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(54) CIRCUIT ARRANGEMENT FOR A WIPER MOTOR

(71) We, SWF-SPEZIALFABRIK FUR AUTOZUBEHOR GUSTAV RAU G.m.b.H., a joint stock company organised under the Laws of Germany, of Stuttgarter Strasse-119, 7120 Bietigheim Bissingen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to a parking circuit arrangement for an electric wiper motor.

By parking circuit is meant a circuit which causes the motor to halt the windscreen-wiper in a position where it does not interfere with visibility through the windscreen.

In a known circuit arrangement for a windscreen wiper a relay serves as a controllable switching element the changeover contact of which closes in one position the motor operating circuit and in the other position a motor short-circuiting path. The winding of said relay connected in series with the operating switch is directly connected to the supply voltage. In parallel to the operating switch a limit switch operating as a circuit-breaker is located, through which the relay is kept in operating position, even after the operating switch has been opened, long enough for the wiper to be driven by the inertia of the motor to a parking position. The relay can be switched off by a disconnection signal of the limit switch, which is conducted through a separate control lead. From the switch to the driving motor of this known type thus two cables have to be layed, namely on the one hand the motor supply lead and secondly the control lead through which the disconnection signal of the limit switch is conducted to the controllable switching element. This circuit arrangement is therefore very expensive, especially if - as it is for instance the case with rear window wiping installations of automotive vehicles - the switch is located remote from the driving motor. Then quite a lot of cable material is required for the supply lead and for the control lead which entails corresponding costs, whereby it has also to be considered that it is always difficult to place an additional lead in an available cable conduit of an automotive vehicle.

According to the present invention there is provided an electric wiper motor parking circuit arrangement, comprising a controllable switching element for switching the motor operating circuit, said switching element being controllable to park the wiper by a disconnection signal of a limit switch, which is actuated by the motor, and also controllable by a control member which has a stable "on" state in which the disconnection signal is not effective to park the motor wiper, wherein the motor is energised via a single supply lead and the disconnection signal of the limit switch is directly conducted to the switching element through the supply lead to the motor.

According to a further aspect of the present invention there is provided an electric motor unit for a vehicle wiper installation and designed for use in a parking circuit arrangement defined in the preceding paragraph, the unit comprising the electric motor, a windscreen wiper drive member, and the limit switch actuated by the motor to effect parking of the drive member, and hence a windscreen wiper blade, in a desired position, the unit being operable by supplying power to the unit via only one power supply lead, apart from an earth connection, and by

the controllable switching element for switching the motor operating circuit which is disconnectible by the disconnection signal from the limit switch via the power supply lead, the switch being opened each time said position is attained during normal operation of the motor, the unit being such that, in use, the limit switch will become closed again before the motor stops.

Between the switching element and the driving motor consequently only one supply lead is necessary, for the earth connection is usually effected through the vehicle body.

The disconnection signal can be generated and evaluated in various manners, but an embodiment is preferred the limit switch of which is directly connected to the motor current supply cable as a circuit-breaker and the switching element of which responds to a change in the motor current. In such a design in comparison to the known arrangement no additional switching elements are necessary, for the motor operating current intensity is directly used as a disconnection signal.

In a particularly simple design the switching element is a current relay, the winding of which is series connected with the limit switch to the motor circuit and the movable switching contact of which closes the motor circuit in operating position. The current relay thus is really operating with a self-holding characteristic which is set by "on" actuation of the control member and remains in this position also, when the control member is actuated "off", until the circuit through the winding, which includes the motor operating circuit, is interrupted by the limit switch for a short time.

Whereas thus in the known circuit arrangement the winding of the relay is connected with a circuit in parallel to the motor operating circuit and either may be energized through the operating switch or the limit switch, in this embodiment the winding is connected in series with the limit switch and the motor operating circuit, so that the additional control lead of the known circuit arrangement is no longer necessary.

In this embodiment, it has therefore to be taken care that the interruption of the motor current is so short that the limit switch is closed again by the inertia of the moving motor. The motor current must also be interrupted long enough to ensure release of the relay. With known limit switches actuated by cams and carefully dimensioned and harmonized it may also happen that, for instance during a short-time interruption of the operating voltage, the driving motor stops in a position in which the limit switch is open and the circuit is interrupted through the winding of the relay. Then the winding of the relay can no longer be energized, when the control member is actuated anew and thus the driving motor can not be put in operation. This disadvantage can simply be eliminated in that according to a development of the invention the switching path of the limit switch is bridged by a by-pass element. This by-pass element can have a time-delay characteristic and for instance be designed as a bimetal switch. In another embodiment of the invention the limit switch has an unstable phase in order to ensure that the motor is started again, whereby in the unstable phase the current is reduced or interrupted for a short time. Such a monostable limit switch thus automatically returns into the operating position after each short-time interruption of current, in which the circuit through the winding of the relay can be energised through actuation of the control member.

A monostable limit switch according to an advantageous development can in a very simple manner be realized as an energy storage unit which is charged in the stable switching phase and during the unstable switching phase its released energy is used for a short-time interruption of circuit.

The limit switch of a preferred embodiment is provided with a pendulum which may be deflected against the tension of the spring element from a rest position in the stable switching phase, whereby the spring element is tensioned, and said pendulum in the unstable switching phase swings beyond the rest position in reverse direction and thereby for a short time removes a contact spring from a stationary contact. Because the pendulum automatically returns to its rest position after the spring element serving as a storage unit is released, thus a permanent interruption through the limit switch is not possible.

The limit switches can comprise a switch wafer, the contact spring of which directly serves as an energy storage unit, said contact spring in its rest position being supported on a contact path and in the unstable switching phase sliding over a contact gap.

Embodiments of the invention are described below with reference to the accompanying drawings, of which:

figure 1 is a circuit diagram comprising a relay as a switching element which is combined in a single unit with an operating switch;

figure 2 is a circuit diagram comprising a relay as a switching element and a separate operating switch,

figure 3 is a circuit diagram comprising a thyristor as a switching element,

figure 4 is a circuit diagram with a by-pass switching element as a starting aid,

figure 5 is an alternative solution to figure 4,

figure 6 is a further alternative solution to figure 4, with additional overcurrent circuit-breaker,

figure 7 is a further alternative solution to figure 4 comprising a relay as a by-pass

switching element,

figure 8 is a further alternative solution to figure 4 comprising a resistor as a by-pass switching element,

figure 9 is a circuit arrangement comprising a monostable limit switch with a pendulum,

figure 10 is a circuit arrangement comprising a monostable limit switch with switch wafer and

figures 11 to 14 are alternative designs hereof.

Throughout the drawings U denotes an electric motor unit comprising a motor and at least a limit switch.

In figure 1 a wiper motor 10 operates a limit switch 11 is directly connected to ground (chassis) 12 through the body of the automotive vehicle. The limit switch 11 has a switch wafer 13 on which two contact springs 14 and 15 are resiliently supported. The contact spring 15 in any position of the switch wafer 13 rests on the contact path 16 of the switch wafer 13 which has a contact gap 17 which passes the contact spring 14 in each revolution of the wafer. The limit switch 11, which is combined with the wiper motor 10 to form the motor unit within the dot-dash line with the wiper motor 10 to form the motor unit U within the dot-dash line thus works as a periodical circuit-breaker.

A current operated relay 20, with a movable changeover contact 21, is a controllable switching element for switching the motor circuit. The normally-closed contact 22 of relay 20 is connected to ground (chassis) the normally-open contact 23 is directly connected to one end of the winding of the relay. The other end of the winding of the relay is directly connected with one pole of a supply of electricity 24.

A control member in the form of an operating switch 30 (only shown schematically) comprises a driver rod 31 which directly acts on the change-over contact 21 or on the armature of the relay 20 and moves it to the normally-open contact 23 when the operating switch 30 is actuated. The operating switch and the controllable switching element are thus combined as a unit and - as can be clearly seen from the drawing - connected to the motor UNIT U through a single connecting lead 32. Said connecting lead is thus both a motor supply lead and a control lead for the relay 20, for through it a disconnection signal generated by opening the limit switch 11 is conducted to the relay 20.

Figure 1 shows the condition where wiper motor 10 is stopped, and the wiper is located in the "parking" position. The two contact springs 14 and 15 are conductively connected through the contact path 16. The wiper motor 10 is started by actuating the driver rod 31 of the operating switch 30 to position I, which moves the changeover contact 21 to the normally open contact 23 whereby a circuit from the supply 24, through the winding of the current relay 20, the changeover contact 21, normally-open contact 23, the motor supply lead 32, the contact springs 14 and 15 via path 16 to the wiper motor 10 is closed. The relay 20 is thus energized and holds the changeover contact 21 in the operating position, even if the driver rod 31 returns to the position 0.

The switch wafer 13 of the limit switch 11 rotates with the movement of the motor 10. If the contact spring 14 is on the contact gap 17, the motor circuit is interrupted for a short time. This interruption of the motor current is used as a disconnection signal from the limit switch 11 to the relay 20 via the motor supply lead 32 which thus simultaneously serves as a control lead. The relay 20 responds to this interruption of the motor current and deenergizes. If at this moment, the driver rod 31 is in the off position, then through the normally-closed contact 22 a short circuit for the motor 10 is prepared, which is closed as soon as the two contact springs 14 and 15 are connected again through the contact path 16 as the motor continues, because of inertia, to revolve. The motor is thereby stopped abruptly. If, however, the changeover contact 21 is held in its operating position through the driver rod 31, the relay 20 re-energizes immediately after it was deenergized and maintains the motor circuit. It has to be ensured that the flywheel effect of the motor 10 is sufficient to turn the switch wafer 13 far enough that the contact spring 14 again bears on the contact path 16. The contact gap 17 must be wide enough that the interruption of current lasts long enough to deenergize the relay 20.

The movable switching contact 21 is connected in series with the limit switch 11 and the motor circuit, so that a single connecting lead 32 is sufficient. In comparison to the known prior art circuit arrangement considerable savings are made for wiper installations on rear windows of automotive vehicles, for the simpler cabling requires no additional components.

In figure 2 the movable changeover contact 21 of the current relay 20 is not arrested mechanically through the rod 31, but held closed through a subsidiary circuit. A switching contact 33 of the operating switch 30 conducts the motor current when it is first operated, so that the relay 20 is energized. The switching path is thereby bridged by the leads 34 and 35 through the switching contact 33 of the operating switch 30, so that the relay 20 maintains the motor circuit until the limit switch 11 interrupts this circuit, if the operating switch 30 is switched off. Apart from this separation of switch 30 and relay 20 the circuit behaves exactly as that in figure 1.

In figure 3 a thyristor 40 connected in the

motor circuit serves as a controllable switching element, the gate terminal 41 of which is connected to the operating switch 30 through a series resistor 42. Said thyristor 40 also has a self-holding characteristic, for after firing, through the operation of the control member (switch) 30, it maintains the motor operating current for so long as the motor operating current does not fall below the holding current until interruption occurs through opening contacts 14 and 15 of the limit switch 11. If the operating switch remains actuated the thyristor 40, however, is very quickly fired, so that the wiper motor continues running as required as the inertia of the motor quickly recloses the path through contacts 14 and 15. If, on the other hand, the switch 30 is opened to disconnect the firing circuit of the thyristor 40, then after an interruption of the operating current by the gap in limit switch 11 for a short time the wiper motor stops. Also in this embodiment the interruption of the operating current is used as a disconnection signal, which switches off the thyristor 40, representing the controllable switching element, via the motor supply lead 32.

In the switching arrangements described until now it can for instance occur, when the supply voltage is interrupted for a short time, that the wiper motor stops in a position in which the contact spring 14 is in the contact gap 17. Then the wiper motor can no longer be started, because the motor circuit can no longer be closed, when the operating switch is actuated. In the embodiments described below reliable starting of the motor is ensured. In the embodiments according to figures 4 to 8 the switching path of the limit switch 11 is bridged through a by-pass switching the element 50. A bimetal switch 51 can serve as a by-pass switching element filament winding 52 of which is connected with the motor circuit.

In figure 4 the filament winding 52 is in series with the limit switch 11 and the switching path of the bimetal switch is normally closed through the contacts 55 and 54. When the wiper motor is switched on the motor circuit is closed at first through said contacts of the bimetal switch, so that the current relay 20 is energized. The limit switch 11 is by-passed until, after a certain heating-up time, the contact 54 of the bimetal switch is removed from the contact 55. The motor of this embodiment can be started without delay, but the filament winding of the bimetal switch has to be designed able to carry the full motor current. It has to be ensured that the switching path through the contacts 54 and 55 is interrupted at a very low ambient temperature before the first interruption of circuit is effected through the limit switch 11, because otherwise under certain circumstances the wiper motor could run continuously.

In figure 5 the filament winding 52 of the bimetal switch 51 is connected in parallel with the limit switch 11 through a series resistor 56 and the contacts 54 and 55 are open in the unheated position. If in case of interruption the contact spring 14 stands in the contact gap 17, this switching path is closed after a certain heating-up time of the bimetal switch through the contacts 54 and 55. The motor can thus be started in any given switching position of the switch wafer 13, whereby the filament winding of the bimetal switch 51 is short-circuited through the limit switch 11 as soon as the contact springs 14 and 15 are connected through the contact path 16. After a certain cooling time the switching path opens through the contacts 54 and 55, so that now also the wiper motor can be switched off. In a wiper installation of this type after an interruption as mentioned above a delay for its switching on has to be accepted.

The circuit shown in figure 6 corresponds to that shown in figure 4, but the bimetal switch 51 has a further contact set comprising the contacts 57 and 58. Normally the filament winding 52 of the bimetal switch 51 carries the operating current of the wiper motor 10, whereby the bimetal switch 51 is heated up far enough for the contact 54 to be removed from the contact 55. The contact 58, fastened on a resilient contact tongue 59, can, however, follow this movement and therewith remains in conductive connection with the contact 57. If, however, the wiper motor 10 is blocked, e.g. by show, the current is increased considerably which results in greater heating of the bimetal strip causing it to bend so far that now also the contact 57 is removed from the contact 58, because the contact tongue 59 can no longer follow the movement. Thereby in a simple manner an overcurrent circuit-breaker is realized, which effectively prevents a burnout of the armature winding of the wiper motor 10.

In figure 7 a relay 65 with a switching contact 66 serves as a by-pass switching element, said switching contact being connected in parallel with the limit switch 11. When the contact spring 15 stands in the contact gap 17 a capacitor 67 is charged through the resistor 68. As soon as the charging voltage has reached the starting voltage of the relay 65, the relay is energized and closes the motor circuit. If the contact sprints 14 and 15 are again in conductive connection with each other through the contact path 16 the capacitor 67 is discharged, so that now the limit switch takes over its function again.

Whereas the by-pass switching element of the four last-mentioned embodiments bridges the switching path of the limit switch only for a short time, in figure 8 a permanent bridging by means of a resistor is provided. This resistor has, however, to be capable of a heavy load, for in case of an interruption it

conducts the motor current. Here a disconnection signal is not obtained by motor circuit interruption, but by a reduction of the motor current in the parking position where the resistor 60 is periodically effective in the motor circuit. Embodiments are possible in which in the parking position of the wiper the motor current is increased and the disconnection signal is derived therefrom.

Until now the assumption was that in a case of interruption the contact spring 14 stands on the contact gap 17 and therefore additional measures have to be taken in order to ensure that the wiper motor can be started in any operating position. Other embodiments being in principle different are described below, the limit switch of which has a monostable behaviour and in the unstable phase the motor current is reduced or interrupted for a short time.

In figure 9 the comparatively simple limit switch 11 is replaced by a pendulum 70, which in its mass centre is arranged to oscillate and because of additional masses 71 has a great moment of inertia. A spring element 72 acts on the pendulum 70, said spring element being untensioned in the position shown. A gear wheel 73, provided with a switching cam 74, is driven by the wiper motor. One end of the pendulum 70 projects into the circular path of said switching cam 74 so that the pendulum may be deflected against the force of the spring element. In a stable switching phase a contact spring 75 firmly rests against a stationary contact 76, so that the motor operating circuit is closed. In this stable switching phase the pendulum is deflected and the spring element 72 is thereby tensioned. When the switching cam 74 releases the pendulum 70 again, it swings beyond its rest position and thereby for a short time removes the contact spring 75 from the stationary contact 76. Finally the pendulum occupies again the rest position shown.

Thus the unstable switching phase occurs when the limit switch interrupts the motor circuit.

The same effect is achieved in the arrangement shown in figure 10. A switch wafer 80 driven by the motor and made of electrically conductive material has, on its outer circumference, a contact path 81, on which a contact spring 82 is supported. A switching cam 83 projects from the contact path, the trailing flank 84 of which is substantially steeper than the ascending flank 85. An insulating portion 86 is embedded in the inclined flank 84. If the switch wafer 80 is moved into the direction of rotation shown, the contact spring 82 is deflected and thereby initially tensioned, but in this stable switching phase remains in conductive connection with the switch wafer 80 and thereby with the ground terminal 12. The energy stored in the contact spring 82 is released, when said contact spring springs back to the contact path 81 and thereby for a short time slides over the insulating portion 86. In this unstable switching phase the motor current is interrupted for a short time, whereby this interruption is automatically discontinued. This is ensured, when the initial tension of the contact spring 82 with regard to the steepness of the inclined flank 84 and to the ratio of friction is accordingly harmonized.

In figure 11 a substantial portion of a switch wafer 80 is shown to the front side of which the contact path is attached. Again a switching cam 83 is provided, the ascending flank 85 of which is in conductive connection with the contact path. The trailing flank 84 is located approximately vertical to the contact path 81 on which a further contact spring 87 slides. The time during which the contact spring 82 springs back on the contact path 81 via the trailing flank 84 of the switching cam 83 representing the contact gap, is sufficient to release the current relay 20.

In figures 10 and 11 the contact spring is deflected transversally to the guide motion of the contact spring in the stable switching position in which it is in conductive connection with the stationary contact. In figure 12 the contact spring 82 on the contrary is deflected into the guide motion of the contact path 81 and thereby initially tensioned by a tripping pin 88 mounted on the switch wafer 80 whereby, however, it remains conductively connected with the contact path 81. During its springing back the contact spring 82 slides very quickly over the contact gap 17 in the contact path 81 and afterwards is again supported on it, so that a conductive connection to the other slide spring 87 is effected.

In figure 13 in the stable switching phase and in the plane of the contact path 81 the contact spring 82 is deflected by an eccentric cam 90 and thereby initially tensioned. During its springing back it slides over a slot 91 forming the contact gap.

The switch wafer 80 according to figure 14 has a recess 92 in the area of the contact path 81 with which engages the looped end 93 of the contact spring 82, being bent in a shape like a shepherds crook. Said looped end is initially tensioned by the movement of the switch wafer. As soon as a certain initial tension is exceeded the end of the contact spring springs out of the recess 92 and in opposite direction to the guide motion of the contact path slides very quickly over the contact gap 17 which is adjacent to the recess 92.

In all these embodiments the limit switch has a monostable behaviour, whereby in the stable switching position the motor circuit is closed and only in an unstable switching position is interrupted for a short time. Thereby these embodiments are based on the principle that an energy storage unit, namely the

spring element, is charged in the stable switching phase, the energy of said storage unit being released during the discharge and bringing about a short-time interruption of the motor current. Because the energy stored in the storage unit is limited, the time of current interruption is limited too, so that for these embodiments no additional by-pass switching elements are necessary as a starting aid for the wiper motor.

These embodiments with a monostable limit switch work very reliably at low cost and enable the control of a wiper motor comprising a limit switch through a single connecting lead.

In the embodiments comprising a relay as a controllable switching element certain difficulties arise with the layout of the current winding of the relay. The drop in voltage on this relay winding has to be as small as possible, which can be realized by using a wire with a correspondingly large cross-section with a small number of turns. On the other hand, however, it has to be ensured that said current relay also reliably energizes, when the supply voltage is small, under conditions of low motor current. In order to fulfil these requirements it can be necessary to provide the current relay 20 with a subsidiary winding 98 which may be energized through the movable changeover contact 21 as this is drawn in figure 4. This winding must be such that alone it cannot keep the relay operated but it sufficiently supplements the other winding, in low current, low-voltage conditions, so that the relay is operated.

WHAT WE CLAIM IS:

1. An electric wiper motor parking circuit arrangement, comprising a controllable switching element for switching the motor operating circuit, said switching element being controllable to park the wiper by a disconnection signal of a limit switch, which is actuated by the motor, and also controllable by a control member which has a stable "on" state in which the disconnection signal is not effective to park the motor wiper, wherein the motor is energised via a single supply lead and the disconnection signal of the limit switch is directly conducted to the switching element through the supply lead to the motor.

2. An arrangement as claimed in claim 1, wherein the limit switch acts as a circuit-breaker and is directly connected with the motor supply lead and the switching element responds to a change in the motor current.

3. An arrangement as claimed in claim 2, wherein the switching element has a self holding characteristic and, when the control member is in an "off" state, maintains the motor current until it is interrupted by the limit switch.

4. An arrangement as claimed in claim 1 or 2, wherein the switching element is a current relay, the winding of which is connected in series with the limit switch and the motor operating circuit, and has a pair of contacts, one of which moves, which close the motor operating circuit in the energized condition of the relay.

5. An arrangement as claimed in claim 4, wherein the pair of contacts can be directly moved to the closed position by a driver rod of the control member.

6. An arrangement as claimed in claim 4 or 5, wherein the switching path of the relay contacts may be bridged through a movable switching contact of the control member.

7. An arrangement as claimed in claim 4, 5 or 6, wherein when the relay is de-energized the movable contact closes a short circuit for the driving motor.

8. An arrangement as claimed in claim 4, 5, 6, or 7, wherein the current relay is provided with an auxiliary winding energizable through the relay contacts.

9. An arrangement as claimed in claim 3, wherein the switching element is a thyristor the gate of which is controllable through the control member.

10. An arrangement as claimed in any one of the preceding claims, wherein the switching path of the limit switch is bridgeable by a by-pass element.

11. An arrangement as claimed in claim 10, wherein the by-pass element is a resistor.

12. An arrangement as claimed in claim 10, wherein the by-pass element comprises relay contacts.

13. An arrangement as claimed in claim 10, wherein the by-pass element is a bimetal switch the filament winding of which is connected to the motor circuit.

14. An arrangement as claimed in claim 13, wherein the filament winding is series connected with the limit switch and the switching path of the bimetal switch is closed when the filament winding is not energized.

15. An arrangement as claimed in claim 13, wherein the filament winding is connected in parallel to the limit switch and the switching path of the bimetal switch is open when the filament is not energized.

16. An arrangement as claimed in claim 13, 14 or 15, wherein the bimetal switch is also an overcurrent circuit-breaker and is provided with an additional set of contacts connected in series with the limit switch.

17. An arrangement as claimed in any one of claims 1 to 9, wherein the limit switch is a monostable device and in the unstable switching phase causes a significant alteration in the motor current for a short time.

18. An arrangement as claimed in claim 17 in which the significant alteration is an interruption.

19. An arrangement as claimed in claim 18, wherein the limit switch has an energy storage unit which is charged in the stable

switching phase, the energy of which is released in the unstable switching phase to cause a short-time interruption of current.

20. An arrangement as claimed in claim 19, wherein a spring element serves as the energy storage unit.

21. An arrangement as claimed in claim 20, wherein the limit switch has a pendulum which is in the stable switching phase deflected from a rest position against the tension of the spring element, whereby the spring element is tensioned, said pendulum, in the unstable switching phase, swinging beyond the rest position in reverse direction and thereby for a short time removing a contact spring from contact with a stationary contact.

22. An arrangement as claimed in claim 20, wherein a contact spring directly forms the energy storage unit, and rests on a contact path of a switch wafer in the stable switching phase and slides over a contact gap in the unstable switching phase.

23. An arrangement as claimed in claim 22, wherein the contact spring is deflected by an eccentric cam on the switch wafer in a plane parallel to that of the contact path and transversally to the spring's longitudinal direction and being thereby tensioned, slides over a contact gap when it springs back.

24. An arrangement as claimed in claim 22, wherein the contact spring is deflected by a switching cam with an ascending contact flank projecting from the plane of the contact path and is thereby tensioned, and during its springing back slides over the trailing flank of the cam which provides a contact gap.

25. An arrangement as claimed in claim 22, wherein the contact spring is deflected and thereby initially tensioned by a tripping pin mounted on the switch wafer in the direction of motion of the contact path and during its springing back slides over a contact gap in opposite direction to the motion of the contact path.

26. An arrangement as claimed in claim 22, wherein at its free end the contact spring is bent into a loop like a shepherd's crook, whereby said free end is tensioned by engagement with a recess in the contact path and during disengagement slides over a contact gap.

27. An electric motor parking circuit arrangement substantially as described with reference to figure 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, or 14 of the accompanying drawings.

28. An electric motor unit for a vehicle wiper installation designed for use in a parking circuit arrangement according to any of claims 1 to 26, the unit comprising the electric motor, a windscreen wiper drive member, and the limit switch actuated by the motor to effect parking of the drive member, and hence a windscreen wiper blade, in a desired position, the unit being operable by supplying power to the unit via only one power supply lead, apart from an earth connection, and by the controllable switching element for switching the motor operating circuit which is disconnectible by the disconnectible by the disconnection signal from the limit switch via the power supply lead, the switch being opened each time said position is attained during normal operation of the motor, the unit being such that, in use, the limit switch will become closed again before the motor stops.

29. An electric motor unit as claimed in claim 28 for a windscreen wiper installation, substantially as hereinbefore described with reference to the reference U in the accompanying drawings.

For the Applicants
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Chartered Patent Agent.

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Fig. 1

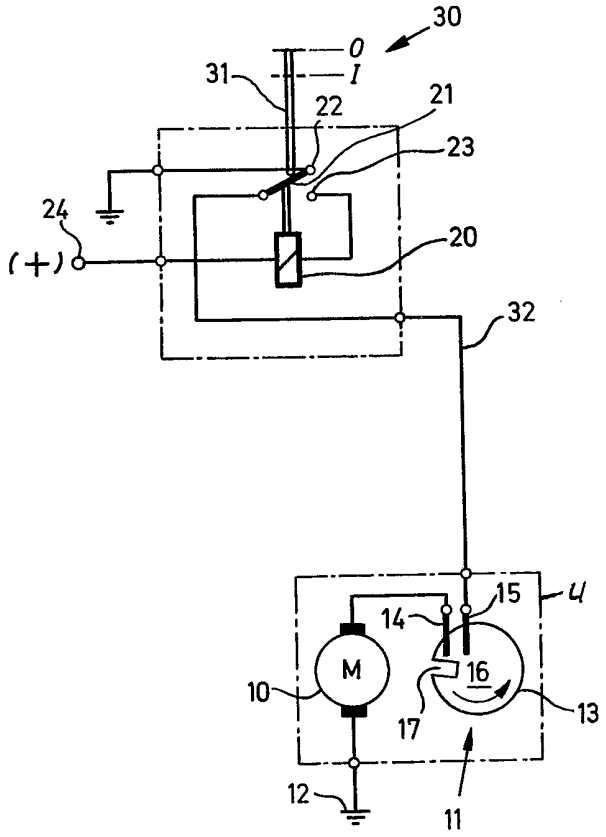


Fig. 2

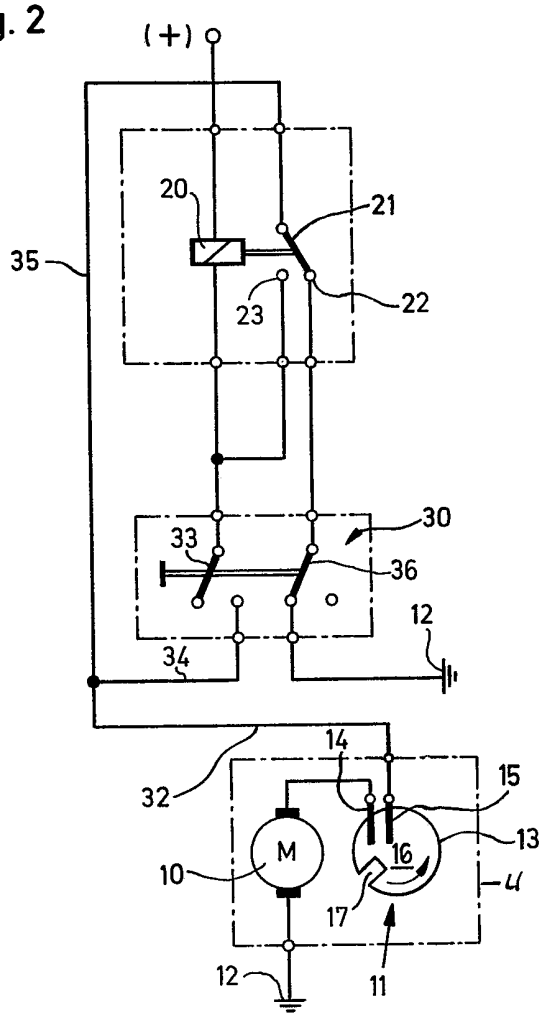
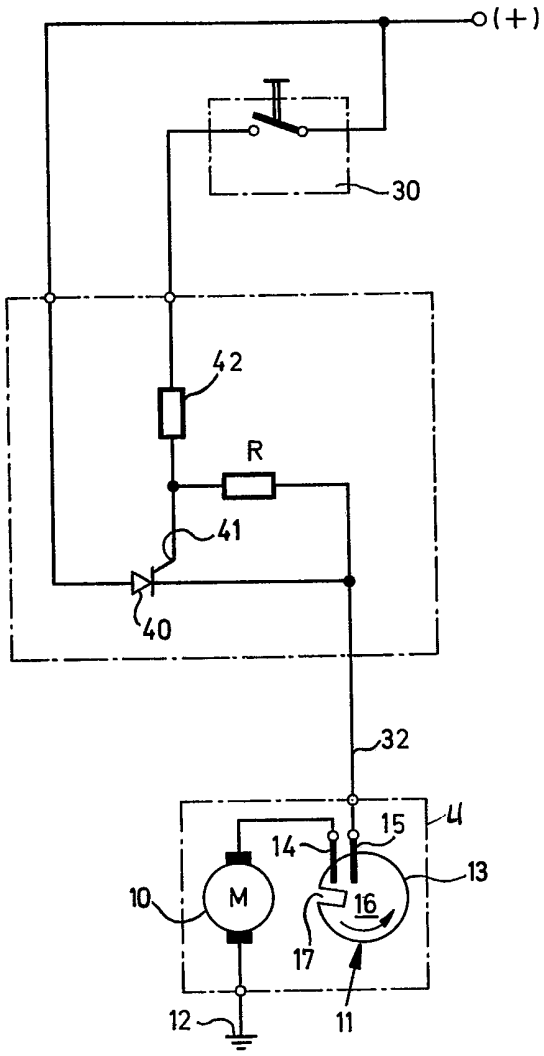


Fig. 3



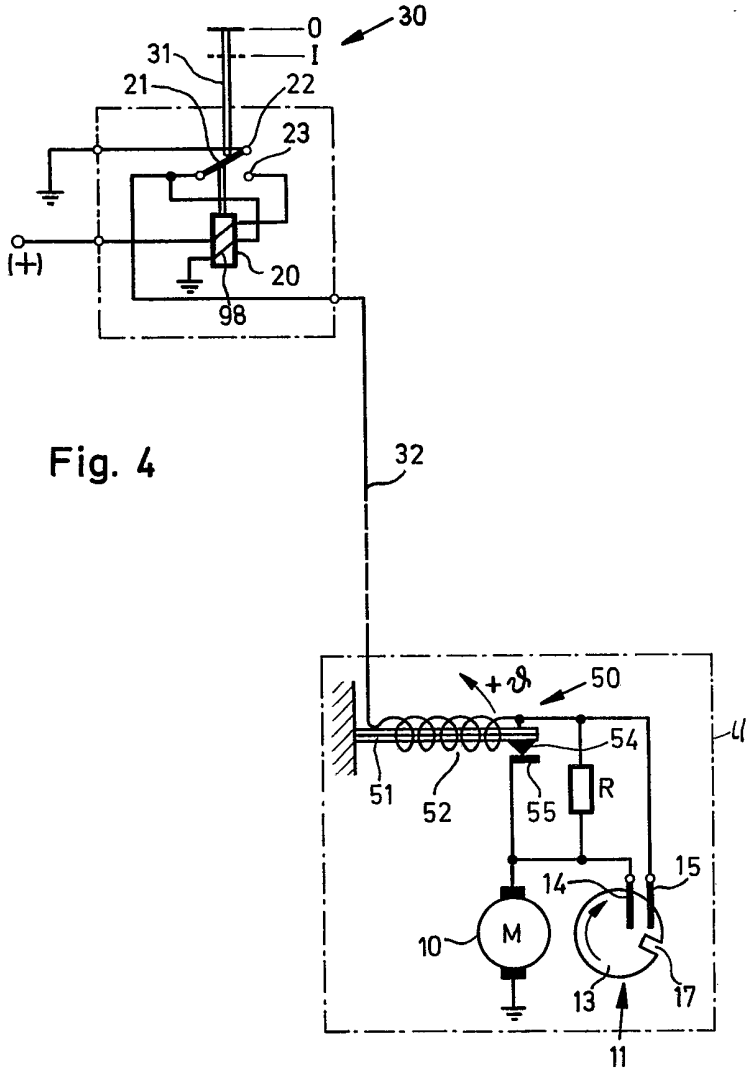


Fig. 4

Fig. 5

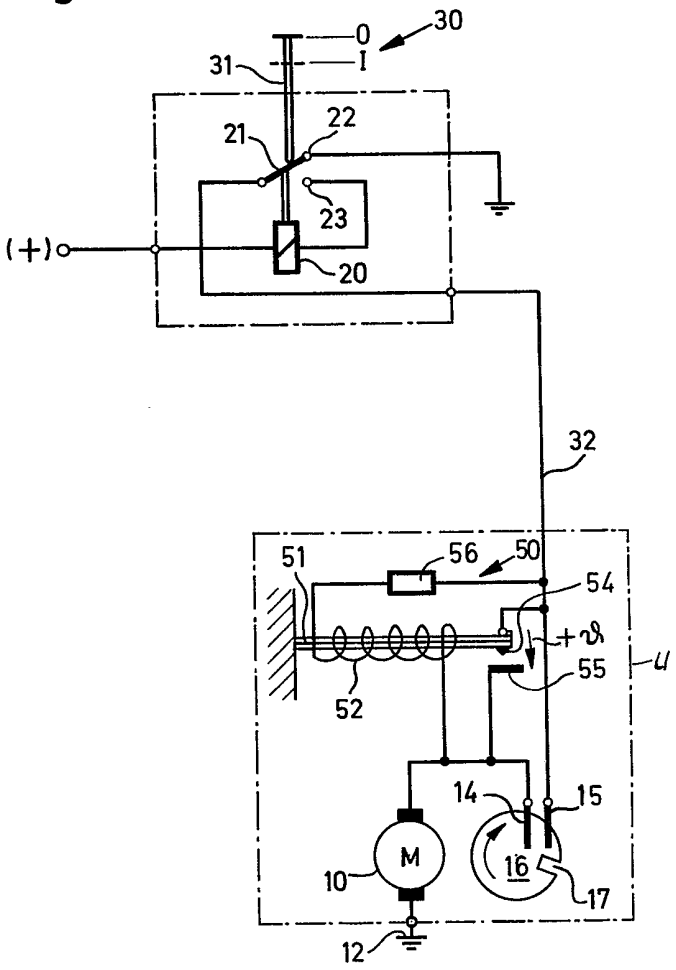


Fig. 6

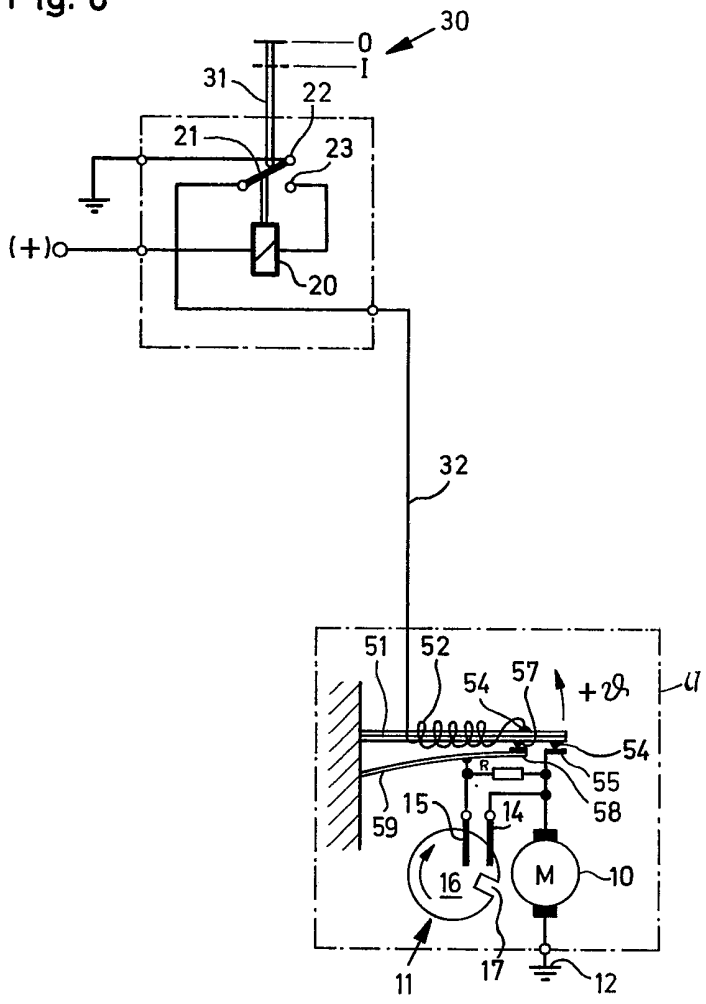

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Fig.7

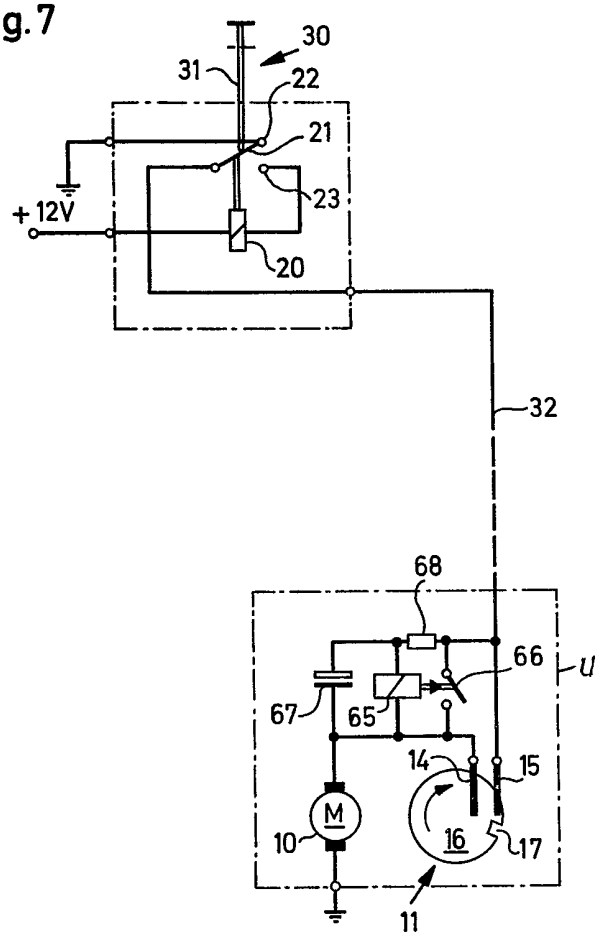

Fig. 8

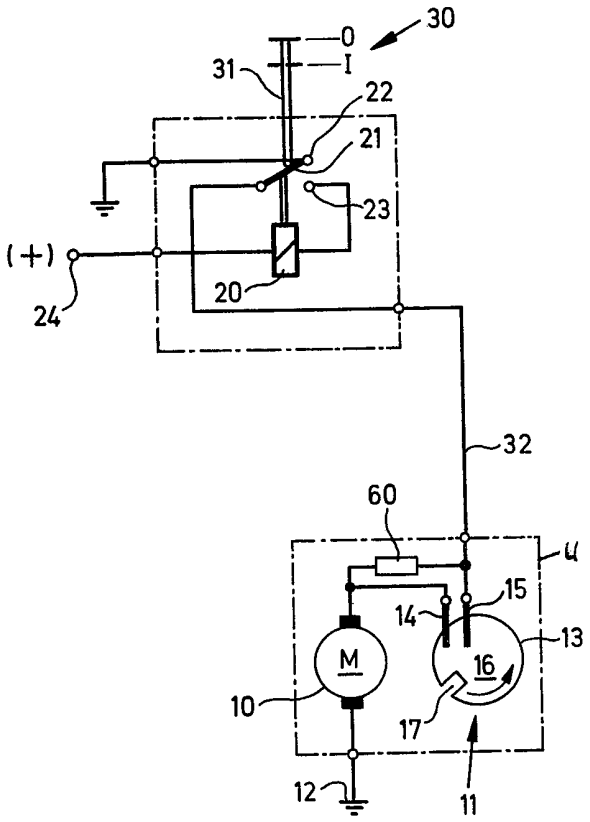

Fig. 9

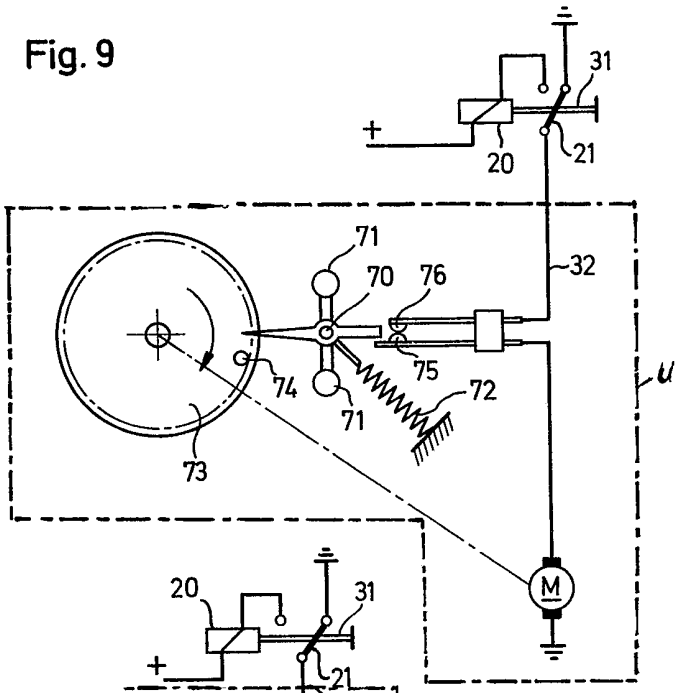
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Fig. 10

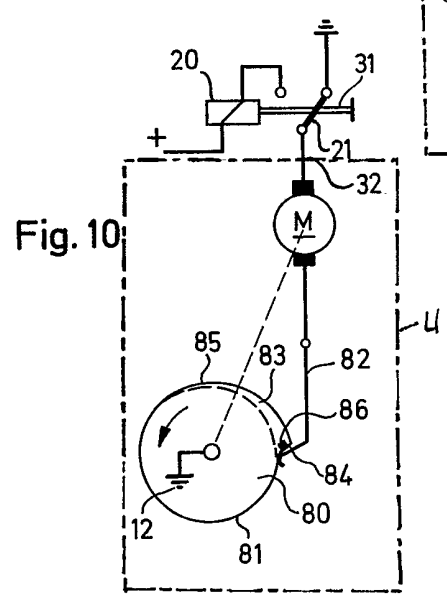
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Fig. 11

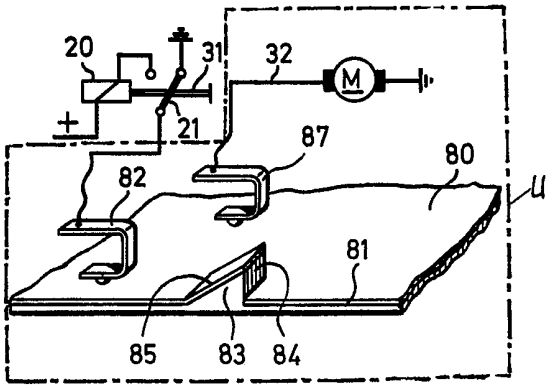

Fig. 12

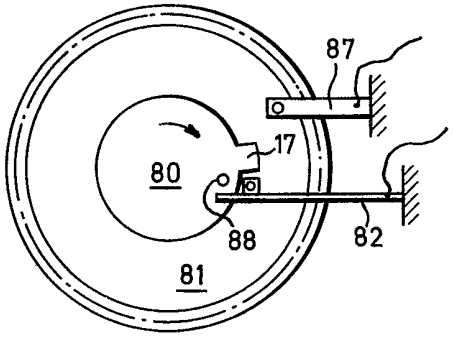

Fig. 14

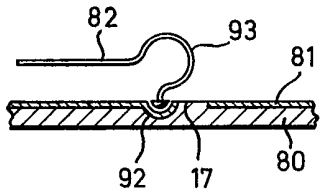

Fig. 13