(No Model.) 2 Sheets—Sheet 1.

I. FISHER.

RAILWAY SIGNAL APPARATUS.

No. 246,304. Patented Aug. 30, 1881.

Fig: 1.

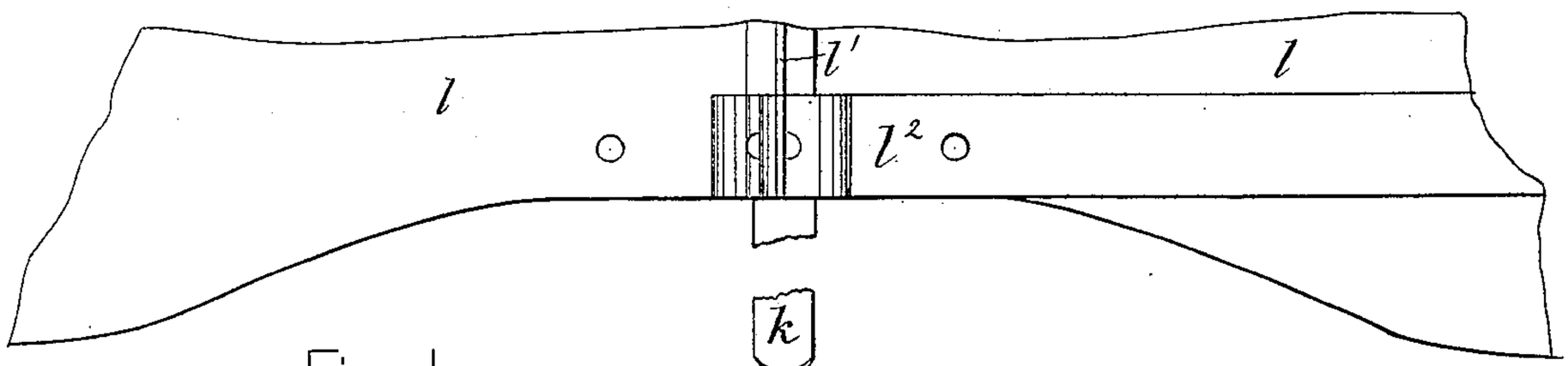
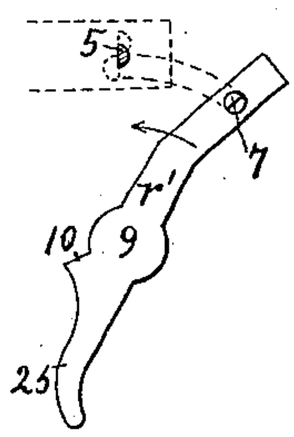


Fig: 5



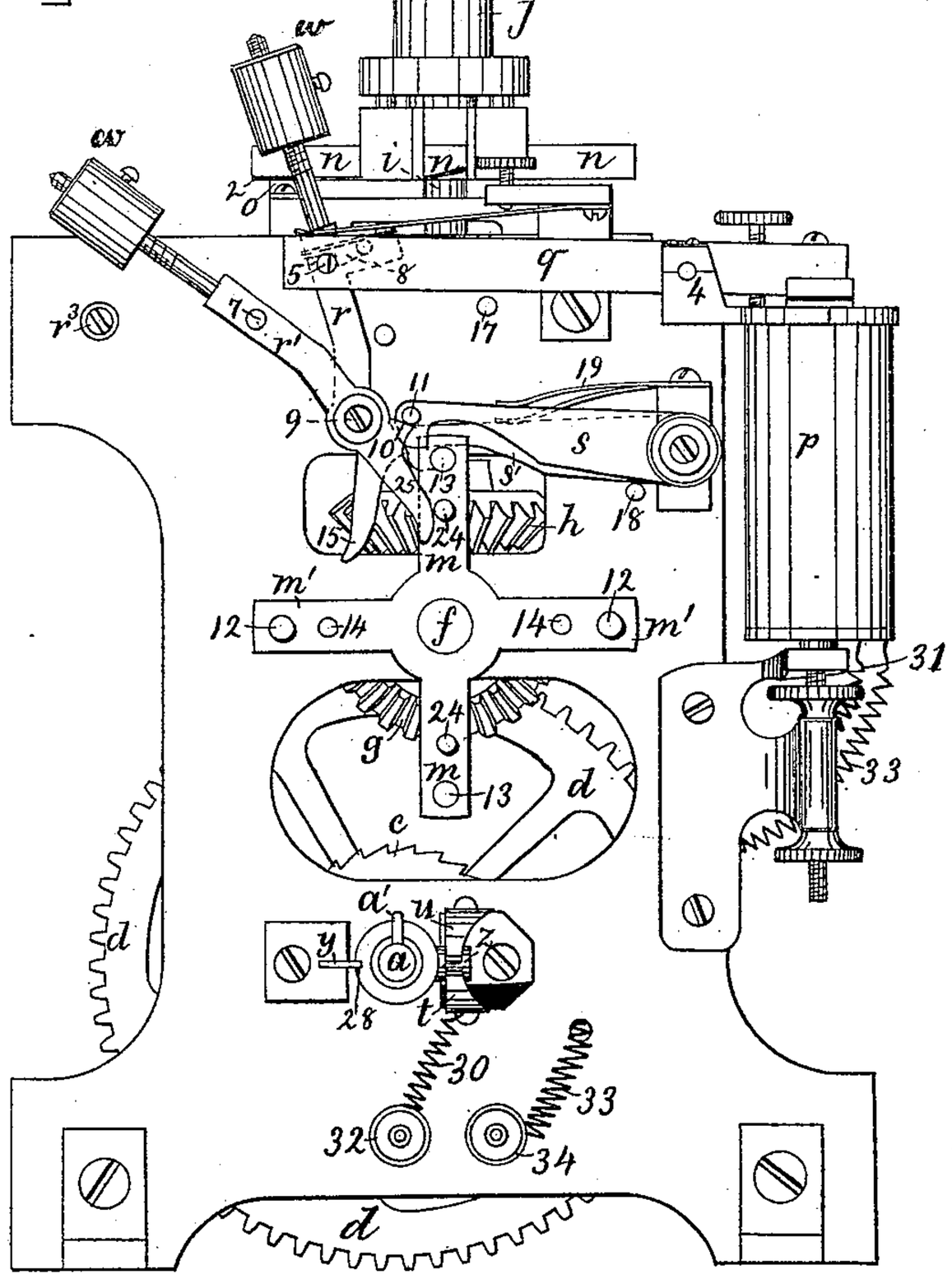
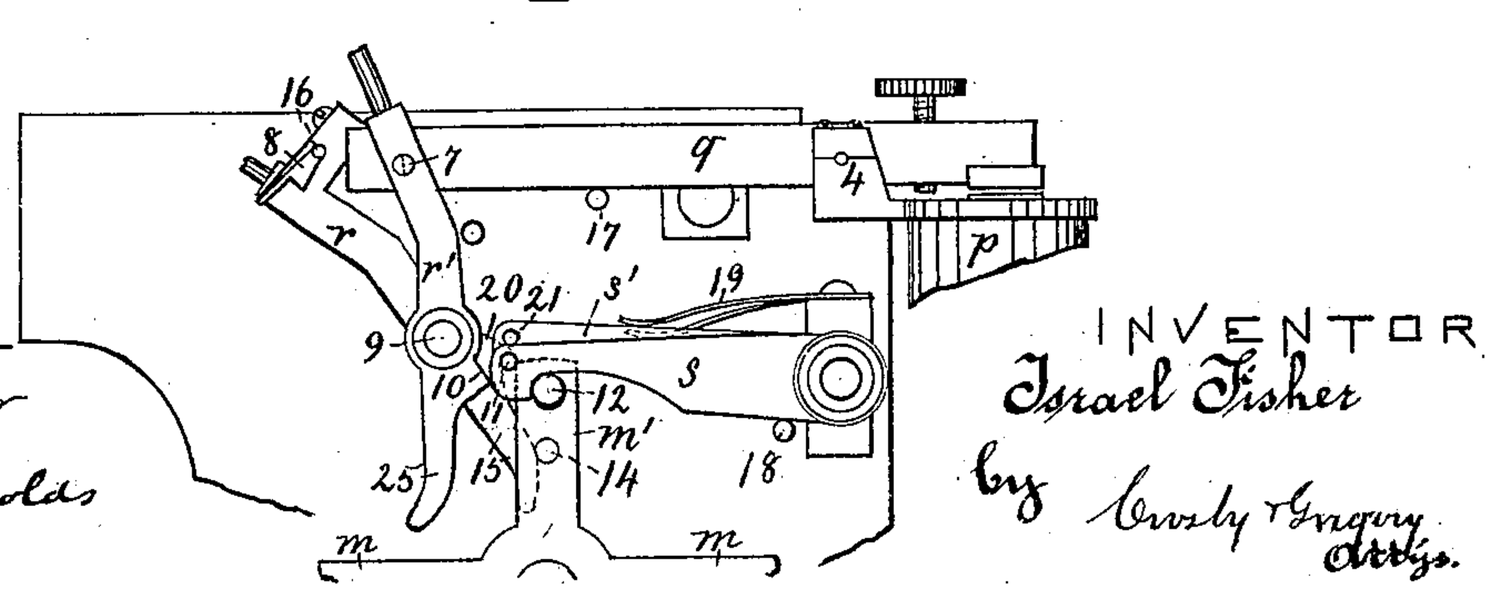


Fig: 2.



WITNESSES

L. F. Connor

Arthur Reynolds

INVENTOR

Israel Fisher

by Crosby & Gregory

Attys.

(No Model.) 2 Sheets—Sheet 2.

I. FISHER.

RAILWAY SIGNAL APPARATUS.

No. 246,304. Patented Aug. 30, 1881.

Fig: 3

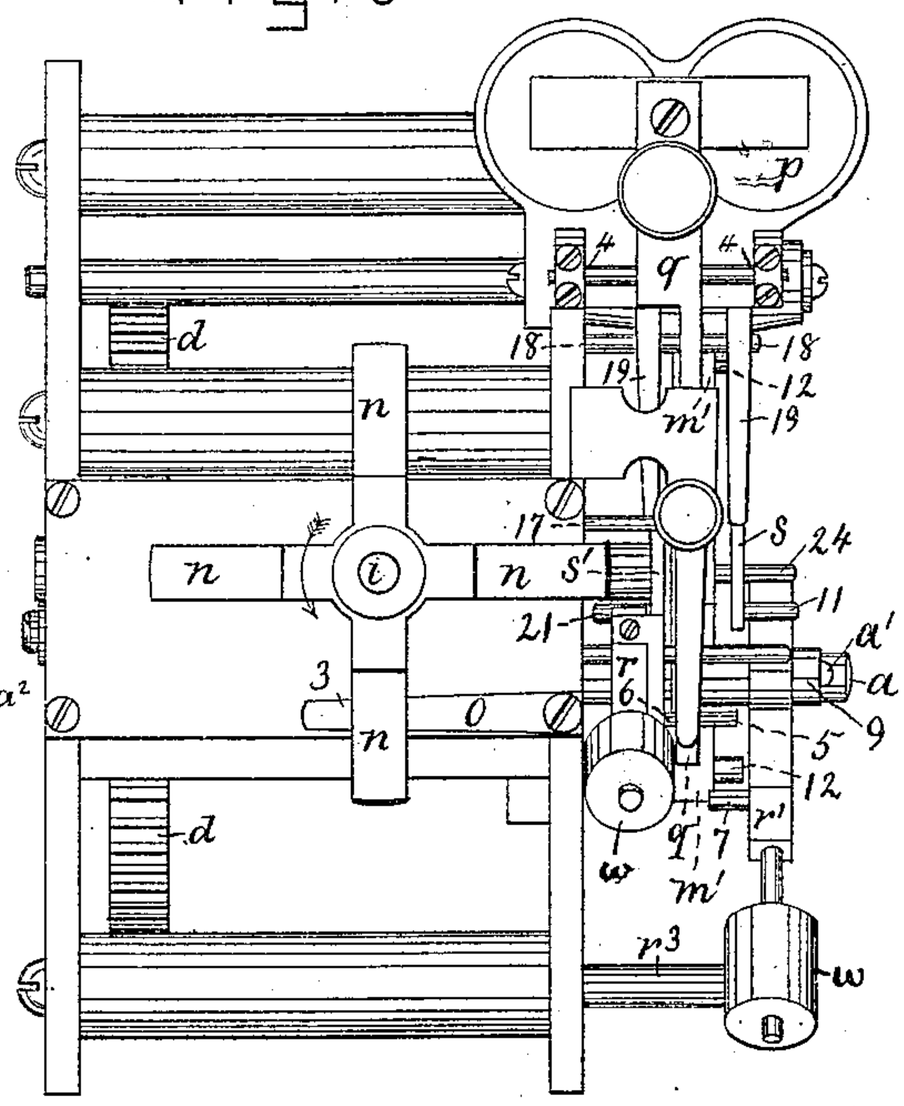


Fig: 6.

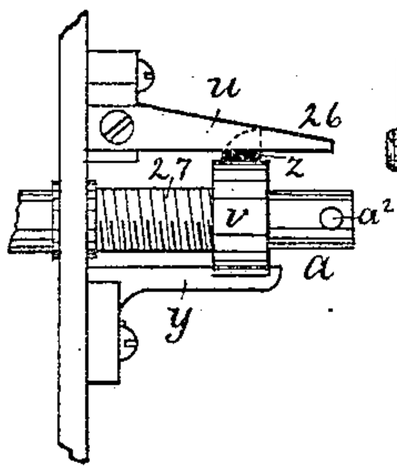


Fig: 7.

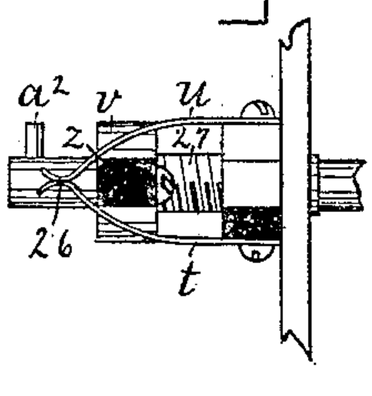


Fig: 8

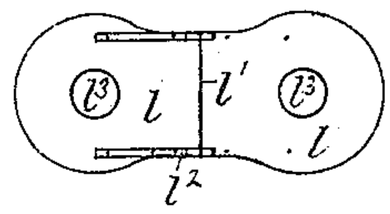


Fig: 9

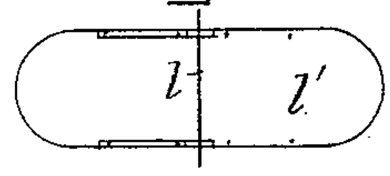


Fig: 10.

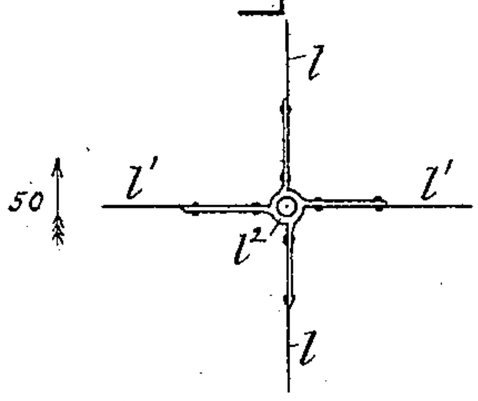
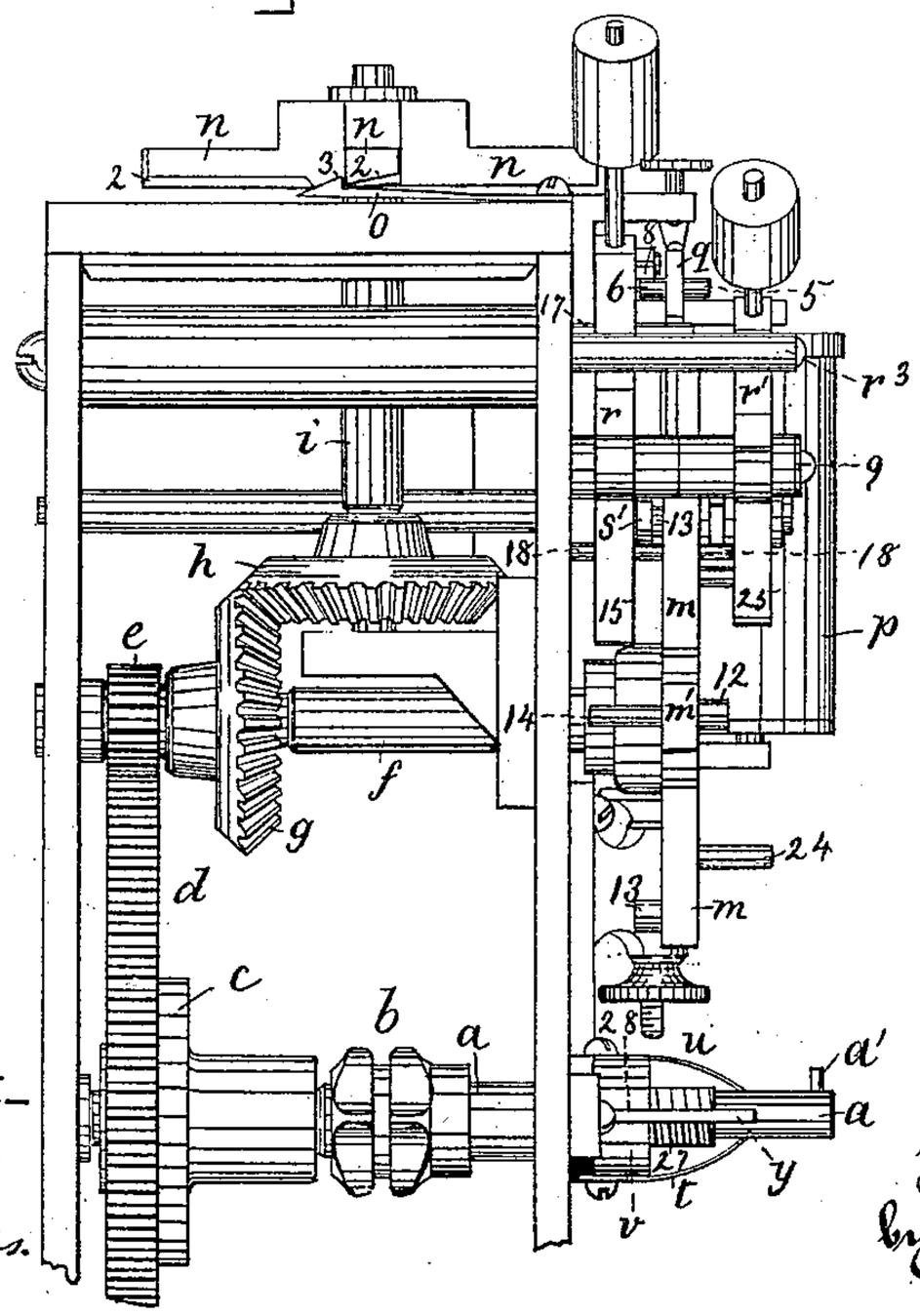


Fig: 4.



WITNESSES—
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INVENTOR—
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UNITED STATES PATENT OFFICE.

ISRAEL FISHER, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE UNION ELECTRIC SIGNAL COMPANY, OF HARTFORD, CONNECTICUT.

RAILWAY SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 246,304, dated August 30, 1881.

Application filed January 4, 1881. (No model.)

To all whom it may concern:

Be it known that I, ISRAEL FISHER, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Railway Signal Apparatus, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to railway-signals, and has for its object to produce a large signal capable of being operated in the open air without an inclosing case or house, the said signal to be controlled by an electric current. The signal is operated or turned into different positions to indicate "safety" or "danger" by a mechanical motor controlled by an electro-magnet, it operating on a principle similar to that shown in United States Letters Patent granted to O. Gassett, November 23, 1880, No. 234,707, and to said Gassett and myself, jointly, October 26, 1880, No. 233,612, to which reference may be had. In the latter case a stopping device was claimed to stop the mechanism with the signal in a position indicating "danger" before the motive power was wholly run down or exhausted, to thereby prevent the machine from being stopped by such running down in its "safety" position, it being an essential feature of this system that the signals shall always indicate "danger" in case of any failure to properly operate, so that a false safety-signal can never be given.

The present invention consists, mainly, in a novel detent device, by which the heavier or stronger actuating mechanism needed to operate the outdoor banner may be properly controlled without necessitating a corresponding increase in the power of the controlling electro-magnet or its vitalizing electric current; and also in a novel method of causing the signal to remain in its "danger" position when the actuating-power is nearly exhausted or run down and needs to be rewound.

The signal is shown as made of sheet metal, consisting of two vertical plates crossing one another at right angles at their middle, where they are supported on a vertical shaft intermittingly rotated one-fourth a revolution to present the face of one or the other of the said plates, which indicate "safety" and "danger," respectively. The said plates are elongated in a horizontal direction, and are of different color to enable them to be distinguished from one another. They are also preferably somewhat different in form as a further distinction, one, for example, having large circular openings at each end. The signal-shaft is rotated by a mechanical motor consisting of a main shaft rotated by a weight attached to a chain passing over a chain-pulley on the said shaft, which is adapted to be engaged by a key for winding the weight. A ratchet-wheel secured on the said shaft engages a pawl on a driving-gear loose thereon, causing the said gear to rotate with the shaft when actuated by the weight, but allowing it to remain stationary while the shaft is turning in the opposite direction to wind the weight in the usual manner. The said driving-gear meshes with and drives a pinion on a horizontal shaft connected by two equal bevel-pinions with the vertical signal-shaft, these two shafts thus having an equal angular movement. The horizontal shaft is controlled by the detent mechanism, and will be hereinafter denominated the "detent-shaft," it being stopped at each quarter-revolution when the signal is in one of its positions as indicating "danger" or "safety," according as the controlling-magnet is demagnetized or magnetized, the said magnet being in a normally-closed electric circuit, which passes mainly through the rails of the track, and may be shunted or short-circuited by the wheels and axles of the train when on the section, as described in the patents above referred to and in other patents referred to therein. The detent-shaft is provided with four stop-arms, two opposite ones of which are herein denominated "safety-arms," and are engaged and held by a stop, herein shown as a hooked arm engaging pins on the said arms when the signal is to indicate "safety," the magnet being then charged, and the other two arms, herein called "danger-arms," are engaged by another similar stop when the signal is in its "danger" position.

Owing to the pressure between the stop-arms and their stops, a considerable friction is developed between their engaging surfaces, and it is not desirable to employ a sufficiently

strong electro-magnet or vitalizing current therefor to detach the stop-arms from the stops by its direct action. The stops are accordingly operated by detaching-arms, (shown as weighted and provided with catches to be engaged by the armature-lever of the electro-magnet,) the catches being so arranged that when the armature-lever is in position to engage one of them and hold the corresponding detaching-arm the other catch is disengaged and its detaching-arm released. When the weighted detaching-arm is engaged by the armature-lever its weight is nearly vertically above the point of support of its arm, so that only a small pressure is brought on the catch; but when released thereby the weight is carried away from its position above the point of support of the arm, thus developing an increased force, which finally acts with a sudden blow on the stop to disengage it from the arm detained thereby.

I am aware that weighted arms have been used in detent mechanism, and do not broadly claim them, this part of my invention consisting in the arrangement and combination of elements necessary to cause the danger detent-arms to be always engaged and held while the armature-lever is in one position, and safety-arms when it is in the other position.

When a detaching-arm is released to disengage a stop from one of the detent-arms, as previously described, the armature-lever is by the same movement that released it brought into position to engage the other arm, and the mechanism, in its movement allowed by the disengagement of the stop, brings the latter arm into position to be engaged by the armature, which is now in position to and does engage it, while the corresponding stop is by the said movement of the weighted arm brought in position to engage the corresponding detent-arm. For example, characterizing by the word "danger" all the parts operating by the release of the armature from the magnet to give the danger-signal, and by the word "safety" the corresponding parts operating to give a safety-signal, and supposing the armature attracted and the signal at "safety," the position of the parts will be as follows: The safety detent-arm will be engaged by its corresponding safety-stop and the safety weighted detaching-arm will be held by the armature, the danger weighted arm will be in its lowest position, and the danger-stop held thereby out of position to engage the danger detent-arm, these parts being in the position assumed when last operated to change the signal from danger to safety. If, now, the armature be released by the demagnetization of the magnet, the safety weighted arm will fall and detach the safety-stop from the safety stop-arm previously held thereby, and the detent-shaft and signal will be rotated by the actuating-power. During this rotation the danger weighted arm will be raised into engagement with the armature-lever, now in proper position therefor, and the danger-stop will thus be allowed to assume its normal position in place to engage and stop the danger stop-arm by the time the latter reaches the said stop in completing the one-fourth revolution necessary to change the signal. The parts will remain in this position until another movement of the armature-lever, when corresponding changes will again take place. The signal in this instance indicates "danger" when the magnet is demagnetized, and the mechanism which operates automatically to show and retain the signal at "danger" when it needs rewinding, in this instance consists of a circuit-breaker in the main circuit connected with the actuating mechanism, and operated thereby to open the circuit, demagnetize the magnet, and set the signal to "danger" before the actuating-power is quite exhausted or run down, the circuit thereafter remaining open and the signal indicating "danger" until the actuating mechanism is again wound up. In this instance the circuit-breaker is operated by a nut on the main driving and winding shaft threaded therefor, the said nut being prevented from turning, and consequently caused to move longitudinally along the shaft as it rotates in actuating or winding the signal mechanism. A projection of insulating material on the nut, in its said longitudinal movement, comes between and separates two springs normally in contact and forming a part of the main circuit, which thus normally passes from one to the other and is broken by the said nut. By thus breaking the circuit the signal is set to "danger," and as there is no further movement of the nut, the circuit cannot again be closed and the signal set to "safety" until the mechanism is again wound up, when the reverse rotation of the winding-shaft causes the nut to move back and allow the springs to again close the circuit.

Figure 1 is a front elevation of a signal apparatus constructed in accordance with my invention, the parts being shown in the position assumed when the controlling electro-magnet is vitalized, the signal then indicating "safety;" Fig. 2, a similar view of a portion of the devices shown in Fig. 1, but with the magnet demagnetized and the parts in position to give the danger-signal. Fig. 3 is a top view, and Fig. 4 an end elevation, of the apparatus in the position shown in Fig. 1; Fig. 5, a rear view of one of the detaching-arms, illustrating its operation when brought into engagement with the armature-lever; Figs. 6 and 7, a side elevation and top view of the automatic circuit-breaking mechanism for breaking the main circuit, and thereby giving a danger-signal and preventing further movement of the parts when the weight needs to be rewound; Figs. 8 and 9, elevations of the signal proper in its two different positions on a reduced scale; Fig. 10, a top view thereof.

The main driving-shaft *a*, provided with a pin, *a'*, to be engaged by a key, and with a chain-pulley, *b*, to be engaged by a chain passing over it and sustaining at one end the actu-

ating-weight, has secured upon it a ratchet, *c*, the teeth of which engage a pawl connected with the driving-gear *d*, loose on the main shaft *a*, thus causing the said gear to turn with the said shaft in its movement produced by the weight in descending, but allowing the said shaft to be turned by the key to wind up or raise the said weight without turning the gear *d* in the usual manner. The gear *d* meshes with a pinion, *e*, on a horizontal shaft, *f*, provided with a bevel-pinion, *g*, engaging a bevel-gear, *h*, with an equal number of teeth, on a vertical shaft, *i*, provided with a socket, *j*, (see Fig. 1,) to receive the stem *k* of the signal proper, *l l'*. It will be seen that the horizontal shaft *f* and the vertical or signal-carrying shaft *i* thus have an equal angular movement; and the former shaft, *f*, is provided with four detent-arms, *m m m' m'*, which are adapted to be stopped in succession by the detent mechanism hereinafter described, the shafts *f i* turning a quarter-revolution after one of the said arms is released, and then being stopped by the engagement of the following arm. The vertical or signal shaft *i* is also provided with four arms, *n*, inclined at their under sides, as shown at 2, one of which at the end of each movement in the direction of the arrow, Fig. 3, passes over the projection 3 of the spring-catch *o*, which engages the rear side of the said arms and prevents any backward rotation or recoil of the signal at the end of its movement; and since the forward movement of the signal is prevented by one of the stops that engage the detent-arms *m* or *m'* for that purpose, as hereinafter described, the signal is positively locked and prevented from being turned by any outside agency, such as the pressure of the wind.

The detent mechanism, by which the horizontal or detent shaft *f* is stopped at the end of each quarter-revolution in which the signal has been turned to present a new face, is controlled by an electro-magnet, *p*, and its armature mounted on the armature-lever *q*, pivoted at 4, and provided with two projections, 5 6, one on either side of the said lever, to engage catches 7 and 8 on the detaching-arms *r r'*, pivoted at 9 on the frame-work. The armature-lever lies in about the same plane with the detent-arms, and there are two corresponding sets of devices—one set to permit the signal to move from the "safety" to the "danger" position and the other set to permit the movement from the "danger" to the "safety" position—the corresponding devices of the two sets being situated on the opposite faces (front and rear) of the said armature-lever and detent-arms. When the armature is in one position, as attracted to the poles of its magnet, as in Fig. 1, the projection 6 is in position to engage the catch 8 of the safety detaching-arm *r*, holding its weight nearly vertically above its pivotal point 9, as shown in Fig. 1, while the projection 5 is not in position to engage the catch 7 of the danger detaching-arm *r'*, which is thus allowed to turn on its pivot 9 under the action of the weight *w* until its heel or short arm 10 engages a pin, 11, on the hook-shaped stop *s*, raising it out of the line of movement of the stop-pins 12 on the front face of the danger detent-arms *m'*, the said detaching-arm *r'*, when thus allowed to fall, having raised the stop-arm *s* from engagement with the pin 12 and allowed the shafts *f* and *i* to turn a quarter of a revolution until one of the stop-pins 13 on the rear face of the safety detent-arms *m* is engaged by the safety-stop *s'*, as shown in Fig. 1. In this rotary movement, permitted by the falling of the arm *r'*, as thus described, a raising-pin, 14, on the rear face of the danger detent-arm *m'* engages the toe 15 of the safety detaching-arm *r*, then in the position shown in Fig. 2, and raises the said arm to its nearly-vertical position, Fig. 1, when the catch 8 will be engaged by the projection 6 to retain the arm in this position. The rear end of the armature-lever, with its projections 6, is elevated and placed in line with the catch 8 on the arm *r* before the said catch is brought, by the action of the raising-pin 14 on the toe 15 of the said arm, into engagement with the said projection, and the said catch 8 has to be moved wholly past the said projection before being engaged thereby to prevent its return movement. To do this either the projection 6 or the catch 8 must yield, and the said catch is pivoted at 16 and turns thereon to allow its engaging end to pass freely by the projection 6 in the upward movement of the said arm, and when past the said projection it drops down under the action of a spring into line therewith, and is engaged thereby to prevent the backward movement of the said arm. When the parts are in the position shown in Fig. 1 and the magnet is demagnetized, the armature-lever, by its own weight, drops upon the stop-pin 17, the projection 6 thereon in the said movement being disengaged from the catch 8 of the detaching-arm *r*. The said detaching-arm is thus left free to drop under the action of gravity, and at the end of its movement the heel 20 thereof strikes the pin 21 of the hooked safety-stop *s'*, raising it from the pin 13, projecting from the rear face of the upper safety detent-arm, thus leaving the shaft *f* free to rotate. In the rotation of the shaft *f* the raising-pin 24 on the front face of the said upper safety detent-arm engages the toe 25 and raises the danger detaching-arm *r'* until its catch 7 passes the projection 5 of the armature-lever *q*, the sides of the projection and catch that meet in this movement being rounded, so that the projection is readily moved to allow the catch to pass, the armature-lever being lifted, and then falling when the catch 7 has passed the projection 5, so that when the arm *r'* is disengaged from the pin 24 and begins to fall back the squared faces of the catch and projection engage and stop the said arm until the armature-lever is again moved by a change in the condition of the magnet. While

the arm r' is thus raised its heel 10 is moved away from the pin 11 of the danger-stop s, allowing the said stop to fall upon the pin 18, it being assisted in this movement by the spring 19, and the hooked end of the said stop is thus brought in line with the stop-pin 12 on the danger detent-arm m', which strikes the said hook and is stopped thereby, the shaft f having made a quarter-revolution and the signal $l\ l'$ turned to present a different face. A pin, r^3, covered with rubber or similar cushioning material, receives the weights when they first drop, and after the shaft f has made its quarter-revolution they remain at rest, with their toes 15 resting against one of the pins 14 24, as shown in Fig. 1, ready to be elevated thereby when the machine is released by the other weight falling.

In order that the actuating-power may not become exhausted when the signal is in its "safety" position, so that it will not be moved to indicate "danger" at the proper time, I in this instance control the circuit of the electro-magnet p by a circuit-controller operated by the running mechanism to put the said magnet in the condition to give the danger-signal—that is, in this instance, to demagnetize it; and as the said magnet will thereafter be controlled by this circuit-controller, and not by any extraneous parts, its condition cannot thereafter be changed to release the detent-arms and allow the mechanism to display a different signal. The signal will therefore remain indicating "danger" until the circuit-controller is again operated, as by the winding of the machine. This circuit-controller consists of two springs, $t\ u$, insulated from one another, except at their extremities 26. The former is connected with the wire 30 and the latter with the wire 31, by which the circuit is continued from the binding-screw 32 to the coils of the magnet p, connected at their other terminal by the wire 33 with the binding-screw 34, so that when the extremities 26 of those springs are separated from one another the circuit of the said magnet is broken.

The main winding-shaft a is screw-threaded for a portion of its length, as shown at 27, and a nut, v, mounted thereon and prevented from turning by a guide, y, fitting a groove, 28, in the said nut, so that as the shaft turns under the action of the weight actuating the machine or key in winding it the said nut has a longitudinal movement thereon. A projection, z, of insulating material, on the side of the said nut extending out between the springs $t\ u$, comes at the end of its movement outward from the body of the machine, caused by the machine running down between the ends 26 of the said springs, thus separating them and breaking the circuit of the magnet, which thereafter remains demagnetized, so that after the signal has come to its "danger" position, corresponding to this condition of the magnet, no further movement can take place until the signal is again wound, when the nut y is moved back and the ends 26 of the springs $t\ u$ again come in contact with one another, closing the circuit at this point, so that the magnet is thereafter controlled by the wheels of the passing train and other circuit-closers outside of the machine, in the usual manner, until it again runs down.

The form of signal preferably used, as illustrated in Figs. 8, 9, and 10, consists of a strong metal frame-piece, l^2, having four arms extending at right angles to one another, as shown in Fig. 10, upon which are riveted the wings $l\ l'$, the signal-post being placed so that one of the said wings is perpendicular to the line of railway indicated by the arrow 50, Fig. 10, when the machine is stopped by the detent mechanism hereinbefore described, the other of the wings being at this time parallel to the line of railway, so that only its edge is presented to the view of one approaching the signal along the line of railway, the said wing being so thin that its edge is not noticeable to the eye.

The disks $l\ l'$ may be distinguished from one another in any usual way—as by their color, the one indicating "danger" being preferably red in color, as is usual in danger-signals. They are in this instance also further distinguished by their shape, the one l being wider at its ends and having circular openings therein, as at l^3, while the other is narrower and has no such opening.

I claim—

1. In a railway signal apparatus, the motor to set the signal in different positions and the detent mechanism therefor, consisting of the following elements, viz: the detent-arms and stops therefor, combined with detaching-arms, one to disengage each of the said stops, and the electro-magnet and its armature, adapted to engage and arrest the movement of one only of the said detaching-arms when attracted and the other of the said arms only when unattracted, substantially as and for the purpose described.

2. The motor and its safety and danger detent-arms and two stops, one to engage the said safety and the other to engage the said danger detent-arms, combined with two detaching-arms and the electro-magnet and its armature to control them, it being adapted to hold only one of the said arms at one time, the said devices being arranged to operate as described, whereby, when the condition of the magnet is changed, one of the said detaching-arms is released to detach one of the stops and allow the motor to move and change the position of the signal, substantially as described.

3. A motor and detent-shaft and detent-arms thereon and two stops, each to engage an alternate pair of the said arms, combined with two detaching-arms, one to disengage one and the other to disengage the other of the said stops from its corresponding detent-arm, and restoring devices operated by the motor in its movement, whereby, when one of

the said detaching-arms is operated to allow the motor to move, the other of the said arms is restored to the position from which it can operate to again release the motor and permit it to move, substantially as described.

4. In a railway signal apparatus, the signal, and motor to set it in different positions, and the electro-magnet to control the said motor, combined with a circuit-controller in circuit with the said magnet, operated by the said motor when nearly run down, whereby the magnet is retained in one condition and the danger-signal remains permanently displayed until the motor is wound up, substantially as and for the purpose described.

5. In a railway signal apparatus, a detent-shaft turning uniformly with the signal-shaft, and having detent-arms corresponding to the "safety" and "danger" position of the signal, the said arms being provided with stop-pins, those of the safety-arms being on the side thereof opposite to those of the danger-arms, combined with safety and danger stops to engage the said safety and danger pins, respectively, and detaching-arms to disengage them therefrom, each of the said detaching-arms being held by the armature of the electro-magnet, while the corresponding stop is engaging its pin, in position to operate upon and disengage the said stop as soon as the condition of the magnet is changed, substantially as described.

6. The main winding-shaft of the motor, screw-threaded and provided with a nut, and a device to prevent the said nut from rotating with the said shaft, combined with an electro-magnet to control the operation of the said motor, and circuit-closing springs in circuit therewith, and adapted to be separated by the said nut to break the circuit when the nut is near the end of its movement along the main shaft caused by the rotation of the said shaft in actuating the machine, substantially as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ISRAEL FISHER.

Witnesses:

JOS. P. LIVERMORE,

L. F. CONNOR.