Oct. 7, 1930. L. H. PETER 1,777,651

RAILWAY SIGNALING SYSTEM OF THE TRACK CIRCUIT TYPE

Filed Jan. 14, 1928

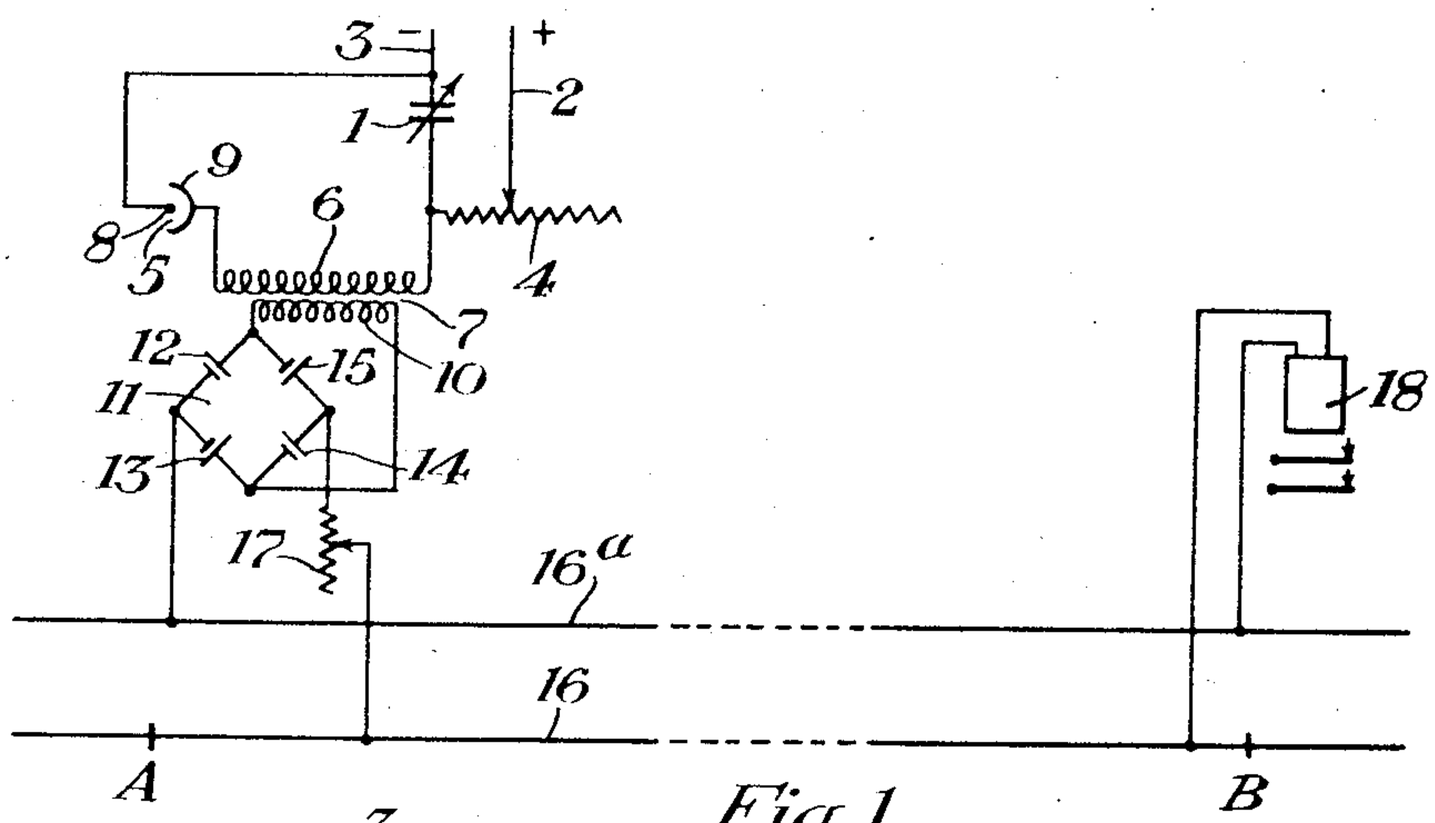

Fig. 1.

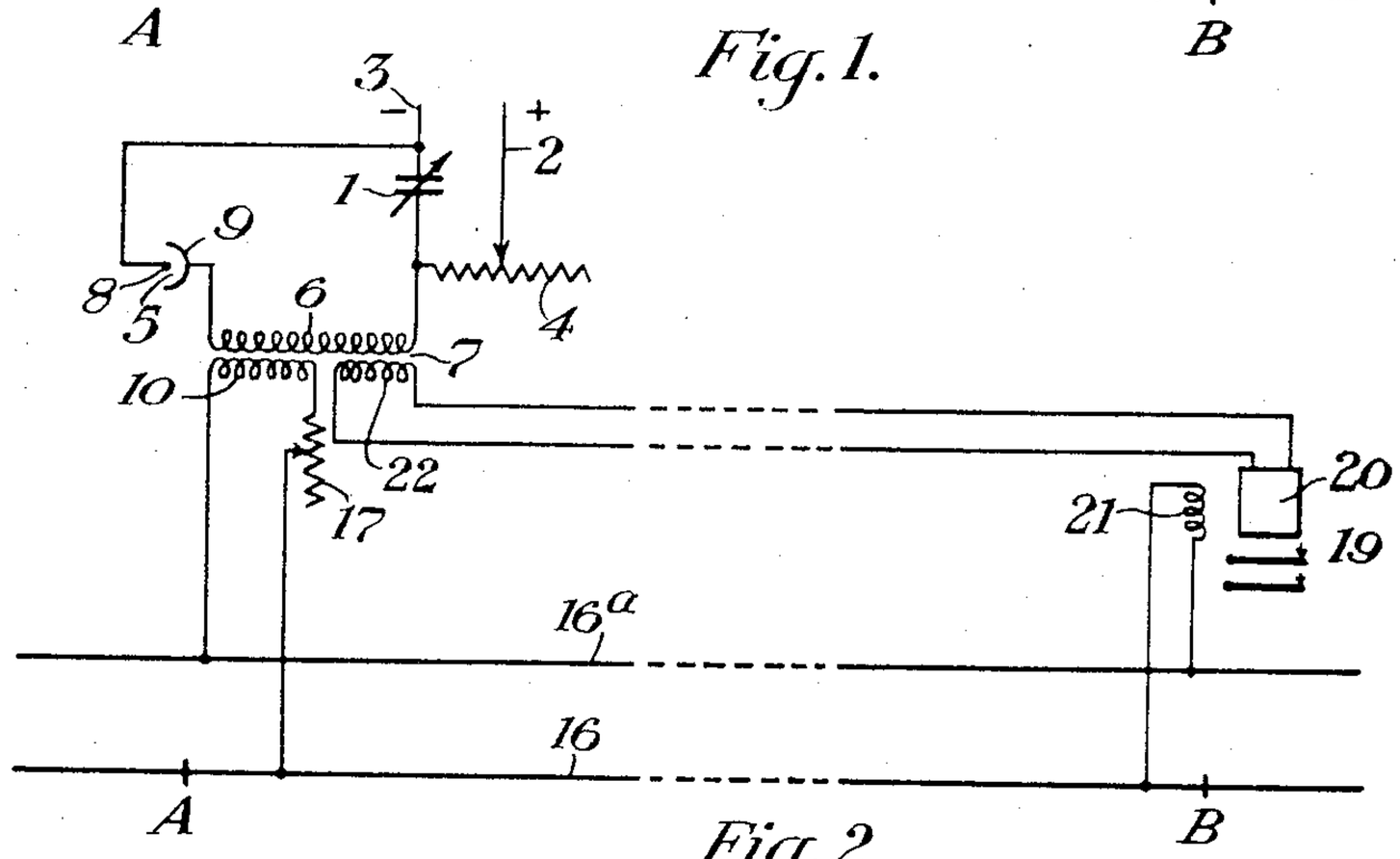

Fig. 2.

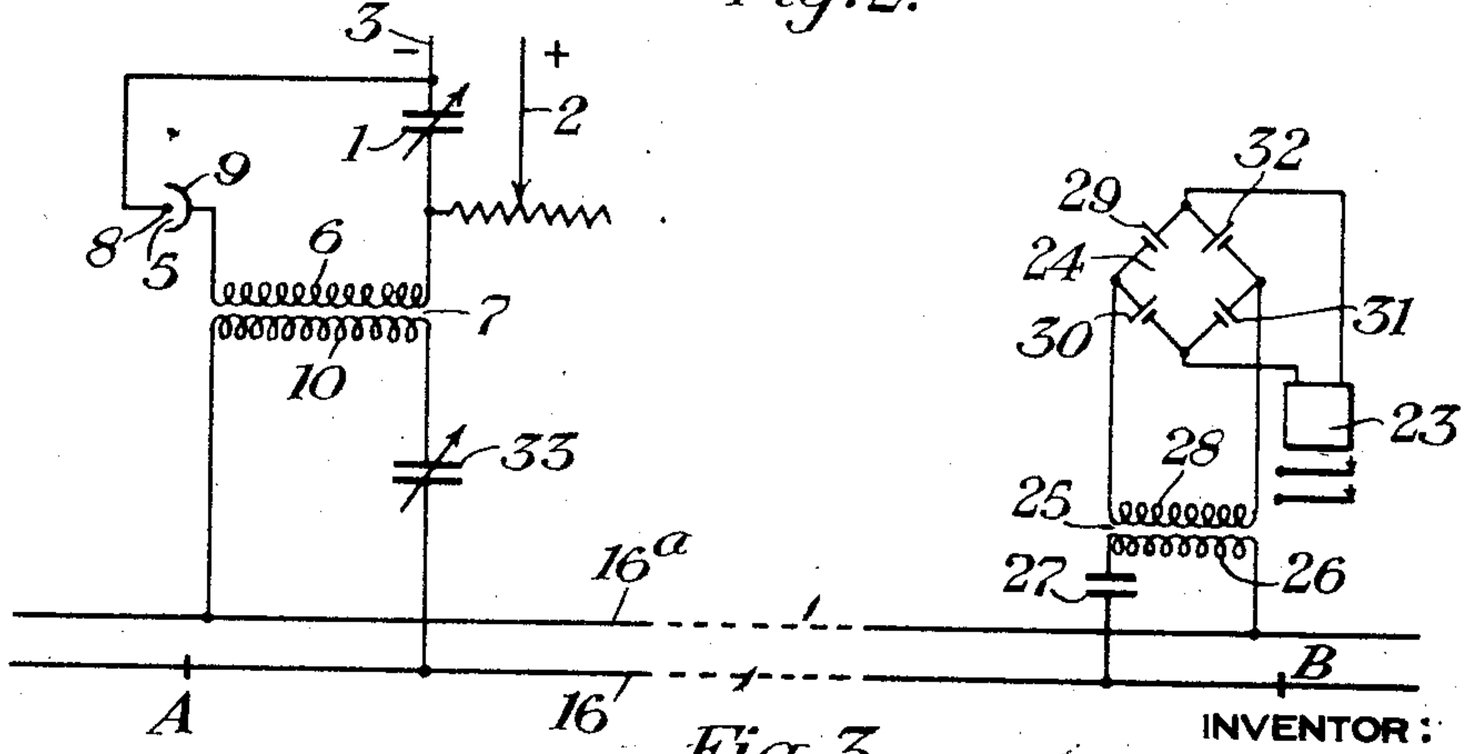

Fig. 3.

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UNITED STATES PATENT OFFICE

LESLIE HURST PETER, OF LONDON, ENGLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNION SWITCH & SIGNAL COMPANY, OF SWISSVALE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

RAILWAY SIGNALING SYSTEM OF THE TRACK-CIRCUIT TYPE

Application filed January 14, 1928. Serial No. 246,693, and in Great Britain January 28, 1927.

My invention relates to railway signaling systems of the track circuit type, and has for its object to provide arrangements whereby signaling current of suitable character may be supplied to the track circuit from a source of direct current at a relatively high voltage.

In the case of steam railways a convenient source of power for signaling purposes is, in certain cases, the direct current supply utilized for lighting or power at an ordinary standard and relatively high voltage, but under these conditions the necessary reduction of the direct current voltage to that required for signaling purposes to be impressed upon the track circuit cannot be effected by any arrangements involving the direct connection of one terminal of the supply circuit to the track rails as this would necessarily involve earthing one pole of the supply circuit.

In the case of electric railways it is, in certain cases, convenient to obtain a supply of signaling current from the third rail, or overhead conductor, of the system, to which direct current for propulsion purposes is supplied, but in such cases not only is the traction voltage unsuitable for signaling, but the relays and other track circuit apparatus employed must necessarily be rendered immune to operation by the propulsion current.

In both the cases above considered, the necessary reduction of voltage to that required for signaling purposes can obviously be effected by the use of motor generators, but the initial cost and the cost of maintenance of such generators, particularly at outlying points in a railway system, renders such an arrangement prohibitive, as will be readily understood.

The present invention enables these difficulties to be overcome by providing arrangements whereby signaling current at the necessary relatively low voltage and under suitable conditions can be obtained from a relatively high voltage supply of direct current such as those above indicated without requiring the employment of any apparatus involving moving parts, and in a relatively economical and efficient manner.

According to the principal feature of the present invention the relatively high voltage direct current constituting the original source of supply is arranged to be first converted into an interrupted or pulsating current by any suitable device, such as a neon or other vacuum tube, or a vibratory or other device, capable of periodically interrupting the direct current, this interrupted current being supplied to the primary winding of a transformer, the secondary winding of which is connected to the track circuit either directly, or through a static rectifier, the transformation ratio being such that the voltage impressed upon the track circuit is suitable for signaling purposes.

The invention will now be described by way of example with reference to the accompanying drawings in which corresponding elements of the various systems illustrated therein are indicated by similar reference numerals, and in which Fig. 1 is a diagrammatic view of a system having as the source of supply of current a direct current lighting or power circuit at an ordinary standard voltage.

Figs. 2 and 3 being diagrammatic views of modifications of the system illustrated in Fig. 1, adapted for utilizing as the source of supply of signaling current the third rail or overhead conductor of an electric railway system.

Referring first to Fig. 1 it will be observed that a condenser 1, preferably of variable capacity as indicated in the drawing, is connected across the direct current supply conductors 2, 3 in series with a variable resistance 4, a neon or other vacuum tube 5 being connected in series with the primary wind-

ing 6 of a transformer 7 across the condenser terminals. The negative supply conductor 3 is connected to the cathode 8 of the neon tube 5, the anode 9 of which is connected through the transformer primary winding 6 to the other or positive terminal of the condenser 1. The terminals of the secondary winding 10 of the transformer 7, which has a suitable transformation ratio, are connected to the diagonally opposite points of a rectifier system 11 comprising four rectifier units 12, 13, 14 and 15, preferably of the copper oxide type arranged in the well-known Wheatstone bridge connection, the other diagonally opposite points of the rectifier system 11 being connected respectively to the track rail 16 through a suitable adjustable resistance 17 and to the track rail 16[a].

The operation of the system is as follows:—

The direct current voltage of the supply circuit is impressed upon the condenser 1 through the variable resistance 4, and the condenser 1 thereby becomes charged until its reactive voltage attains a value sufficient to cause a discharge between the anode 9 and cathode 8 of the neon tube 5. When this occurs, a surge of current passes through the primary winding 6 of the transformer 7, and as soon as the voltage across the condenser 1 is thereby reduced to a value insufficient to maintain the discharge from the neon tube 5 the circuit including this tube is interrupted, this cycle of operation being repeated periodically. The current traversing the primary winding 6 of the transformer will thus consist of successive surges of unidirectional current which are converted by the transformer 7 into alternating current of reduced voltage, this alternating current being rectified in the rectifier system 11 and supplied to the track rails 16, 16[a] of a block section A—B as a unidirectional pulsating current. It will thus be understood that the signaling current actually traversing the track rails 16, 16[a] is a unidirectional current, and the relay such as is indicated at 18 and other signal apparatus connected to the track circuit will thus be of the direct current type.

The arrangement above described is suitable for cases in which a relatively small amount of signaling energy is required and if desired a number of supply units each arranged in the manner above described may be connected in parallel between the supply circuit conductors 2, 3 and the track circuit. For direct current circuits of higher voltage the neon tube 5 may be replaced by an argon tube, and an increased current output can be obtained by the use of a mercury vapor tube. It will thus be appreciated that the invention is not limited to any particular type of device for effecting the intermittent surges in the primary winding 6 of the transformer 7.

An application of the invention to a case in which the source of supply of signaling current is the third rail or overhead conductor of an electric railway system is illustrated in Fig. 2 of the same general arrangement being adapted with the omission of the rectifier system 11 (Fig. 1) the secondary winding 10 of the transformer 7 being connected directly to the track rails 16, 16[a], through a suitable variable resistance 17. In this case the signaling current actually traversing the track circuit is an alternating current, and the relay such as is indicated at 19 and other signal apparatus are of the alternating current type. The relay indicated at 19 in Fig. 2 is a two-element relay having elements 20 and 21 the current supplied to element or winding 20 of the relay 19 being preferably obtained as illustrated from a second secondary winding 22 of the transformer 7, the other winding 21 being connected across the track rails 16, 16[a], in the usual manner.

In Fig. 3 a modification of the system described above with reference to Fig. 2 is illustrated. Referring now to Fig. 3 a relay 23 of the direct current type is employed by interposing a rectifier system 24 in the connection of the relay 23 to the track circuit, this connection preferably including a transformer 25 the primary winding 26 of which is connected through a condenser 27 to the track rails 16, 16[a], the secondary winding 28 of the transformer 25 being connected to the diagonally opposite points of the rectifying system 24 which comprises four rectifying units 29, 30, 31 and 32 preferably of the copper oxide type, arranged in a Wheatstone bridge connection, the other diagonally opposite points of the rectifying system 24 being connected to the terminals of the relay 23. At the supply end of the block section a condenser 33 preferably of the variable capacity type as indicated in the drawing is included in the connection of the secondary winding 10 of the transformer 7 and the track circuit.

The operation of the systems described above with reference to Figs. 2 and 3 is similar to that of the system described with reference to Fig. 1 and will be readily apparent without further description.

My invention is evidently not limited to the particular arrangements and connections above described by way of example, which may be varied in many respects within the scope of the invention in order to meet particular conditions of operation.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

A railway signaling system of the track circuit type comprising a source of direct

current of relatively high voltage, means for converting said direct current into pulsating current, a step-down transformer the primary of which is supplied with such pulsating current and the secondary of which is connected with the track rails, and a rectifier interposed between said secondary and the track rails for converting the alternating current traversing the secondary into unidirectional current.

In testimony whereof I affix my signature.

LESLIE HURST PETER.