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(71) Applicant(s)
VAE GmbH, VAE Eisenbahnsysteme GmbH

(72) Inventor(s)
Oberhoffner, Wolfgang; Berlitz, Gerhard

(74) Agent/Attorney
Madderns, Level 4 19 Gouger Street, Adelaide, SA, 5000

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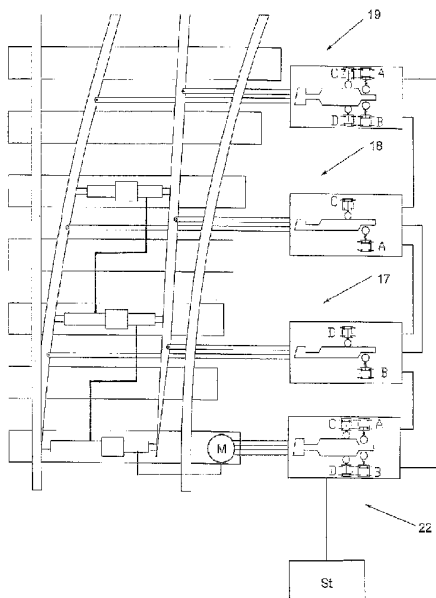
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- (71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von
US): VAE EISENBAHNSYSTEME GMBH [AT/AT];
- (72) Erfinder; und
- (75) Erfinder/Anmelder (nur für US): OBERHOFER,
Wolfgang [AT/AT]; Flossweg 11, A-8740 Zellweg (AT).
BERLIZ, Gerhard [AT/AT]; Sandgasse 62A, A-8720
Knittelfeld (AT).
- (74) Anwalt: HAFNER, Thomas, M.; Schottengasse 3a,
A-1014 Wien (AT).
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(54) Title: DEVICE FOR THE REMOTE SUPERVISION OF POINT MECHANISMS

(54) Bezeichnung: EINRICHTUNG ZUM FERNÜBERWACHEN VON WEICHENANTRIEBEN



(57) Abstract: The invention relates to a device for the remote supervision of point mechanisms operated by means of four lines e.g. by a three-phase current or by an alarm circuit which is operated by four lines and comprises contacts which are switched according to the position of the points and, once the respective end position has been reached, switch off an alarm circuit guided over the four lines for a points monitoring device that is e.g. fed by a constant voltage. A plurality of checking planes is provided in the longitudinal direction of the rails, and at least four switching contacts are interconnected in each checking plane and co-operate with mobile parts of the point mechanism or the point, e.g. a checking rod, in such a way that respectively two switching contacts are in a closed switching position and two switching contacts in an open switching position in an end position, and the switching position of each switching contact is changed once when it is moved into the other end position. According to the invention, the switching contacts of a plurality of checking planes are interconnected in such a way that, in the respective end positions, all closed switching contacts of the interconnected checking planes are mounted in series to form respectively one alarm circuit.

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Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(57) Zusammenfassung: Bei einer Einrichtung zum Fernüberwachen von über vier Leitungen z.B. drehstrombetriebenen Weichenantrieben oder eines über vier Leitungen betriebenen Überwachungsstromkreises mit in Abhängigkeit von der Position der Weiche geschalteten Kontakten, über die sich nach dem Erreichen der jeweiligen Endlage ein über die vier Leitungen geführter Überwachungsstromkreis für einen z.B. gleichspannungsgespeisten Weichen-Überwacher schließt, wobei eine Mehrzahl von in Schienenlängsrichtung versetzt angeordneten Prüfebenen vorgesehen ist und in jeder Prüfebene wenigstens vier Schaltkontakte miteinander verschaltet und derart mit bewegten Teilen des Weichenantriebs oder der Weiche, z.B. einer Prüferstange, zusammenwirken, dass sich in einer Endlage jeweils zwei Schaltkontakte in geschlossener und zwei Schaltkontakte in offener Schaltstellung befinden und die Schaltstellung jedes Schaltkontaktes bei Umstellung in die andere Endlage einmal geändert wird, sind die Schaltkontakte mehrerer Prüfebenen derart miteinander verschaltet, dass in den jeweiligen Endlagen alle geschlossenen Schaltkontakte der miteinander verbundenen Prüfebenen zur Ausbildung jeweils eines Überwachungsstromkreises in Serie geschaltet sind.

Device for the Remote Monitoring of Railway Switch Drives

The invention relates to a device for the remote monitoring of railway switch drives operated via four lines, for instance by three-phase current, or of a monitoring circuit operated via four lines and including electric contacts which are switched as a function of the position of the railway switch and via which, upon reaching of the respective end position of the switch tongue, a monitoring circuit is closed across said four lines, for a railway switch monitor fed, for instance, by direct voltage, wherein a plurality of checking planes arranged in an offset manner in the longitudinal direction of the rails are provided and in each checking plane at least four electric switching contacts are circuited together and cooperate with moved parts of the railway switch drive or railway switch, for instance a check rod, in a manner that in an end position of the switch tongue two electric switching contacts are each in the closed, and two electric switching contacts are each in the open, switching position and the switching position of each of the electric switching contacts is changed once at a changeover into the other end position of the switch tongue.

A device of the initially defined kind can, for instance, be taken from EP 0 052 759 A2. In that known device, it is departed from an electronic switch tower for feeding and remotely monitoring a railway switch drive that is operated by three-phase current via four lines. In the star point connections of the motor windings are arranged contacts controlled by the drive, via which the motor windings can be connected to the three-phase mains upon closure of the switching-on contacts and via which, upon rotation of the actuator and reaching of the respective new end position, a monitoring circuit is closed across the four lines and three windings of the drive for a railway switch control circuit fed, as a rule, with direct

voltage. The motor windings during rotation in correct operation are fed symmetrically and fed asymmetrically at least during run-down. The monitoring device responds to the monitoring currents via respectively associated diodes and via connection contacts of a running-direction selector, whereby the setting current is switched off and the monitoring voltage is switched on with the railway switch having assumed one of the two end positions. Upon rotation of the drive and reaching of the respective new end position, the monitoring circuit conducted across two of the four end position contacts, the three motor windings and the four three-phase current lines will close in a manner that a thus formed power circuit will signal the correct functioning of the electric end position switches. Further devices of the initially defined kind are, for instance, known from DE 36 38 681 A1, in which the remote monitoring of three-phase railway switch drives is performed by the aid of two current-direction sensitive indicators connected in parallel via connection contacts of a running-direction selector. A monitoring direct voltage source will feed a control potential to the two indicators via the three-phase line, the motor windings of the drive and the end position contacts, if the drive assumes one of its end positions.

From DE 198 19 162 A1, another device of this type for a railway switch comprising several switch drives can be taken. The end positions of the switch drives are monitored in that the respective end position messages of the individual further switch drives are combined to a summation message. The circuitry in this case is to safeguard that the monitoring circuit will be realized only if all of the respective, commonly monitored drives assume identical end positions. In the event of cut-off switch drives, the normal positions of all of the connecting relays are monitored.

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In the initially mentioned device known from EP 0 052 759 A2, a number of additional monitorings were effected and centrally detected. Common to all known devices is that in the event the configuration is to be used for a plurality of checking planes without any basic changes in the lines involved, the signals combined to a summation message will in certain special cases not be suitable to monitor all of the electric switches, and maladjustments of an electric switch may, therefore, lead to that a monitoring circuit will still build up and the respective error message will not occur, or cannot be evaluated.

SUMMARY

According to a first aspect of the present invention, there is provided a device for the remote monitoring of a railway switch drive a railway switch, the railway switch having a switch tongue having two end positions and the railway switch drive operated via four lines and including electric contacts which are switched as a function of the position of the switch tongue and via which, upon arrival in a respective end position of the switch tongue, and including a monitoring circuit which is closed across said four lines wherein a plurality of checking planes are arranged in an offset manner in the longitudinal direction of the rails, and in each checking plane at least four electric switching contacts are electrically connected together and cooperate with moved parts of the railway switch in a manner that in an end position of the switch tongue two electric switching contacts are each in the closed switching position and the two other electric switching contacts are each in the open switching position, and the switching position of each of the electric switching contacts is changed once at a changeover into the other end position of the switch tongue, characterised in that the four electric switching contacts of each of the plurality of checking planes are connected with one another in a manner that in the respective end positions of the switch tongue all of the closed electric switching contacts of said checking planes are connected with one another in series to form the respective monitoring circuit.

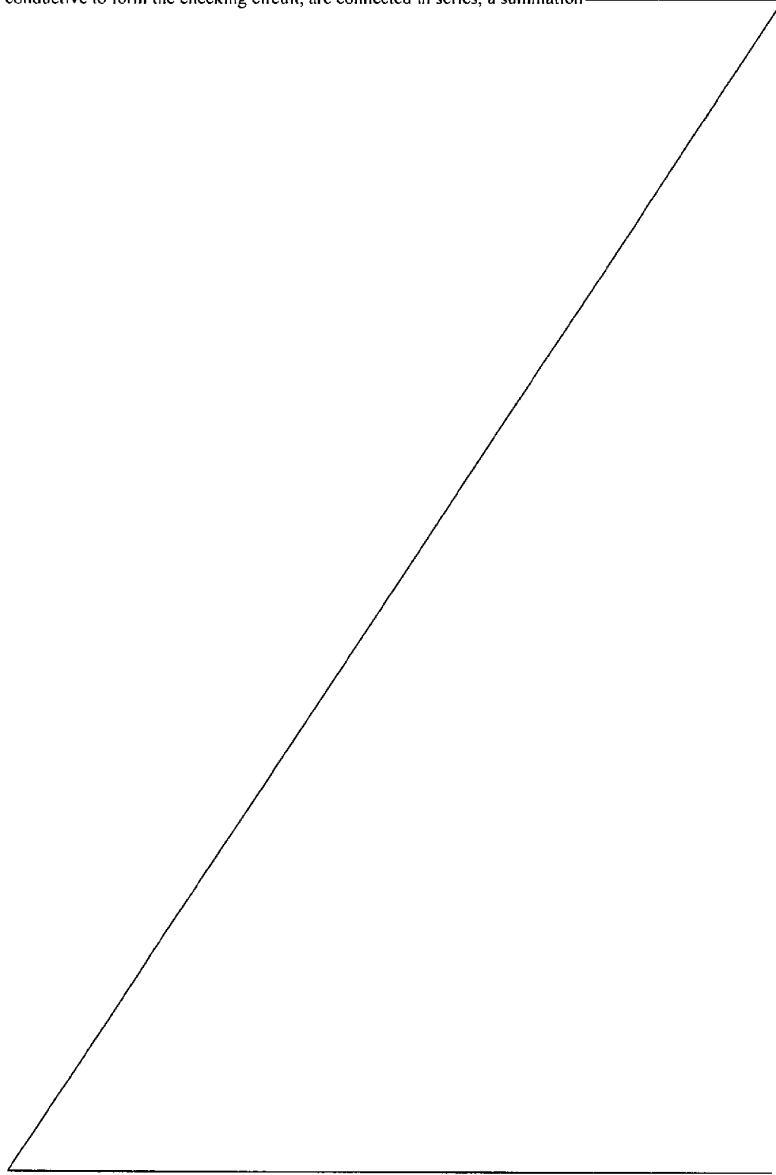
DESCRIPTION

Departing from the initially described device for feeding and remotely monitoring railway switch drives operated by three-phase current via four lines, the present invention aims to ensure the safe monitoring of several checking planes of one and the same railway switch without any increase in lines involved and without any adaptation work worth mentioning, and to enable the safe check of all electric switches of a plurality of checking planes of the same or several railway switches by a single monitoring unit. To solve this object, the device according to the invention consists essentially in that the electric switching contacts of several checking planes are connected with one another in a manner that in the respective end positions of the switch tongue all of the closed electric switching contacts of the checking planes connected with one another are connected in series to form a respective monitoring circuit. While in the known configurations only part of the electric switches were each always

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connected in series and other electric switches were connected in parallel, in the configuration of the invention, by which the electric switching contacts of several checking planes are connected with one another in a manner that all of the closed electric switching contacts, i.e. all of the connections that are conductive to form the checking circuit, are connected in series, a summation



signal will actually be formed, and the monitoring circuit will actually close, only if all of the switches of several checking planes are actually working and the changeover of the railway switch was correct.

Yet, in order to ensure correct working and the necessary check, not only the electric switch position as such, but also the respective time required by the three-phase motor for the switching procedure are essential criteria to be evaluated for the correct working of the railway switch and its safety. The configuration in this respect, as known per se, is devised such that motor windings of a three-phase motor are connected in series with the electric switching contacts and connectable to the three-phase mains via the same, wherein the configuration in a particularly advantageous manner is devised such that the monitoring circuit corresponding to one of the end positions and the monitoring circuit corresponding to the other of the end positions are connected with each other in a manner that the monitoring circuits will be connected to a star point connection at the occurrence of a malfunction of at least one of the electric switching contacts or a faulty setting of the railway switch in at least one checking plane. If a failure of an electric switching contact occurs, a new star point connection can be formed with this switching arrangement, whereby the correct function, or a malfunction, can be directly concluded from the parameters: period of changeover and current consumption of the three-phase drive.

An absolute potential separation between logics and power range is to be ensured both in the signaling and in the setting modes of operation. As already mentioned in the beginning, the voltage in the monitoring circuit, as a rule, is a direct voltage, whereas the power range, as a rule, is fed by a three-phase source. During a setting procedure, it is to be taken care that

the drive will be switched off upon reaching of the end position, in order to ensure the respective potential separation required for the subsequent check. If the end position is not reached, the drive will have to be switched off after a maximally admissible running time, thus enabling an error to be immediately recognized or evaluated by verification of the summation signals.

The switching arrangement according to the invention, which connects a plurality of checking planes with one another, can be realized with conventional electric switches or electric switching contacts or controlled electric contacts such that the only expenditure involved is limited to connecting the electric contacts in the correct manner in order to enable the desired series connection in any position. In this context, the configuration advantageously is devised such that two electric switching contacts each of a checking plane, which have different switching positions, are combined in a switch component and cooperate with a common actuating member. In principle, electric switching contacts of a checking plane need not necessarily be redundant. However, in order to ensure the redundancy necessary for the series connection according to the invention also in those cases, the total number of electric switching contacts must comply with the criteria of redundancy. To this end, the configuration is devised such that the number of electric switching contacts of all checking planes corresponds to an integral multiple of eight. With such a number of electric switching contacts and the respective crosswise connection or self-monitoring mode of construction in a first checking plane, it is feasible to safely avoid shunts or parallel connections in all switching positions such that the required series connection by which a summation signal can be correctly determined for all of the electric switching contacts to be monitored will actually always be guaranteed.

In the preferred embodiment, the device according to the invention is further developed in a manner that at least two electric switching contacts are connected in series having the same switching position at the same end position of the switch tongue, wherein, in a further preferred manner, two electric switching contacts having different switching positions, of an electric switch component are linked with each other for the same end position of the switch tongue. This safeguards enhanced failure disclosure.

Finally, the configuration may also be devised such that three electric switching contacts, of which at least two comprise different switching positions, are combined in an electric switch component to cooperate with a common actuating member. In this case, three instead of two electric switching contacts are, thus, each integrated in a component and commonly actuated, wherein two such electric switch components can be arranged in the checking plane such that a total of six electric switching contacts are provided.

In order to increase the operating safety, further marginal condition are to be observed, wherein above all the wiring of the first checking plane for the complete series connection requires special attention irrespective of the respective position. In this context, the configuration may either be devised such that a separate, self-monitoring checking unit is arranged in a first one of said checking planes connected with one another, or be devised such that the electric switch components allocated to a first one of said checking planes connected with one another are crosswisely circuited. In both cases, it is ensured in the first checking plane that no undesired shunts will occur and, as a result, the series connection will actually always be ensured for all closed

electric switching contacts of a plurality of checking planes each.

In the following, the invention will be explained in more detail by way of exemplary embodiments of different switching states schematically illustrated in the drawing. Therein, Figs. 1 to 8 depict a monitoring device according to the prior art, Fig. 9 illustrates the schematic structure of the monitoring device according to the invention, and Figs. 10 to 16 are circuit diagrams of the monitoring device according to the invention in different states of the railway switch.

Fig. 1 schematically illustrates a railway switch drive 1, which is fed via four feed lines 2, 3, 4 and 5 and capable of being controlled and monitored from a switch tower. The drive 1 comprises a three-phase motor including windings U, V and W, which are connected in a known manner with the electric switching contacts 6, 7, 8 and 9. A rotary current mains including three phases L1, L2, L3 as well as the common center point conductor serves as power supply means for a changeover of the drive. Further arranged in or between two of the three external conductors L1, L2 and L3 is a railway switch running-direction selector not illustrated in detail, via which, for instance, the phase positions of the currents flowing on the outer conductors L1 and L2 for the right-handed and the left-handed rotation, respectively, of the drive are interchangeable. In Fig. 1, the electric switching contacts 6, 7, 8 and 9 are switched in a manner that the phases L1, L2 and L3 are interconnected to a star point 10 such that the three-phase motor can be operated at full power.

Figs. 2a and 2b exemplify two configurations of electric switch components 11 and 12, in which two electric switching contacts are each combined. The electric switch component 11 comprises

electric switching contacts 6 and 7, the electric switch component 12 comprises electric switching contacts 8 and 9. The electric switching contacts 6, 7 and 8, 9 each arranged in one electric switch component 11 and 12, respectively, are allocated a common actuating member 13, which, for instance, cooperates with grooves 15 and 16 formed in a check rod 14. In Fig. 2, the actuating member 13 of the electric switch component 12 engages in the groove 15 and is therefore in the released state. The electric switch component 11, on the other hand, is in the tensioned position. The switch positions illustrated in Fig. 2 correspond with one of the two end positions of a railway switch tongue, or a movable frog. In the other end position of the switch tongue, the electric switch component 12 is in the tensioned position and the electric switch component 11 is in the released position. During the resetting movement, both electric switch components 11, 12 are tensioned. The two electric switching contacts 6, 7 and 8, 9 of the electric switch components 11 and 12, respectively, are in different switching positions.

From this results in the right-hand end position the circuit diagram represented in Fig. 3. In this right-hand end position, the feed lines 2, 3, 4, 5 by the switch tower are interconnected in a manner that a monitoring circuit can build up across the four feed lines 2, 3, 4, 5 and the three motor windings U, V, W. The monitoring circuit is designed as a direct voltage circuit having a feed voltage of 60 Volts. If the correct right-hand end position of the switch tongue is assumed, the monitoring circuit will be closed and extend across feed line 2, motor winding V, electric switching contact 8, feed line 3, monitoring relay Wü, feed line 4, motor winding U, electric switching contact 7, motor winding W and feed line 5.

In Fig. 4 it is anticipated that the switch computer of the switch tower has issued the switch command for switching the railway switch, whereby the monitoring circuit is opened, and the feed circuit for the drive motor is closed, by the switch tower. The winding V of the drive motor lies at the phase voltage, whereas the windings U and W lie at the phase-to-phase voltage between phases L2 and L3. The drive motor starts rotating, yet without the electric switching contacts 6, 7, 8, 9 being initially switched over. In this starting phase, the motor starts running at a torque of about 70%. Then the electric switching contacts 8, 9 are switched over in the starting phase, since the actuating member 13 of the electric switch component 12 is pressed out of the groove 15 of the check rod. Hence results the circuitry illustrated in Fig. 1, in which the motor windings are star-connected.

Fig. 5 depicts the feed circuits of the drive in the run-down phase shortly before the drive motor is switched off. In this phase, the electric switching contacts 6, 7 too have changed their switching positions and thus separated the star point connection of the motor windings. The motor is now asymmetrically excited via the phase voltage and the phase-to-phase voltage, whereby the motor continues to run at 70% of the torque. Via the center point conductor Mp, the switch tower recognizes that the changeover has been completed. At the switch tower, the feed voltage for the three-phase motor is, therefore, cut off and the monitoring voltage for the left-hand end position is applied. Thereby, a monitoring circuit as illustrated in Fig. 6 builds up across feed line 4, motor winding U, electric switching contact 6, feed line 3, monitoring relay WU, feed line 2, motor winding V, electric switching contact 9, motor winding W and feed line 5.

In the illustration according to Fig. 7 the situation in which the railway switch was run through, i.e. trailed against the position defined by the switch command executed last, is shown. The two electric switching contacts 6 and 7 have changed their switching positions. Due to the contact change, the hitherto existing monitoring circuit was interrupted with the monitoring relay Wü being released and the driving relay WA being picked up. The application of the feed voltage again causes the formation of a star connection of phases L1, L2, L3 such that the three-phase current can again be applied for a new changeover.

Fig. 8 illustrates a circuitry as provided according to the prior art in a monitoring device that takes into account several checking planes arranged in an offset manner in the longitudinal direction of the rails. Each of the checking planes 17, 18 and 19 comprises a checking circuit including two electric switch components each having two electric switching contacts interconnected in a cascade-like manner. In the illustration according to Fig. 8, the monitoring voltage for the right-hand rail end position has been applied, and it is apparent that the faulty behavior of individual contact switches is not recognized. With the correct functioning of all electric switching contacts, whereby the electric switching contact 20 would be open and the electric switching contact 21 would be closed, the monitoring circuit should extend across the electric switching contact 21 as indicated by broken lines. At a malfunctioning of the electric switching contacts 20 and 21, which are combined to an electric switch component according to the electric switch component 11 and 12, respectively, (as illustrated in Fig. 8), the electric switching contact 20 is, however, closed and the electric switching contact 21 is open, so that the monitoring circuit will nevertheless be closed via the electric switching contact 20. Such malfunctioning will not

be recognized by the switch tower, because the individual electric switching contacts are connected in parallel, so that no summation signal that would indicate the malfunctioning even of a single electric switching contact will be available.

It is, therefore, proposed according to the invention that the electric switching contacts of several checking planes are connected with one another in a manner that all of the closed electric switching contacts of the interconnected checking planes will be connected in series in the respective end positions of the switch tongue. A schematic illustration of a monitoring device according to the invention is depicted in Fig. 9. The individual checking planes are denoted by 17, 18 and 19, and electric switch components A, B, C and D are apparent, each of which comprises two electric switching contacts having different switching positions. In the following Figures, the electric switching contacts of the individual electric switch components are denoted by A1/2, A3/4, B1/2, B3/4, C1/2, C3/4 and D1/2, D3/4, respectively, wherein two electric switching contacts may each be integrated in an electric switch component, for instance electric switching contacts A1/2 and A3/4 in electric switch component A. The electric switch components can be configured as illustrated in Figs. 2a and 2b. The drive motor is denoted by M and the switch tower is denoted by St. Fig. 10 depicts the circuitry of the individual electric switching contacts, wherein, based on a first drive end position monitoring 22, three additional checking planes 17, 18 and 19 are consecutively arranged and connected in series. In the end position shown in Fig. 10, the monitoring circuit is closed and optically emphasized. It is apparent that all of the electric switching contacts closed in this end position of the switch tongue are connected in series with the monitoring circuit each extending across the electric switching contacts A1/2, B1/2, C3/4 and D3/4 of the individual checking planes. In the other

end position of the switch tongue, a monitoring circuit extending across the electric switching contacts C1/2, D1/2, A3/4 and B3/4 of the individual checking planes would result, as indicated by broken lines. It is apparent that the monitoring circuit connects all of the respectively closed electric switching contacts in series such that the malfunctioning of a single switching contact arranged in the row will cause the interruption of the monitoring circuit in a manner that the malfunctioning of a single electric switching contact will be recognized any time. The monitoring circuits corresponding to the two end positions of the switch tongue (indicated in Fig. 10 by full lines and by broken lines, respectively) are connected via connections 23 in a manner that a star connection will result from a malfunctioning of any of the electric switching contacts such that the three-phase motor will continue to run during the changeover and the faulty behavior will be recognized by the switch tower on account of the exceeded changeover period. Fig. 11 depicts the situation in which the electric switch component comprising the electric switching contacts B1/2 and B3/4 in the checking plane 19 does not indicate the reaching of the desired end position, so that the monitoring circuit will be interrupted and a star-point connection with star point 10 will result such that the three-phase motor will continue to run at full power. Thus, the point of connection for the star point of the first checking plane with a conventional four-wire technique is shifted under inclusion of the individual checking planes and thereby enables the conductance of the monitoring current path through the individual star points of the checking planes.

In the lowermost connection plane 22, a self-monitoring monitoring unit or a crosswise connection of two electric switch components may be provided, as indicated in Fig. 10, for instance, for switch components B and D. Such a crosswise

connection safeguards the constant monitorability of all of the consecutively arranged electric switching contacts in the respective end position upon application of the monitoring circuit. Alternatively, a separate electric switch component E may be employed as illustrated in Fig. 16. The electric switch component E in this case may be designed in accordance with Fig. 2b.

An external feature such as, e.g., a trailing signaling means 32 may be integrated in this device for the remote monitoring of railway switches.

The monitoring device according to the invention can also be integrated into a separate four-wire monitoring circuit. In Fig. 12, a contact circuitry is illustrated, which comprises a monitoring relay 23 acting in both directions. If a single one of the numerous electric switching contacts fails, the monitoring current fed at, for instance, 48 Volts will be unable to flow and the railway switch arrangement will have to be checked. As in contrast to the illustration according to Fig. 12, in which the monitoring circuit is closed and consequently no error message is indicated, the electric switch component A during the switchover according to Fig. 13 will not be reset upon reaching of the desired end position of the rail such that the monitoring relay will be short-circuited, which will appear as an error message in the switch tower.

Overall, it is advantageous if a number of electric switching contacts corresponding to an integral multiple of eight are circuited together in the monitoring device according to the invention, and it is, therefore, required with but two electric switch components arranged in one checking plane to combine a group of four electric switch components each in a manner that a group of two electric switch components will each be arranged in

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the released position and two electric switch components will each be in the tensioned state, as is the case with the checking plane 19 in Figs. 9 to 11. A checking plane may be arranged in the drive plane or within the extension of the tongue or of the movable frog.

Fig. 14 depicts another structural design of an electric switch component 25, 26, in which three electric switching contacts are each combined. Electric switch component 25 comprises electric switching contacts 27, 28, 29. The electric switching contacts 27, 28, 29 and 24, 30, 31 respectively arranged in an electric switch component 25 and 26 are allocated a common actuating member 13 cooperating, for instance, with grooves 15 and 16 formed in a check rod 14.

The electric switch component 26 engages in the groove 15 by its actuating member 13 and is in the released position with the electric switching contact 30 closed and the contacts 24 and 31 opened. The electric switch component 25 by contrast is in the tensioned state with the electric switching contacts 27 and 28 closed and the electric switching contacts 29 opened. The switch positions illustrated in Fig. 14 correspond to one of the two end positions of the switch tongue or movable frog.

The checking device according to the invention can be assembled by electric switch components as described in Fig. 14. It is apparent that all of the electric switching contacts closed in the end position of the switch tongue are again connected in series and a monitoring circuit closes as illustrated in Fig. 15, extending across the electric switching contacts A11/12 and C4/3 and C13/14, respectively, of the individual checking planes.

It will be understood that the term "comprise" and any of its derivatives (eg comprises, comprising) as used in this specification is to be taken to be inclusive of features to which it refers, and is not meant to exclude the presence of any additional features unless otherwise stated or implied.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgement of any form of suggestion that such prior art forms part of the common general knowledge.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A device for the remote monitoring of a railway switch drive a railway switch, the railway switch having a switch tongue having two end positions and the railway switch drive operated via four lines and including electric contacts which are switched as a function of the position of the switch tongue and via which, upon arrival in a respective end position of the switch tongue, and including a monitoring circuit which is closed across said four lines wherein a plurality of checking planes are arranged in an offset manner in the longitudinal direction of the rails, and in each checking plane at least four electric switching contacts are electrically connected together and cooperate with moved parts of the railway switch in a manner that in an end position of the switch tongue two electric switching contacts are each in the closed switching position and the two other electric switching contacts are each in the open switching position, and the switching position of each of the electric switching contacts is changed once at a changeover into the other end position of the switch tongue, characterised in that the four electric switching contacts of each of the plurality of checking planes are connected with one another in a manner that in the respective end positions of the switch tongue all of the closed electric switching contacts of said checking planes are connected with one another in series to form the respective monitoring circuit.
2. A device according to claim 1, characterised in that motor windings of a three-phase motor are connected in series with the four electric switching contacts and connectable to the three-phase mains via the same.
3. A device according to claim 1 or 2, characterised in that the portion of the monitoring circuit corresponding to one of the end positions of the switch tongue and the portion of the monitoring circuit corresponding to the other of the end positions of the switch tongue are connected with each other in a star point connection at the occurrence of a malfunction of at least one of the electric switching contacts or a faulty changeover of the railway switch in at least one checking plane.
4. A device according to claim 1, 2 or 3, characterised in that two electric switching contacts each of a checking plane which have different switching positions, are combined in an electric switch component and cooperate with a common actuating member.
5. A device according to any one of claims 1 to 4, characterised in that the number of electric switching contacts of all checking planes corresponds to an integral multiple of eight.

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- 5 6. A device according to any one of claims 1 to 5, characterised in that at least two electric switching contacts are connected in series having the same switching position at the same end position of the switch tongue.
- 10 7. A device according to any one of claims 1 to 6, characterised in that two electric switching contacts having different switching positions, of an electric switch component are linked with each other for the same end position of the switch tongue.
8. A device according to any one of claims 1 to 3 and 7, characterised in that three electric switching contacts of which at least two comprise different switching positions, are combined in an electric switch component to cooperate with a common actuating member.
- 15 9. A device according to any one of claims 1 to 8, characterised in that a separate, self-monitoring checking unit is arranged in a first one of said checking planes connected with one another.
10. A device according to any one of claims 1 to 8, characterised in that the electric switch components allocated to a first one of said checking planes connected with one another are crosswisely circuited.
- 20 11. A device as claimed in claim 1 substantially as herein described with reference to the accompanying drawings.
12. A device substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings.

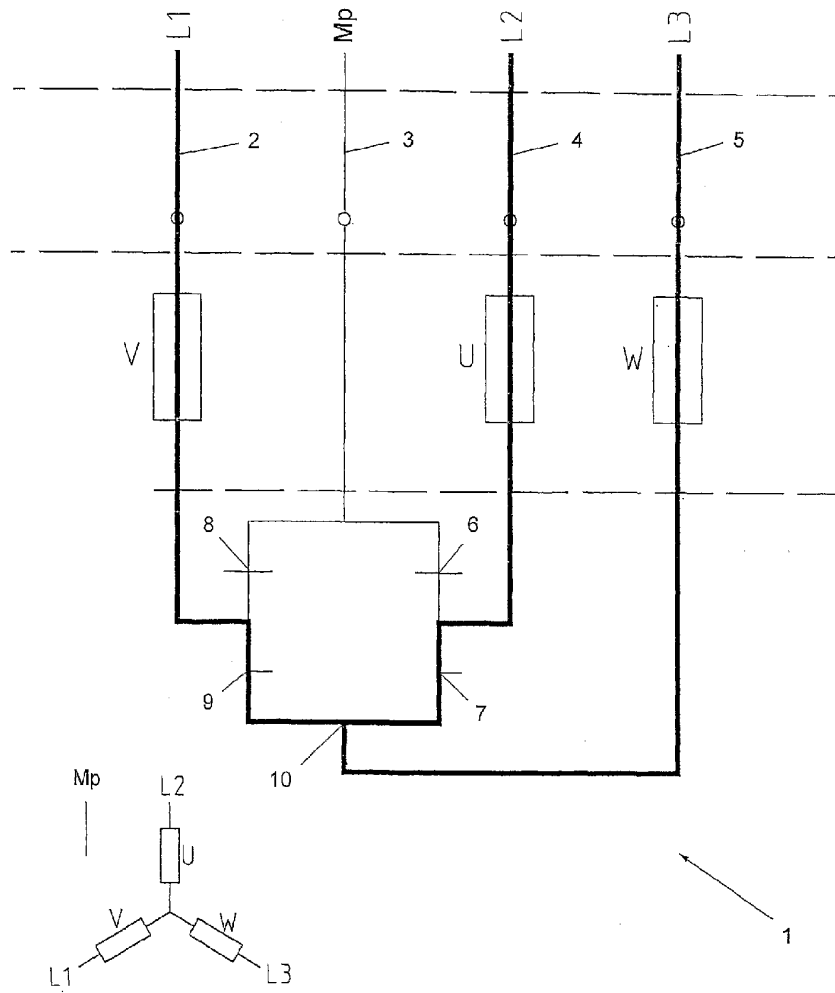


Fig. 1

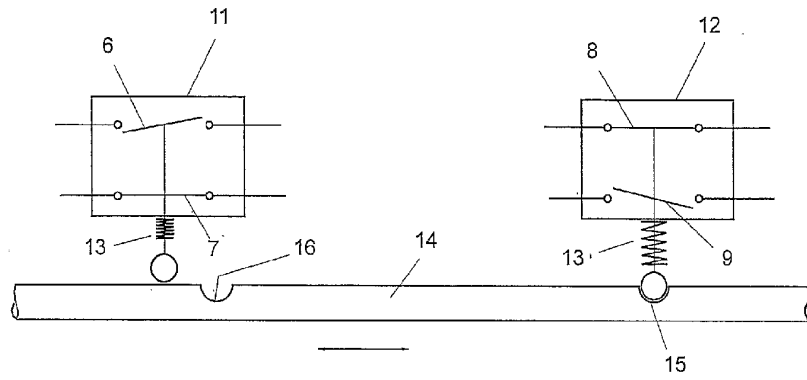


Fig. 2a

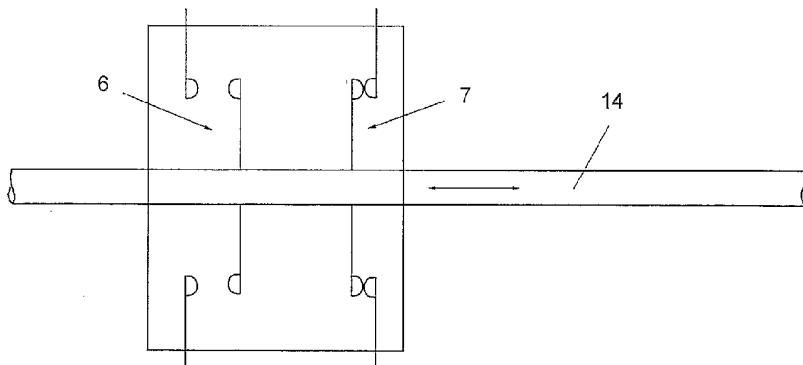


Fig. 2b

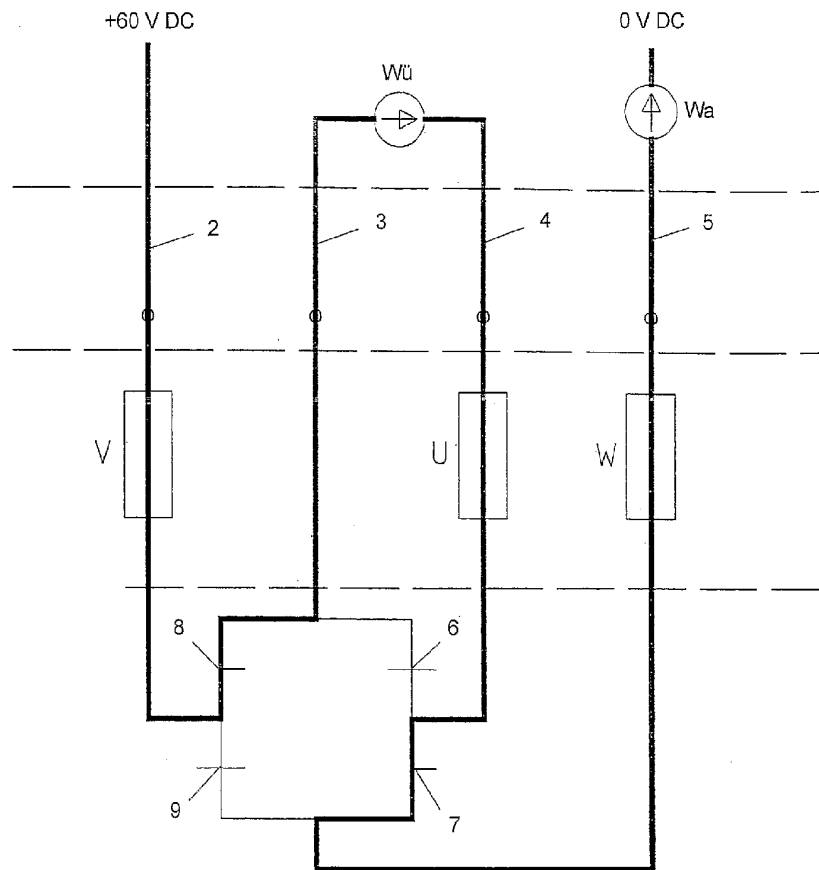


Fig. 3

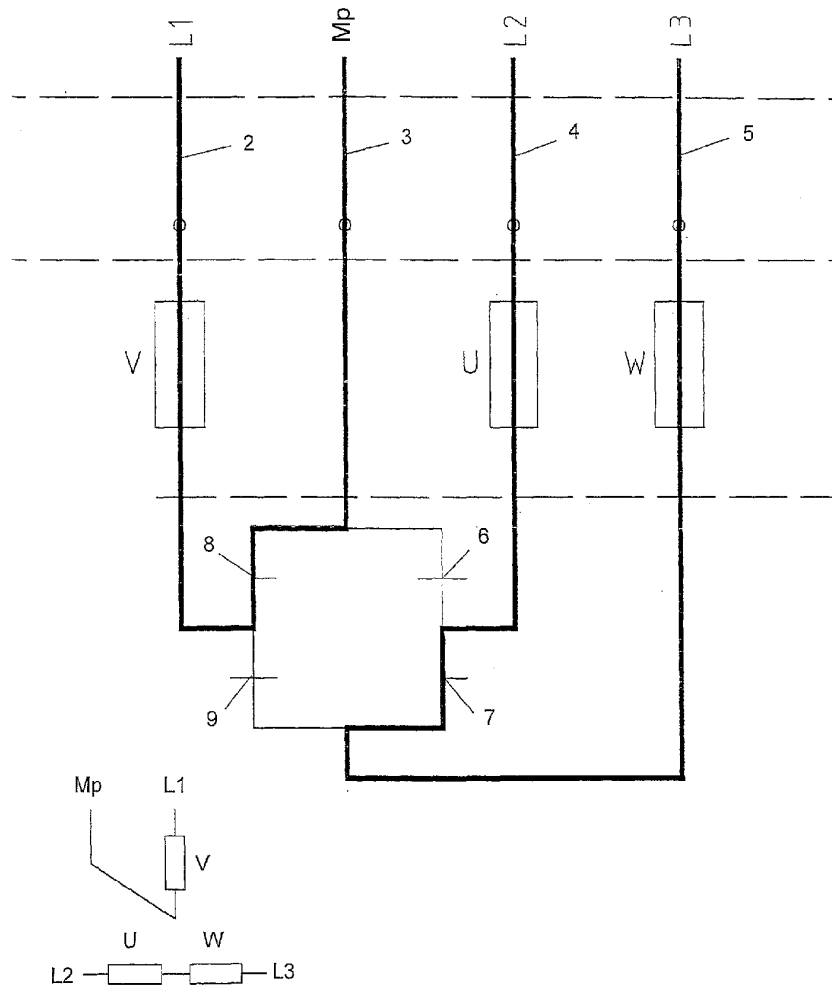


Fig. 4

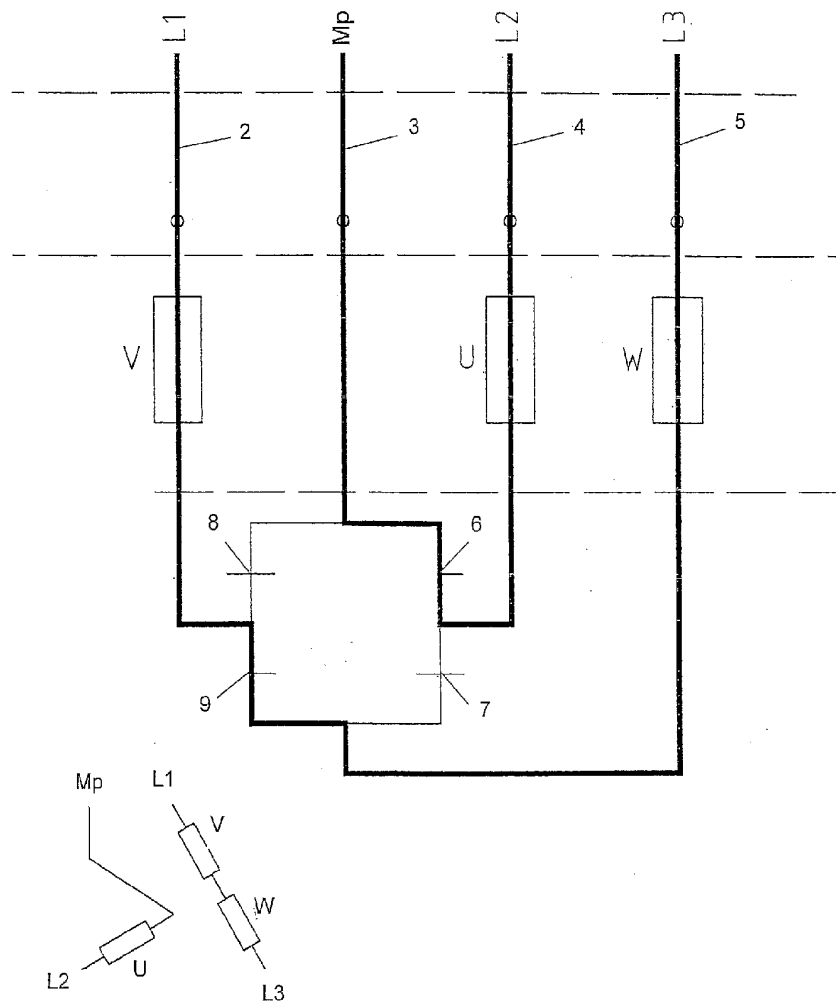


Fig. 5

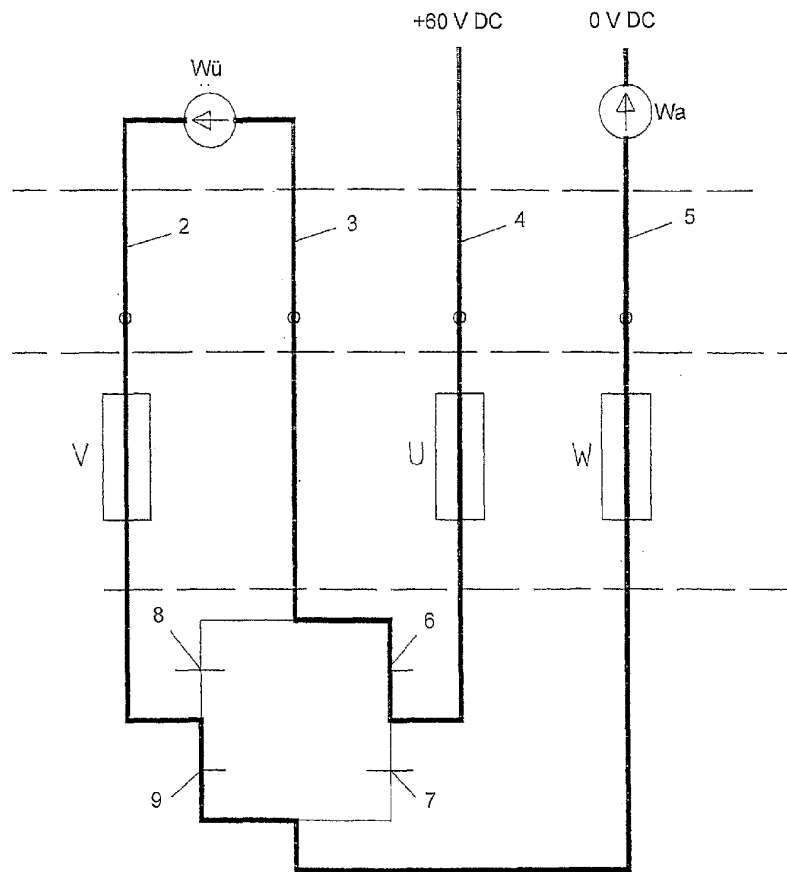


Fig. 6

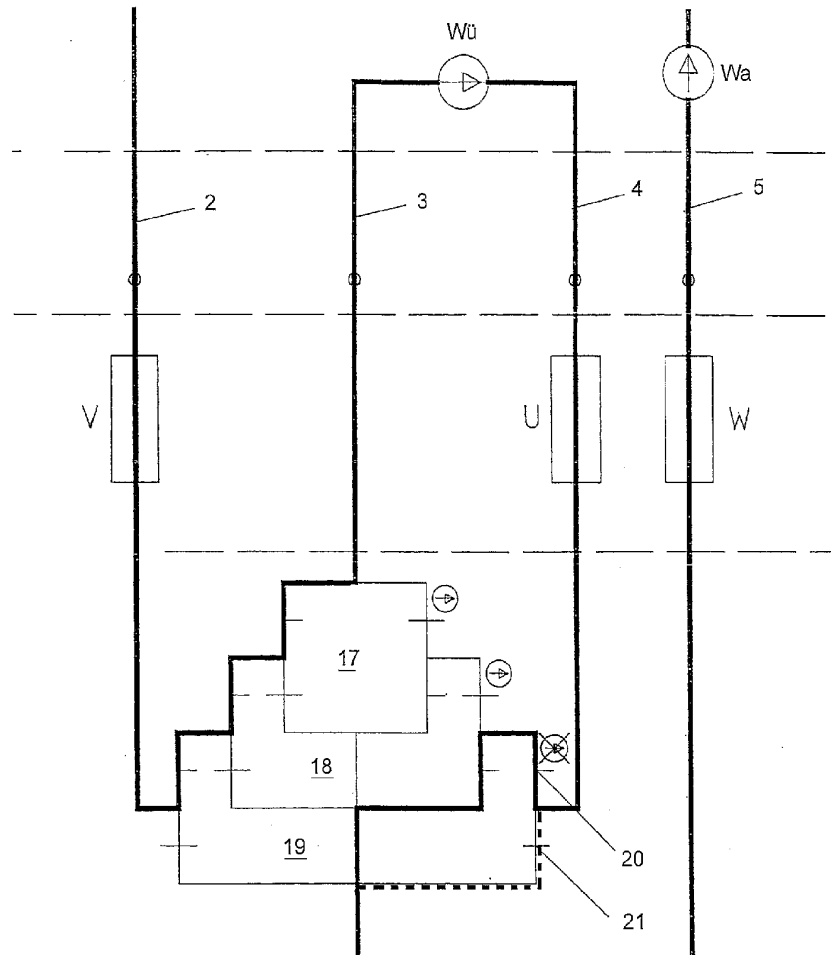


Fig. 8

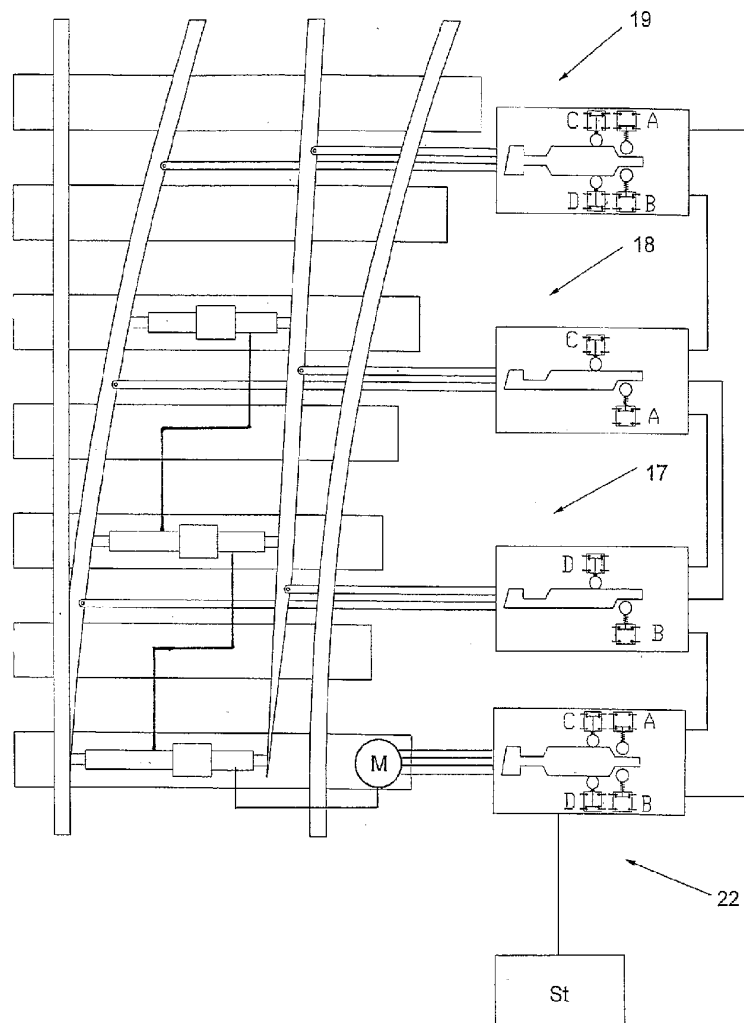


Fig. 9

Fig. 10

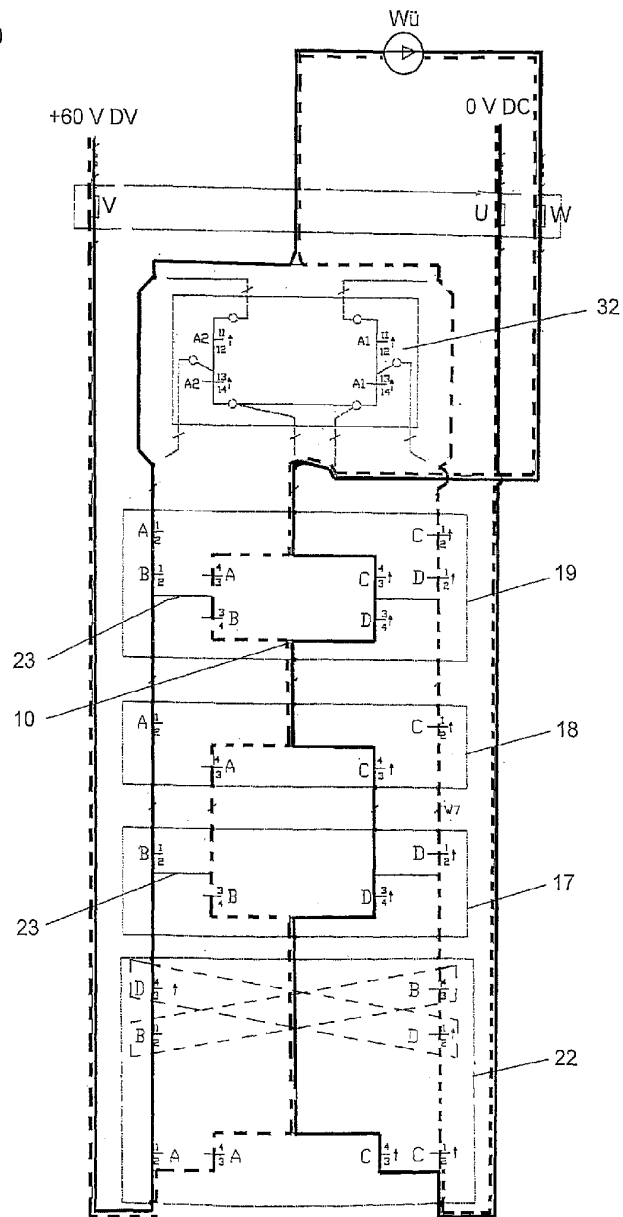


Fig. 11

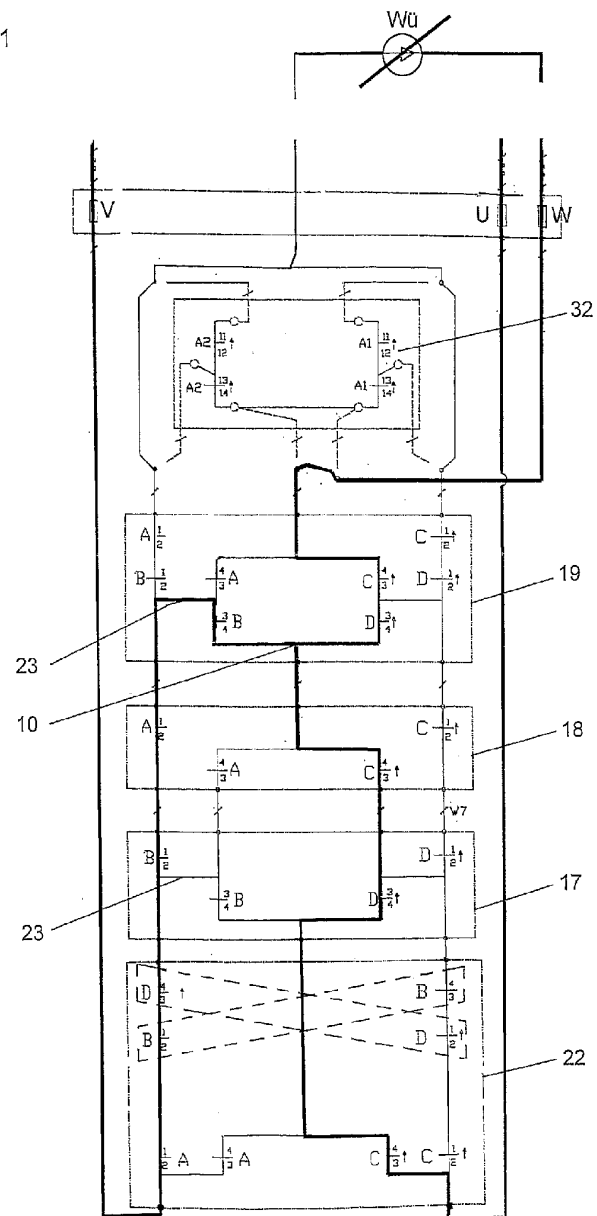


Fig. 12

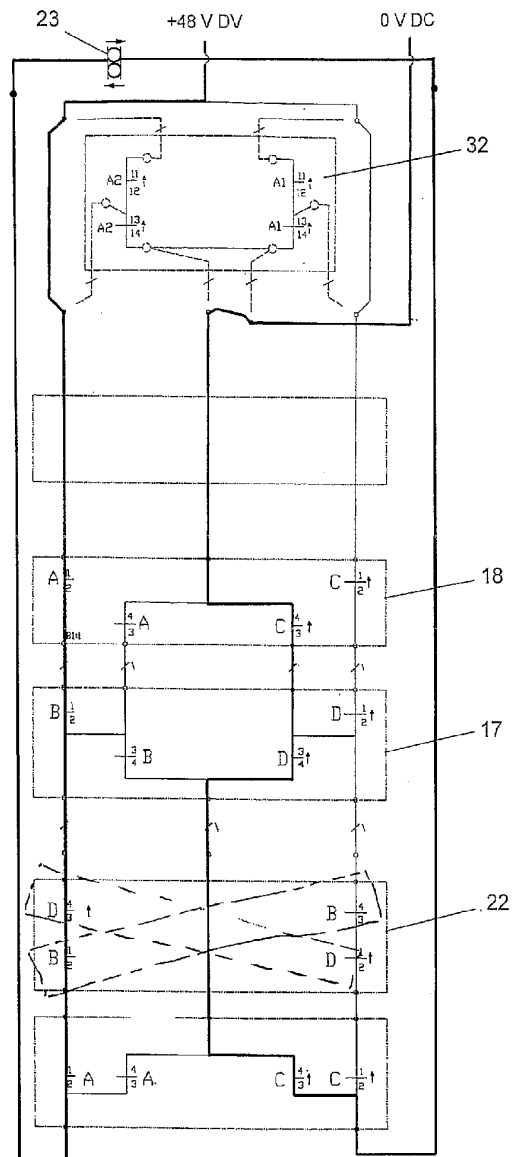
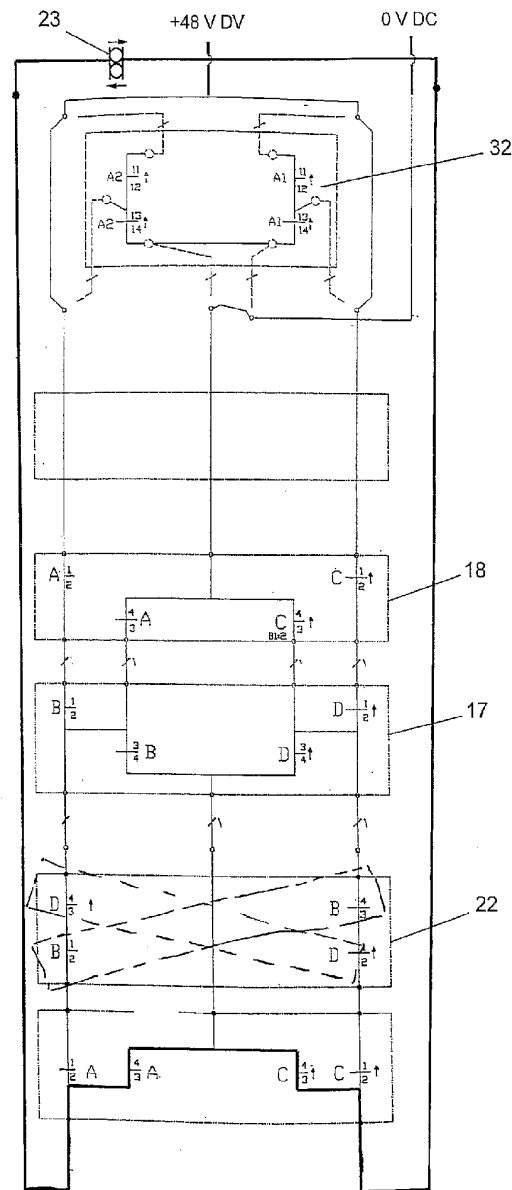


Fig. 13



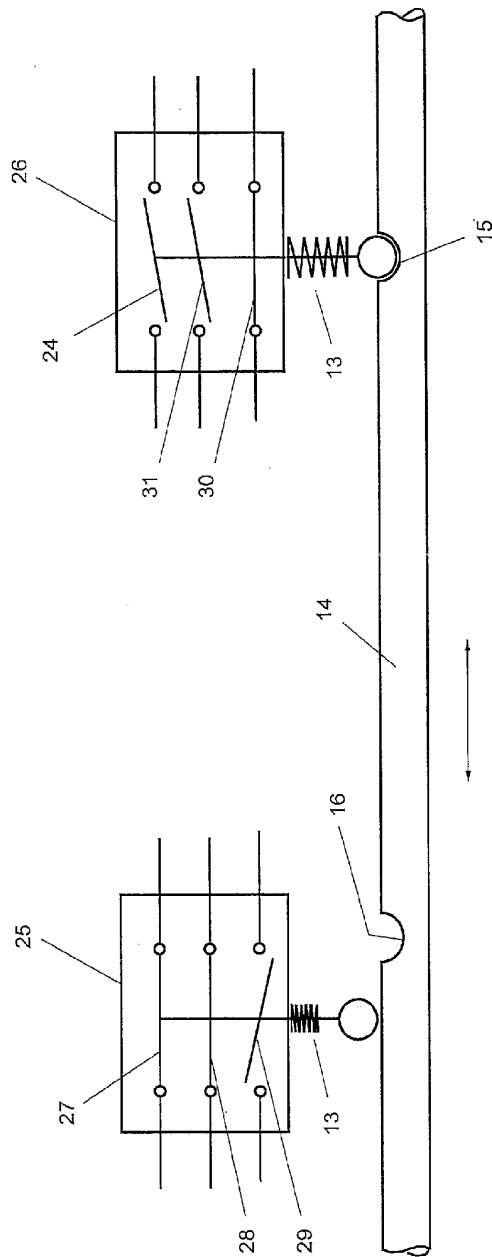
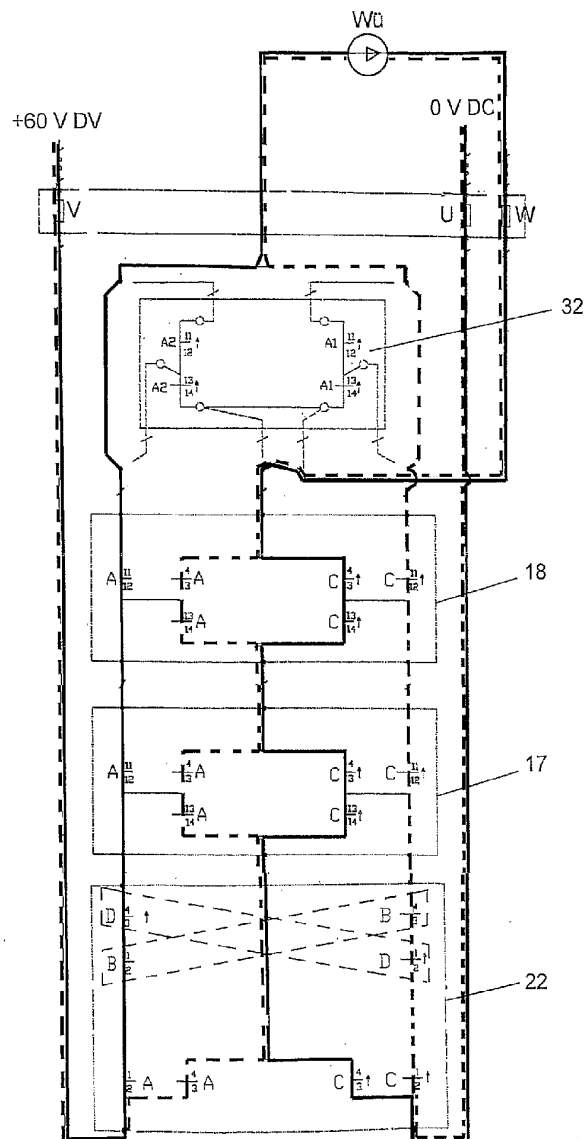


Fig. 14

Fig. 15



[illegible]