July 17, 1928. 1,677,816

W. DAYA

RAILWAY SIGNAL APPARATUS

Filed Nov. 18, 1926

Fig.1.

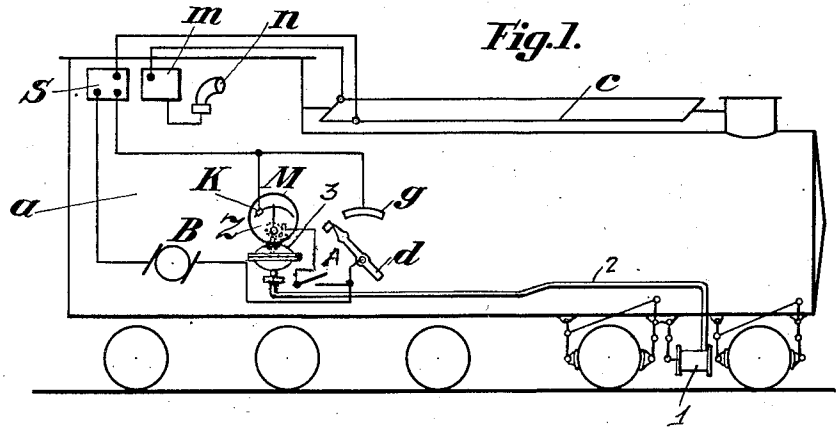


Fig.2.

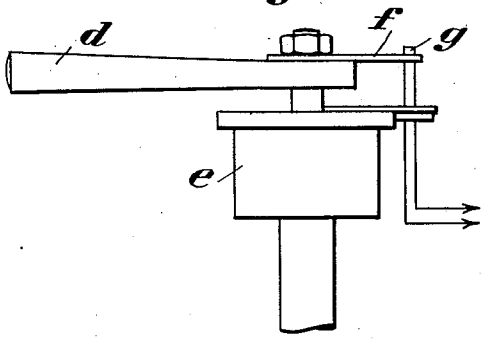


Fig.3.

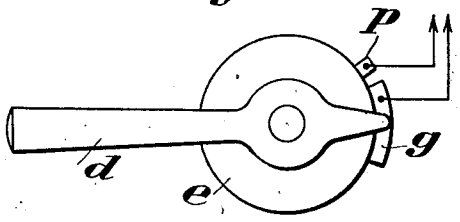
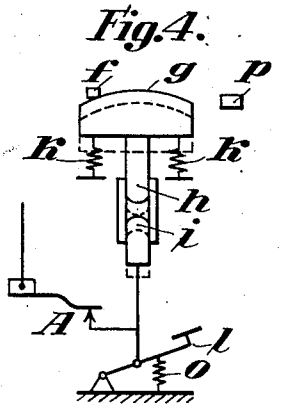


Fig.4.



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UNITED STATES PATENT OFFICE.

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RAILWAY SIGNAL APPARATUS.

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All existing systems of transmitting signals in railway traffic are based on the employment of fixed signalling posts along the rail track. These systems are attended with the known drawback that their operation is dependent on human attention and for this reason the signals may be wrongly set in consequence of wrong information of the block positions or, if properly set, they may be overlooked by the engine drivers. The defects of the existing systems of signalling are most marked, however, when a train is compelled to stop for some reason not prescribed in the running schedule, whether on account of (*a*) the section in front being blocked, (*b*) the train becoming derailed or brought to a standstill through engine trouble, (*c*) the entrance to the station being barred for example by a train already there. Experience has shown that the majority of railway mishaps are attributable to such causes, the driver of a following train generally not having his attention called to the danger until he is so close to the stationary train that he is no longer able to stop his own train in time but collides with the stationary train.

My present invention is concerned with an entirely novel method of transmitting signals for the protection of railway trains; it renders the giving of the signal independent of human attention and presence of mind, and provides direct and automatic transmission of signals between trains without the aid of fixed signalling posts along the rail track.

According to the invention, the desired object is achieved by a radio signal transmitter carried on the train, the signals from which transmitter are caught by a receiver on another train, and the energizing circuit of which transmitter passes through a circuit breaker which is automatically closed when the train brakes are applied. Each train is preferably fitted with a transmitting apparatus and with a receiving apparatus, so that it can receive signals from another train and send out its own signals. The waves emitted by the transmitter of one train can be caught by the receiver on a following train and used for conveying a signal to the driver, or even for automatically setting the brake lever to the "on" position.

Transmitting is preferably by means of short waves, because the generation of these is possible with a small expenditure of energy and greater accuracy in tuning. The arrangement may be such that each transmitter emits different signals the rhythm of which will indicate what train is being approached.

Automatic closing of the contact controlling the energizing circuit of the transmitter may be arranged in positive dependence on the position of the brake lever, by providing that said lever, when in the "on" position, depresses a key which closes the energizing circuit of the transmitter. If, however, it be required that the sending of the signals should also be effected without the intervention of the engine driver as might be needed on the application of the emergency brakes for example, or on the train accidentally breaking in two, then the control of the contact device may be made dependent on the positive or negative pressure in the brake pipes; for example by arranging for the pointer on the brake-pipe gauge to touch a contact when the brakes are applied and thereby close the energizing circuit of the transmitter.

Further details of the invention will now be described with reference to the accompanying drawing, in which Fig. 1 is a diagram of a locomotive fitted with a transmitting apparatus in accordance with the invention, and with a receiver, Fig. 2 shows (to a larger scale) a side elevation of the brake lever arranged for positive control of the circuit breaker, Fig. 3 is a plan corresponding to Fig. 2, and Fig. 4 shows the key controlled by the brake lever.

In Fig. 1, S denotes the transmitting apparatus, fed by a source of current B, one pole of which leads to the brake lever *d* and through a switch A to the pointer Z of the pressure gauge M. A pressure pipe line 2 runs from a pressure diaphragm 3 of pressure gauge M to cylinder 1 for applying the brakes in a well known manner by means of valve *e*. Said lever *d* controls the brake valve *e* (Figs. 2 and 3) and is provided with an extension *f* arranged to move over the curved surface *g* of a key *h* thereby depressing the key to the dotted-line position (Fig. 4). In that position, the key *h* touches the contact *i* and completes the current- or oscillation-circuit of the transmitter so that the latter comes into action. When the brakes are released the lever extension *f* slides away from the curved surfaces *g* of the key *h*, whereby

the key moves, under the influence of springs *k*, into the "off" position and puts the transmitter out of action.

To avoid unnecessary emission of signals when a train is stopping at a station according to schedule, a device may be provided which enables the engine driver to break the circuit whenever it is not necessary for a signal to be sent. For example, a pedal *l* may be provided to enable the contact stud *i* to be brought into the dotted-line position (Fig. 4) where it cannot be touched by the contact *h* even when this is depressed to its lowest position. In order, however, to enable the arrangement to be again made ready for sending at any moment, a spring *o* is arranged to constrain the foot lever *l* and therefore the contact *i*, toward the upper position. The spring *o* may, of course, be replaced by a pneumatic piston or by a time-release. When such a releasing lever or pedal *l* is employed, a second parallel-connection contact *p* is conveniently arranged adjacent the contact surface *g*, against which contact the extension *f* bears in the emergency position, so that, in emergency, signals can be sent in any circumstances and therefore independently of the position of the release lever or pedal.

Aforesaid pressure gauge M enables signals to be sent automatically, even on the application of the emergency brake, without the agency of the engine driver. When the brakes are applied, the pointer Z touches a contact K and thus completes the energizing circuit of the transmitter. The switch A in the circuit of the pressure gauge enables the engine driver to open the circuit when the brakes are applied according to schedule, so that no signal will be sent out. If both a contact pressure gauge M and a key *h* controlled by the brake lever be employed for completing the energizing circuit of the transmitter, it is advisable to couple the pedal *l* for the key with the switch A in such manner that when the pedal is depressed, the switch A is opened. This may be done, for example, in the manner represented in Fig. 4.

In the embodiment of the invention according to Fig. 1, the engine driver's cab is provided not only with a transmitting apparatus, but also with a receiver *m* which may serve either for checking the operation of the transmitter itself and/or for the reception of extraneous signals. Said receiver may be fitted with an optical, acoustic or other signal device *n*, which will draw the attention of the engine driver to the stoppage of a train in front.

The transmitting apparatus and the receiver *m* are connected in the usual way with an aerial *c* arranged for instance above the boiler of the locomotive.

The invention is not restricted to the embodiment described and illustrated as numerous modifications are possible without departing from the scope of the invention. For example, the transmitter may be arranged to be in continuous operation throughout the journey, and be stopped only when the brakes are applied. With such a modification the signal controlled by the receiver will respond only when the operation of the transmitter is interrupted. It is also unnecessary to employ for the closing of the circuit, a pressure gauge dependent on the pressure existing in the brake pipe; other devices responding to differences in pressure may be used instead. Finally, the switch A, that is the key *l*, arranged in series with the control contact, may be of such construction as to set up periodical opening and closing, and definite rhythmic signals, when the train is braked and stopped according to schedule.

Having now fully described my invention, what I claim and desire to secure by Letters Patent is:—

1. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, pressure operated means for automatically applying the brakes in emergency, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter, a contact switch included in the circuit arranged to be closed by the brake control lever, and means for energizing and de-energizing the transmitter dependent upon the pressure operated means.

2. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, pressure operated means for automatically applying the brakes in emergency, a radio transmitter of signals, a circuit for energizing the transmitter, a contact switch included in the circuit arranged to be closed by the brake control lever, means for energizing and de-energizing the transmitter dependent upon the pressure operated means, and means for preventing energizing of the transmitter when the brakes are to be applied according to schedule.

3. In a railroad vehicle, the combination with the vehicle brakes, of pressure operated means for automatically applying the brakes in emergency, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter, and means for closing the circuit dependent upon the pressure operated means.

4. In a railroad vehicle, the combination with the vehicle brakes, of a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter having one ter-

minal at the contact stud and another terminal at the brake control lever, and means acting to constrain the key normally away from engagement with the contact stud.

5. In a railroad vehicle, the combination with the vehicle brakes, of a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from engagement with the contact stud, and means enabling the contact stud to be moved to a position where it cannot be engaged by the key.

6. In a railroad vehicle, the combination with the vehicle brakes, of a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from engagement with the contact stud, a pedal connected with the contact stud by which this can be moved at will to a position out of reach of the key, and spring means for returning the contact stud on the pedal being released.

7. In a railroad vehicle, the combination with the vehicle brakes, of pressure operated means for automatically applying the brakes in emergency including a pressure gauge, a radio receiver of signals, a radio transmitter of signals, and a circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer.

8. In a railroad vehicle, the combination with the vehicle brakes, of pressure operated means for automatically applying the brakes in emergency including a pressure gauge, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, and a manually operable switch in the circuit.

9. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio receiver of signals, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the lever, and a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer.

10. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, a pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal for moving the contact stud at will out of reach of the key, and a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer.

11. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal for moving the contact stud at will out of reach of the key, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, and a switch in the second circuit.

12. In a railroad vehicle, the combination with the vehicle brakes, of a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal

for removing the contact stud at will out of reach of the key, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in tne path of movement of the pointer, a switch in the second circuit, and means operatively connecting the pedal and the switch.

13. In a railroad vehicle, the combination of brakes for the vehicle, a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, and a radio receiver of signals.

14. In a railroad vehicle, the combination of brakes for the vehicle, a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from engagement with the contact stud, and a radio receiver of signals.

15. In a railroad vehicle, the combination of brakes for the vehicle, a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from engagement with the contact stud, means enabling the contact stud to be moved to a position where it cannot be engaged by the key, and a radio receiver of signals.

16. In a railroad vehicle, the combination of brakes for the vehicle, a brake control lever, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from engagement with the contact stud, a pedal connected with the contact stud by which this can be moved at will to a position out of reach of the key, spring means for returning the contact stud on the pedal being released, and a radio receiver of signals.

17. In a railroad vehicle, the combination of brakes for the vehicle, pressure operated means for automatically applying the brakes in emergency including a pressure gauge, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, and a radio receiver of signals.

18. In a railroad vehicle, the combination of brakes for the vehicle, pressure operated means for automatically applying the brakes in emergency including a pressure gauge, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, a manually operable switch in the circuit, and a radio receiver of signals.

19. In a railroad vehicle, the combination of brakes for the vehicle, a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the lever, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, and a radio receiver of signals.

20. In a railroad vehicle, the combination of brakes for the vehicle, a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal for moving the contact stud at will out of reach of the key, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, and a radio receiver of signals.

21. In a railroad vehicle, the combination of brakes for the vehicle, a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be

moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal for moving the contact stud at will out of reach of the key, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, a switch in the second circuit, and a radio receiver of signals.

22. In a railroad vehicle, the combination of brakes for the vehicle, a manually operable brake control lever, pressure operated means including a pressure gauge for automatically applying the brakes in emergency, a slidably mounted key arranged to be moved by the lever when this is set to apply the brakes, a movable contact stud adapted to be engaged by the key, a radio transmitter of signals, a circuit for energizing the transmitter having one terminal at the contact stud and another terminal at the brake control lever, means acting to constrain the key normally away from the contact stud, a pedal for moving the contact stud at will out of reach of the key, a second circuit for energizing the transmitter having one terminal at the pressure gauge pointer and another terminal at a predetermined point of the gauge in the path of movement of the pointer, a switch in the second circuit, means operatively connecting the pedal and the switch, and a radio receiver of signals.

23. In a railroad automatic signalling apparatus for use in preventing collisions, comprising a radio transmitter, a circuit for energizing the transmitter and means in cooperative relation with the brake actuating means, closing the said circuit on the application of the vehicle brakes so as to energize the said transmitter only if the brakes are actuated.

In testimony whereof I have affixed my signature.

WERNER DAYA.