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(54) DEVICE FOR DETECTING VEHICLE ON TRACK

VORRICHTUNG ZUR FAHRZEUGERKENNUNG AUF EINER SPUR

DETECTEUR DE VEHICULES SUR UNE PISTE

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Description

Technical Field

The present invention relates to a vehicle detecting apparatus for detecting whether or not a vehicle is present on a railroad or on rails in a marshaling yard.

Background Technique

As the vehicle detecting apparatus in a railway signal system, there is known a railway relay in which rails are used as parts of a circuit, a short circuit is formed between two rails through wheels and a wheel shaft when a train is present on a track and the change of the voltage by the formation of the short circuit is read to actuate the relay and detect the presence or absence of the vehicle. More specifically, a predetermined length of the track is divided into sections, and rails of the specific section are utilized as parts of an electric circuit. If a short circuit is formed between the rails by a train present on the track, the presence of the vehicle in this section is detected by an electromagnetic track relay. Various safety devices of the railway signal system are controlled by this detection signal. As one of the railway relay of this type, there is known an alternating current railway relay which is actuated by an alternating current flowing in rails.

For example, an alternating current railway relay disclosed in a pamphlet published by LM ERICSSON Signalling Systems Department, Stockholm, Sweden is driven and controlled by utilizing a semiconductor switch. Generally, this alternating railway relay comprises an electric circuit including a first transformer for the input of an alternating current local signal applied as a reference signal to rails of the specific section, a second transformer for the input of a track signal, which is connected to rails on which a train runs, a third transformer for putting out a train detection judgement signal, a plurality of thyristors, a plurality of diodes and an output relay to be actuated based on the detection signal of the third transformer.

Generally, the phase of the track signal for the specific closed section is made different by π from that for the adjacent precedent section. When the phase of the track signal of the specific section becomes in agreement with the phase of the local signal and the voltage level of the track signal is maintained at a level above a predetermined value because of formation of no short circuit between the rails, that is, only when these two conditions are satisfied, an alternating current output is generated on the secondary side of the third transformer, and a signal of the absence of a train is put out to excite the railway relay.

On the other hand, if a short circuit is formed between the rails through a train, the voltage level is reduced below the predetermined value, and therefore, no output is generated on the secondary side of the third transformer and the railway relay is placed in the non-excited state, whereby the presence of a vehicle in the specific section is indicated.

In the case where an electric short circuit is formed between the specific section and the adjacent section, the voltage level is reduced to zero by the formation of this short circuit since there is the phase difference π between both the sections, and the presence of a vehicle is similarly informed.

In this conventional apparatus, the phase of the track signal is made different in respective track sections, and the presence of a vehicle is informed based on the result of the judgement of the voltage level and phase of the track signal.

In the conventional apparatus, however, since the phase judgement and the level judgement are performed by one thyristor, the noise resistance is extremely poor.

Namely, in order to judge the phases of the local signal and track signal precisely, it is most advantageous to detect the zero level at which the polarity of the signal is changed. In the judgement of the receipt level, a noise is greatly perceived at the judgement of the zero level and the noise resistance is poorest at this point. In order to prevent this defect, it is expedient that the threshold level for receipt of signals is elevated to broaden the noise-insensitive region. On the other hand, the judgement of the phase is precise when the alternating current signals, that is, the track signal and local signals, are close to the zero points, because the judgement is hardly influenced by changes of amplitudes of the signals. In the conventional apparatus, however, since both the judgement of the phase and the judgement of the receipt level are performed based on the gate voltage of one thyristor, it is impossible to simultaneously satisfy the above-mentioned contradictory requirements, that is, increase of the threshold level at the level judgement and reduction to the zero point at the phase judgement, and therefore, it is impossible to perform the phase judgement precisely and a high precision cannot be expected in the judgement of the presence or absence of a vehicle in the specific track section.

Furthermore, in the conventional apparatus, the output relay is operated by the on-off operation of the local signal by the thyristor through the first and third transformers, and the conventional apparatus cannot be integrated as a detection apparatus having so-called intelligent functions necessary for a train detection sensor, such as the function of a precise level judgement and the filter function. Moreover, in the case where a trouble such as formation of a short circuit or disconnection is simultaneously caused in a plurality of thyristors, the level judgement of the track signal becomes impossible and even if a train is present and the track signal is at the low level, the circuit is constructed and an output is generated in the third transformer, with the result that no fail-safe effect is attained. This is a defect which is essentially caused because the voltage exciting the output relay depends on the frequency of the input signal, that is, the third transformer directly treats the frequency of the input signal.

Another alternating current track circuit is shown in a United States Patent 4,065,081. The track circuits are a kind of coded track circuits wherein one of rate codes is modulated by a local signal, the modulated code signal is delivered from a code transmitter through a typical track section and received by a receiver, the received signal which is applied as a track signal is demodulated to attain the code signal, a level judgement and a phase judgement of the demodulated code signal are performed and then existence or nonexistence of a vehicle on the track section is detected based on the both judgements.

However this prior art code track circuit performs the local judgement of the track signal based on the level judgement of the code signal.

DE-A-2047147 describes an apparatus which includes the features of the pre-characterising part of claim 1.

It is a primary object of the present invention to eliminate the foregoing disadvantages of the conventional apparatus by performing the judgement of the phases of the local and track signals and the judgement of the level of the track signal separately by semiconductor signal processing means and putting out a signal of the absence of a vehicle only when the following two requirements are simultaneously satisfied, that is, when by a phase judging signal vibrating with the reference level being as the center, both the phase signals are judged as being of the same phase and the voltage level of the track signal is higher than a predetermined value.

Another object of the present invention is to provide a vehicle detecting apparatus having a fail-safe effect.

Disclosure of the Invention

According to the present invention there is provided an apparatus for detecting a vehicle on a track, which comprises a track circuit in which a local signal which is an alternating current voltage signal of a specific frequency is applied to a specific closed section of a pair of rails, and a track signal whose voltage varies according to the presence or absence of a vehicle on the rails, is produced, phase judgement means for judging whether the phase of the local signal and the track signal are the same, and level judgement means for judging whether a voltage level of the track signal is higher than a predetermined value and which produces a signal indicative of the absence of a vehicle on the pair of rails in the specific closed section only when both the local signal and the track signal are of the same phase and the level of the track signal is higher than the predetermined value,

characterised in that the apparatus comprises:

first phase judgement signal generating means which receives the local signal of sinewave and shapes it at a rectangular wave the reference voltage level of which is the zero level of the local signal to produce a first phase judgement signal for judging the phase of the local signal, said first phase judgement signal being a vibrating rectangular waveform which is centred about said reference voltage level,

second phase judgement signal generating means which receive the track signal of sinewave and shapes it at a rectangular wave the reference voltage level of which is the zero level of the track signal and produces a second phase judgement signal for judging the phase of the track signal, said second phase judgement signal being a vibrating rectangular waveform which is centred about the last defined reference voltage level,

level judgement signal generating means for putting out a level judgement signal for judging a level of the track signal, said level judgement signal being a vibrating waveform that is centred about a reference voltage level derived from the track signal,

a first logical product circuit which comprises a power source and a semiconductor circuit and is arranged to receive the first phase judgement signal output from said first phase judgement signal generating means and said second phase judgement signal output from said second phase judgement signal generating means, and to produce a signal indicating that both the phase judgement signals are of the same phase when both the phase judgement signals are of the same phase and higher than the power source voltage, but does not generate any signal in the event of a failure of the first logical product circuit due to, for example, a short circuit or a disconnection;

a level judging circuit which produces a signal when the voltage level of the level judgement signal is higher than a predetermined value which is higher than the zero level of the track signal but does not put out any signal when the level judging circuit fails due to, for example, a short circuit or a disconnection,

a second logical product circuit which produces a signal indicative of the absence of a vehicle only when both the first logical product circuit and the level judging circuit simultaneously produce signals, but does not produce any signal in the event of a failure of the second logical product circuit due, for example, to a short circuit or disconnection, and wherein the second phase judgement signal generating means comprises a differential circuit for differentiating the output signal of the level judging circuit and self-retaining means for feeding back the output of the first logical product circuit to the first logical product circuit through a diode and self-retaining the output of the first logical product circuit.

The first and second logical product circuits may be constructed by a single logical product computing oscillating circuit.

According to the present invention, by the above-mentioned structure, the judgement of the phases can be performed at a low level to reduce the influences of variations of the amplitude and the level judgement can be performed at a high level to improve the noise resistance.

Moreover, according to the present invention, the local input signal can be subjected to integration processing.

The invention will be described now by way of example only, with particular reference to the accompanying drawings. In the drawings:

Fig. 1 is a block diagram illustrating the schematic structure of the present invention.
Fig. 2 is a diagram illustrating a known alternating current track circuit.
Fig. 3 is a block diagram illustrating an embodiment of the circuit of the apparatus for detecting a vehicle on a track according to the present invention.
Fig. 4 is a circuit diagram illustrating a voltage multiplying half-wave rectifier circuit used as the rectifier in the above-mentioned embodiment.
Fig. 5 is a circuit diagram illustrating a differential circuit used in the above-mentioned embodiment.
Fig. 6 is a circuit diagram illustrating a logical product circuit used in the above-mentioned embodiment.
Fig. 7 is a time chart illustrating the operation state in the above-mentioned embodiment.

Best Mode for Carrying Out the Invention

The present invention will now be described in detail with reference to the accompanying drawings.

Referring to Fig. 2, a vehicle 1 runs on two rails 2 and 3 in the direction indicated by the arrow. The rails 2 and 3 are divided into a plurality of sections such as a specific section 4 and a section 5 rear with respect to the direction of advance of the vehicle. For example, a transmission signal which is an alternating current reference voltage $V\ell$ (this signal is simultaneously fed to the reception side and acts as a local signal $S\ell$) is applied to the rails of each of the block sections 4 and 5. The rails 2 and 3 are utilized as parts of the circuit and the voltage Vt between the rails 2 and 3 is put out as a track signal St for reception. This circuit is known as the alternating current track circuit.

The transmission signal of the track, that is, the local signal $S\ell$, is a sine wave alternating current signal shown in Fig. 7-A and is put in a rectifying smoothening circuit 21 and a wave form rectifying circuit 22 through a transformer 11. The rectifying smoothening circuit 21 is a known circuit for rectifying and smoothening an alternating current signal arid forming a direct current output power source Vs. The wave form rectifying circuit 22 acts as the first phase judgement signal generating means and is a known circuit, for example, a Schmitt circuit for rectifying a sine wave local signal to a rectangular wave as shown in Fig. 7-C. By these circuits, a rectangular wave phase judgement signal vibrating with the reference voltage level being as the center is obtained.

The track signal St is put in a level judging signal 23 and a wave form rectifying circuit 24 through a second transformer 12. The level judging circuit 23 is a circuit for detecting whether or not a voltage obtained by transforming the track signal St by the transformer 12 acting as the level judgement signal generating means, that is , a level judging signal, is higher than a predetermined value. for example, this circuit comprises a level detecting circuit such as a Schmitt circuit and a known voltage doubling half-wave rectifying circuit for rectifying the output of this detecting circuit, which includes, for example, capacitors C1 and C2 and diodes D1 and D2, as shown in Fig. 4. A relatively high threshold level is set in the Schmitt circuit. The voltage doubling half-wave rectifying circuit rectifies and smoothens the alternating current voltage put out from the Schmitt circuit by the diode D2 and the capacitor C2 through the coupling capacitor C1 and the clamp diode D1 and a rectified output is obtained from an output terminal D. The voltage doubling half-wave rectifying circuit has such a fail-safe structure that at the time of a trouble such as disconnection, no rectified output is obtained (a known four-terminal capacitor which generates no output at the time of disconnection of a terminal is shown as the capacitor C2). The direct current voltage Vs of the rectifying smoothening circuit 21 is put in the rectifying circuit. The diode D1 is constructed so that a computing oscillator of the subsequent stage is oscillated by the output of the rectifying circuit by clamping the input signal from the capacitor C1 to this input power source Vs.

The wave form rectifying circuit 24 has a threshold level sufficiently lower than the track signal St put in the circuit 24. Accordingly, a wave-rectified output which changes substantially at the zero point of the track signal St can be produced.

A differential circuit 25 comprises, for example, a capacitor C3 and a resistor R1, as shown in Fig. 5, and has such a known structure that the reference voltage level is set at the above-mentioned level Vs. Thus, the phase of the track signal is generated substantially at the zero point (reference voltage level). Of the output of the differential circuit 25, that is, the phase signal of the track signal, only a positive signal is put into an input terminal c of a three-input logical product circuit 26 through a diode D4. A structure capable of performing a desired operation may be formed even by omitting the diode D4.

The logical product circuit 26 has three input terminals a, b and c, and this circuit receives the output of the wave form rectifying circuit 22 at the input terminal a and the output of the level detecting circuit 23 at the input terminal b. The logical product circuit 26 is a logical product computing oscillating circuit shown in Fig. 6, which comprises a first logical product circuit for detecting (phase judgement) that the phase judgement signal of the local signal Sℓ by the wave form rectifying circuit 22 and the phase judgement signal of the track signal St by the differential circuit 25 are of the same phase, a second logical product circuit which generates an output signal when a signal of the detection of the same phase in the first logical product circuit and a signal of the detection of the level judgement signal of the track signal St higher than the predetermined value by the level detecting circuit are received. The logical product computing oscillating circuit generates an oscillating output when all of the inputs at the input terminals a, b and c are higher than the power source voltage Vs and has a fail-safe structure in which when a constituent element of the circuit gets out of order, oscillation is impossible and therefore, no output is generated at the time of a trouble, In order to construct the computing oscillator so that it is actuated by a negative power source, it is sufficient if the type of the transistor is changed to NPN from PNP and the direction of the diode is reversed.

The specific structure of the logical product computing oscillating circuit 26 will now be described with reference to Fig. 6. Transistors Tr1 and Tr2 are connected to each other through an attenuation resistor R6, and the collector of the transistor Tr2 is connected to the base of a transistor Tr3 through a level shifting Zener diode ZD1 and the connecting point between a Zener diode ZD2 connected to the collector of the transistor Tr3 and a resistor R4 is connected to the base of the transistor Tr1 through a resistor R5. R2 and R3 represent collector resistors, R7 represents a resistor on the leak current side, that is, a resistor for flowing of a leak current of the base of the transistor Tr3, Vs represents an input power source, and C represents an output terminal. In the logical product computing oscillator having this structure, when Zener voltages VZD1 and VZD2 of the Zener diodes ZD1 and ZD2 and a voltage Ve higher than the power source voltage Vs are put in the input terminals a, b and c respectively, that is, when voltages exceeding the range of the power source voltage are put in the input terminals a, b and c, the transistors Tr1 through Tr3 are turned on and off in sequence and an oscillating output oscillating between the input voltage level given to the input terminal and the level substantially equal to zero is obtained at the output terminal C. On the other hand, if the input voltage applied to any one of the input terminals a, b and c is lower than the power source voltage, the operation of the transistors Tr1 through Tr3 is not reversed and the oscillation is stopped. Also when a trouble such as disconnection is caused in the circuit, the oscillation is stopped and no oscillating output is generated at the output terminal C. In this case, it is preferred that the Zener voltages VZD2 and VZD2 of the Zener diodes ZD1 and ZD2 be selected to satisfy the condition of VZD2 < Vs < VZD1. Incidentally, as is obvious to experts in the art, a computing oscillator of a high output can be constructed by connecting a known amplifier to the input terminal.

Incidentally, the level judging circuit 23 and the rectifying circuit 27 described hereinafter may comprise, for example, the voltage doubling half-wave rectifying circuit, and this voltage doubling half-wave rectifying circuit and the logical product computing oscillator shown in Fig. 6 may be a known fail-safe logical product circuit in which no output is produced unless input signals are applied to all of the input terminals a, b and c, disclosed in, for example, Japanese Utility Model Application Laid-Open Specification No. 4764/82 or Japanese patent Publication No. 38211/76.

The rectified output of the rectifying circuit 27 for rectifying the output of the logical product computing oscillating circuit 26 is fed back to the input terminal c, in which the output of the differential circuit 25 is put, through the diode D3. An alternating current amplifying circuit 28 amplifies the oscillating output of the logical product computing oscillating circuit 26, and the amplified output is rectified by a rectifying smoothening circuit 29 to drive a trade relay 30, as in the conventional apparatus.

The above-mentioned transformer 12, wave form rectifying circuit 24, differential circuit 25, rectifying circuit 27 and diodes D3 and D4 constitute the second phase judgement signal generating means, and the wave rectifying circuit 24 and differential circuit 25 constitute the means for detecting the zero point of the track signal.

The operation will now be described with reference to the time chart of Fig. 7.

The alternating current local signal shown in Fig. 7-A is put in the rectifying smoothening circuit 21 and wave form rectifying circuit 22 through the first transformer 11. At the rectifying smoothening circuit 21, there is generated the direct current output Vs to be used as the power for driving the level detecting circuit 23, wave form rectifying circuits 22 and 24, amplifying circuit 28, logical product computing oscillating circuit 26 and track relay 30. Furthermore, at the wave form rectifying circuit 22, a rectangular wave shown in Fig. 7-C is generated as the phase judging signal. This phase judging signal oscillates with the reference voltage level (corresponding to the zero point of the track signal) being as the center.

When the vehicle 1 is not present in the specific section 1, the track signal St put in the second transformer 12 from the rails 2 and 3 has a shape of a sine save as shown in Fig. 7-B. The track signal St is put in the level judging circuit 23 and wave form rectifying circuit 24, and a rectified direct current output VL1 for detecting a level higher than a predetermined value, as shown in Fig. 7-D, is produced from the former circuit. Furthermore, a rectangular wave as shown in Fig. 7-E is put out from the latter circuit and a differential pulse as shown in Fig. 7-F is put out from the differential circuit

25. Incidentally, each of the outputs of the wave form rectifying circuits 22 and 24, level judging circuit 23 and differential circuit 25 is put out in the state where the direct current output Vs of the rectifying smoothening circuit 21 is over-lapped.

Accordingly, each of positive pulses of the wave rectifying circuit 22, level judging circuit 23 and differential circuit 25 to be put into the input terminals a, b and c of the logical product computing oscillating circuit 26, respectively, has an input level higher than the power source voltage Vs at which initiation of the oscillation is possible, And, if positive pulses are put in the logical product computing oscillating circuit 26 from the wave form rectifying circuit 22 and differential circuit 25, the phase judgement condition (the local signal and the track signal are of the same phase) is established (first logical product), and the logical product (second logical product) of this established condition and the already established level judgement condition (the voltage level of the track signal is higher than a predetermined value) is established and oscillation is initiated in the logical product computing oscillating circuit 26.

The oscillating output of the computing oscillating circuit 26 is put in the alternating current amplifying circuit 28 and is simultaneously rectified by the rectifying circuit 27 and fed back to the input terminal c through the diode D3 to self-retain the output of the computing oscillator 26 until the phase signal on the local signal side (Fig. 7-C) falls, whereby amplification of the pulse width is effected (see Fig. 7-G). Incidentally, the diode D3 prevents extinction of the differential pulse at the capacitor C2 of the rectifying circuit 27.

The pulse width-amplified output, shown in Fig. 7-G, of the computing oscillating circuit 26 is amplified by the alternating amplifying circuit 28, rectified by the rectifying smoothening circuit 29 and supplied to the relay 30 to retain the relay 30 in the excited state. Namely, the absence of a train in the track circuit is informed.

If a train intrudes into the track circuit, a short circuit is formed between the rails 2 and 3 by the train and the voltage level Vt of the track signal St put in the second transformer 12 is reduced. At this point, the output of the level judging circuit 23 is reduced to VL2 shown in Fig. 7-D and the condition of the logical product of the computing oscillating circuit 26 is not established. Accordingly, the oscillation is impossible and generation of the output is stopped, and therefore, the relay 30 falls in the non-excited state and the presence of the train in the track circuit 4 is detected.

Incidentally, in this phase judgement, if there is a phase deviation between the local signal and the track signal, it happens that the oscillation condition of the computing oscillating circuit 26 is satisfied even when both the signals are not of the same phase, and an erroneous judgement is made.

In order to prevent this disadvantage, in the present embodiment, the track signal St put out from the wave rectifying circuit 24 is differentiated and the positive differential pulse is put in the computing oscillating circuit 26, whereby the oscillating output is self-retained and maintained.

In the conventional apparatus, when the level at which the thyristor is turned on, that is, the voltage level of the track signal for judging formation of a short circuit between the rails, is determined, the phase to be judged is simultaneously determined. In this case, since the voltage level of the track signal is greatly varied by changes of the rail-laying environment, for example, rain or snow, the judged value of the phase is changed with this change of the voltage level. This change becomes great as the set value for the judgement of the level is large. In order to prevent an erroneous operation by a noise generated by a train current or the like, it is preferred that the above-mentioned set value be large. Accordingly, the conventional apparatus is disadvantageous in that if increase of the precision of the level judgement is intended, the precision of the phase judgement is reduced and if maintenance of a high precision of the phase judgement is intended, the precision of the level judgement is reduced.

In contrast, in the present embodiment, since signals for the level judgement and the phase judgement are independently generated and both the judgements are separately performed, the set value for the level judgement can be increased, and the phase judgement can always be done at the point where the phase judging signal crosses the reference voltage, that is, at the point (zero point) where the track signal is changed to the positive value from the negative value. Accordingly, the detection precision can be elevated and the reliability can be improved. Moreover, since known fail-safe logical product computing oscillating circuit 26, level judging circuit 23, rectifying circuit 27, alternating current amplifying circuit 28 and differential circuit 25 are used, a fail-safe structure is realized in the detecting apparatus. Moreover, since the computing oscillating circuit 26 is not self-retained if the diode D3 is opened, a power sufficient to excite the relay 30 is not obtained, and since the differential pulse is absorbed in the capacitor C2 and no signal is put in the input terminal c of the computing oscillating circuit 26 if a short circuit is formed, a fail-safe effect is attained.

Incidentally, in the present embodiment, the logical product of the level judgement and the phase judgement is made by one logical product circuit, but the present invention is not limited to this structure. Namely, there may be adopeted a structure in which the phase judgement is carried out by using a fail-safe logical product circuit, the relay 30 is driven by this judgement signal and the contact output of the relay driven by the output of the level judging circuit 23 is connected in series to the contact output of the relay 30. Although the rectifying circuit is used as the level judging circuit 23, it is obvious that the output may be rectified by using a known level detector of the alternating current input type.

In the case where the input level of the track signal is stable, it is obvious that an alternating current output from the level detecting circuit of the level judging circuit 23, as indicated by a dot line in Fig. 3, can be utilized instead of the wave rectifying circuit 24. Furthermore, if the input detection level of the logical product circuit is made equal to the judgement level of the track signal, the logical product circuit can be utilized as the level judging circuit 23. In this case, it is sufficient if the level judging circuit 23 is replaced by a rectifying circuit.

Moreover, it is obvious that if the oscillating output of the logical product computing oscillating circuit 26 is not directly applied to the alternating current amplifying circuit 28 but the oscillating output is put in a voltage multiplying rectifying circuit as shown in Fig. 4 and the input terminals a, b and c shown in Fig. 6 are connected to one common computing oscillating circuit and if the alternating current output signal of this computing oscillating circuit is put in the alternating current amplifying circuit shown in Fig. 3 (that is, if a rectifying circuit and a computing oscillating circuit are interposed between the logical product computing oscillating circuit 26 and the alternating current amplifying circuit 28), the capacity of the smoothening capacitor C2 of the interposed rectifying circuit can be increased, whereby an erroneous operation by a noise of the track signal or the like can be moderated.

As is apparent from the foregoing description, according to the present invention, the local input signal is rectified to obtain a direct current power and precise and various level detections can be performed by this direct current power, and the logical computation is carried out as the logical processing of the output of such level detection and such processing can be integrated, whereby the size of the apparatus can be reduced. Moreover, when the apparatus gets out of order, the output is inevitably reduced to zero and the relay falls to the safe side, and a fail-safe effect can be assuredly attained. Furthermore, since the phase difference between the local signal and the track signal is judged separately from the level of the track signal, the phase judgement can be made at a voltage level close to the reference level while the level judgement can be made at a voltage level higher than a predetermined value, and precise phase judgement and level judgement become possible.

<u>Industrial</u> <u>Applicability</u>

As is apparent from the foregoing description, the apparatus for detecting a vehicle on a track according to the present invention is most effectively utilized for detecting a train on a rails in a signal system of a railroad line or in an unmanned operation system in a factory, a dockyard or an assorting or marshaling yard.

Claims

1. An apparatus for detecting a vehicle (1) on a track (2, 3), which comprises a track circuit in which a local signal which is an alternating current voltage signal of a specific frequency is applied to a specific closed section of a pair of rails (2, 3), and a track signal whose voltage varies according to the presence or absence of a vehicle on the rails, is produced, phase judgement means (22, 24, 25) for judging whether the phase of the local signal and the track signal are the same, and level judgement means (23) for judging whether a voltage level of the track signal is higher than a predetermined value and which produces a signal indicative of the absence of a vehicle on the pair of rails in the specific closed section only when both the local signal and the track signal are of the same phase and the level of the track signal is higher than the predetermined value,

   characterised in that the apparatus comprises:

   first phase judgement signal generating means (22) which receives the local signal of sinewave and shapes it at a rectangular wave the reference voltage level of which is the zero level of the local signal to produce a first phase judgement signal for judging the phase of the local signal, said first phase judgement signal being a vibrating rectangular waveform which is centred about said reference voltage level,
   second phase judgement signal generating means (24, 25) which receive the track signal of sinewave and shapes it at a rectangular wave the reference voltage level of which is the zero level of the track signal and produces a second phase judgement signal for judging the phase of the track signal, said second phase judgement signal being a vibrating rectangular waveform which is centred about the last defined reference voltage level,
   level judgement signal generating means (12) for putting out a level judgement signal for judging a level of the track signal, said level judgement signal being a vibrating waveform that is centred about a reference voltage level derived from the track signal,
   a first logical product circuit (26) which comprises a power source (V_s) and a semiconductor circuit and is arranged to receive the first phase judgement signal output from said first phase judgement signal generating means (22) and said second phase judgement signal output from said second phase judgement signal generating means (24, 25), and to produce a signal indicating that both the phase judgement signals are of the same phase when both the

phase judgement signals are of the same phase and higher than the power source voltage (V_S), but does not generate any signal in the event of a failure of the first logical product circuit due to, for example, a short circuit or a disconnection;

a level judging circuit (23) which produces a signal when the voltage level of the level judgement signal is higher than a predetermined value which is higher than the zero level of the track signal but does not put out any signal when the level judging circuit fails due to, for example, a short circuit or a disconnection,

a second logical product circuit (26) which produces a signal indicative of the absence of a vehicle only when both the first logical product circuit (26) and the level judging circuit (23) simultaneously produce signals, but does not produce any signal in the event of a failure of the second logical product circuit due, for example, to a short circuit or disconnection, and

wherein the second phase judgement signal generating means (24, 25) comprises a differential circuit (25) for differentiating the output signal of the level judging circuit (23) and self-retaining means for feeding back the output of the first logical product circuit (26) to the first logical product circuit through a diode (D3) and self-retaining the output of the first logical product circuit.

2. A vehicle detecting apparatus according to claim 1, wherein the second phase judgement signal generating means includes a transformer (12) for transforming the voltage of the track signal, and a first wave form rectifying circuit (24) for rectifying the output signal of the transformer (12) to a rectangular wave signal centred about the reference voltage, said differential circuit (25) differentiating the output of the first wave form rectifying circuit (24).

3. A vehicle detecting apparatus according to claim 1, wherein the level judging circuit (23) comprises a threshold circuit for producing only a voltage higher than a predetermined value of the level judgement signal produced by the level judgement signal generating means (12) and a voltage doubling half-wave rectifying circuit (C1, C2, D1, D2) for processing the output signal of the threshold circuit.

4. A vehicle detecting apparatus according to claim 1, wherein the first logical product circuit and second logical product circuit constitute logical product computing oscillating means (26) which has an input terminal (a) for receiving the output of the first phase judgement signal generating means (22), an input terminal (b) for receiving the output of the level judging circuit (23), an input terminal (c) for receiving the output of the second phase judgement signal generating means (24, 25) and a reference voltage input terminal for receiving a signal of a direct current voltage V_s, and which is constructed so that an oscillating output is generated when voltages exceeding the range of the direct current voltage V_s are simultaneously applied to the three input terminals (a), (b) and (c).

5. A vehicle detecting apparatus according to claim 4, wherein the first phase judgement signal generating means (22) comprises a second wave form rectifying circuit for rectifying the local signal to a rectangular wave signal and putting out the rectangular wave signal to the input terminal (a), and the second phase judgement signal generating means (24, 25) comprises a first wave form rectifying circuit (24) for rectifying a track signal to a rectangular wave signal, a differential circuit (25) for differentiating the output of the first wave form rectifying circuit (24) and putting the differentiated output into the input terminal (c), a rectifying circuit (27) for rectifying the oscillating output of the logical product computing oscillating circuit (26) and self-retaining means including a diode (D3) for feeding the output of the rectifying circuit (27) to the terminal (c).

6. A vehicle detecting apparatus according to claim 4, wherein the logical product computing oscillating means comprises a first transistor (Tr1) connected through a first collector resistor (R2) between the input terminal (a) and the reference voltage input terminal, the collector voltage of said first transistor (Tr1) being applied to the base through an attenuation resistor, a second transistor (Tr2) connected through a second collector resistor (R3) between the input terminal (b) and the reference voltage input terminal, the collector voltage of the second transistor being applied to the base through a first Zener diode (ZD1), a leak resistor (R7) interposed between the base and earth, and a third transistor (Tr3) connected through a third collector resistor (R4) and a second Zener diode (ZD2) being fed to the base of the first transistor (Tr1) and an output terminal being connected between the second Zener diode (ZD2) and the collector of the third transistor (Tr3).

7. A vehicle detecting apparatus according to claim 6, wherein the first phase judgement signal generating means (22) comprises a second wave form rectifying circuit (22) for rectifying the local signal to a rectangular wave signal and producing a rectangular wave signal which is fed to the input terminal (a), and the second phase judgement signal generating means comprises a first wave form rectifying circuit (24) for rectifying the track signal to a rectangular

wave signal, a differential circuit (25) for differentiating the output of the first wave form rectifying circuit and producing a differentiated signal which is fed to the input terminal (c), a rectifying circuit (27) for rectifying the oscillating output of the logical product oscillating computing circuit (26) and a diode (D3) for feeding the output of the rectifying circuit to the terminal (c).

8. A vehicle detecting apparatus according to claim 7, wherein the level judging means (23) comprises a threshold circuit for producing a voltage higher than a predetermined value of the level judging signal put out from the level judging signal generating means (12) and a voltage multiplying half-wave rectifying circuit (C1, C2, D1, D2) for processing the output signal of the threshold circuit.

9. A vehicle detecting apparatus according to claim 1, wherein the first phase judgement signal generating means (22), second phase judgement signal generating means (24, 25), level judgement signal generating means (12), level judging circuit (23), first logical product circuit (26) and second logical product circuit (26) use a direct current output obtained by rectifying the local signal as a power source.

Patentansprüche

1. Ein Gerät zum Erkennen eines Fahrzeugs (1) auf einem Gleis (2, 3), das beinhaltet:

einen Gleis-Stromkreis, in dem ein lokales Signal, das ein Wechselspannungssignal einer spezifischen Frequenz ist, an einen spezifischen geschlossenen Abschnitt eines Schienenpaars (2, 3) gelegt wird, und ein Gleissignal, dessen Spannung sich verändert, je nachdem ob auf den Schienen ein Fahrzeug steht oder nicht, erzeugt wird,

Phasenbeurteilungsmittel (22, 24, 25) zur Beurteilung, ob die Phase des lokalen Signals und des Gleissignals gleich sind, und Spannungshöhenbeurteilungsmittel (23) zur Beurteilung, ob eine Spannungshöhe des Gleissignals höher als ein vorgegebener Wert ist, und das ein Signal erzeugt, das nur dann anzeigt, ob ein Fahrzeug in dem spezifischen, geschlossenen Abschnitt auf dem Schienenpaar steht, wenn die beiden, das lokale Signal und das Schienensignal, phasengleich sind und die Spannungshöhe des Schienensignals höher ist als der vorgegebene Wert,
dadurch gekennzeichnet, daß das Gerät umfaßt:

ein Mittel (22) zum Generieren des ersten Phasenbeurteilungssignals, das das lokale Signal als Sinuswelle empfängt und zu einer Rechteckwelle umformt, deren Bezugsspannungshöhe die Nullhöhe des lokalen Signals ist, um ein erstes Phasenbeurteilungssignal zum Beurteilen der Phase des lokalen Signals zu erzeugen, wobei das erste Phasenbeurteilungssignal eine vibrierende Rechteckwellenform ist, die um die Bezugsspannungshöhe zentriert ist,

zweite Mittel (24, 25) zum Generieren eines Phasenbeurteilungssignals, das das Schienensignal in Sinuswellenform empfängt und zu einer Rechteckwelle umformt, deren Bezugsspannungshöhe die Nullhöhe des Schienensignals ist, und ein zweites Phasenbeurteilungssignal zum Beurteilen der Phase des Gleissignals erzeugt, wobei das Beurteilungssignal für die zweite Phase eine vibrierende Rechteckwellenform ist, die um die zuletzt definierte Bezugsspannungshöhe zentriert ist,

ein Mittel (12) zum Generieren des Spannungshöhenbeurteilungssignals zum Beurteilen einer Spannungshöhe des Gleissignals, wobei das Spannungshöhenbeurteilungssignal eine vibrierende Wellenform ist, die um eine Bezugsspannungshöhe zentriert ist, die aus dem Gleissignal abgeleitet wird,

eine erste logische Produktschaltung (26), die eine Stromquelle (V_s) und eine Halbleiterschaltung enthält und so angeordnet ist, daß sie den ersten Phasenbeurteilungssignalausgang aus dem ersten Phasenbeurteilungssignal-generierenden Mittel (22) und den zweiten Phasenbeurteilungssignalausgang aus dem zweiten Phasenbeurteilungssignal-generierenden Mittel (24, 25) empfängt, um ein Signal zu erzeugen, das anzeigt, daß beide Phasenbeurteilungssignale phasengleich sind, wenn beide Phasenbeurteilungssignale phasengleich sind und höher sind, als die Stromquellenspannung (V_s), das aber kein Signal erzeugt im Falle des Nichtwirksamwerdens der ersten logischen Produktschaltung infolge beispielsweise eines Kurzschlusses oder einer Trennung;

eine Spannungshöhenbeurteilungsschaltung (23), die ein Signal erzeugt, wenn die Spannungshöhe des Spannungshöhenbeurteilungssignals höher ist als ein vorgegebener Wert, der höher ist als die Nullhöhe des Gleissignals, das aber kein Signal ausgibt, wenn die

Spannungshöhenbeurteilungsschaltung nicht wirksam wird, beispielsweise durch einen Kurzschluß oder eine Trennung,

eine zweite logische Produktschaltung (26), die ein Signal erzeugt, das das Nichtvorhandensein eines Fahrzeugs nur dann anzeigt, wenn beide, die erste logische Produktschaltung (26) und die Spannungshöhenbeurteilungsschaltung (23) gleichzeitig Signale erzeugen, die aber kein Signal erzeugt im Falle des Nichtwirksamwerdens der zweiten logischen Produktschaltung beispielsweise bei Kurzschluß oder Trennung, und

in dem das zweite Phasenbeurteilungssignalgenerierende Mittel (24, 25) eine Differenzschaltung (25) zum Unterscheiden des Ausgangssignals der Spannungshöhenbeurteilungsschaltung (23), und Selbstrückhaltemittel zum Rückkoppeln des Ausgangs des ersten logischen Produktschaltung (26) mit der ersten logischen Produktschaltung über eine Diode (D3), und zum Selbstrückhalten des Ausgangs der ersten logischen Produktschaltung aufweist.

2. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 1, in dem das zweite Phasenbeurteilungssignal-generierende Mittel einen Transformator (12) zum Transformieren der Spannung des Gleissignals, und eine erste Wellenform-Gleichrichterschaltung (24) zum Gleichrichten des Ausgangssignals des Transformators (12) zu einem Rechteckwellensignal, das um die Bezugsspannung zentriert ist, beinhaltet, wobei die Differenzschaltung (25) den Ausgang der ersten Wellenformglieichrichterschaltung (24) differenziert.

3. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 1, in dem die Spannungshöhenbeurteilungsschaltung (23) eine Schwellenspannungsschaltung zum Erzeugen nur einer Spannung, die höher als ein vorgegebener Wert des Spannungshöhenbeurteilungssignals ist, das vom Spannungshöhenbeurteilungs-signal-generierenden Mittel (12) erzeugt wird, und eine Spannungsverdopplungs-Halbwellengleichrichterschaltung (C1, C2, D1, D2) zum Verarbeiten des Ausgangssignals der Schwellenwertschaltung enthält.

4. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 1, in dem die erste logische Produktschaltung und eine zweite logische Produktschaltung ein logisches Produktberechnungs-Schwingungsmittel (26) darstellen, das eine Eingangsklemme (a) zum Empfangen des Ausgangs des ersten Phasenbeurteilungssignal-generierenden Mittels (22), eine Eingangsklemme (b) zum Empfangen des Ausgangs der Spannungshöhenbeurteilungsschaltung (23), eine Eingangsklemme (c) zum Empfangen des Ausgangs des zweiten Phasenbeurteilungssignal-generierenden Mittels (24, 25), und eine Bezugsspannungseingangsklemme zum Empfangen eines Signals einer Gleichspannung V_s umfaßt, und die so ausgelegt ist, daß ein Schwingungsausgang generiert wird, wenn Spannungen, die den Bereich der Gleichspannung V_s überschreiten, gleichzeitig an die drei Eingangsklemmen (a), (b) und (c) gelegt werden.

5. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 4, in dem das erste Phasenbeurteilungssignal-generierende Mittel (22) eine zweite Wellenform-Gleichrichterschaltung zum Gleichrichten des lokalen Signals zu einem Rechteckwellensignal und Legen des Rechteckwellensignals an die Eingangsklemme (a), und das zweite Phasenbeurteilungssignalgenerierende Mittel (24, 25) eine erste Wellenform-Gleichrichterschaltung zum Gleichrichten eines Gleissignals zu einem Rechteckwellensignal, eine Differenzschaltung (25) zum Unterscheiden des Ausgangs der ersten Wellenformgleichrichterschaltung (24) und Legen des differenzierten Ausgangs an die Eingangsklemme (c), eine Gleichrichterschaltung (27) zum Gleichrichten des Schwingungsausgangs der logischen Produktberechnungs-Schwingschaltung (26), und Selbstrückhaltemittel einschließlich einer Diode (D3) zum Legen des Ausgangs der Gleichrichterschaltung (27) an die Klemme (c) enthält.

6. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 4, in dem das das logische Produkt berechnende Schwingungsmittel einen ersten Transistor (Tr1) aufweist, der durch einen ersten Kollektorwiderstand (R2) zwischen der Eingangsklemme (a) und der Bezugsspannungs-Eingangsklemme verbunden ist, wobei die Kollektorspannung des ersten Transistors (Tr1) über einen Dämpfungswiderstand an der Basis liegt, ein zweiter Transistor (Tr2) durch einen zweiten Kollektorwiderstand (R3) zwischen der Eingangsklemme (b) und der Bezugsspannungs-Eingangsklemme verbunden ist, wobei die Kollektorspannung des zweiten Transistors über eine erste Zener-Diode (ZD1) an der Basis liegt, ein Anleitwiderstand (R7) zwischen Basis und Erde gelegt ist, und ein dritter Transistor (Tr3) durch einen dritten Kollektorwiderstand (R4) und eine zweite Zener-Diode (ZD2) an die Basis des ersten Transistors (Tr1) gelegt ist, und eine Ausgangsklemme zwischen der zweiten Zener-Diode (ZD2) und dem Kollektor des dritten Transistors (Tr3) liegt.

7. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 6, in dem das erste Phasenbeurteilungs-signal-generierende Mittel (22) eine zweite Wellen-form-Gleichrichterschaltung zum Gleichrichten des lokalen Signals zu einem Rechteckwellensignal enthält, und ein Rechteckwellensignal erzeugt das an die Eingangsklemme (a) gelegt wird, und das zweite Phasenbeurteilungssignal-generierende Mittel eine erste Wellenform-Gleichrichterschaltung (24) zum Gleichrichten des Gleissignals zu einem Rechteckwellensignal, eine Differenzschaltung (25) zum Unterscheiden des Ausgangs der ersten Wellenformgleichrichterschaltung enthält und ein differenziertes Signal erzeugt, das an die Eingangsklemme (c) gelegt wird, eine Gleichrichterschaltung (27) zum Gleichrichten des Schwingungsausgangs der logischen Produktberechnungs-Schwingschaltung (26), und eine Diode (D3) zum Legen des Ausgangs der Gleichrichterschaltung an die Klemme (c) enthält.

8. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 7, in dem das Spannungshöhenbeurteilungsmittel (23) eine Schwellenspannungsschaltung zum Erzeugen einer Spannung, die höher als ein vorgegebener Wert des Spannungshöhenbeurteilungssignals ist, das vom Spannungshöhenbeurteilungssignalgenerierenden Mittel (12) ausgegeben wird, und eine Spannungsvervielfachungs-Halbwellenglelchrichterschaltung (C1, C2, D1, D2) zum Verarbeiten des Ausgangssignals der Schwellenwertschaltung enthält.

9. Ein Gerät zum Erkennen eines Fahrzeugs gemäß Anspruch 1, in dem das erste Phasenbeurteilungs-signal-generierenden Mittel (22), das zweite Phasenbeurteilungssignal-generierenden Mittels (24, 25), das Spannungshöhenbeurteilungssignalgenerierenden Mittel (12), die Spannungshöhenbeurteilungsschaltung (23), die erste logische Produktschaltung (26) und die zweite logische Produktschaltung (26) einen Gleichstromausgang als Stromquelle benutzen, der durch Gleichrichten des lokalen Signals erhalten wird.

Revendications

1. Appareil de détection d'un véhicule (1) sur une voie (2, 3), comprenant un circuit de voie dans lequel un signal local, qui est un signal de tension alternative d'une fréquence spécifique, est appliqué à une section spécifique fermée d'une paire de rails (2, 3), et un signal de voie dont la tension varie en fonction de la présence ou de l'absence d'un véhicule sur les rails, est produit, un moyen (22, 24, 25) d'évaluation de phase pour évaluer si les phases du signal local et du signal de voie sont les mêmes, et un moyen (23) d'évaluation de niveau pour évaluer si un niveau de tension du signal de voie est supérieur à une valeur prédéterminée et qui produit un signal indiquant l'absence d'un véhicule sur la paire de rails dans la section fermée spécifique uniquement lorsque le signal local et le signal de voie ont tous deux la même phase et le niveau du signal de voie est supérieur à la valeur prédéterminée,

caractérisé en ce que l'appareil comprend:

un premier moyen (22) de génération d'un signal d'évaluation de phase qui reçoit le signal local sinusoïdal et le met sous la forme d'une onde rectangulaire dont le niveau de tension de référence est le niveau zéro du signal local, afin de produire un premier signal d'évaluation de phase pour évaluer la phase du signal local, ledit premier signal d'évaluation de phase étant une forme d'onde rectangulaire vibratoire centrée autour dudit niveau de tension de référence,

un deuxième moyen (24, 25) de génération d'un signal d'évaluation de phase qui reçoit le signal de voie sinusoïdal et le met sous la forme d'une onde rectangulaire dont le niveau de tension de référence est le niveau zéro du signal de voie et produit un deuxième signal d'évaluation de phase pour évaluer la phase du signal de voie, ledit deuxième signal d'évaluation de phase étant une forme d'onde rectangulaire vibratoire centrée autour du niveau de tension de référence défini en dernier,

un moyen (12) de génération de signal d'évaluation de niveau pour fournir un signal d'évaluation de niveau en vue d'évaluer un niveau du signal de voie, ledit signal d'évaluation de niveau étant une forme d'onde vibratoire qui est centrée autour d'un niveau de tension de référence dérivé du signal de voie,

un premier circuit de produit logique (26) qui comprend une source d'énergie (V_s) et un circuit à semi-conducteur et est conçu pour recevoir le premier signal d'évaluation de phase fourni par ledit premier moyen (22) de génération d'un signal d'évaluation de phase et ledit deuxième signal d'évaluation de phase fourni par ledit deuxième moyen (24, 25) de génération d'un signal d'évaluation de phase, et pour produire un signal indiquant que les signaux d'évaluation de phase ont tous deux la même phase lorsque les deux signaux d'évaluation de phase ont la même phase et sont supérieurs à la tension (V_s) de la source d'énergie, mais qui ne génère aucun signal en cas de défaillance du premier circuit de produit logique due, par exemple, à un court-circuit ou à une coupure;

un circuit d'évaluation de niveau (23) qui produit un signal lorsque le niveau de tension du signal d'évaluation de niveau est supérieur à une valeur prédéterminée qui est supérieure au niveau zéro du signal de voie, mais qui ne fournit aucun signal lors d'une défaillance du circuit d'évaluation de niveau due, par exemple, à un court-circuit ou à une coupure,

un deuxième circuit de produit logique (26) qui produit un signal indiquant l'absence d'un véhicule uniquement lorsque le premier circuit de produit logique (26) et le circuit d'évaluation de niveau (23) produisent tous deux simultanément des signaux, mais qui ne produit aucun signal en cas de défaillance du deuxième circuit de produit logique due, par exemple, à un court-circuit ou à une coupure, et

dans lequel le deuxième moyen (24, 25) de génération de signal d'évaluation de phase comprend un circuit différentiel (25) pour différentier le signal de sortie du circuit d'évaluation de niveau (23) et un moyen de retenue automatique pour réinjecter la sortie du premier circuit de produit logique (26) à l'entrée du premier circuit de produit logique à travers une diode (D3) et retenir automatiquement la sortie du premier circuit de produit logique.

2. Appareil de détection de véhicule selon la revendication 1, dans lequel le deuxième moyen de génération de signal d'évaluation de phase comprend un transformateur (12) pour transformer la tension du signal de voie, et un premier circuit redresseur de forme d'onde (24) pour redresser le signal de sortie du transformateur (12) en un signal rectangulaire centré autour de la tension de référence, ledit circuit différentiel (25) différentiant la sortie du premier circuit redresseur de forme d'onde (24).

3. Appareil de détection de véhicule selon la revendication 1, dans lequel le circuit d'évaluation de niveau (23) comprend un circuit à seuil pour produire uniquement une tension supérieure à une valeur prédéterminée du signal d'évaluation de niveau produit par le moyen (12) de génération de signal d'évaluation de niveau et un circuit redresseur à une alternance, doubleur de tension (C1, C2, D1, D2) pour traiter le signal de sortie du circuit à seuil.

4. Appareil de détection de véhicule selon la revendication 1, dans lequel le premier circuit de produit logique et le deuxième circuit de produit logique constituent un moyen oscillant (26) de calcul de produit logique possédant une borne d'entrée (a) pour recevoir la sortie du premier moyen (22) de génération d'un signal d'évaluation de phase, une borne d'entrée (b) pour recevoir la sortie du circuit d'évaluation de niveau (23), une borne d'entrée (c) pour recevoir la sortie du deuxième moyen (24, 25) de génération d'un signal d'évaluation de phase et une borne d'entrée d'une tension de référence pour recevoir un signal d'une tension continue V_s, et qui est construit de façon à ce qu'une sortie oscillante soit générée lorsque des tensions excédant la plage de la tension continue V_s sont appliquées simultanément aux trois bornes d'entrée (a), (b) et (c).

5. Appareil de détection de véhicule selon la revendication 4, dans lequel le premier moyen (22) de génération d'un signal d'évaluation de phase comprend un deuxième circuit redresseur de forme d'onde pour redresser le signal local en un signal rectangulaire et pour fournir le signal rectangulaire à la borne d'entrée (a), et le deuxième moyen (24, 25) de génération d'un signal d'évaluation de phase comprend un premier circuit redresseur de forme d'onde pour redresser un signal de voie en un signal rectangulaire, un circuit différentiel (25) pour différentier la sortie du premier circuit redresseur de forme d'onde (24) et pour fournir la sortie différentiée à la borne d'entrée (c), un circuit redresseur (27) pour redresser la sortie oscillante du circuit oscillant (26) de calcul de produit logique et un moyen de retenue automatique comportant une diode (D3) pour injecter la sortie du circuit redresseur (27) à la borne (c).

6. Appareil de détection de véhicule selon la revendication 4, dans lequel le moyen oscillant de calcul de produit logique comprend un premier transistor (Tr1) branché, par le biais d'une première résistance (R2) du collecteur, entre la borne d'entrée (a) et la borne d'entrée de la tension de référence, la tension du collecteur dudit premier transistor (Tr1) étant appliquée à la base par le biais d'une résistance d'atténuation, un deuxième transistor (Tr2) branché, par le biais d'une deuxième résistance (R3) du collecteur, entre la borne d'entrée (b) et la borne d'entrée de la tension de référence, la tension du collecteur du deuxième transistor étant appliquée à la base par le biais d'une première diode Zener (ZD1), une résistance de fuite (R7) interposée entre la base et la terre, et un troisième transistor (Tr3) branché, par le biais d'une troisième résistance (R4) du collecteur et une deuxième diode Zener (ZD2) étant appliquée à la base du premier transistor (Tr1) et une borne de sortie étant branchée entre la deuxième diode Zener (ZD2) et le collecteur du troisième transistor (Tr3).

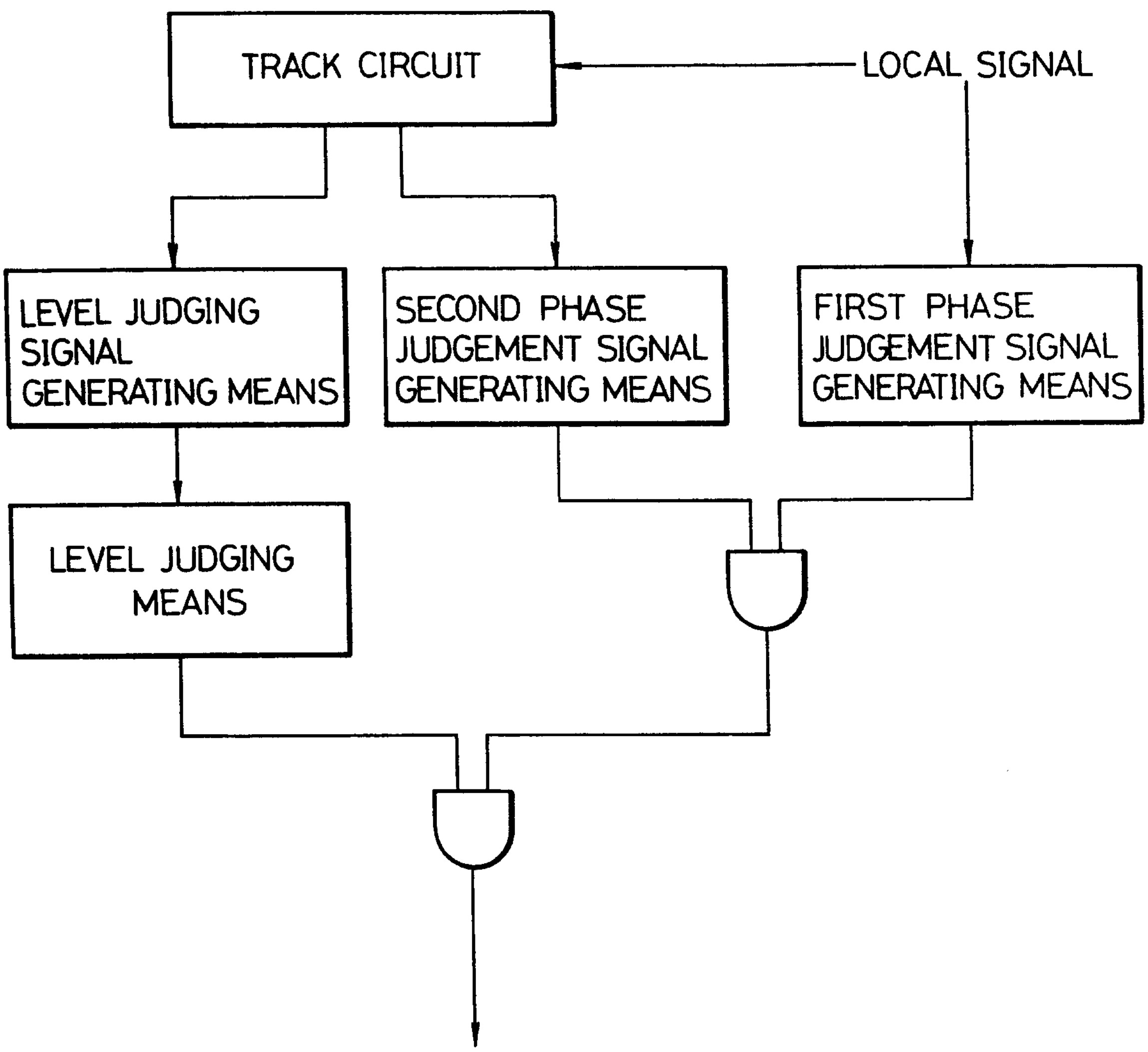
7. Appareil de détection de véhicule selon la revendication 6, dans lequel le premier moyen (22) de génération d'un signal d'évaluation de phase comprend un deuxième circuit redresseur de forme d'onde (22) pour redresser le signal local en un signal rectangulaire et pour produire un signal rectangulaire qui est injecté à la borne d'entrée (a), et

le deuxième moyen de génération d'un signal d'évaluation de phase comprend un premier circuit redresseur de forme d'onde (24) pour redresser le signal de voie en un signal rectangulaire, un circuit différentiel (25) pour différentier la sortie du premier circuit redresseur de forme d'onde et pour produire un signal différentié qui est injecté à la borne d'entrée (c), un circuit redresseur (27) pour redresser la sortie oscillante du circuit oscillant (26) de calcul de produit logique et une diode (D3) pour injecter la sortie du circuit redresseur à la borne (c).

8. Appareil de détection de véhicule selon la revendication 7, dans lequel le moyen (23) d'évaluation de niveau comprend un circuit à seuil pour produire une tension supérieure à une valeur prédéterminée du signal d'évaluation de niveau produit par le moyen (12) de génération de signal d'évaluation de niveau et un circuit redresseur à une alternance, doubleur de tension (C1, C2, D1, D2) pour traiter le signal de sortie du circuit à seuil.

9. Appareil de détection de véhicule selon la revendication 1, dans lequel le premier moyen (22) de génération d'un signal d'évaluation de phase, le deuxième moyen (24, 25) de génération d'un signal d'évaluation de phase, le moyen (12) de génération d'un signal d'évaluation de niveau, le circuit (23) d'évaluation de niveau, le premier circuit (26) de produit logique et le deuxième circuit (26) de produit logique utilisent comme source d'énergie une sortie continue obtenue par redressement du signal local.

FIG.1


TRACK CIRCUIT
LOCAL SIGNAL
LEVEL JUDGING SIGNAL GENERATING MEANS
SECOND PHASE JUDGEMENT SIGNAL GENERATING MEANS
FIRST PHASE JUDGEMENT SIGNAL GENERATING MEANS
LEVEL JUDGING MEANS

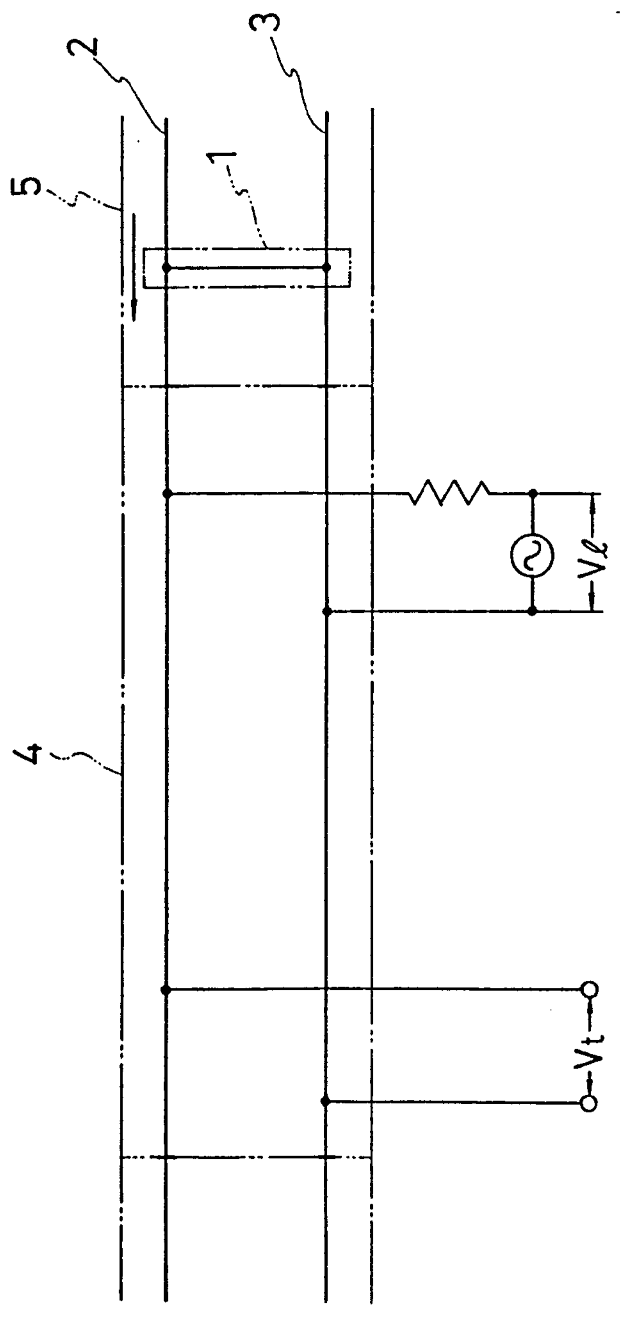


FIG 2

FIG. 3

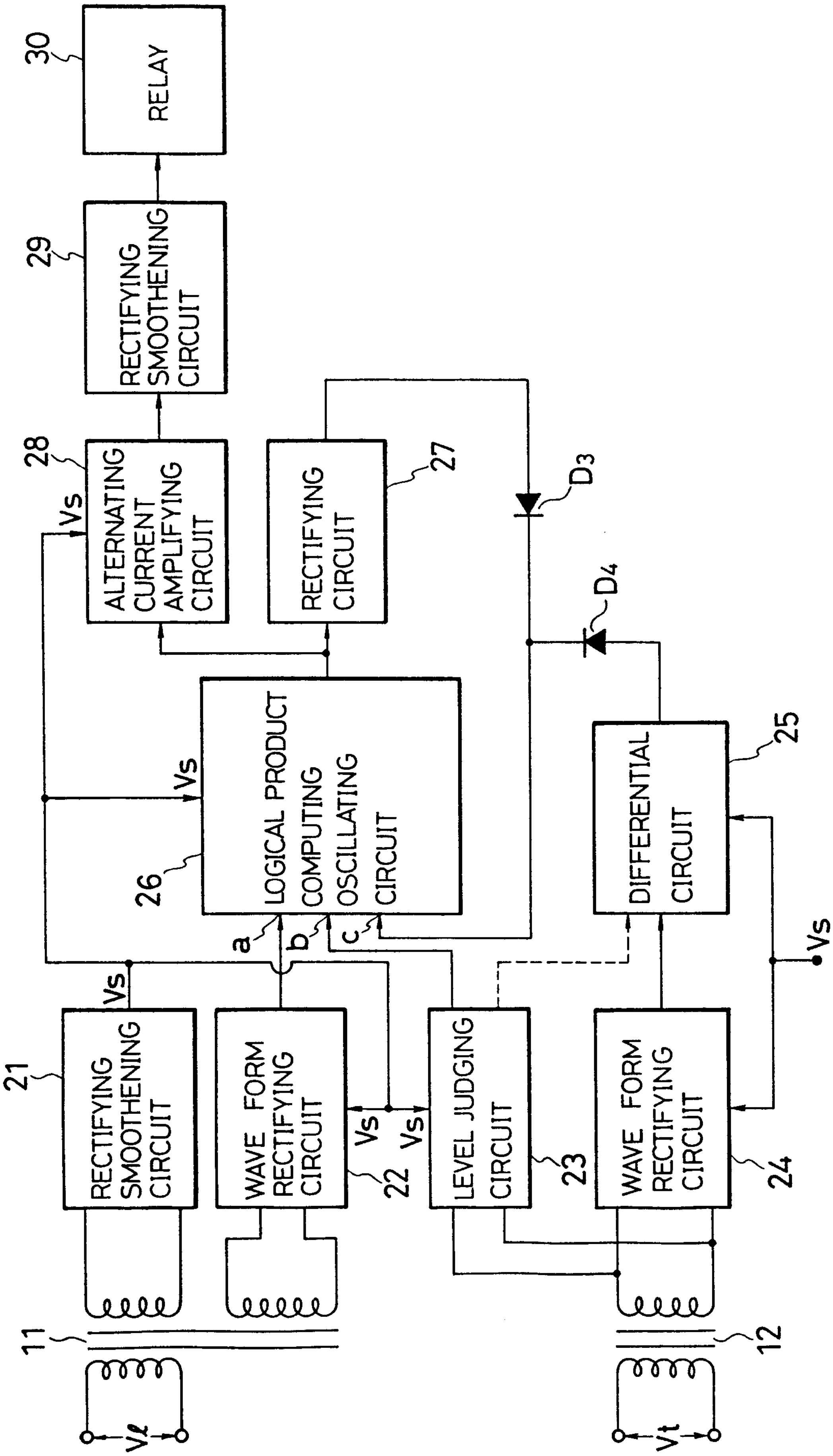

RELAY
RECTIFYING SMOOTHENING CIRCUIT
ALTERNATING CURRENT AMPLIFYING CIRCUIT
RECTIFYING CIRCUIT
LOGICAL PRODUCT COMPUTING OSCILLATING CIRCUIT
DIFFERENTIAL CIRCUIT
RECTIFYING SMOOTHENING CIRCUIT
WAVE FORM RECTIFYING CIRCUIT
LEVEL JUDGING CIRCUIT
WAVE FORM RECTIFYING CIRCUIT
Vs
a
b
c
D_3
D_4
V_ℓ
V_t
11
12
21
22
23
24
25
26
27
28
29
30

FIG 4

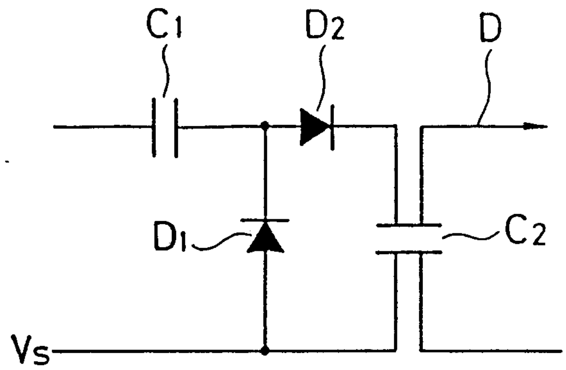


FIG 5

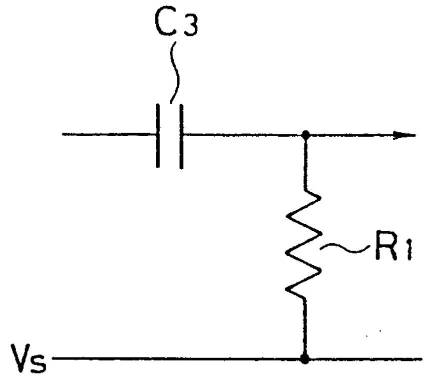


FIG 6

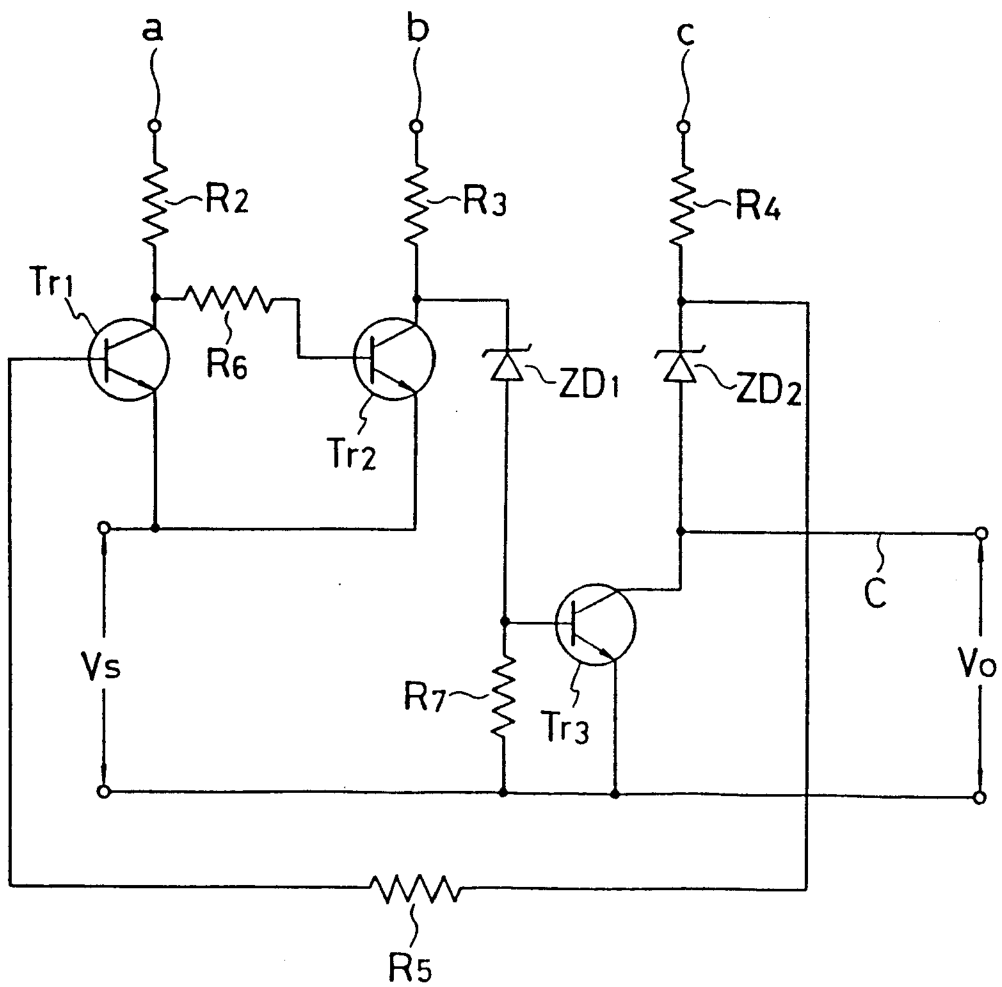


FIG 7