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J. A. GEHRUNG.

SIGNAL SYSTEM.

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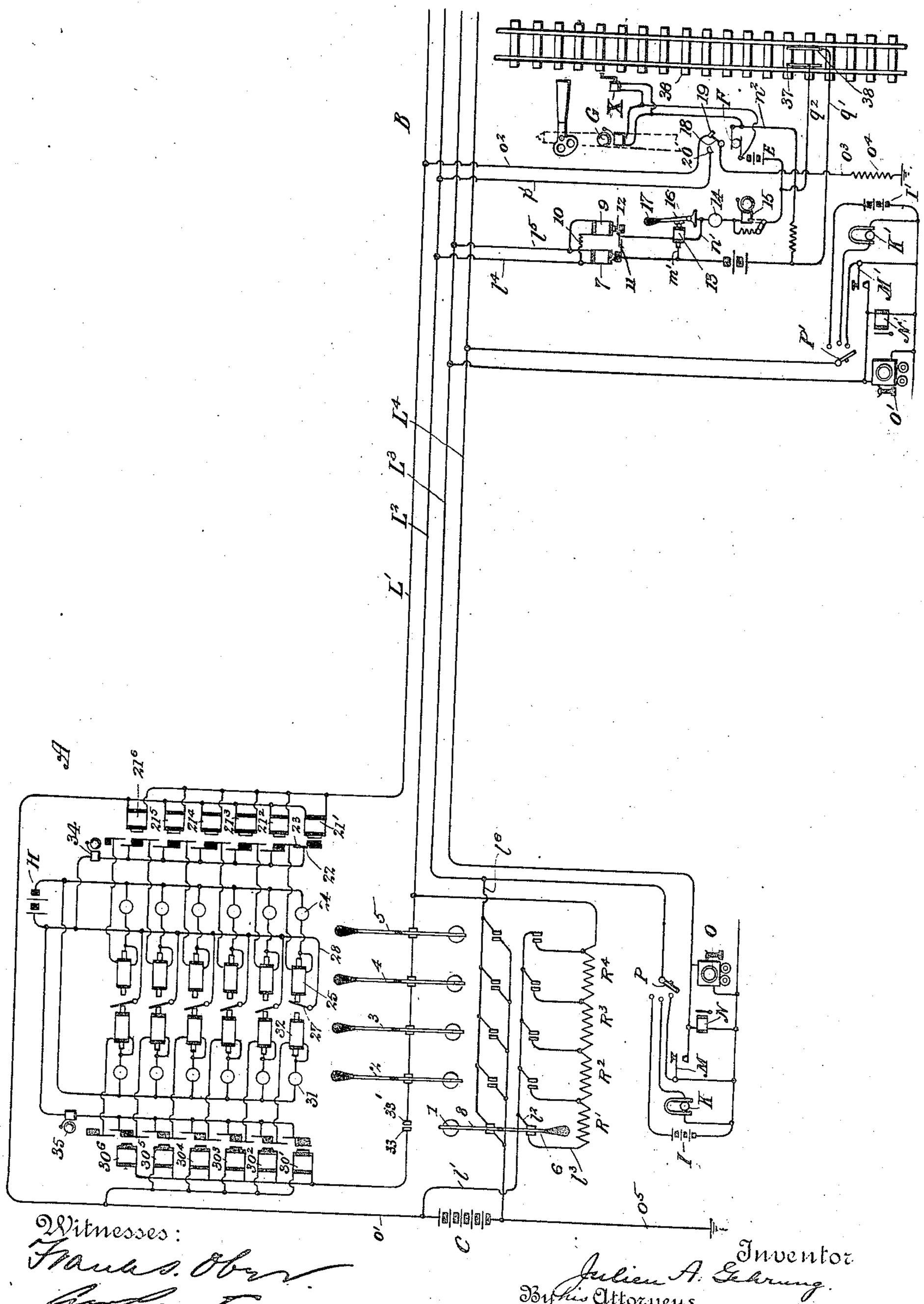

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SIGNAL SYSTEM.

No. 868,424. Specification of Letters Patent. Patented Oct. 15, 1907.

Application filed February 15, 1907. Serial No. 357,514.

To all whom it may concern:

Be it known that I, JULIEN A. GEHRUNG, a citizen of the United States, residing at the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Signal Systems, of which the following is a full, clear, and exact description.

My invention relates to railroad signals, particularly where it is desired to have the entire traffic over a single division in the hands of one responsible train despatcher.

In my companion application, Serial No. 355,369, filed February 2, 1907, I have set forth the general principles of a signal installation accomplishing the above purpose, in its broad aspects. In the present case is set forth an installation similar to that of the above application, except that many of the detail features are modified, for the purposes of illustrating the different embodiments of the essential idea, and also to obtain certain results which are possibly not attained in the first application. The present case also includes certain features and constructions which accomplish new purposes, for which there is no equivalent in the original case. Among these latter features are certain signals which are constantly exhibited under all circumstances, so as to produce a continuous display, corresponding to the setting of the semaphore signals on the line at all times. It is an advantage to have a continuous indication of the position of every signal on the line instead of having the information obtained by a merely temporary test. By having the position of every semaphore constantly indicated, it is never possible for the train despatcher to make a mistake through oversight or forgetfulness, as he might do if he were obliged to rely on his memory for the condition of certain signals on the line.

Another feature of the present invention which is novel in the present case is the special wire for the telephone and telegraph messages, and the special sets at each station by which telephonic or telegraphic communication is established. By the present invention the communications are made entirely separate from the signal circuits, so that it is possible for a conversation to be going on between the train despatcher and any particular station at the same time that the signals are being sent over their own special wire.

A still further feature of the present case lies in a device for establishing a signal within the locomotive cab so that the engineer is positively notified if a signal is set against him, although fogs may wholly obscure the semaphore arm, and the signal light may have become extinguished in storms, or in any way. A bell, or equivalent sounding device, is also rung whenever the semaphore arm is displayed, so that an audible, as well as a visual, indication is always provided.

With these various objects in view, the present invention consists in the features of construction and combination hereinafter set forth and claimed.

The drawing shows diagrammatically the arrangement of circuits and parts for the despatcher's station, and one semaphore station of a signal system embodying the principles of my invention.

In carrying out the present invention, four line wires are used which extend along the track or railway division to be protected, throughout the entire length thereof. Wherever it is intended to have a semaphore station, connections with these wires are established, and by means of which any selected semaphore or signal can be exhibited at will from the despatcher's station, and a return signal repeating or checking up the actuations sent. At the same time means are provided for establishing the telephonic and telegraphic communication from the despatcher's station to each semaphore station, as above mentioned, and by means of which the orders are transmitted to a train after it has been stopped by the signals.

Referring to the drawing, A is the despatcher's station, and B the first of a series of semaphores or signal stations extending along the railroad. L', L^2, L^3, L^4, are the line wires over which all the connections are made. C is the central battery which can be any source of electric current. This battery furnishes the current for all of the line signaling circuits.

The outgoing signals from the despatcher's station to any semaphore station pass by the line wire L^2. There are switches 1, 2, 3, 4, 5, at the despatcher's station, corresponding to the number of semaphore or signal stations along the road. These switches are normally moved into the upward position shown, but when it is desired to actuate any selected semaphore or signal, the appropriate switch is moved downward. In the drawing, the first switch No. 1, corresponding to the first semaphore station B, is moved downward in this way. As a result of moving any selected switch downward, a circuit is completed from the battery C, and through the line L^2. There are a number of resistance elements R', R^2, R^3 and R^4, and these are in the circuit of the line L^2, and having such connections with the switches 1, 2, 3, 4 and 5, as to be selectively cut out of the circuit according to which switch is actuated. In this way the line resistance is varied according to the switch moved. For switch No. 1, the maximum resistance corresponding to all of the elements R', R^2, R^3 and R^4, is included in the line. The result of different resistances is, of course, to vary the intensity of the current passing from the battery C. Now for certain particular values of current, there are provided magnetic devices at the various semaphore stations which are selectively actuated. A practical form of these selective magnetic devices is fully set forth in my companion application above referred to. In the present case I will generally refer to an apparatus of

the same general class having slightly different circuit connections. The current from the battery C passes through wire l', connection l^2, the metallic part 6, of the switch blade 1, connection l^3, resistances R′, R², R³, R⁴, wire L², connection l^4, magnet 7, wire l^5, line wire L³, connection l^6, and portion 8, of switch blade 1, back to the battery C. In addition to passing through the magnet 7 of semaphore station B, this current also finds a divided circuit through the magnet 9 thereof, there being a resistance 10, however, in this second divided circuit. The result is that both magnets 7 and 9 are energized, but the magnet 7 is energized to slightly greater intensity than magnet 9, by reason of the less resistance of its circuit. Now the degree of energization of the magnets 7 and 9 depends upon the current flow, and this in turn upon the particular switch 1, 2, 3, 4, 5, which was moved. The adjustment is such that when switch 1 is moved, the magnet 7 is energized just enough to attract its armature, but the magnet 9 does not, so that the armatures of the two magnets take the relation as shown. Each armature has a clip 11 and 12, respectively, which are brought into contact under these circumstances, and these clips form terminals of a local circuit adapted to actuate the semaphore signal. This circuit is as follows: battery D, clips 11, 12, magnet 13, wire n', lamp 14, bell 15, battery E, motor F, wire n^2, back to the battery D. In this way the motor F is started in operation to raise the semaphore. The details of the connection may be of any desired sort, and form no part of the present invention. A divided circuit is also formed in any suitable way for ringing the alarm bell G. In this circuit the batteries D and E work together, and of course only a single battery may be used if desired. The magnet 13 attracts its armature 16, to which is connected a handle 17. The movement of the armature 16 completes a new circuit through a wire m', the core of the magnet 13, and armature 16, so that thereafter the semaphore motor F operates to keep the semaphore raised, whether or not the clips 11 and 12 continue in contact. This is a desirable condition, inasmuch as when a semaphore has once been raised to stop a train, it is best to have the semaphore replaced under no circumstances, except by the train actually stopping. The only way, therefore, that the circuit of the motor F can be broken is by an employee or the engineer or conductor of the train getting off and actually moving the lever 17 away from the magnet 13 so as to break the circuit of the wire m'. When the lever is moved in this way, the semaphore again falls, and the lamp 14 ceases to be displayed. It will thus be clear that when the magnetic devices 7, 9, move the clips 11 and 12 into contact, that the semaphore arm is raised, and is not again brought to safety except by an officer of a train, who manually repositions the handle 17. In addition to these various functions a return signal is sent as follows: The semaphore arm, or some part connected thereto, which need not be described, has a blade or pointer 18, which either moves past or on to the contacts 19 and 20 when the semaphore passes from danger to safety position. Conversely, the finger moves over contacts 20 and 19 when the semaphore arm passes from safety to danger position. In the drawing the pointer 18 is on the contact 19 corresponding to a danger position. A return signaling circuit is completed to the despatcher's station as follows: from battery C, through wire o', magnets 21′, 21², 21³, 21⁴, 21⁵ and 21⁶, in a divided circuit, line wire L′, branch wire o^2, contact 19, pointer 18, wire o^3, resistance o^4, to ground. The other side of the battery C is grounded at o^5 so as to complete the circuit. Now all of the magnets 21′, 21², etc., are of different resistances so as to be selectively energized according to the strength of the current. For the feeblest currents only the lowermost magnets 21′, 21², etc., will be energized, but as the currents become stronger a greater number of magnets are energized to attract their armatures, until for the current corresponding to a ground circuit of the line wire L′ all of the magnets will be energized sufficiently to attract all the armatures. The strength of the current and therefore the particular magnets energized, depends upon the amount of the resistance o^4 at the semaphore stations, and it will be understood that this is different at each station and made an amount proper to energize any selected magnets. In the drawing only the armature of the magnet 21′ is shown attracted since the current is of the minimum strength corresponding to the first semaphore station B, which has the greatest resistance o^4.

The result of the energization of the magnet 21′, but not of the magnet 21², is to bring the clips 22 and 23 of their respective armatures into contact in a manner which will be clearly understood from the drawing, and from a more detailed description in my companion application above referred to. The clips 22 and 23 form the terminals of a local circuit, including a battery H, lamp 24 and magnet 25. The magnet 25 acts on an armature 27, and a branch connection 28 is made from the battery H to the armature 27 so as to establish a circuit through the core of the magnet, and through the signal lamp 24, independently of the contacts 22, 23. Accordingly the signal lamp 24 is displayed and continues to be displayed, although the contacts 22 and 23 only move into contact momentarily. The lamp 24 is a danger indication, and is preferably colored red so as to show that the semaphore or signal at station B of the road is moved to danger. Inasmuch as the magnets 21², 21³, etc., have not attracted their armatures, the lowermost lamp 24 of this bank is the only one displayed under these circumstances. If any other semaphore is subsequently moved to danger, a greater number of magnets 21′, 21², 21³, will be simultaneously energized, and an additional lamp 24 illuminated to correspond to the second semaphore at danger. Thus as many lamps are illuminated as there are semaphores at danger position. All of the lamps having once been set at illuminating relation continue in this way by reason of the branch circuits formed by the armatures of the magnets 25.

I will now consider the way in which the semaphores are returned to safety and the signal lamps 24 caused to correspondingly repeat or check the movements of the semaphores. It will be understood that the levers 1, 2, 3, 4 and 5, are merely for operating the semaphores, and it is not intended that their position should be an indication of the condition of the semaphore. In fact, it is necessary that any particular lever should be returned before another lever is moved. Accordingly if it is desired to set the first, third and fifth semaphores of the series, the first lever would be moved, and then returned, then the second moved and returned, and so on. The position of the levers 1, 2, 3, 4 and 5, would,

therefore, not correspond to the positions of the semaphore signals, but the lamps 24 would be a perfect and proper record, because of the holding devices formed by the branch circuits through the armatures 27. It is intended that the levers 1, 2, 3, 4 and 5, shall be promptly returned after a downward movement so that they are all pointed upward under normal circumstances. When the levers are all pointed upward in this way, a circuit of the line L^2 is in position for completion through the various magnets $30'$, 30^2, 30^3, 30^4, 30^5 and 30^6, to the potential or ungrounded side of the battery C. Now when any train is stopped by a semaphore signal set against it, and the proper officer thereof lowers the semaphore signal by moving the handle 17 in the manner already described, a circuit is completed through the line L^2, and the magnets $30'$, 30^2, etc. This circuit is established by the point 18 moving over the contact 20. At the instant that the point makes contact at 20, a circuit is established as follows: from battery C, through the various magnets $30'$, 30^2, etc., line wire L^2, connection p', contact 20, point 18, wire o^3, resistance o^4, to ground. The other side of the battery is grounded at o^5. Thus current is allowed to flow, and the intensity of this current is proportional to the amount of the resistance o^4. As already stated, this resistance is different in the different semaphore stations, and in the particular station B it is just sufficient to energize the magnet $30'$, but not the magnet 30^2. The result is that a local circuit of the battery H is established, including the lamp 31, and magnet 32. The energization of the magnet 32 causes the armature 27 to be attracted to the left, thereby cutting out the signal lamp 24, and establishing a new and similar circuit through the signal lamp 31. The armature 27 is free to make this movement, since the magnet 25 is not included in the circuit which was established by the armature 27, but only in the circuit included by the engagement of the contacts 22, 23. The armature therefore moves over to the other position of its throw, and establishes a circuit through the lamp 31, which continues as long as the armature is in this new relation. It is evident that the armature will lay over to one side or the other of its central position by gravity until a new magnetic force is applied tending to again displace it. Thus it will be seen that when the train officer moved the handle 17, and lowered the semaphore signal at station B, he produced a record of this act by extinguishing the red or danger lamp 24, and lighting the white or safety lamp 31, corresponding to semaphore station B at the recording device of the despatcher's station. Similarly, when the signals at any other semaphore station are restored to safety, the fact is at once notified to the despatcher's office by the extinguishing of the corresponding red lamp and the illuminating of the appropriate white one. It is evident that the circuit of the magnetic devices $30'$, 30^2, etc., for the white lamps is not complete when signals are being transmitted from the despatcher's station, because the movement of any switch lever 1, 2, 3, 4 or 5, opens this circuit, for example, at the points 33, $33'$. This prevents any improper safety signal being displayed by signals sent out over the line L^2 from the despatcher's station.

The above constitute the most essential features of the system, but in addition to these there are provided a number of auxiliary devices, which are important or advantageous in practice. Among these are signal bells 34 and 35 at the despatcher's station, of which 34 is momentarily rung when a danger lamp 24 is illuminated, and 35 is momentarily rung when a safety lamp 31 is illuminated. The two bells 34 and 35 are preferably of different tones, in order that the train despatcher may know by the sound what has taken place, even without looking at the signal lamps. The signal lamps thereafter furnish a record of the conditions.

A further feature of the invention lies in the provision of a circuit by which the locomotive engineer is directly notified of the signal set against him without seeing it. It is necessary that the engine or a car of the train be equipped with depending contacts or shoes forming the terminals of a circuit on the train including an alarm bell. Many patents are issued showing such a circuit and depending brushes or shoes, and since these features do not in themselves constitute a part of my invention, I have not deemed it necessary to show them. Along the track 36 are a couple of contact plates 37, 38, with which the depending shoes or brushes on the train are adapted to contact in passing. These contact plates 37 and 38 are connected by wires q' and q^2 with the circuit of the batteries D and E, forming a divided circuit therefrom, so that the contact plates 37 and 38 are charged to a difference of electric potential at the same time that the semaphore is raised to danger. Thus the bell or alarm devices on the train are rung at the same time that the semaphore signal is raised and the gong G rung adjacent to the track. X indicates a train stop also operated to prevent a signal at danger being passed.

I will now describe the telegraph and telephone sets by which the actual communication is had from the despatcher's station to the officers of the train. All of the telegraphic and telephonic communication is had over an entirely separate line wire L^4. At the despatcher's station there is a battery I, a magneto generator K, telegraph key M, a telegraph relay N, and a telephone set O, including a transmitter and a receiver and the usual signal bell. There are similar devices I', K', M', N' and O', at the semaphore station B, and also at the other semaphore stations. P and P' denote switches respectively at the despatcher's station and at the semaphore station B, and these switches are normally in the open circuited relation shown. When communication is desired, switches P and P' are moved on to certain contacts as follows: When despatcher A wishes to talk to station B, the switch P is moved on to the second contact shown, while the switch point P' is moved against the lowermost contact. Station A may now ring up station B, and by moving the switch point P' on to the upper contact, may talk to B. In order to telegraph to B, it is merely necessary to move the switch point P to the uppermost contact, whereupon the key M will produce such variations in the current flow as to affect the distant relay N', supposing that the switch P' is in its proper position on the lowermost contact. In exactly the same way it is possible for B to telephone and telegraph to station A. The switch points P should under ordinary circumstances be at the lowermost contacts capable of receiving calls or telephonic or telegraphic messages. If desired, however,

the telephonic and telegraphic apparatus may be entirely cut out by moving the switch points P, P′, into the positions shown.

While I have in this description and in the following claims referred to the central station as the despatcher's station and the stations along the line as semaphore stations, it is to be understood that these terms are merely for convenience and clearness, and are not intended to limit the invention to a particular use by train despatchers, or to particular railway signals of the type having a painted arm, in accordance with the general usage. It is obvious that the particular nature of the signals may be of any desired character, either painted arms, or lamps with shutters, or vertically moving balls, or any of the other devices ordinarily used for signaling trains. I, therefore, use the term "semaphore station" in the sense of a station having signaling means to stop or control the passage of a train.

It will be noted that there are six of the magnetic devices 21′, 21², 21³, etc., and 30′, 30², 30³, etc., shown in the drawing, while there are only five of the switch levers 1, 2, 3, 4, 5, shown. The extra magnetic devices are provided for the purpose of giving an immediate indication in case of a ground or short circuit of the line wires. It is evident that should a short circuit occur, that a maximum current will flow, greater than the current which is allowed to pass through any semaphore station. Accordingly in case the top signal lamps of the series are exhibited, it will show at once that there is a fault in either the line L′ or L² due to a ground or short circuit. If the ground is not a perfect one due to a falling wire, the condition is also indicated at the despatcher's station, notwithstanding the fact that the resistance may be of any uncertain quantity. This is because a falling wire makes a very uncertain contact with the ground, especially as it is moved back and forth by the wind or in falling, and this varying and uncertain resistance will produce erratic and very unusual and irregular illumination of the various signal lamps 24 and 31. In case, therefore, that the lamps are illuminated in this way, the despatcher is at once informed of the "winking wire".

In practice it will probably be found sufficient to have merely a semaphore arm and a train stop to suit all conditions. A semaphore arm cannot alone be depended upon to prevent accidents, because the engineer is not always on the look-out for signals set against him. But if a train stop, as shown at X, is used in connection with the semaphore arm, being disposed along the track a few hundred yards beyond the same, a method is obtained of insuring the observance of the semaphore signals. Thus accidents are prevented, and at the same time the engineer is penalized for running past the semaphore signal, because the actuation of a train stop always requires the officers of the train to get off and reset it, and this fact must be made of record and brought to the attention of the road officials.

What I claim, is:—

1. In a signal system, a despatcher's station and a plurality of semaphore stations, means for respectively displaying any selected signal at the semaphore stations, and two entirely separate sets of recording apparatus at the despatcher's station for separately indicating the safety and danger positions of each semaphore signal at all times.

2. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively displaying any selected signals at the semaphore stations, and two sets of indicating means at the despatcher's station each with a separate line wire connection for continuously showing the position of every semaphore signal on the line, said indicating means being automatically operated by the movement of the semaphore signals.

3. In a signal system, a despatcher's station and a plurality of semaphore stations, means at the semaphore stations for displaying signals selectively operated by currents of varying intensity from the despatcher's station, means whereby currents of predetermined strength are caused to flow in the despatcher's station by the operation of any particular semaphore, and means whereby a continuous record of the condition of all of the semaphores of the line is constantly displayed at the despatcher's station.

4. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively displaying signals at any selected semaphore stations, means whereby currents flow from the semaphore stations to the despatcher's station when any semaphore signal moves to danger or safety position, the currents traversing separate wires in the two cases, and recording devices at the despatcher's station actuated by said currents for producing a continuous display at the despatcher's station of the condition of all the semaphore signals.

5. In a signal system, a despatcher's station and a plurality of semaphore stations, three line wires, means for transmitting currents of varying intensity over one of said line wires from the despatchers' station, means at the semaphore stations selectively operated by said signals, means for transmitting currents of varying intensity over another of said line wires when any semaphore moves to danger, and means for transmitting currents over the third of said line wires when any semaphore moves to safety, and recording devices at the despatcher's station operated by the currents in said second and third line wires to produce a continuous display of the condition of all the semaphore signals.

6. In a signal system, a despatcher's station and a plurality of semaphore stations, means for transmitting currents of varying strength from the despatcher's station, semaphore stations to selectively operate any desired semaphore signal, and means for re-transmitting currents of varying strength from the semaphore signal operated to produce a continuous record or display at the despatcher's station of the condition of all the semaphore signals.

7. In a signal system, a despatcher's station and a plurality of semaphore stations, recording signals at the despatcher's station, and means actuated by currents of varying intensity from the semaphore stations for operating said recording signals to produce a continuous display of the condition of all the semaphore signals.

8. In a signal system, a despatcher's station and a plurality of semaphore stations, a plurality of pivoted armatures at the despatcher's station, each armature having two magnets acting thereon, the different armatures corresponding to different semaphore signals, and means whereby one of the magnets acting on an armature is energized when a semaphore signal moves to danger and the other of said magnets energized when the semaphore signal moves to safety position.

9. In a signal system, a despatcher's station and a plurality of semaphore stations, a plurality of pivoted armatures at the despatcher's station, each armature having two magnets acting thereon, the different armatures corresponding to different semaphore signals, and means whereby one of the magnets acting on an armature is temporarily energized when a semaphore signal moves to danger and the other of said magnets temporarily energized when the semaphore signal moves to safety position.

10. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively displaying signals at any selected semaphore stations, said means including a plurality of switch levers, and a circuit closed when said switch levers are all in their normal position for producing a repeat or checking signal at the despatcher's station of the operation of any semaphore signal.

11. In a signal system, a despatcher's station and a plurality of semaphore stations, two line wires over which the signals are transmitted for connecting said stations, one of said wires carrying signals from the despatcher's station to the semaphore stations, and the other carrying signals from the semaphore stations to the despatcher's station, a separate line wire, and means for transmitting telephonic and telegraphic messages over said last wire and one of the signal line wires.

12. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively displaying signals at any selected semaphore stations, and manually operated means at the semaphore stations for restoring said signals to safety, said manually operated means producing a signal at the despatcher's station showing that the semaphore has been moved to safety.

13. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively setting a train stop at any selected semaphore station, and manually operated means at the semaphore station for producing a signal at the despatcher's station showing that the train has been properly stopped.

14. In a signal system, a despatcher's station and a plurality of semaphore stations, means for selectively operating a train stop at any desired station, and means for causing a repeat or checking signal at the despatcher's station.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

JULIEN A. GEHRUNG.

Witnesses:
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