. 1^a. A branch of pipe 34 will be extended and connected so as to communicate with the open air at the stop-cocks adjacent to all the signals which are connected with the pipes 29^b and 31^a and corresponding with the signal to the right of Fig. 1^a. A branch of pipe 35 will be extended and connected so as to communicate with the open air at the stop-cocks adjacent to all the signals which are connected with the pipes 30^a and 31, and corresponding with the signal to the left of Fig. 1^a.

It will be seen that no air can be compressed in the pipe 34, and its continuation communicating with stop-cocks of all this system of signals at the left hand, until every signal of this system has been turned to danger in the

process of closing all these stop-cocks; and also no air can be compressed in the pipe with which the pipe 34 communicates, namely, the pipe 29^b, its continuation and all safety motors of the system at the right hand with which they communicate, thus rendering it impossible to move any of the system of conflicting signals at the right hand to safety. It will also be seen that no air can be compressed in the pipe 35 and its continuations, communicating with the stop cocks of all the systems of signals at the right hand, until every signal of this system has been turned to danger, its present position (Fig. 1^a) in the process of closing all these stop cocks; and also that no air can be compressed in the pipes with which the pipe 35 communicates, namely, the pipe 31 and all the safety motors of the system, at the left hand with which they communicate, thus rendering it impossible to move any of the system of conflicting signals at the left hand to safety.

It will be remembered that it is the moving of the last of the individual signals in each system to danger that entirely closes the pipes 34 or 35 respectively, and it results that the interlocking in systems, as in pairs of signals, depends finally upon the working of individual signals in relation to each other, which has been fully described.

Such an application of my invention to an intersection of systems of railway tracks is diagrammatically illustrated in Fig. 7, in which 75, 76, 77, 78 represent four railway tracks crossing another series 79, 80, 81, 82, 83 and 84. As railways are now usually operated upon the double track plan, I have shown one signal for each track, the arrows indicating the direction of movement of trains over the tracks, and the signals for the closing of the several tracks being located adjacent to the arrows.

Let A, B, C, D, E, F represent a series of signals for closing the tracks from 79 to 84 inclusive, and W, X, Y and Z represent a series of signals for closing the tracks 75 to 78 inclusive, the motors of each signal being represented by circles and the signals by the lines across or between the circles. The direction of the lines indicates that all of the signals in the series A to F are set to safety, leaving clear the tracks covered by this series, and all the signals in the series from W to Z are set to danger, closing the tracks covered by this series. It rests with the operator at the signal station S S to permit the tracks A to F to be used or to danger the signals covering them and then safety those signals covering tracks W to Z so they may be used. Now, let it be supposed that the series of signals A to F each have the stop-cock adjacent to the standard thereof in communication with the same pipe 34 in Fig. 1^a and its continuation above suggested, for instance, and that each of the series of signals W to Z have their stop-cocks communicating with one pipe 35 in Fig. 1^a and its continuation above suggested, the process of manipu-

lating the systems would be similar to that of operating the pair of signals already described, and it will be seen that the interlocking feature may be extended so as to include two systems of signals operating in the same manner in every particular as has been described with reference to two single signals, and as illustrated in Fig. 1^a.

From the foregoing particular description of the mode of action and the various applications of my invention, it will be seen that the underlying principle thereof in its simplest form is the provision of a pneumatically operated signal with means whereby it is held or locked in either of its indicative positions and in such manner that it cannot be unlocked except by the person having control of the motor fluid. Further that the principle of the invention as applied to such a signal used in connection with another like signal or other moving device is that the device to be guarded by the signal may not be shifted until the signal itself is appropriately set, and this principle is, as before stated, applicable either to a signal when coupled with another signal or other moving device guarded thereby or to a system of signals when interlocked with another like system of signals or with other moving devices.

While the particular mechanism which I have described for operating the signal is novel and forms a part of my claimed invention, it is obvious that structural changes may be made therein, and my invention in its broader scope is not confined to such structural details.

While I prefer in all cases to employ a locking mechanism substantially as described in order to secure certainty in maintaining the signal in either of its set positions until it is changed by the person controlling the motor fluid, it is obvious that so long as the air pressure is maintained unimpaired the signal will be held in the position to which it is adjusted; and it is also apparent that the change of the signals is dependent upon the will and action of the operator, and that the interconnection or interlocking of two signals or sets of signals is independent of the locking mechanism.

I claim—

1. In a signaling apparatus, the combination with a rotatable shaft or standard, of two motors and connections between the motors and the shaft whereby the latter may be moved in opposite directions to change the signal, a locking plate carried by the shaft, pivoted locking levers and connections between the locking levers and the motors whereby by the operation of either of the motors the locking lever thereof is first released and the shaft is turned with its plate in position for engagement by the other locking lever, substantially as described.

2. In a signaling apparatus, the combination with a rotatable shaft or standard, of two motors and connections between the motors and

the shaft whereby the latter may be turned to change the signal, a locking plate carried by the shaft, pivoted locking levers adapted to engage the plate, and arms pivotally connecting the locking levers with the motors respectively and the motors respectively being adapted when operated to release the locking lever and by their return to normal position to permit the locking lever to re-engage the plate, substantially as described.

3. In a signaling apparatus, the combination with a revoluble shaft or standard for operating the signal, of two air motors each having a movable wall or side, bell cranks connected to the movable members of the motors, a flexible connection between the opposite ends of the bell cranks and the shaft, a locking plate carried by the shaft, pivoted locking levers for engaging the plate and connections between the movable members of the motors and said locking levers, substantially as described.

4. In a signal apparatus, the combination with two or more interlocking signals each having two motors whereby the signal is moved to its indicative positions respectively, a main supply pipe for a motor fluid and branch pipes connected therewith and with the motors, a three-way valve at the junction of the main supply pipe and the branches and a three-way valve at the junction of the branches with each other, substantially as and for the purpose described.

5. The combination with a signal apparatus having two motors whereby the signal is moved to its indicative positions respectively, of a lock to engage a moving device such as a signal, gate, bridge or switch, a motor to operate the lock, a system of pipes for conveying a motor fluid consisting of a main supply pipe and branches leading therefrom to the signal motors and to the motor that operates the lock, a three-way valve at the junction of the main pipe with the branches, and a three-way valve at the junction of the branches with each other, substantially as and for the purpose described.

6. In a signal apparatus, the combination with two or more interlocking signals, each having two motors whereby the signal is moved to its indicative positions, respectively,

a pipe system for a motor fluid comprising a main supply pipe and branch pipes connected therewith and with the motors, a valve at the junction of each branch with the main supply pipe, and a valve at the junction of the branches with each other, said valves being adapted when operated to direct the motor fluid into one of the pipes and to open the other to the atmosphere, substantially as and for the purpose described.

7. The combination with a signal having two motors whereby it is moved to its indicative positions respectively, a movable device such as a signal, gate, bridge or switch, a lock therefor and a motor for operating said lock, a pipe system for a motor fluid comprising a main supply pipe and branch pipes connected therewith and with the signal and lock motors, valves for controlling the entrances to the branch pipes, branch pipes communicating with the system and extending to the vicinity of the signals and the movable device and normally open to the atmosphere at their extremities, valves for closing the openings therein, connections between the signal and one of said valves and connection between the movable device and the other of said valves, the valves controlling the entrances to the branches being adapted to be operated to direct the motor fluid to one of the motor signals whereby to change said signal and thereby close the opening in the pipe system thereat and then to direct the motor fluid to the lock motor whereby to release the lock, substantially as described.

8. In a signal apparatus, the combination with two connected signals or systems of signals and their operating motors, of a system of pipes for supplying a motor fluid, said pipe system being open to the atmosphere in as many places as there are signals, valves actuated by the signal operating mechanism for controlling said openings, locking mechanisms actuated by the motors, and the pipe system having valves whereby the motor fluid may be manually controlled, substantially as described.

WILLIAM P. ELLIOTT.

Witnesses:

C. C. LINTHICUM,
N. M. BOND.