Nov. 9, 1937. S. CITTERIO ET AL 2,098,719

RAILWAY SIGNALING SYSTEM AND APPARATUS

Filed April 11, 1934 3 Sheets-Sheet 1

Fig. 1

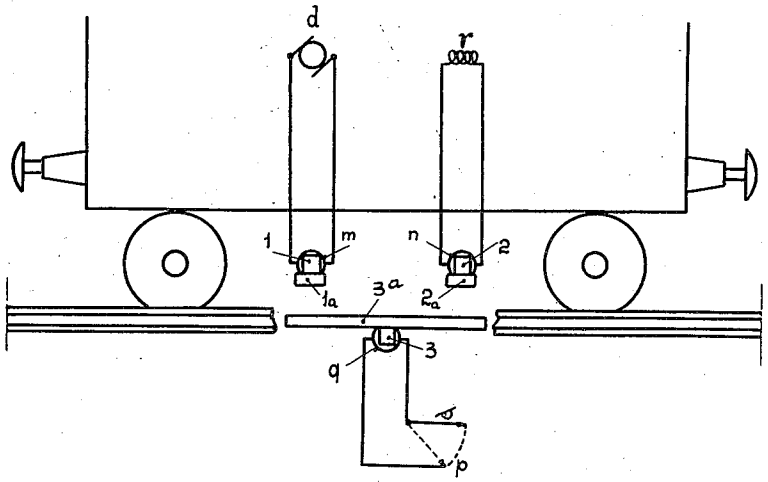
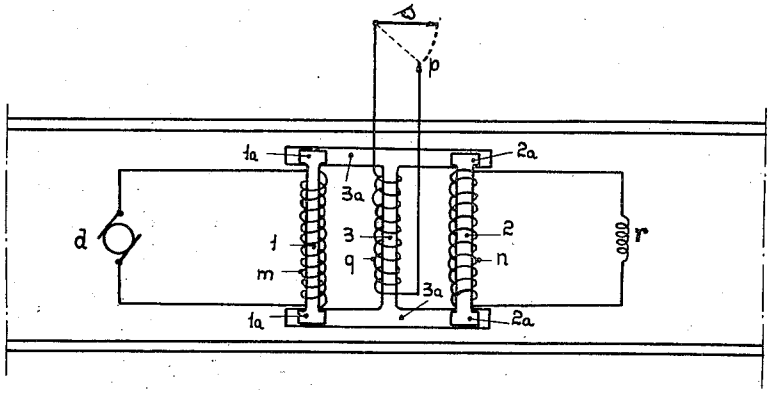


Fig. 2



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RAILWAY SIGNALING SYSTEM AND APPARATUS

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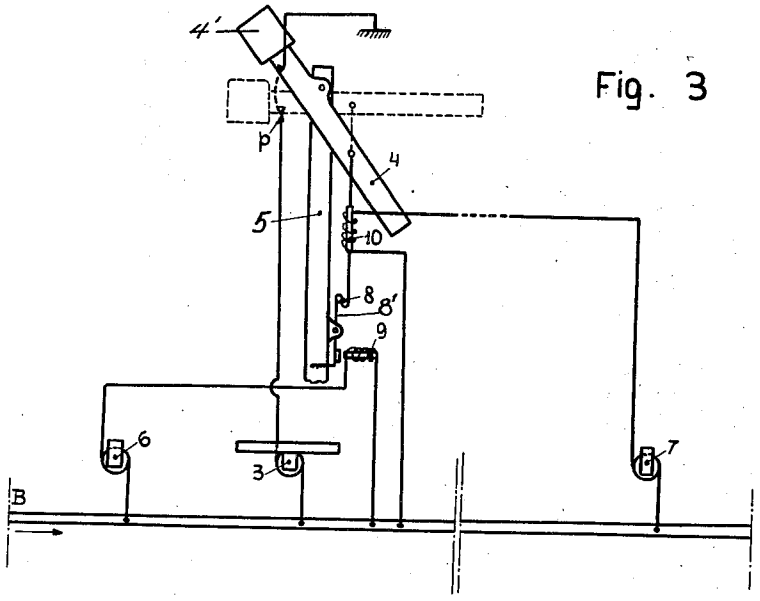
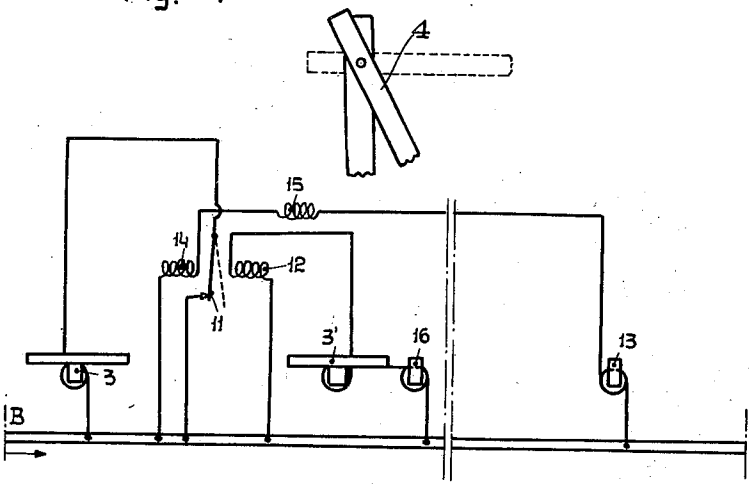


Fig. 3

Fig. 4



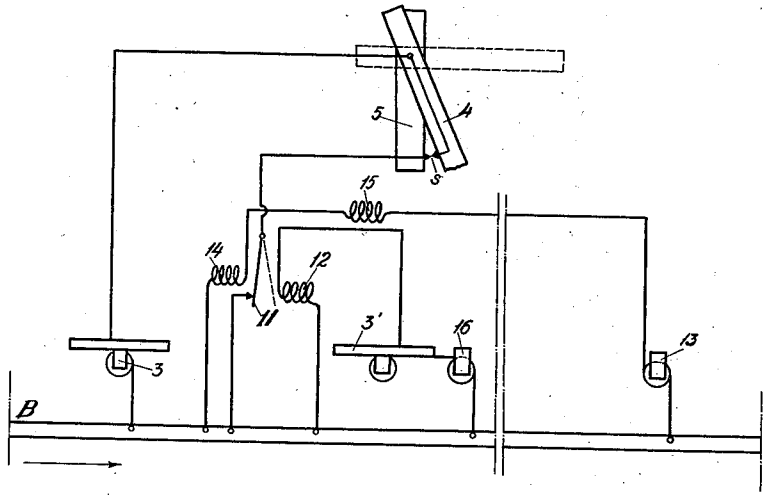
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RAILWAY SIGNALING SYSTEM AND APPARATUS

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Fig. 5



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RAILWAY SIGNALING SYSTEM AND APPARATUS

Siro Citterio and Palmino Vacchina, Turin, Italy

Application April 11, 1934, Serial No. 720,110
In Germany April 15, 1933

5 Claims. (Cl. 246—63)

It is already known to employ electromagnetic devices for transmitting signals between a train passing over a certain point on a railway line and a fixed point, which do not require any source of current in the controlled section of the track. This is generally obtained by arranging at the desired point two electromagnets of which the pole pieces are flush with the rails and the windings are in series with each other and with a switch, while as said above no source of current is provided.

Two further electromagnets are placed on the train and suitably positioned either on the locomotive or on a car; the winding of one electromagnet is placed in the circuit of a source of current and the winding of the other electromagnet is connected in series with an acoustic or an optical signal. The working of this device which on account of the electromagnetic induction effect when the circuit of the first mentioned electromagnet is closed, actuates a signal on the train driving over them (as well as on the track, if a signaling device is placed in the circuit) while when the circuit is open no signal is actuated, is known and requires no further detailed description.

According to this invention the same result is obtained by employing only one electromagnet on the line, thus simplifying and cheapening the installation and upkeep, and with the considerable advantage that the signal is actuated also when the circuit is open, which signal can be utilized and serves at any rate to attract the engineer's or the chief conductor's attention. Two electromagnets are provided on the train, and the winding of one electromagnet is supplied with power, while the other winding is connected in series with the signaling device. The pole pieces of the two electromagnets are directed outwardly for example towards the ground. The pole pieces of the electromagnet placed at the point to be controlled on the line are wide enough to embrace the pole pieces of the electromagnets placed on the train and the space therebetween. When the train runs over the point at which the fixed electromagnet is positioned, the pole pieces of the two electromagnets on the train bridge the two pole pieces of the electromagnet on the track.

The magnetic circuit of the first of the electromagnets placed on the train, namely of the electromagnet under power, is closed over the core of the fixed electromagnet. When the circuit of the latter is open, a small quantity of magnetic flux flows through the core of the other movable electromagnet, namely of the electromagnet connected in series with the signaling apparatus producing a current having given characteristics, so that a signal is given on the train, for example a deep sound.

When the circuit of the fixed electromagnet is closed, the winding is traversed by an induced current having characteristics other than the former which produces a magnetic flux having also different characteristics through the second movable electromagnet and the actuation of another signal, for example a shrill sound, on the train.

The pole pieces are of course shaped in such manner as to improve these effects.

The invention is illustrated on the accompanying drawings showing some constructions by way of example and on which

Figures 1 and 2 show in elevation and in plan, respectively, the working of the movable electromagnets on the train and of the electromagnet on the track.

Figure 3 shows diagrammatically the circuit for actuating a semaphore from the train.

Figure 4 shows diagrammatically an automatic block system independent of the semaphores.

Figure 5 shows a modification in which the automatic block system is combined with a semaphore.

Referring to Figures 1 and 2, the locomotive or other train vehicle carries suspended thereto in the transverse direction two magnetic cores **1** and **2**, of which the pole pieces **1***a* and **2***a* are turned downwardly.

Along the track, at the points where a determined signal should be given to the running train, such as "clear" or "blocked section", we arrange a double T-magnetic core **3**, of which the pole pieces **3***a* are turned upwardly and are of a size such as to bridge the pole pieces **1***a* and **2***a*, when the train runs over said magnetic core **3**.

A solenoid *m* is wound upon the core **1** and is fed with current by a source of current *d*; the core **2** carries wound thereupon the solenoid *n* in series with a relay *r* adapted to actuate a signal (not shown) on the locomotive; the core **3** carries wound thereupon a solenoid *q* that can be short-circuited by means of a switch controlled by a track signal; in the example shown *s* indicates diagrammatically the arm of a semaphore cooperating with the stationary contact *p*, thereby forming a switch. When said arm is in blocked section or "stop" position, the circuit is open, and when it is in "clear" position, the circuit is closed.

If the winding *q* wound on the core **3** of the

track is in open circuit and the two windings *m* and *n* carried by the train pass on the track, the core 3 will act simply as the soft iron armature of an electromagnet and produces in the winding *n* a flux variation, which generates a current of a certain value and sign. If on the contrary the winding *q* is closed in short circuit when the train runs on the track, a current will be produced in the winding *q* and produces in turn a magnetic flux opposed to the magnetic flux generated by the winding *m* thus producing in the winding *n* a current of different value and sign.

Two different currents can, therefore, be obtained in the electromagnet 2*n* according to whether the switch *s*—*p* is open or closed; consequently, two distinct signals are given.

A semaphore, barrier or other signaling apparatus arranged on the track can be actuated by the train personnel, who will receive on the train itself a confirmation that the apparatus has been actuated. Figure 3 shows an example of a device for actuating from the train a semaphore at a grade crossing.

The train runs on the track in the direction shown by the arrow. An electromagnet 6 is arranged across the track at the leading end of the controlled track section B and an electromagnet 7 is similarly arranged at the subsequent end of said section. A semaphore 4 is arranged at the grade crossing and is normally kept lowered by the engagement of a hook 8 carried by the semaphore arm 4 with a corresponding tooth carried by a lever 8' fixed to the mast 5 of the semaphore. The lever 8' is subjected to the action of an electromagnet 9 connected in series with the electromagnet 6. When the train is about to run onto the controlled section, the engineer closes the energizing circuit of the electromagnet *lm* (Fig. 1) by a switch or other suitable means and, on coming over the electromagnet 6, the electromagnet *lm* generates in the latter a current energizing the electromagnet 9. The electromagnet 9 draws, as it is energized, its own armature carried by the lever 8', disengaging the arm 4 which takes a horizontal position under the action of a weight 4', to denote at the level crossing that the train has entered the controlled section.

As the semaphore 4, which is grounded, reaches its horizontal position, it grounds a contact *p* of the circuit of the electromagnet 3. When the train runs over this electromagnet, a confirmation is given on the train of the signaling effected, in the manner explained above in connection with Figures 1 and 2.

The hook 8 is solidly connected with the core of an electromagnet 10 connected in series with the trailing end electromagnet 7. When the train runs over the electromagnet 7, the electromagnet 10 is energized, lowers the arm 4 and returns the hook 8 into engagement with the lever 8', locking the arm 4 in its lowered position, ready for giving a new signal.

Should for any reason whatever the electromagnet 10 fail, the semaphore arm 4 will remain horizontal and denote that the section is occupied, thus avoiding any accidents although the signal is not correct.

Figure 4 shows diagrammatically an automatic block system, in which the "clear" track condition is indicated on the train by two successive identical signals, while the "occupied" track condition is indicated by two successive different signals.

An electromagnet 3 with a double T-shaped core as described in connection with Figures 1 and 2 is arranged at the leading end of the block section B. The circuit of this electromagnet comprises a switch 11 which is closed in the "clear" condition of the track. At a given distance from the former a second electromagnet 3' of the same type is arranged on the track. An electromagnet 12 is inserted in the circuit of the electromagnet 3' which is always closed, and is energized when the train runs over the electromagnet 3', to open the switch 11 and place the controlled section in the "occupied" track condition. At a given distance from the electromagnet 3' an electromagnet 16 is arranged on the track and its winding is connected in series with that of the electromagnet 3'.

An electromagnet 13 is arranged at the trailing end of the block section, and in its circuit are connected in series an electromagnet 14 acting on the switch 11 which is closed as the train runs over the electromagnet 13 and an electromagnet 15 adapted to actuate a signal (not shown) at the leading end of the block section.

Assuming the switch 11 is closed, when a train runs into the block section B it receives a first signal on passing over the electromagnet 3 and after a short interval of time a second signal equal to the first on running over the electromagnet 3'. These signals denote that the track is clear and, therefore, the train can run further on the block section. At the same time the electromagnet 3' energizes the electromagnet 12 which opens the switch 11. Should a second train now run into the block section, it receives on running over the electromagnet 3 a signal different from that indicated above, the circuit of the electromagnet 3 being now open, while on running over the electromagnet 3' it receives a signal like the one received by the preceding train; two different signals are thus given which denote that the section is occupied. The second train shall, therefore, stop while the first train is still in the block section B. When the first train leaves the block section, it causes a signal to be given in the manner now to be described. On leaving the block section B, the first train comes over the electromagnet 13 and energizes the electromagnet 14 which closes again the switch 11 placing the block section in "clear" track condition and at the same time an electromagnet 15 which may actuate at the leading end of the block section a signal advising the engineer of the second train that the track is clear. The electromagnet 15 may be connected in the signaling circuits as the electromagnet 10 of Fig. 3 or in any other known suitable manner for the purpose of producing the said signal. The second train can thus run further and as it proceeds it runs over the electromagnet 16 which energizes the electromagnet 12, the latter re-opening the switch 11 again placing the block section into "occupied" track conditions.

When the second train runs out of the block section, the switch 11 is again closed by the electromagnet 14 energized by the current induced in the electromagnet 13. A third train can now freely travel over the blocked section.

The circuit of the electromagnet 3 can further include a switch *s* actuated by the semaphore arm 4, Fig. 5, of which the position can thus be verified from the train in the manner described above.

By this arrangement any accidental interruption of any circuit will give an "occupied" signal, as is required.

What we claim is:

1. Signaling device for railways, comprising an operating electromagnet carried by the train, a generator for continuously energizing said electromagnet, a signaling electromagnet carried by the train at a fixed distance from the operating electromagnet, said signaling electromagnet being magnetically separate from the operating electromagnet, an armature of magnetic material arranged on the track to complete a magnetic circuit between said operating and signaling electromagnets, respectively, when said electromagnets pass over said armature and thus generate in the winding of the signaling electromagnet a current having a given characteristic to positively produce a given signal, a winding on said track armature and means responsive to the track conditions to short-circuit said winding, to generate in said winding a current producing a flux which modifies the characteristics of the current of the signaling electromagnet to give a second positive signal.

2. Signaling device for railways comprising track signals, an operating electromagnet carried by the train, a generator for continuously energizing said electromagnet, a signaling electromagnet carried by the train at a fixed distance from the operating electromagnet, the cores of said electromagnets being arranged in a transverse direction with respect to the track and magnetically separate from each other, an armature of magnetic material of H-shape arranged on the track in a longitudinal direction, to complete a magnetic circuit between said electromagnets when the latter pass over said armature and to generate in the signaling electromagnet a current having a given polarity to positively produce a given signal, a winding on said armature and means controlled by said track signals to short-circuit said winding, to generate in said winding a current producing a flux which reverses the polarity of the current of said signaling electromagnet to positively produce a second signal.

3. Apparatus for controlling railway traffic, comprising, in combination with a block section a protecting track signal and means for maintaining said signal in the clear position, an electromagnet at the beginning of said block position to release said signal from said means and allow of said signal coming to its occupied position, an armature of magnetic material of H-shape arranged in a longitudinal direction in said block section ahead of said track signal, an electromagnet at the end of said block section for bringing said track signal to its clear position, an operating train electromagnet, a generator for continuously energizing said electromagnet, a signaling electromagnet carried by the train at a fixed distance from the operating electromagnet, the cores of said electromagnets being magnetically separate from each other and a winding on said armature of H-shape controlled by said signal so that when the train passes over the electromagnet at the beginning of the block section, the operating electromagnet releases said signal which comes into occupied position and closes the circuit of the winding wound on the H-shaped armature, when the train passes over the H-shaped armature the magnetic circuit between the cores of the operating and signaling electromagnets is completed to positively produce on the train a signal indicating the position of said track signal, and when the train passes over the electromagnet at the end of the block section, the operating electromagnet energizes said electromagnet to return the track signal to the clear position.

4. In a railway line divided into sections, an automatic block system comprising on each train an operating electromagnet, a generator for continuously energizing said electromagnet and a signaling electromagnet at a fixed distance from the operation electromagnet, the cores of said electromagnets being magnetically separate from each other; in each block section, an H-shaped armature adapted to complete a magnetic circuit between the cores of said train electromagnets to indicate to the train entering the block section the state of said section and comprising a winding and a switch short-circuiting said winding, said switch being closed in clear track conditions, a second H-shaped armature adapted to complete a magnetic circuit between the cores of said train electromagnets and arranged behind the first-mentioned armature, a winding on said armature connected in a normally closed circuit, comprising a relay for opening said switch as the train passes and consequently placing the block section into occupied track conditions and giving at the same time on the train the signal of said variation, an electromagnet at the end of said block section for closing said switch and producing a clear track signal at the beginning of said block section and an electromagnet behind the second H-shaped armature connected in series with the winding of said armature for opening said switch, the clear track condition being indicated by two identical successive signals as the train runs over the two H-shaped armatures and the occupied track condition being indicated by two successive different signals as a second train passes over said armatures before the first train has left the block section.

5. In a railway line divided into sections, an automatic block system as claimed in claim 4, in which the circuit of the winding of the first H-shaped armature comprises a switch controlled by the track signals so that it is possible to obtain on the train also the indication of the signal position.

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