(No Model.) 3 Sheets—Sheet 1.

M. TOULMIN.

ELECTRO MECHANICAL SIGNALING APPARATUS AND SYSTEM THEREFOR.

No. 304,583. Patented Sept. 2, 1884.

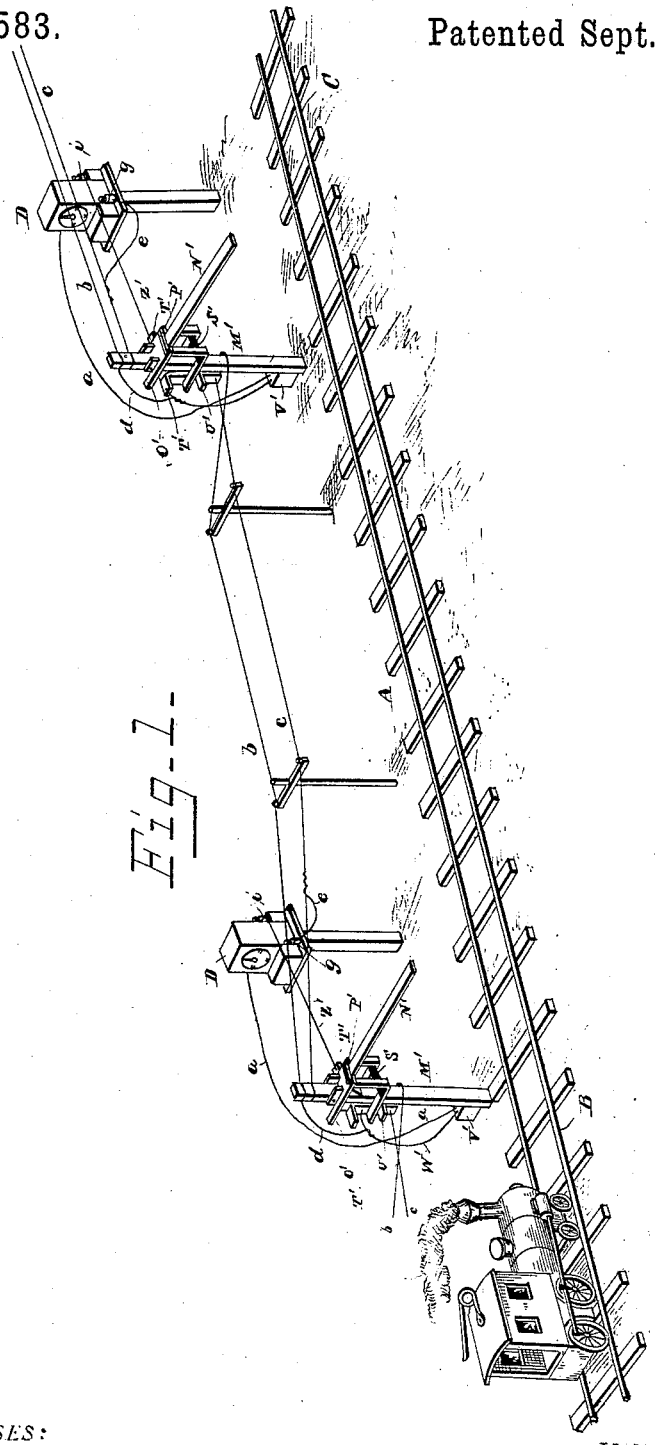

Fig. 1.

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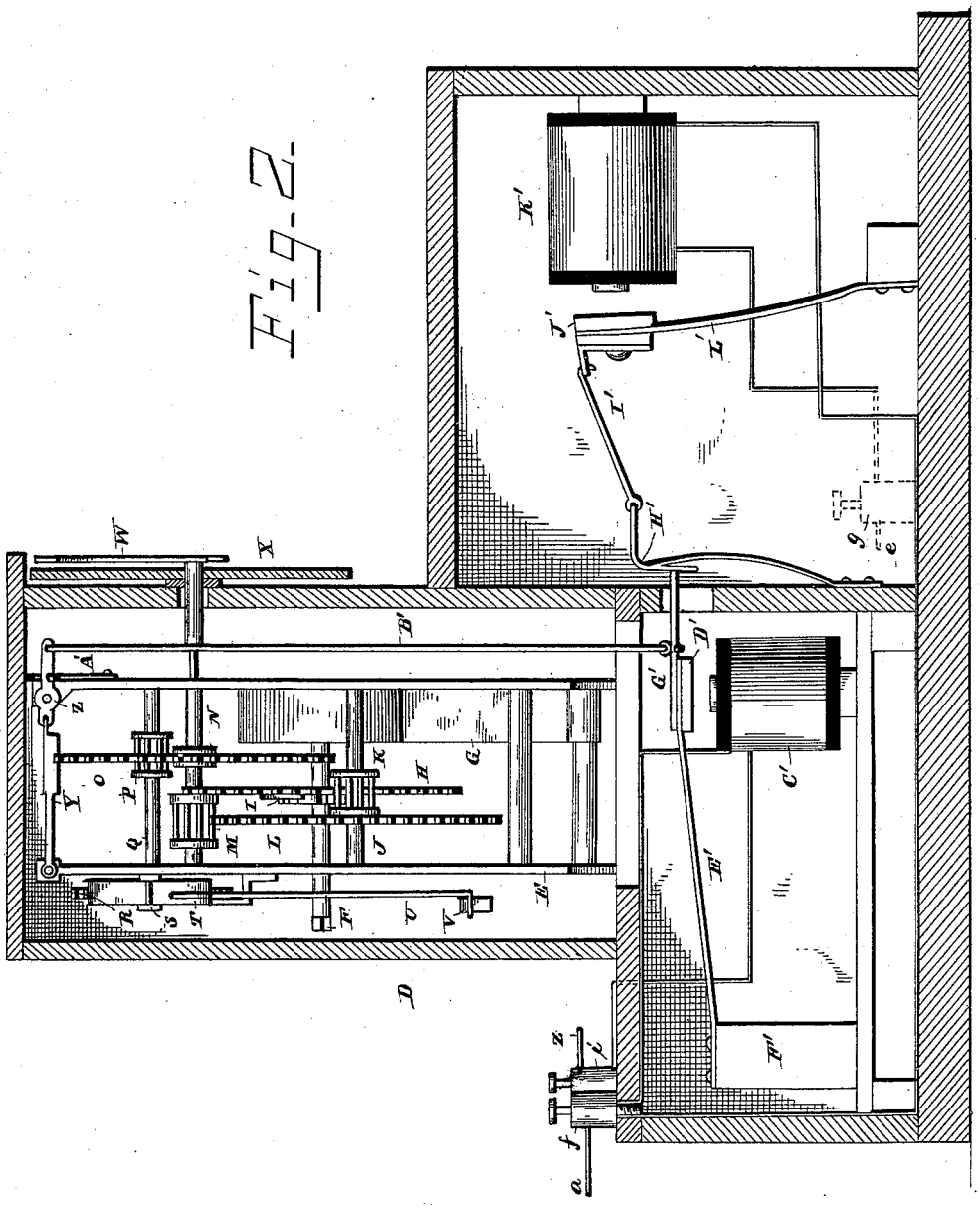
(No Model.) 3 Sheets—Sheet 2.

M. TOULMIN.

ELECTRO MECHANICAL SIGNALING APPARATUS AND SYSTEM THEREFOR.

No. 304,583. Patented Sept. 2, 1884.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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ELECTRO MECHANICAL SIGNALING APPARATUS AND SYSTEM THEREFOR.

No. 304,583. Patented Sept. 2, 1884.

Fig. 3.

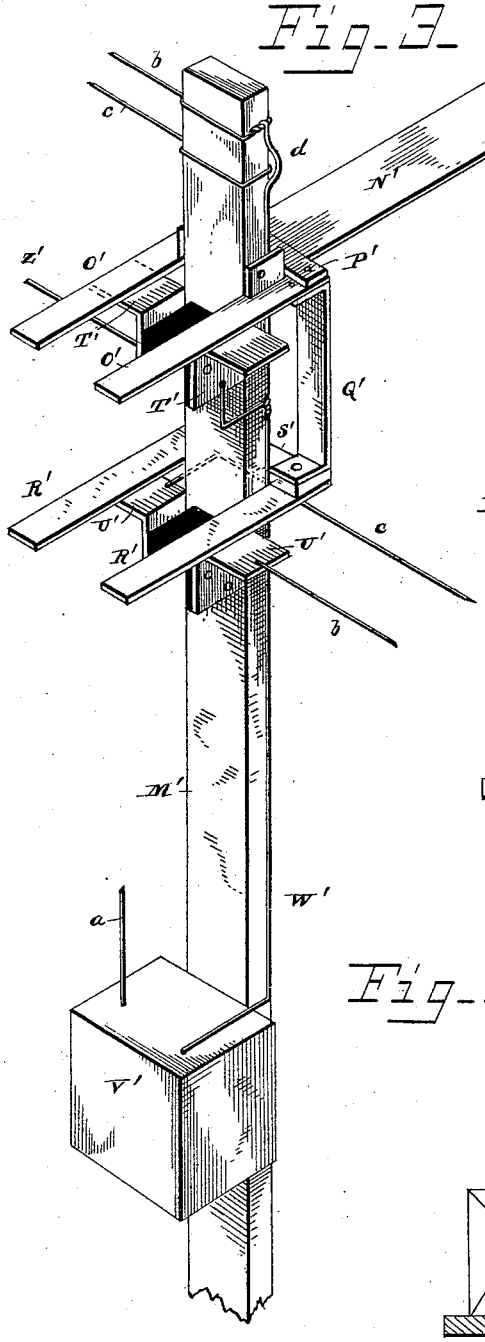


Fig. 4.

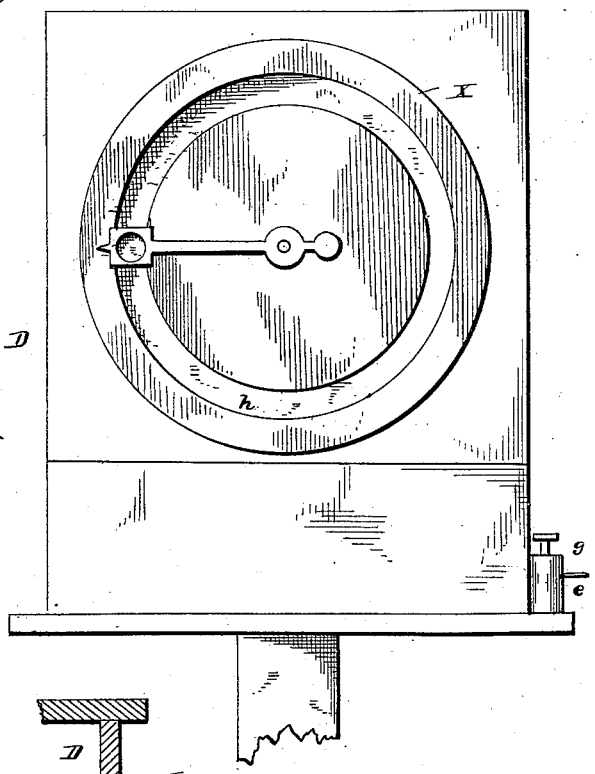


Fig. 5.

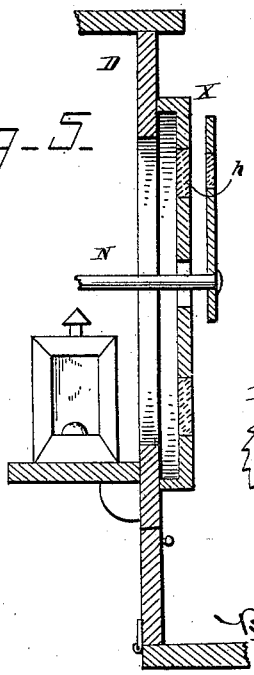
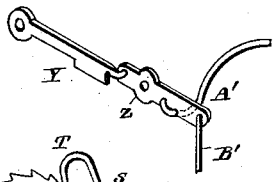


Fig. 6.



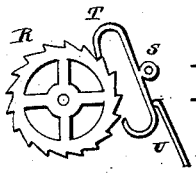


Fig. 7.

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UNITED STATES PATENT OFFICE.

MORTON TOULMIN, OF WASHINGTON, DISTRICT OF COLUMBIA.

ELECTRO-MECHANICAL SIGNALING APPARATUS AND SYSTEM THEREFOR.

SPECIFICATION forming part of Letters Patent No. 304,583, dated September 2, 1884.

Application filed March 10, 1884. (No model.)

To all whom it may concern:

Be it known that I, MORTON TOULMIN, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Electro-Mechanical Signaling Apparatus and System Therefor, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in electro-mechanical railway-signaling apparatus, and the system therefor, in carrying out the purpose of which it is designed that a number of such apparatus shall be placed along a railway-track at such intervals as the natural conditions of the country through which the road passes require.

The invention has for its objects, first, to provide an apparatus for automatically indicating to a locomotive-engineer or other person having charge of a railway-train whether the track between two given points is occupied or unoccupied by any other train; second, to provide such an apparatus with a duplex circuit-closer, which, by the passing of a train, will simultaneously close the main-line circuit of the railway-section the train has just passed over, whereby the apparatus last passed is stopped, and the local circuit of the next preceding railway-section, whereby the apparatus of that section is started; third, to provide such an apparatus with a local-circuit electro-magnet and a main-line circuit electro-magnet, the one to start the apparatus by the closing of its circuit and adapted to be held in such closed position by mechanical devices after said circuit is broken, and the other to free such mechanical devices to stop the apparatus by the closing of its circuit; fourth, to provide such an apparatus with a dial having a transparent line or portion and with an indicating-hand having a like portion, the transparent portions being constructed to present different colored lights.

In carrying out the first object of my invention I mount upon suitable pedestals near a railway-track a succession of apparatus consisting each, essentially, of a train of gearing operated by a power-spring, so as to rotate a signaling device, each apparatus being provided with an electro-magnet connected respectively with the local and main-line circuits. In close proximity to each apparatus I also place a circuit-closer, which, when a train passes it, will be actuated thereby to close the local circuit and start the apparatus in proximity, and at the same time close the main-line circuit of the section just passed over and stop the apparatus at a distance of that section.

In carrying out the second object of my invention I construct a duplex circuit-closer consisting of a pivoted lever having a plurality of contact-arms. Near these arms I fix contact-plates, one set of which is connected with the local circuit, and the other set of which is connected with the main-line circuit, so that when the circuit-closer is actuated it will start one apparatus and stop another.

In carrying out the third object of my invention I provide an apparatus of the character above described with a local-circuit electro-magnet having an armature connected with a catch. When this armature is attracted, it frees the catch whereby the apparatus is started, and when it is in contact with this magnet it is engaged by a spring-detent, which holds it in such position. This spring-detent is connected with the armature of a main-line circuit electro-magnet which I also provide. When this armature is attracted, the detent is withdrawn and the local-circuit magnet-armature freed, whereby the catch is thrown into engagement with one of the gears of the apparatus and the same is stopped.

In carrying out the fourth object of my invention I provide the apparatus with a dial having a transparent circular portion, and mount upon a rotating shaft an indicating-hand, also having a transparent portion, the said transparent portions being composed of different colored glass, so that the light from behind the dial will present a clear ring-like illumination through the dial and a red or other colored illumination in the shape of a ball through the hand.

In the accompanying drawings, forming a part of this specification, and on which the same letters of reference indicate the same or corresponding features, Figure 1 represents a perspective view of my improved apparatus entire, showing the local circuit and main-line

circuit-wires, as also one section entire of the railway-track, and the end and beginning, respectively, of two sections; Fig. 2, a vertical sectional view of the housing in which the apparatus proper is contained, showing the latter and the electro-magnets in side elevation; Fig. 3, a detail perspective view of the duplex circuit-closer, the contact-plates, portions of the several wires, and the box containing the batteries, these devices being mounted upon a suitable post or pedestal; Fig. 4, a front or face view of the apparatus, showing one form of the dial and indicating-hand; Fig. 5, a vertical sectional view of the same, showing a portion of the housing; Fig. 6, a detached perspective view of the catch and spring for actuating it, and Fig. 7 a detached view of the escapement-wheel and the speed-regulating device.

The letter A designates what I term a "section" of a railway-track, the same being that portion of the track which lies between two circuit-closers; and the letters B and C indicate, respectively, the end and the beginning of other similar sections. The lengths of these sections of track will vary according to the positions of the circuit-closers, and these positions will be determined by the requirements of the respective roads, incident to the natural conditions of the country through which they are built.

The letter D indicates the housing of the apparatus proper, this housing being constructed of any desired material, and mounted upon a post or pedestal located near the railway-track.

The letter E indicates the frame of the apparatus, which is preferably constructed of metal, mounted within which is a power-shaft, F, carrying a convolute power-spring, G, the ends of which are secured, respectively, to said shaft and a fixed portion of the frame. This shaft is provided with a driving gear-wheel, H, the usual pawl and ratchet, I, being employed to connect this gear with its shaft, whereby the latter may be rotated in one direction to wind the spring, and carry the gear with it when revolved in the opposite direction; also, mounted in the frame is a shaft, J, carrying a pinion, K, which meshes with the gear H. This shaft J also carries a gear-wheel, L, which in turn meshes with a pinion, M, mounted on the shaft N. This shaft is further provided with a gear-wheel, O, which meshes with the pinion P on the escapement-shaft Q, which latter is also mounted in the frame. Secured to this shaft Q is a friction-wheel, R, and mounted on a stud, S, extending from the frame, is an arm, T. The position of this arm is angular or out of a perpendicular, and its ends are bent so as to alternately engage with the teeth in the friction-wheel, and depending therefrom, also out of a perpendicular and rigidly connected therewith, is an arm, U, carrying at its free end an adjustable weight, V. These devices are similar to the speed-regulating device described in my application for a patent on electro-mechanical signaling apparatus filed on or about March 1, 1884, save that in this instance the lever which in the other device is mounted on a rock-shaft is substituted for the rod U, and, further, that the spring which in the other device engages with the upper end of this lever is in this instance omitted. The angular position, however, of the arm T is preserved in the present instance, and the engagement of either of its ends with the teeth in the wheel is very slight, so that the only effect of the friction-wheel on the regulating device is to oscillate the latter a slight distance to and from its normal position, such arrangement accomplishing the retardation of the velocity of the friction-wheel, thereby regulating the speed of the rotation of the indicating-hand and governing the time it shall take to travel around the dial, yet not preventing the starting of the train of gearing from its power-shaft.

In the ordinary clock the escapement devices which regulate the speed of the time mechanism also prevent the starting of such mechanism from the power-shaft unless the pendulum itself is given an independent initial start.

I have ascertained the result above ascribed to my improved speed-regulating device by actual trial, and have also by actual trial ascertained that the ordinary clock-escapement devices will not accomplish this result, but will require, as above stated, an independent initial starting of the pendulum.

The shaft N is provided at one end with an indicating or signaling hand, W, which, when the apparatus is operating, revolves around a dial, X, secured, preferably, to the housing D. The hand in this instance may be made broad, as described in my application above alluded to, and its color may be in contrast with that of the face of the dial. The dial X thus forms a back-ground for the hand.

Pivotally connected with a suitable portion of the frame is a catch, Y, which extends across the face of the gear-wheel O, and is of suitable thickness to enter between the teeth of said wheel. This catch is pivotally connected at one end with the short arm of a trip-lever, Z, pivotally connected with the frame. A spring, A′, connected with the frame at one end engages at its other with the trip-lever Z, so as to maintain the engagement of the pivoted catch Y with the teeth of the gear-wheel O. This spring also serves to aid the armature in sustaining the rod B′, which is connected at one end with the trip-lever and at the other to the armature.

The letter C′ designates the local-circuit electro-magnet, the same being located within the housing D, and, by preference, placed beneath the apparatus proper. The armature D′ of this magnet is yieldingly supported by a spring, E′, connected rigidly at one end to a post or fixture, F′. Extending from the armature is a strip, G′, which, when the armature

is attracted by the magnet C′ is engaged and held in such position by the detent of the spring H′. This spring is attached to the housing at one end and is provided at the other with an eye, to which is connected a link, I′, which, in turn, connects with the armature J′, of the main-line-circuit electro-magnet. The detent which extends from the spring H′ is of a yielding nature, so as to make its contact with the strip G′ more delicate, whereby there will be less resistance to that strip when the armature D′ is attracted by its magnet. Also located in the housing D is the main line circuit electro-magnet K′, the armature J′ of which is yieldingly supported by the spring L′, one end of which is connected with a suitable fixture.

The letter M′ refers to the post which supports the circuit-closer and its several devices. This post is located relatively with the track and the apparatus proper, substantially as shown in Fig. 1 of the drawings, it being somewhat in advance of the apparatus for the purpose described in my application above mentioned—namely, to give the engineer an opportunity of seeing whether the hand or other signaling device is operating after he closes the circuit and before he passes the apparatus.

The duplex circuit-closer consists of a beam, N′, of wood or metal, pivotally connected with the post M′, and having extending from it the arms O′, which form the local-circuit closer. These arms are electrically united by the strip P′, (if the beam N′ is a non-conductor.) Extending either from the beam or from said arms are the strips Q′ of insulating material, (or the joints may be insulated,) the lower ends of which are connected with the arms R′, which constitute the main-line circuit-closer. These latter arms are also electrically connected by the strip S′.

Secured to the post are the local-circuit contact-plates T′ and main-line-circuit contact-plates U′, their respective positions being such relatively with the circuit-closer arms O′ and R′ as to readily admit of the contact of these arms therewith when the beam is slightly elevated by the passing of a train. A housing, V′, which contains the battery, may be secured to this post or placed at any other convenient point.

I will now describe the electrical connections; first of the local circuit.

One pole of the battery is connected by a wire, W′, with one end of the local-circuit contact-plates T′. The other local-circuit contact-plate is connected with one end of the local magnet-wire by a wire, Z′, through a post, *i*. The other end of this magnet-wire is connected to the post *f*, which, by the wire *a*, is connected to the other pole of the battery. The local circuit is thus completed, save the break occasioned by the insulation existing between the respective local-circuit contact-plates. This break is bridged over by the arms O′ of the circuit-closer when they are in contact with such plates, thereby closing the circuit.

I will now describe the electrical connections existing in the main-line circuit.

As represented in Fig. 1, two wires, *b* and *c*, are stretched between the posts M′ M′. One of these wires, *b*, is connected at one end with one of the main-line contact-plates U′, and at the other with the post M′. From this point it is connected with one pole of the battery by a wire, *d*, which either connects with the wire W′ of the local circuit or may run directly to the said pole of the battery. The other main-line circuit-wire, *c*, connects at one end with the opposite main-line contact-plate U′ and at the other with the post M′. A branch wire, *e*, connects this wire *c* with one end of the main-line-circuit magnet-wire through the post *g*. The other end of this magnet-wire, as seen in Fig. 2, connects with the post *f*. From this post the remainder of the main-line circuit is formed by the wire *a*, which connects with the other pole of the battery, and also forms a part of the local circuit. This completes the main-line circuit, save the break occasioned by the insulation existing between the contact-plates R′. When the beam N′ is actuated upwardly, the arms R′ engage said plates U′, and thus close the main-line circuit by bridging the gap between these plates.

As represented in Figs. 4 and 5, I have constructed the dial X with a transparent circular portion, *h*, preferably of clear glass, the edges of the dial being turned in and fitted closely to the housing to keep out the wind.

The free end of the indicating-hand W is provided with an opening, in which is fitted a piece of transparent red glass, or glass of any other color which will contrast strongly with a clear light.

It is designed to place a lantern or other light within the housing, as seen in Fig. 5, an aperture being formed in the housing to allow the light to shine through the transparent portion of the dial, and thence through the glass in the hand. A door or other opening may be provided, so as to afford access to the interior of the housing.

Instead of constructing the dial as above described, the housing itself may be provided with a glass and the light allowed to shine directly through it. These constructions are resorted to, as it may be desirable in some instances to illuminate the housing instead of depending upon the light afforded by the engine head-light, as described in my application above mentioned, to see the indicating-hand.

Secured to the locomotive-cab or other part of the train is a yielding inclined arm adapted to effect a yielding and sweeping or drawing contact with the circuit-closer, as the train passes the same.

The operation of my invention will be readily understood when taken in connection with the above, and is as follows: The apparatus being located and set up as represented

in Fig. 1, the local and main line circuits stand normally open. When a train reaches one of the circuit-closers and actuates the same, it closes the local circuit by putting the arms O′ in contact with the plates T′. This closes the local circuit, thereby magnetizing the magnet C′ and attracting the armature G′, which, through the rod B and the trip-lever, disengages the catch from the gear-wheel O. This allows the power-spring to actuate the gears so as to revolve the indicating-hand. At the moment the strip G′, secured to the armature of the local-circuit magnet, passes below the detent of the spring H′, that spring forces said detent over it, thereby holding said strip down and maintaining the disengagement of the catch with the gear. This is necessary, as the local circuit is closed but for a moment, the normal position of the circuit-closer being such as to keep this circuit open. The action of the circuit-closer just described also closes the main-line circuit, which magnetizes the magnet K′, thereby attracting the armature J′. This draws the detent of the spring H′ away from the strip G′ in the apparatus last passed by, thereby allowing the armature D′ to be elevated, and through the intermediate connections to engage the catch with the gear-wheel, thus stopping that apparatus. The hand in the apparatus just actuated continues to revolve until the train reaches the terminal of that section of track, when, by the operation just described, such apparatus is stopped and the apparatus of the succeeding section is operated. When an engineer of a succeeding train approaches one of these signals and finds the hand revolving, he knows that the section of track ahead is yet occupied by a train, and therefore stops his train until such hand ceases to rotate. When this takes place, he knows that the track lying between himself and the next apparatus is clear.

One material reason why the local circuit is allowed to be closed but a moment is to prevent the local-circuit magnet from becoming permanently magnetized; and in order to hold the armature of this magnet in the same position it would be in if it continued under the influence of the magnet, I provide mechanical devices (in the present instance the spring-detent H′) for this purpose.

In some instances it may be found desirable to employ two single circuit-closers in lieu of one duplex circuit-closer.

It will be observed that should a train jump the track the hand will continue to revolve, thereby preventing the succeeding train from entering upon the same section of track, and giving time for the receipt of intelligence of the accident.

I am aware that in railway block-signaling signals have been operated at the same time to indicate danger in advance and safety in the rear; but

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electro-mechanical signaling apparatus and the system therefor, the combination, with a railway-track, of the successive apparatus provided each with a signaling device constructed and provided with power mechanism to continuously move it during the time a train is running to the succeeding apparatus to indicate that the intervening track is occupied, the successive circuit-closers, and the intermediate devices constructed to stop one apparatus and to start another by the action of a passing train on each circuit-closer.

2. In an electro-mechanical signaling apparatus and the system therefor, the combination with a railway-track, of the successive apparatus provided each with a signaling device constructed and provided with power mechanism to continuously move it during the time a train is running to a succeeding apparatus to indicate that the intervening track is occupied, the successive duplex circuit-closers, and the contact-arm carried by a passing train, whereby the local and main-line circuits are simultaneously and but once closed by the passing of a train, the one to start the apparatus in proximity and the other to stop the apparatus at a distance through intermediate devices.

3. In an electro-mechanical signaling apparatus and the system therefor, the combination, with a railway-track, of apparatus placed at intervals along the track, and provided with a movable signaling-device, power mechanism to operate the same, a device to hold such mechanism against operation, an electro-magnet connected with said holding device, and adapted to actuate the same to liberate the operating means, a detent or stop to engage the holding device to maintain such liberation, an electro-magnet to free the holding device, whereby it is allowed to stop the operating means, and the circuit-closers and main-line and local circuits.

4. In an electro-mechanical signaling apparatus, the combination, with a movable signaling device and means to operate the same, of a device to hold such means against operation, an electro-magnet connected with said holding device, and adapted to actuate the same to liberate the operating means, a detent or stop to engage the holding device to maintain such liberation, and an electro-magnet to free the holding device, whereby it is allowed to stop the operating means.

5. In an electro-mechanical signaling apparatus and the system therefor, the combination, with the signaling-hand, a dial of contrasting color, and mechanical means to operate the hand, of electro-magnets adapted to control such means, the one through an intermediate catch or device, constructed so as to normally engage the operating means to start it by instantaneous magnetization, and the other through an intermediate detent or stop, constructed so as to directly or indirectly en-

gage said catch to arrest it by instantaneous magnetization.

6. In an electro-mechanical signaling apparatus, the combination, with a movable signaling device, and means which, when liberated, will operate the same, of a catch or device to hold such means against operation, an electro-magnet which by instantaneous magnetization will liberate or start such operating means, a detent or stop to maintain such liberation, whereby the signaling device is made active, and an electro-magnet which by instantaneous magnetization will free such holding catch or device to stop the operating means, whereby the activity of the signaling device is maintained between the starting and stopping of the apparatus, and the magnets are but momentarily under the magnetic influence.

7. In an electro-mechanical signaling apparatus, the combination, with a power-spring, a series of gears, a revolving shaft carrying an indicating or signaling hand, a pivoted catch, and its operating lever and rod, of an electro-magnet whose armature is connected with said rod, a spring-detent which engages said armature and holds it to its magnet after attraction, and an electro-magnet whose armature is connected to said detent and is adapted to break said engagement when attracted.

8. In an electro-mechanical signaling apparatus, the combination, with a power-spring and a series of gears, of a shaft carrying an indicating or signaling hand, a dial, a pivoted catch, its operating-lever, the spring which bears against the same, the armature of the electro-magnet connected to said lever by a rod, and means to hold the armature down mechanically.

9. In an electro-mechanical signaling apparatus, the combination, with a train of gearing, a pivoted catch adapted to engage the teeth of one of the gears of said gearing, its operating lever and rod, of an electro-magnet whose armature is connected to said rod, and provided with a prolongation, a spring-detent adapted to engage said portion, and an electro-magnet whose armature is connected with said detent.

10. In an electro-mechanical signaling apparatus, the combination, with a train of gearing and a revolving shaft carrying an indicating or signaling hand, of a catch adapted to engage one of the gears of said gearing, its operating-lever, and a speed-regulating device having a rod which stands out of a perpendicular, and provided with an adjustable weight, whereby the apparatus may be started without first actuating said regulating device and its speed regulated.

11. In an electro-mechanical signaling apparatus and the system therefor, the combination, with a duplex circuit-closer, consisting of a pivoted beam carrying a plurality or double sets of flexible arms, the said sets being insulated from each other, and the one constructed to close one circuit and the other to close another circuit simultaneously by the tilting of the beam in one direction, of the yielding operating-arm carried by a passing train.

12. In an electro-mechanical signaling apparatus, the combination, with an indicating or signaling hand having a transparent colored portion, of a dial having a transparent portion, whereby a clear light is exhibited through the dial and a contrasting light through the hand.

13. In an electro-mechanical signaling apparatus, the combination, with a revolving indicating or signaling hand having an aperture provided with a colored transparent material, of a dial having a ring-like transparent portion of clear material.

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

MORTON TOULMIN.

Witnesses:

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M. P. CALLAN.