Jan. 15, 1929. 1,698,864

E. WILCKENS

TRAIN CONTROL APPARATUS

Filed Oct. 12, 1926 2 Sheets-Sheet 1

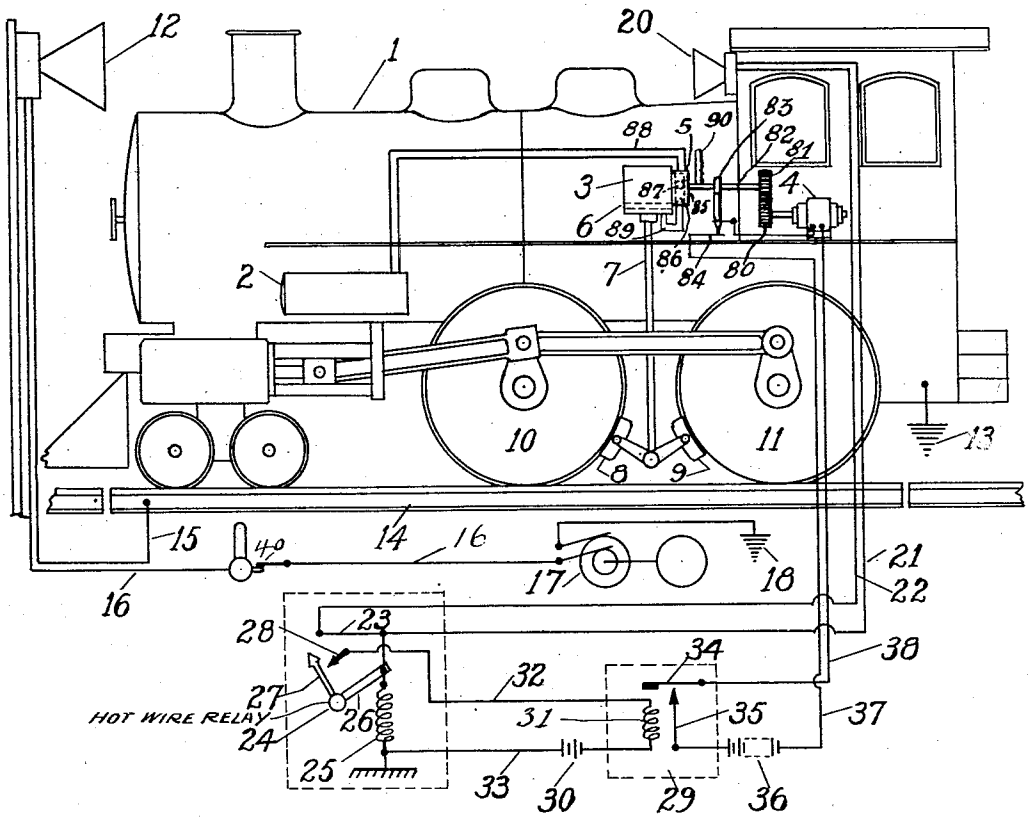


Fig. 1

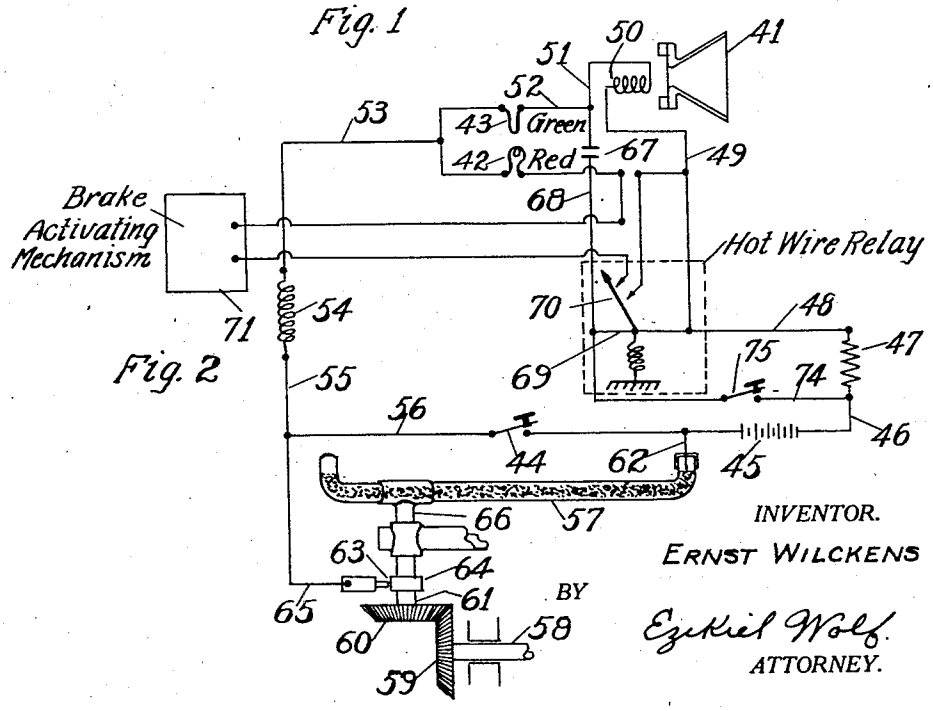


Fig. 2

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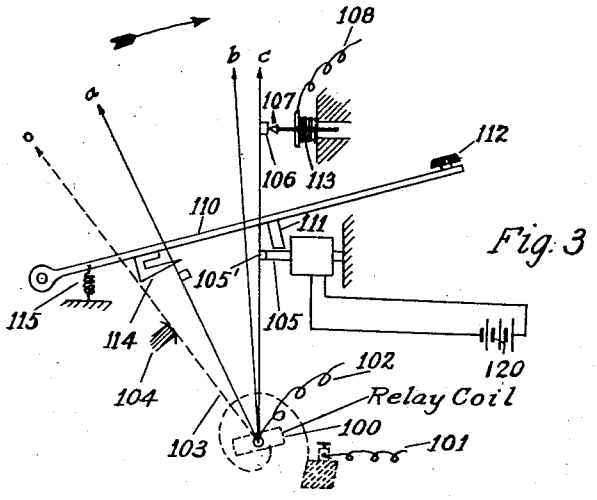


Fig. 3

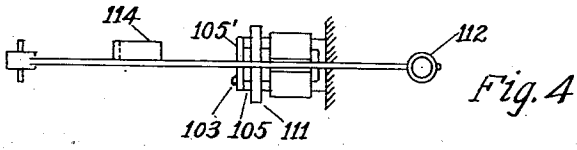


Fig. 4

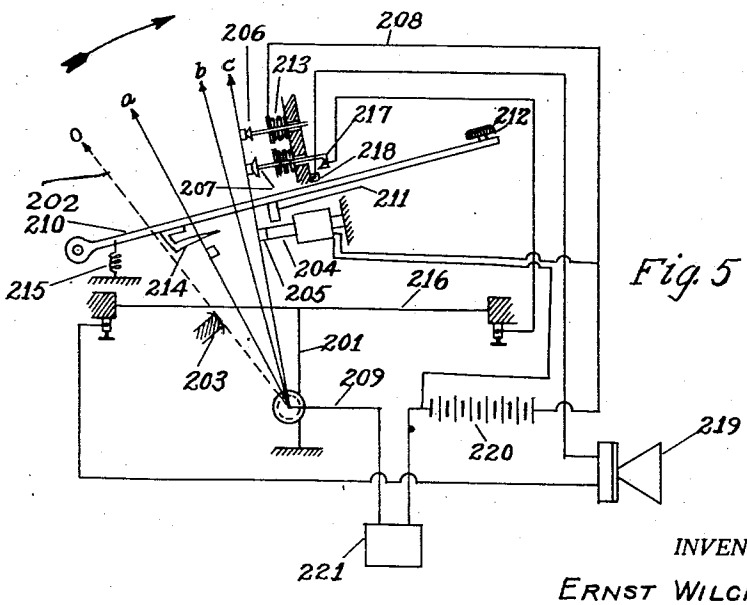


Fig. 5

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UNITED STATES PATENT OFFICE.

ERNST WILCKENS, OF KIEL, GERMANY, ASSIGNOR TO SIGNAL GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, A FIRM, OF KIEL, GERMANY.

TRAIN-CONTROL APPARATUS.

Application filed October 12, 1926, Serial No. 141,184, and in Germany October 16, 1925.

I have filed applications for patent in Germany on October 16, 1925, December 4, 1925 and June 26, 1926.

The present invention relates to an acoustical method and means for controlling the operation of a train moving into a section or block in which there is some dangerous obstacle in the way. While there are other methods for having the brakes automatically applied to a train to bring it to a stop when it has entered a block in which there is some dangerous obstacle in the way, the method employed in the present invention has not only proved useful but also in some instances more reliable than other methods hitherto employed.

Most of the railroad accidents involving train collisions happen because the engineer fails to see the danger signal. He may be inattentive or may be occupied at the moment the train passes the signal so that he does not note sharply how the signal is set or what color it is. On the other hand it may be foggy or he may be color blind or indisposed. Any one of many reasons may be responsible for the train running past the danger signal and causing an accident.

According to the present invention if the train runs past a danger signal, it will automatically be brought to a halt without any effort or action on the part of the engineer. A powerful sound source is situated on a pole near the track, while in the locomotive sound receivers responding only to the sound source pick up the sound and operate mechanism which applies the brakes and bring the train to a halt.

The manner of operation and the new features involved in the invention will appear more plainly from the description of the apparatus and its operation, along with the accompanying drawing in which:

Figure 1 shows schematically the invention applied to a locomotive.

Figure 2 shows in further detail some elements in the system.

Figure 3 shows a relay for operating the brake mechanism.

Figure 4 shows a detail of Figure 3, and

Figure 5 shows a slight modification of Figure 3.

In Figure 1 the locomotive is indicated as 1. 2 is the air tank for supplying air to the air brake cylinder 3 when the motor 4 by means of the gears 80 and 81 turns the shaft 82, thus opening the valve 5. The motor 4 continues to rotate until the cam 83 permits the contacts 84 in the motor circuit to open, thus stopping the motor. A handle 90 is provided to enable the engineer to reclose the valve 5, which comprises a casing 85, and a rotatable cylinder 86 inside the casing and connected to the shaft 82. When the valve is in the open position the hole 87 in the valve cylinder connects the air pipe 88 to the air pipe 89, which conducts the air to the lower side of the air brake cylinder 3. The piston 6 is forced upwards and also the rod 7, thus forcing the brakes 8 and 9 against the wheels 10 and 11 respectively, effectively bringing the train to a halt. The motor 4 for operating the air brakes is operated when the acoustic horn 12 sends out a sound blast.

As shown in Figure 1, the train is in a position to cause the horn 12 to operate. The circuit closing the electrically operated source of sound may be traced from the locomotive 1, which is grounded through the opposite rail (not shown) but indicated at 13, to the insulated track 14, through the wire 15 connected to the track to the source of sound 12, through 12 back through wire 16 and circuit closer 40 to the electrical source 17 and thence to ground at 18, thus completing the circuit.

When the train, therefore, comes into the position shown in Figure 1, the sound source 12, which is tuned to a definite frequency, will operate and emit a sound blast affecting the sound receiver 20, which is tuned to the same frequency and situated on the locomotive approaching the dangerous block. The sound receiver 20 sends a current by means of the wires 21 and 22 to the hot wire 23 of the hot wire relay 24 in a manner to be presently described. The mechanical resistance of the wire is therefore decreased allowing the spring 25 to retract and draw downward with it the end of the pivoted lever 26 which causes thereby the hand 27 to rotate clockwise and make contact with the contact member 28. When this is done a circuit is closed through the electromagnet 29 in the following manner: from the battery 30 through the electromagnet coil 31, wire 32, contact 28, hand 27, lever 26, spring 25 and to battery 30 through wire 33.

The closing of this circuit causes the armature 34 to move downward closing a circuit through the hand 35, the battery 36, lead 37, motor 4, lead 38, returning to the battery 36,

through 34 and 35. As mentioned above the motor 4 opens the air valve 5 and allows the air pressure to force the brakes against the wheels 10 and 11 and bring the train to a halt. In practice the sounding circuit can be tied up with the semaphore as shown at 40 in Figure 1. When the train in the danger block has set the semaphore as shown at 40, the circuit which otherwise is broken is made in the line 16, 16 so that the approaching train will automatically cause the horn 12 to sound.

Figure 2 shows a convenient circuit which may be employed in the operation of the system. The receiver is shown at 41, a red light and a green light at 42 and 43 respectively. When the train is standing still the light circuit is ordinarily open and the green light is not lighted, but when the key 44 is depressed the circuit is closed in the following manner: from the battery 45, wire 46, resistance 47, wires 48, 49, coil 50, wires 51, 52, light 43, wire 53, choke coil 54, wires 55, 56 and key 44, back to battery 45.

The key is provided so that the circuit may be tested before the train starts. When the train starts the circuit is closed automatically through the mercury tube 57. The shaft 58 is driven off the wheels of the locomotive and drives the gears 59 and 60, thus driving the shaft 61 and rotating the tube 57. The centrifugal action of the mercury in the tube causes it to rise and contact with the end of the wire 62. A lead from the wire 55 goes to the brush 63 contacting with the commutator 64. The key 44 is thus shunted through the wire 65, brush 63, commutator 64, shaft 66, mercury in tube 57 and wire 62. When the train starts up, therefore, the green light lights.

The receiver 41 receives the sound waves and induces a current in the coil 50 which travels over wire 51, condenser 67, wire 68, relay wire 69, and wire 49 back to coil 50. The current traverses the circuit described, since same is tuned to the frequency of the sound waves generated by the source of sound. The heating of the wire 69 causes as explained in Figure 1, the hand 70 to close the circuit to the brake activating mechanism 71. The red light is also lighted at the same time and, since the current is lightly diminished through the green light, on account of the drop in voltage across it, the green light is so chosen that a slight drop in voltage will cause the light to become very dim or even go out entirely. When the red light comes on therefore the green light goes out. The circuit made when the hand 70 connects the contacts 72 and 73 may be traced through very easily from the battery 45 through the resistance 47 to the wire 48, through the hand 70 to the brake actuating mechanism 71, to the red light 42, wire 53, coil 54, wire 55, wire 65, commutator 64, mercury tube 57, wire 62, and thus back to the battery 45. A connecting wire 74 with a key 75 in series, connects to one end of the wire 69, connecting the resistance 47 in shunt across the hot wire 69. When the key 75 is depressed, the relay may be tested, since the voltage across the resistance 47 is the correct voltage for operating the hot wire 69.

In Figure 3 is shown in detail one form of a relay capable of operating in the present invention. The operating coil is shown at 100, connected to the sound receiver by wires 101 and 102. Normally the operating hand 103 rests against the rest 104 as shown by the dotted line in the position O. When excited by the sound receiver, the hand takes the position shown at *b*, which then brings the hand within the pull of the electromagnet 105, which is energized by the battery 120, and attracts the armature 105′ of the hand 103 towards it, thus forcing 106 to make contact with 107, compressing the spring 113 at the same time. A contact through the wire 108 and the hand 103 may be used to close the circuit to the brake activating mechanism.

To restore the relay back to normal the operator presses the button 112 thus depressing the lever 110 and causing the bar 111 to come across the poles of the magnet 105 releasing the magnetic attraction of the armature 105′ to an extent, sufficient to allow the spring 113 to send the hand 103 back to its normal position. In going back to its normal position the armature 105′ makes a friction contact with the piece 114 thus preventing a jar or bending of the hand 103 and allowing the hand to come gently to rest against the stop 104.

Figure 4 shows more plainly than Figure 3 how the bar 111 of the lever 110 releases the hold of the magnet 105 on the hand 103. A spring 115 restores the lever 110 back to normal when the button 112 is released.

In Figure 5 the same type of relay is shown except that the hot wire 216 takes the place of the coil 100 of Figure 3. When the signal is received through the receiver 219, a current passes by way of the contacts 217 and 218 to the hot wire 216 and back to the receiver. The tension on the wire 201 is therefore relieved and the indicator 202 moves from its initial position against the stop 203 to the position *b* where it is attracted by the electromagnet 205 which is energized by the battery 220. The other parts of the relay are exactly similar to the corresponding parts of Figure 3 with the exception that two springs 213 similar to spring 113 of Figure 3 are provided, one for making a contact to the hot wire which is broken immediately when the relay is set in operation. The hand 202 depresses the rod 217 when the relay is first brought into action which immediately breaks the circuit to the hot wire 216 at the contact

217, thus allowing the hot wire 216 to cool off and be in operative position when the button 212 is depressed to release the hand 202. The closing of the contacts 206 and 207 operates to close the circuit to the brake activating mechanism 221, through the wire 209 and the battery 220.

In the operation of the system as explained above, a positive action can be obtained between the sender and the receiver of the sound energy since the sender and receiver are tuned to the same pitch and while the sound sender is designed to operate most efficiently at the given pitch it is used, the receiver is highly tuned and receives best at that pitch so that outside noises interfere very little with the operation of the system. In addition to this such a powerful source is used and the sender and receiver are placed so near together that most any type of relay can be operated. The relay may be rugged as there is plenty of energy to operate it.

While serving also as a warning signal the sound horn functions primarily to operate the sound receiver upon the train and should therefore for best operation face towards it, but it has been found possible to operate the receiver by having the sound horn face towards the track instead of towards the approaching train.

Having now described my invention I claim:

1. A system for preventing a train from running past a block signal indicating danger, comprising, in combination with means for placing an operating circuit in operable condition, an acoustic source of energy tuned to a definite frequency, means for operating said source of energy when a train approaches said source, acoustic receiving means tuned to the frequency of the source and situated upon said train for receiving said energy, and means operated by said receiving means for causing the brakes to operate to bring the train to a halt.

2. A system substantially as defined in the present invention including an acoustic source of energy operated at a given definite frequency, acoustic receiving means responsive to the same frequency situated upon a train, and means operated by said receiving means for causing the brakes to operate to bring the train to a halt.

3. A system for preventing a train from running past a block signal indicating danger, comprising means for closing an opening in an electrical circuit for ultimately bringing a train to a halt when a train is in the danger block, an acoustical sound source tuned to a given definite frequency, means including the approaching train for operating said acoustical sound source, means positioned upon said train for receiving only the sound from said sound source, and means operated by said receiving means for causing the brakes to operate to bring said train to a halt.

4. A system for preventing a train from running past a block signal indicating danger, comprising in combination means for closing an opening in an electrical circuit, a sound source operated at a given definite frequency, means including the approaching train for operating said sound source, sound receiving means positioned on said train and tuned to respond to substantially only the frequency of said sound source, relay means operated by said receiving means, and means operated by said relay means for bringing the train to a halt.

5. A train control system comprising in combination with a train, an insulated section of track, an electric circuit closed by said train when it reaches said track section, a producer of sound waves of a given definite frequency located near said track and operated when said circuit is closed, a sound receiver carried by said train responsive only to sound of the same frequency as produced by said sound producer, and means operated by said sound receiver for setting the brakes on said train, whereby said train is stopped.

6. A train control system comprising in combination a source of acoustic energy of a given definite frequency set into operation by an approaching train, means carried by said train for receiving substantially only said acoustic energy from said source, relay means operated by said receiving means, and an electric circuit closed by said relay means and including means for setting the brakes on the train to bring it to a halt.

7. A system of train control including a source of acoustic energy operated at a given definite frequency, acoustic receiving means responsive to the same frequency situated upon a train, and means including a hot wire relay operated by said receiving means for causing the brakes to operate to stop the train.

In testimony whereof I affix my signature.

ERNST WILCKENS.