

S. M. YOUNG.

AUTOMATIC SYSTEM OF BLOCK SIGNALING FOR ELECTRIC RAILWAYS.

APPLICATION FILED MAY 4, 1908.

1,082,840.

Patented Dec. 30, 1913.

2 SHEETS—SHEET 1.

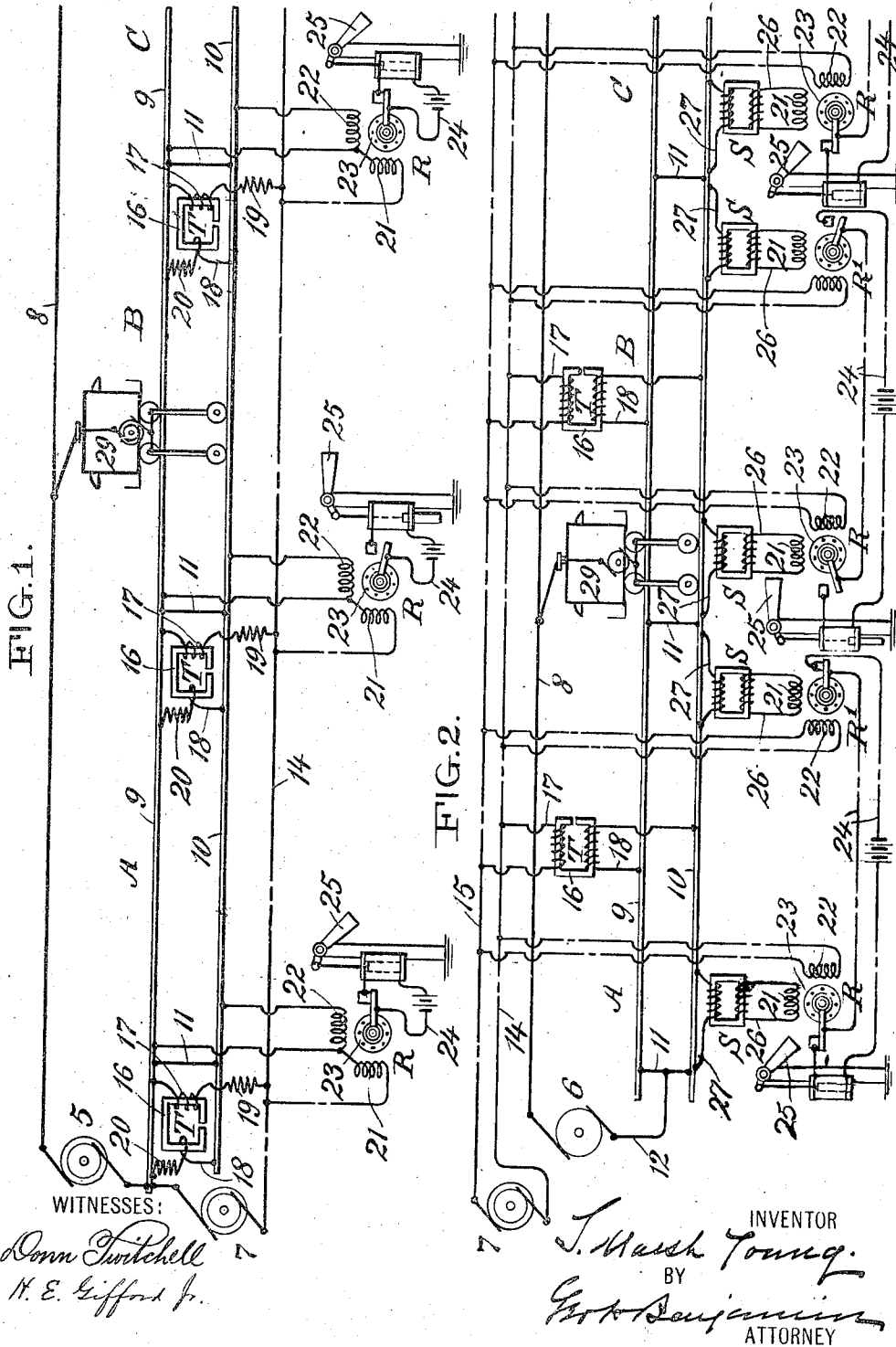


FIG. 3.

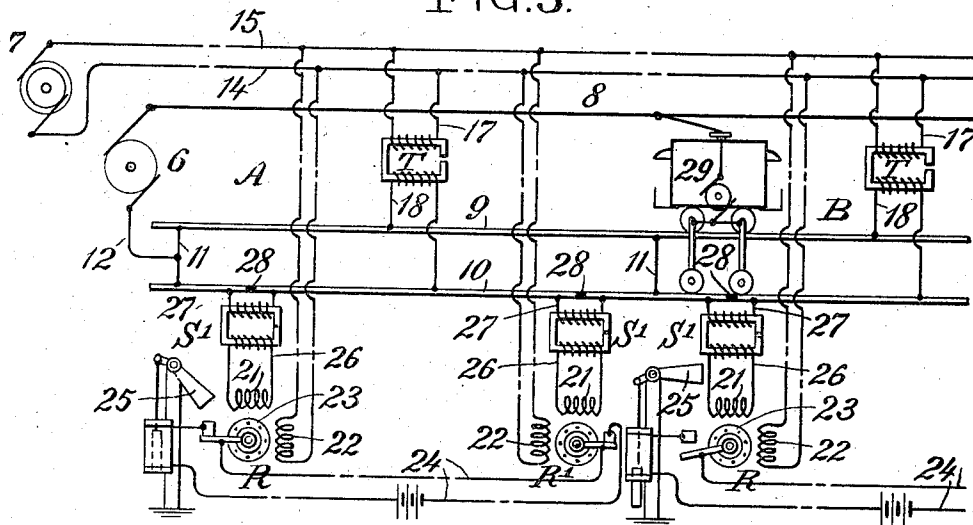


FIG. 4.

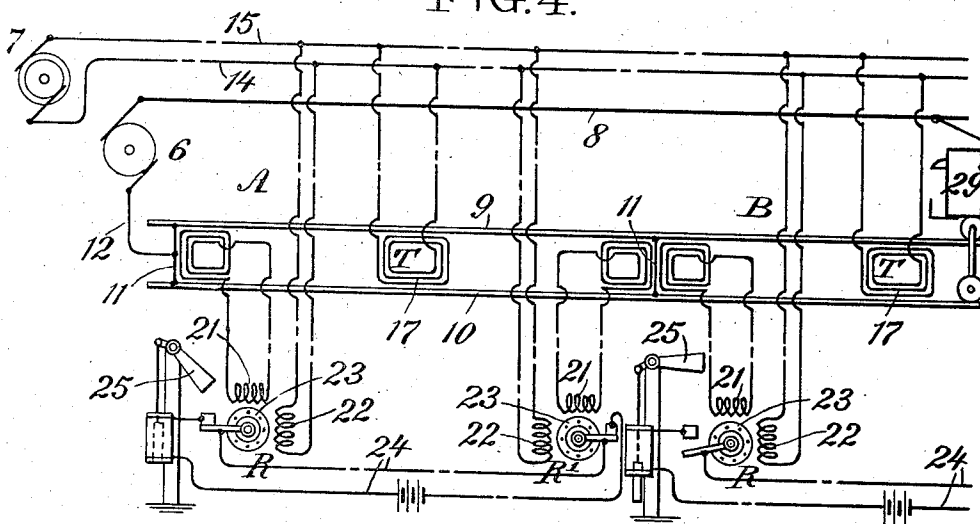
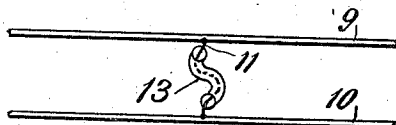


FIG. 5.



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AUTOMATIC SYSTEM OF BLOCK-SIGNALING FOR ELECTRIC RAILWAYS.

1,082,840.

Specification of Letters Patent.

Patented Dec. 30, 1913.

Application filed May 4, 1908. Serial No. 430,721.

To all whom it may concern:

Be it known that I, SAMUEL MARSH YOUNG, a citizen of the United States, residing at New York city, county and State of New York, have invented an Automatic System of Block-Signaling for Electric Railways, of which the following is a specification.

My invention relates to automatic systems of block signaling for electric railways.

In certain applications heretofore made by me and now pending and in certain patents obtained by me, I have described an "automatic system of block signaling," comprising, a source of propulsion current, a conductor leading therefrom and arranged parallel with the track rails, both of which are connected to the power generator and serve as separate returns for the propulsion current, means for dividing the railway into block sections, a source of signaling current, means for impressing the signaling current upon each block section, and means in each block section normally energized by the signaling current in the block section, and de-energized by the movement of a motor vehicle into the block section, for controlling signals or other devices for controlling traffic. The essential requirements of such combination of elements, so far as signaling is concerned, consists in dividing the railway into a series of closed track circuits, impressing an alternating current upon the track circuits, utilizing the alternating current to energize signal controlling devices and providing means whereby the action of the signaling current will be limited to the signal controlling devices in the closed track circuits, the object of my invention, as described in said applications and patents being (a) to maintain the integrity of the usual electric railway system, where both rails serve as separate returns for the propulsion current, thus insuring a return path for the propulsion current to the generator, in case of the rupture of either rail by reason of a defective joint or broken rail; (b) to provide that the movement of a train into and out of a block section, shall control the signals, and that the apparatus employed shall not be susceptible to the action of the propulsion current or stray currents.

My present application involves the same general system and mode of operation, described and shown in my prior applications and patents, and is intended to describe and

show various specific modifications, as for instance;—in my former applications and patents, I have described the employment of reactances as a means for limiting the action of the signaling current impressed upon the block sections, to the translating devices within the block sections, and several types of reactance devices were shown and described; in my present application the reactance employed to confine the signaling current to the limits of the block sections, is induced within the substance of the track rails by the impressed current. In my former applications and patents, the means employed for impressing the alternating current upon the block sections consisted of transformers with their secondaries connected directly to the rails. In the present application, in Figure 4, I have illustrated a construction, where the conductors of the closed track circuits form the secondaries of the energy transformers. In my prior applications and patents I have described and shown the translating devices for controlling the signals as arranged in shunt across the rails. In my present application, Fig. 2, I show the translating devices in shunt of one of the rails and in Fig. 4, as in inductive relation with the conductors of the closed track circuits, the closed track circuits in this arrangement forming the primaries of transformers and the coils of the translating devices the secondaries of such transformers.

In my former applications and patents, I have described and illustrated a reactance device, which may be given two forms, *i. e.*, that known as an "air bond," which consists of a body of insulated twisted wires, and that known as a "core bond," which consists of a laminated core and a coil or coils thereon. These two forms are respectively illustrated in Figs. 2 and 3 of my prior Patent No. 757,537. In an application filed in the name of S. Marsh Young and Fitzhugh Townsend on November 21st, 1903, other types of reactance devices are disclosed, for instance, in Fig. 1, the arrangement is such that reactance is created within the body of the conductors of the closed track circuits, the rails being joined at the opposite ends of the track circuits or block sections by cross conductors. In Figs. 4 and 5 the employment of a metallic sleeve in connection with the cross conductors is illustrated.

In my former applications and patents, I

have described the employment of tractive relays, rotary relays, and polyphase relays. In my present application I have described the employment of polyphase relays which may be actuated, either by two phases derived from the signaling current, or one phase derived from the propulsion current and one phase from the signaling current.

I wish it understood that I consider the description and illustrations of this application as presenting no new system, but as before stated, merely different specific embodiments of my system, as set forth in my Patent No. 757,537, which patent contains the following statement: "I wish it understood that I do not limit myself in any wise to the particular details of construction shown, as it is manifest that many changes may be made therein and yet embody the same general inventive idea."

"I have not entered into a detailed account of the electrical actions taking place in the system or the effect thereon of transformers, reactance-bonds, with or without iron, condensers, &c., as it would require too long a description. The general features of construction as described are all that is necessary for an electrician to install and operate the system, the size and character of the transformers, the size and character of the reactance-bonds, &c., all being matters which may be readily determined by experiments, having in mind the character of the currents employed, the length of the blocks used, the reactance of the rails, and other features and details within the knowledge of electric-railway engineers."

The accompanying diagrams which show modifications of my system will serve to illustrate my invention, in which—

Fig. 1 illustrates my system as designed for employment with an alternating power current with continuous track rails divided into block sections by cross conductors and the translating devices having one member connected across the rails. Fig. 2 illustrates my system as designed for employment with a direct power current with continuous track rails divided into sections by cross conductors and the translating devices having one member in shunt with one rail. Fig. 3 corresponds to Fig. 2, with the exception that one rail is broken between the terminals of one member of each relay; thus diverting the whole power current from the rail through one member of each relay. Fig. 4 is a similar view with the energy transformers and one member of each relay arranged in inductive relation with the closed track circuits. Fig. 5 is a detail view of the rails and a cross bond with an iron sleeve on the bond.

In the diagrams, Figs. 1 and 2, the track is shown as divided into three block sections A, B, C; 5, Fig. 1, indicates an alternating

power generator and 6, Figs. 2, 3 and 4, a direct power generator. The generator 6 of Fig. 3 may be an alternating power generator; 7 in all of the figures is an alternating signaling generator; 8 indicates the power feeder, which may be a conductor arranged along the railway or a third rail; 9, 10, are the rails, which are mechanically and electrically continuous for all currents, that is, these rails are bonded together in the usual manner for electric railways. They are also bonded together by cross conductors 11 at each end of each block section, the position of these cross conductors determining the length of the block sections. The rails are both connected to one terminal of the power generator, as, for instance, by the conductor 12, Figs. 2, 3 and 4. In Fig. 1, the cross conductor 11 forms the connecting member. Each block section forms a closed track circuit, such closed track circuit consists of the rails 9, 10, and two bonds 11 at opposite ends of a block section. The bonds or cross conductors 11 may be formed as shown in Figs. 1, 2, 3, and 4, or as shown in Fig. 5, that is, provided with an iron sleeve 13, the purpose of this sleeve is to set up a reactance. It will be understood that the cross conductor 11 presents some slight reactance, that the use of the sleeve 13 increases the reactance, and that such reactance may be still further increased by adopting either of the form of bonds shown in my Patent No. 757,537. Under ordinary conditions the reactance of the rails 9, 10, and that of the cross bonds 11 will be sufficient for practical purposes, as will be further described, but I wish it understood that I may, if I desire, increase the reactance by the use of the instrumentalities heretofore described and shown by me in my prior applications and patents. The primary purpose of employing the sleeve 13 as shown in Fig. 5 upon the cross bond 11, is to increase the reactance of the path through bond 11 to such a point that the consumption of signaling current required by the track circuit will not exceed an economical limit, and the particular mode of increasing the reactance also protects the bond from mechanical injury. Leading out from the signaling generator 7 in Fig. 1, is a conductor 14. In Figs. 2, 3, and 4, two conductors are shown 14, 15. In Fig. 1, the rail 9 corresponds to the conductor 15 of the other figures. Situated at one end of each block section in Fig. 1, is an energy transformer T provided with a core 16 having its primary 17 connected across the rail 9 and the conductor 14, and its secondary 18 connected across the rails. I may insert in the primary and secondary of this transformer, resistances 19, 20, which serve a purpose well known in the art. Located at the opposite end of the block section is a

translating device R, *i. e.*, a signal controlling device, which is shown in the form of a polyphase relay, one coil 21, of the stator member of which, is connected across the rail 9 and the conductor 14, and the other member 22 across the rails 9, 10, and having its rotor member 23 connected in a local circuit 24 with any suitable form of signal 25. Manifestly the design of the translating device is immaterial, that is, it may be a relay device or local circuit or a motor to mechanically act upon a signal or equivalent device to control traffic, provided it be such that it is only susceptible to the action of the signaling current, or the conjoint action of two current phases, one derived from the power current, and the other from the signaling current. In Fig. 2 the energy transformer is situated at the middle of the block and has its primary 17 across the conductors 14, 15, and its secondary across the rails 9, 10. Translating devices R, R' in this figure, are located at the opposite ends of the block and are shown as polyphase relays. Each member 21 in this form, forms the secondary 26 of a transformer S having its primary 27 in shunt of the rail 10. The other member 22 of the relay is connected across the conductors 14, 15. The translating devices in this figure are both connected in the local circuit 24, from which it will be seen that in this figure the short circuiting of a primary 27 of a transformer S at either end of a block, will give a danger signal.

The arrangement shown in Fig. 3 corresponds to that shown in Fig. 2, with the exception that the rail 10 is divided into sections by the insulations 28. The primary 27 of this transformer S' is in shunt of the rail 10, as in Fig. 2, but the whole power current flows through the primary. If desired the power generator 6 shown in this figure may be made an alternating generator, and assuming the number of cycles from such generator to correspond with that of the signaling generator, the relays will be controlled by one phase taken from rail 10 and one phase taken from across the conductors 14, 15, thereby differing from the construction shown in the other figures, where the relays are controlled by two phases derived from the generator 7. The only purpose of introducing the insulation 28 is to increase the strength of the phase traversing coil 21. In Fig. 4 the energy transformer T is shown as having its primary 17 arranged in inductive relation with the rails 9, 10. By this arrangement, each closed track circuit forms the secondary of the energy transformer of the block section. The translating devices also are arranged in a similar manner. In this case each coil 21 is in inductive relation with rails 9, 10, of the closed track circuits. In practice this arrangement is found to be of advantage in

that—the electric railway system as commonly employed is in no wise altered by connection to the signaling apparatus, the electric railway system and the signaling system being physically distinct, although in inductive relation. 29 indicates a motor car.

The operation of the system will be readily understood. Each energy transformer causes alternating current to flow in the closed track circuits and to energize the translating devices of said circuits which close local circuits, or otherwise control the signals to show "clear."

In laying out a system, the frequency of the signaling current, the reactance of the rails and cross bonds is determined and fixed so that the reactance of the rails will confine the current to the limit of the block sections; or in other words, reactance will oppose the signaling current derived from the energy transformers, in an amount sufficient to prevent the signaling current flowing into adjacent blocks and thus operate the translating devices of adjacent blocks. In short it will be seen that my system depends upon the principle of impressing an alternating current upon the track rails, utilizing said current to normally actuate signal controlling devices within the limit of the block section and restricting said impressed current to the limit of the block section upon which it is impressed.

It will be understood by electricians that the reactance of the rails will depend upon the frequency of the currents transmitted over them, thus if the power current be given a frequency of 20 cycles and the signaling current a frequency of 60 or more, the rails will transmit the power current back to the generator without opposing reactance, but on the other hand, will oppose sufficient reactance to the signaling current impressed upon each block to confine it to the limits of the block. It will be further understood that the operation of the system is the same irrespective of whether the opposing reactance to the signaling current is set up in the rails forming a part of the closed track circuits, or by means of reactance devices interposed between the divided ends of one rail or two rails as disclosed in my prior applications and patents, the effect being the same in each case. It will be further understood that in order to obtain a closed track circuit, such as is disclosed in this application and in the prior application made in the name of Young and Townsend, both rails cross connected must be employed and preferably as separate and independent returns for the power current to the power generator.

In this application I have described the rails as continuous, and by that term I wish to have understood mechanically continu-

ous, as rails, to support the motor vehicles thereon, and electrically continuous through bonds of any type for any class of current that may be fed to or produced in said rails, having in view the normal resistance and reactance of such rails presented to the type and frequency of current on them.

Having thus described my invention, I claim:

- 10 In a block signaling system, in combination with an electric railway having both rails conductively continuous for all currents, sources of alternating current connected across the rails at intervals, im-

pedances connected across the rails at points between said sources, track relays, each connected in shunt to a short length of track rail adjacent to one of said impedances, said rail lengths being alone sufficient to provide the necessary drop in potential for operating the relays, and signals controlled by said relays. 20

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

SAMUEL MARSH YOUNG.

Witnesses:

W. A. TOWNER, Jr.,

H. E. GIFFORD, Jr.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."