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(54) **Control and monitoring equipment for gas burners**

Regelungs- und Überwachungsschaltung eines Gasbrenners

Circuit de régulation et de sûreté d'un brûleur à gaz

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(56) References cited:
DE-A- 2 809 843
GB-A- 2 042 154
GB-A- 2 078 398
US-A- 3 488 131
US-A- 3 524 717
US-A- 3 574 495

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Description

The invention concerns a control and monitoring equipment for a gas burner applied to a heat generator. The best known burner control and monitoring equipments are suited to monitor different operation phases, such as the pre-ventilation of the combustion chamber where the burner operates, the ignition of the flame preceded by the opening of the solenoid valves for the inlet of the gas, the holding of said flame and a resting period whenever the reference figure of the physical value preset in the heat generator has been reached.

European and international safety rules foresee that when the pre-ventilation phase has been completed, the control and monitoring equipment of the gas burner must monitor the appearance of the flame within a period of time set by the rule, which is usually 3-5 seconds from the end of the pre-ventilation phase. If the flame does not appear within such period of time, the burner equipment must shut down with the consequent cut-off of the power supply to the solenoid valves monitoring the gas distribution.

GB-A-2 078 398 discloses an electric control circuit for a fuel-fired burner where a safety timer is successively operable in two sequences, the first sequences actuating the fuel release means, the second sequences and control means being operable to close the fuel release means if the flame monitoring means fails to respond.

In order to meet such safety requirement the usual known technique foresees for the low-rate oil or gas burners to be supplied with a resistance wound on a bi-metallic element, which, properly fed, causes a contact controlled by the bi-metallic element to commutate within the time set by the rules, should the flame not ignite. On the contrary, if the flame appears, the power supply to the resistance is cut off before the time necessary for the bi-metallic element to intervene on the contact controlled by it. With regard to high rate equipment, the bi-metallic element is replaced by a timer which intervenes with the same above mentioned procedures. If one of the two safety devices now described breakdown at the moment they should intervene, the known technique does not foresee any reserve safety and, therefore, the chance for the equipment to keep the gas valves fed without a flame burning exists. This fact represents a highly dangerous situation, which the invention has the purpose of overcoming.

The main purpose of the invention is to obtain a control and monitoring equipment for gas burners which, in the transient period between the end of the pre-ventilation phase and the ignition of the flame, foresees a double safety device such that the second device can intervene if the first one breaks down. All of this has the purpose of increasing the operating safety of the equipment and the prevention of accidents caused by the failure of the shutdown to occur because of a breakdown not foreseen by the rules.

These and other purposes which will be better illustrated hereinafter are reached by a control and monitoring equipment for gas burners the main features of which are according to claim 1.

Advantageously, a first resistance wound on a bi-metallic element according to the invention, acts as an alternative of the shutdown relay should the flame disappear while the burner is in operation and should the shutdown relay break down.

A preferred embodiment of the invention also foresees another resistance wound on the same bi-metallic element which allows the equipment to insure the performance of the electric fan even after the water temperature of the boiler has been reached when the equipment sensor has opened its contacts, should the flame sensor continue to detect the flame.

This fact is particularly important since, should the solenoid valves for the gas distribution break down, so that the gas continues to flow even after the closing command has been given to the solenoid valves, the amount of air sufficient for keeping the burner in operation until the flame goes off will be assured.

A preferred embodiment of the invention also foresee another resistance interacting with another bi-metallic element which, with a proper circuit, will insure the shutdown of the equipment if there already is a flame when starting or if, during the pre-ventilation phase, the air necessary for the burner to work is insufficient.

The control and monitoring equipment for gas burners according to the invention will now be described with reference to a particular wiring diagram given by way of illustration only with the help of the enclosed tables referring to the various temporal phases of the equipment performance, beginning from the moment in which the sensor for the control of the physical value to be monitored gives the start signal to the equipment until the latter performs its operation and then stops. Some intervention procedures of the equipment intervening during operations of the burner which differ from the rules will be also described. The drawings attached to the patent refer to the electronic diagram of the equipment circuit according to the invention, wherein:

- Fig. 1 represents the equipment according to the invention soon after the thermostat has disconnected;
- Fig. 2 shows the diagram of the equipment during the pre-ventilation phase;
- Fig. 3 shows the diagram of the equipment at the end of the pre-ventilation phase with the solenoid valves for the gas distribution being energized and with the ignition transformer being fed, but before the flame ignites;
- Fig. 4 shows the diagram of the equipment in case of normal operation before the second regulating solenoid valve begins to be energized;
- Fig. 5 shows the diagram of the equipment during the normal operation of the burner;

- Fig. 6 shows the diagram of the equipment in case of shutdown at the end of the safety period of time;
- Fig. 7 is the diagram showing the condition of the equipment if the flame ignites during the pre-ventilation phase;
- Fig. 8 shows the diagram of the equipment when the pressure sensor senses the lack of air at the start;
- Fig. 9 shows the diagram of the equipment, should the flame disappear while the burner is working;
- Fig. 10 shows the diagram of the equipment should the combustion continue after the thermostat has come on again.

THE DEVICE AT THE INSTANT 0+1.

As soon as the thermostat marked with TL in the diagram of Fig. 1 closes, for instance because the lower limit temperature of the room or the lower limit temperature of the water has been reached, the T relay is excited and, as a consequence, all the contacts T1, T2, T3 and T4 are closed. Through the 1E contact, which is normally closed the B relay, also called third relay, is also excited, then the B1 and B2 contacts also close. The motor M of the fan is energized through the PA contact which is connected with the air pressure sensor, which at this time does not sense the presence of air yet. Thus the M motor of the fan is fed and the pre-ventilation phase begins.

PRE-VENTILATION PHASE

With reference to Fig. 2 and to the power part of the equipment, as soon as the M motor starts operating, the air pressure sensor senses the presence of a sufficient pressure and the PA contact commutes, so as to excite the RPA2 relay.

The M motor of the fan presents a secondary winding at the ends of which the VBT low tension is collected, said low tension feeding the entire logical part L for the monitoring of the equipment which, as can be observed in Fig.2 is to be found after the terminals 1, 2. The feeding of the monitoring circuit entails the feeding of the A RF logic circuit and, through the latter the RPA1 relay is also fed.

The feeding of said relay causes the 1RPA1 contact to close. The closing of the 1RPA1 contact makes it possible for the M motor to continue to be fed, even if in the meantime the PA contact has gone to its resting position from the feeding of the motor to the feeding of the RPA2 relay. The feeding of the monitoring circuit of the equipment also entails the energizing of the t1 timer, which starts counting down a period of time, for instance of about 20÷70 seconds, this occurring as a function of the RC time constant of the t1 circuit due to the R, R1 resistances placed in series and to the inner capacity of the logic circuit of t1.

As can be observed, the feeding of the t1 circuit closes through the 2RF contacts.

END OF THE PRE-VENTILATION PHASE - OPERATION WITHOUT FLAME

At the end of the pre-ventilation phase, the circuit of the equipment sends out a signal which opens the gas valves and also feeds a transformer connected with the spark.

According to the safety rules the ignition of the flame must occur within a maximum time span of 3 seconds from the end of the pre-ventilation.

For this reason, with reference to Fig. 3, when the electronic timer t1 has finished the pre-ventilation phase and has therefore finished the count down of the time pre set for the pre-ventilation, a first signal $t1_1$ is sent out by the logic circuit which excites the RT relay and, as a consequence, its RT1 and RT2 contacts close. These contacts permit a retention current through the BL2 resistance, also called second resistance, through the 2RPA2, RT1, RT2, RTA contacts

Said retention current suffices to excite the first RTA relay. As a consequence the contacts of said relay, namely the 1RTA and 2RTA contacts, close. The closing of the 1RTA contact causes the short circuit of the R resistance and, as a consequence, the variation of the RC time constant of the logic circuit of t1. Thus the RC constant of the circuit changes from 20 ÷ 70 seconds to a max. of 3 seconds.

The closing of the 2RTA contact with the 3RF contact in its resting position causes the REV relay to be fed through the BLS1 resistance, also called first resistance. The feeding of the REV relay entails the closing of the 1REV contact and, therefore, the consequent feeding of the REV1 relay placed in series with the RL relay. During this phase the RL relay is not excited.

During the time interval corresponding to the 3-second count down it occurs that, since the REV and REV1 relays are excited, the corresponding EVS and EV1 solenoid valves for the gas distribution are opened, the EVS valve being the safety valve placed before the two EV1 and EV2 valves.

When the REV1 relay is excited, the 1REV1 contact also closes and, through the T3 contact and the 2RL contact, which is normally closed, it feeds the transformer feeding the TR spark. Therefore, all the conditions for the ignition of the flame are present, since the TR transformer feeding the spark and the EVS and EV1 solenoid valves for the gas distribution are being fed.

THE FLAME IGNITES DURING THE SAFETY PERIOD OF TIME

As has previously been said, the safety rules foresee a period of time not exceeding 3 seconds after the end of the pre-ventilation phase within which the flame must ignite.

If the flame ignites, as can be observed in the dia-

gram of Fig. 4, the A RF flame sensor senses the ignition and all the contacts 1RF, 2RF, 3RF and 4RF, the last one being also called first contact, are commuted. By commuting the 2RF contact, the t1 timer stops being fed, so that the count down and any signal output are stopped. By subsequently commuting the 3RF contact so that, as a consequence the first BLS1 resistance is no longer fed, the RL relay is fed at full voltage, so that the normally closed 2RL contact opens and the igniting spark stops because of the interruption of the feeding of the TR transformer. The commutation of the 3RF contact causes the t2 timer to start counting, so that for the purpose of counting a signal is sent out such that it will excite the REV2 relay, as can be observed in Fig. 5.

NORMAL OPERATION

During the normal operation of the burner with the regular presence of the flame it occurs that the EV2 solenoid valve also opens, since at the end of the count down by t2 the REV2 relay is excited and the 1REV2 contact feeds the EV2 solenoid valve. Therefore, during its normal operation, the burner is fed through the EVS safety valve and the EV1 and EV2 valves.

SAFETY PERIOD OF TIME AT THE END OF THE PRE-VENTILATION PHASE

Within a maximum of three seconds from the end of the pre-ventilation it has been said that the rules require for the flame to ignite. With reference to Fig. 6, if the flame sensor does not sense the flame within this period of time, a few fractions of a second before the three seconds have elapsed, the logic of t1 is such, that a $t1_2$ second impulse, much stronger than the pulse t11, which would send the RT relay into conduction, is sent out by the logic circuit of t1. In this situation the second BL relay also enters into conduction. The conduction of the second BL relay entails the closing of the 1BL1 contact and, therefore, the opening of the circuit feeding the part of power relating to the burner, thus sending the burner into a shutdown.

The operation can be reset by the user by manually commuting the 1BL1 contact.

CASE OF WORKING FAILURE OF THE ELECTRONIC CIRCUIT LOGIC DURING THE 3 SECONDS FOLLOWING THE PRE-VENTILATION PHASE

Always with reference to Fig. 6, should the logic circuit t1 interrupt the countdown, or should a breakdown occur, thus causing the second impulse $t1_2$ to be sent out by the logic circuit t1 so that the shutdown relay BL is activated, or should said second shutdown relay BL, because of working failure, not start working, so that the feed circuit does not stop, it happens that the gas continues to flow through the EVS and EV1 solenoid valves, without the flame igniting, even though the TR ignition transformer is activated.

In this case, since the first RTA relay is excited, the 1RTA and 2RTA contacts are also closed and, through the REV relay, feed said first BLS1 resistance, which is a resistance wound around a bi-metallic rod, which begins to heat up because of the movement of the bi-metal. After a period varying from 3.1 to 5 seconds this bi-metallic rod on which BLS1 is wound will commute the BLG1 contact. This commutation interrupts the feeding of the entire logic of the monitoring circuit and, as a consequence, also of the REV1 relay. This causes the opening of the REV1 contact which by opening stops the feeding of the EVS and EV1 solenoid valves. Thus one more safety feature is obtained, besides the traditional shutdown which occurs within the 3 seconds.

This safety feature intervenes regardless of the operation of the electronic logic, since said safety feature depends on the electro-mechanic operation of a bi-metallic rod commuting the contacts after a very brief heating-up period.

The BLG1 contact, the commutation of which has caused the shutdown of the equipment, is protected so that it can not be accessible to the user, but only to specialized personnel, whose intervention becomes necessary, since the commutation of the BLG1 contact has only occurred because of a failure of the BL shutdown relay, so that it becomes important to replace it.

IN CASE THE FLAME IS IGNITED AT THE START OF THE OPERATION

When the contacts of the thermostat, i.e. the T1, T2, T3 and T4 contacts, close, according to the diagram represented in Fig. 7, the M motor for the pre-ventilation begins to be fed. At the same time the countdown of the logic circuit t1 should also start. The presence of a flame which is sensed by the A RF circuit for the monitoring of the flame, the 1RF, 2RF, 3RF 4RF contacts are commuted. As can be observed in Fig. 7, because of the position of the 2RF contact, the RC charge circuit of the time constant of the timer t1 is not closed at this point, so that it is not possible for the first impulse $t1_1$ to be sent out, since the countdown is interrupted. Since the A RF flame monitoring contact is excited, the RPA1 relay is also excited and, as a consequence, the 2RPA2 contact, also called second contact, is commuted and it permits, also through the closing of said first 4RF contact, the feeding of said second BL shutdown relay through the second BL2 resistance, which is also wound around a bi-metallic element, deferring from the one previously described. Thus it occurs that if a flame is ignited at the start up, the equipment foresees the immediate shutdown.

NO AIR IS PRESENT DURING THE PRE-VENTILATION PHASE

With reference to Fig. 9, during the normal opera-

tion of the burner the EVS, EV1, EV2 solenoid valves for the gas distribution are open. When the flame goes out the A RF system resumes its resting state, during which all the 1RF, 2RF, 3RF and 4RF contacts re-open. By commuting the 1RF contact, said second BL relay is fed through the second BL2 resistance, so that an immediate shutdown occurs, because the 1BL1 contact connected with said second BL relay opens.

If, however, for any reason, said second BL relay is not excited, the interruption of the 3RF contact due to the disappearance of the flame entails the feeding of the first BLS1 resistance which, as has been said, is wound around a bi-metallic element and, therefore, after a period of time slightly exceeding 3 seconds, the bi-metal closes the BLG1 contact and the system shuts down irreversibly.

POST-COMBUSTION SHUTDOWNS

With reference to Fig. 10, when the TL limit thermostat opens, the T relay is de-energized and, as a consequence, all the T1, T2, T3 and T4 contacts open. When the T3 contact opens the EVS safety solenoid valve is no longer energized. In the same way, the opening of the T2 contact causes the solenoid valve of the REV2 relay to stop being energized. As a consequence, the corresponding EV2 solenoid valve is no longer energized. If no gas leaks out of the EVS safety solenoid valve, EV1 receives no gas, so that the flame goes out. If the flame goes out, the A RF relay commutes again and consequently the fourth E relay, which was kept in short circuit by the 2RF contact, is also excited. Consequently the corresponding 1E contact also opens and it causes the third B relay to open. The de-energizing of the third B relay causes also the opening of the contacts connected with said relay, i.e. the B1 and B2 contacts, which cause the M motor to stop: it then occurs that after the signal has been sent out by the limit thermostat, the motor keeps on working as long as the logic circuit which senses the presence of the flame insures that the flame is on.

On the other hand, should the flame continue to burn, because, for instance, some gas still leaks out of the EVS safety solenoid valve, although it has been de-energized, since the RF flame circuit is excited, the 2RF contact feeds, as can be observed in Fig. 10, a third BLG resistance wound around the same bi-metallic element, around which the first BLS1 resistance is wound. Said bi-metallic element permits, after a certain pre-determined period of time, to close the irreversible BLG1 contact. When BLG1 goes into commutation, the feeding of the REV1 relay stops, because the circuit does not give enough voltage to feed said relay. As a consequence the EV1 solenoid valve is no longer fed. If the closing of the EV1 solenoid valve suffices to put out the flame, the 2RF contact goes into commutation, since it depends on the A RF circuit and said circuit no longer senses the flame. Consequently said fourth E relay is fed and the corresponding 1E contact opens. With the opening of the 1E contact the third B relay is de-energized. As a consequence the B1 and B2 contacts open and the M motor is no longer fed. In this situation the pre-combustion ventilation stops.

If, on the other hand, the flame keeps on burning after the EVS and EV1 solenoid valves have closed, it occurs that, because the 2RF contact remains in the position described and represented in Fig. 10, it continues to keep said fourth E relay de-energized. Consequently the 1E contact remains closed, so as to insure the exciting of the third B relay which, as a consequence keeps the B1 and B2 contacts closed, so that the feeding of the M motor continues.

Therefore, should the flame continue to burn in spite of all the controls of the gas solenoid valve being closed, the system foresees that the motor, which supplies the combustion air, keeps supplying an amount of ventilation sufficient for the inlet gas to burn, thereby creating the ideal condition preventing dangerous situations due to the buid-up of unburnt gas.

Claims

1. A control and monitoring equipment for a gas burner suited to control and monitor the following phases: pre-ventilation of the burner chamber, ignition of the flame, holding of said flame, extinguishing said flame when a reference temperature of a medium to be heated has been reached, comprising:

   A) A power part (P) including and powering over a supply line:

   - the electric motor (M) of at least one electric fan supplying the air necessary for the combustion;
   - at least one safety solenoid valve (EVS) placed upstream of at least one solenoid valve (EV1) for the distribution of the gas;
   - a device (TR) for the gas ignition;

   and further including

   - a sensor of a temperature of said medium to be monitored and a sensor of the air pressure in the burner having respective electrical contacts (TL, PA) connected to said equipment;

   B) a logic part (L) consisting of:

   - a logic circuit (A RF) for the monitoring of the flame;
   - a logic circuit (t1) for the count down of a pre-ventilation time and of an ignition interval within which a flame shall be detected,

said logic circuit sending out a first impulse ($t1_1$) at the end of the pre-ventilation phase such that it causes the solenoid valves (EVS, EV1) of the gas distribution to open, and a second impulse ($t1_2$) terminating the ignition interval and having such an intensity as to set a first shutdown relay (BL) of the equipment into conduction, should the flame not be detected,

characterized in that said first impulse ($t1_1$) feeds a first relay (RTA), the contacts (1RTA, 2RTA) of which close a circuit feeding a second shutdown relay (REV) through a first resistance (BLS1) wound on a bi-metallic element interacting with a commutable contact (BLG1), said connection causing the equipment to stop either through the intervention of the first shutdown relay (BL) which opens a contact (1BL1) in the power part supply line feeding the equipment or, in case of operating failure of said firsts-hutdown relay (BL), through the commutation of said commutable contact (BLG1) interacting with the bi-metallic element (BLG) coupled with said resistance (BLS1) (Fig. 6).

2. An equipment according to claim 1, characterized in that said first resistance (BLS1) wound around said bi-metallic element is dimensioned in such a way, that the commutation of the contact (BLG1) interacting with said bi-metallic element occurs after the output of the second impulse (tl_2) of said count down logic circuit (tl) if the flame is absent and if said first shutdown relay (BL) of the equipment fails to intervene (Fig. 6).

3. An equipment according to claim 1, characterized in that the absence of the flame while the burner is in operation without the opening of the contact (TL) connected with the sensor measuring the value of said medium temperature, causes the feeding of said second shutdown relay (BL) and of said first resistance (BLS1) wound around a bi-metallic element, suited to commutate a contact (BLG1) through the opening of the contacts (1RF, 3RF) controlled by the flame monitoring logic circuit (A RF), said contacts causing the shutdown of the equipment through the stop of said first shutdown relay (BL) which opens the contact (1BL1) feeding the equipment or, should said second shutdown relay (BL) fail to operate, through the commutation of the contact (BLG1) connected with the bi-metallic element interacting with said first resistance (BLS1) and having a commutation period of time which is longer than the time of intervention of the first shutdown relay (Fig. 9).

4. An equipment according to claim 1, characterized in that, at the beginning of the operation and if the flame is present, the flame monitoring logic circuit (A RF) commutates a first contact (4RF) which, together with a second contact (2RPA2) commuted by a relay (RPA2), feeds said first shutdown relay (BL) through a second resistance (BL2) wound around another bi-metallic element, said connection causing the shutdown of the equipment through the intervention of said second shutdown relay (REV) which opens the contact (1BL1) feeding the equipment.

5. An equipment according to claim 1, characterized in that, when the sensor (PA) of the air pressure during the pre-ventilation phase senses the lack of air, the contacts (1RPA2, 2RPA2) of the relay (RPA2) connected with said sensor (PA) feed said first shutdown relay (BL) through said second resistance (BL2) wound around another bi-metallic element, said connection causing the shutdown of the equipment through the intervention of said first shutdown relay (BL) which opens the contact (1BL1) feeding the equipment (Fig. 8).

6. An equipment according to claim 1, characterized in that when the temperature of said medium to be monitored has been reached and the flame keeps on burning in the burner after the solenoid valve for the gas distribution has been closed, the electric feeding of the motor (M) of the electric fan supplying the combustion air continues, said feeding action being insured by the closing of the contacts (B1, B2) of a third relay (B) which is excited by the closed position of a normally closed contact (1E) belonging to a de-energized fourth relay (E), said fourth relay (E) being placed in series to a third resistance (BLG) wound around a bi-metallic element and in parallel with a closed contact (2RF) belonging to the flame monitoring logic circuit (A RF), said commutation excluding the short circuit of said fourth relay (E) placed in series to said third resistance (BLG) and opening the normally closed contact (1E) of said fourth relay (E) so as to interrupt the feeding of said third relay (B), the open contacts (B1, B2) of which de-energize the motor (M) of the electric fan (Fig. 10).

7. An equipment according to the claims 1 or 3 or 6, characterized in that the resistances (BLS1, BLG) which intervene respectively in case of breakdown of the timer logic at the end of the pre-ventilation phase and if the flame continues to burn after the end of the combustion, are wound around the same bi-metallic element activating the same contact (BLG1).

Patentansprüche

1. Eine Steuer- und Überwachungsaustrüstung für einen Gasbrenner, dazu geeignet, die folgenden Phasen zu steuern und zu überwachen: Vorlüftung der Brennkammer, Zündung der Flamme, Halten der Flamme und Löschen der Flamme, wenn die Bezugstemperatur eines zu erhitzenden Mediums erreicht ist, die folgendes umfaßt:

   A) Einen Leistungsteil (P), der folgendes umfaßt und über eine Speiseleitung versorgt:

   - den Elektromotor (M) von wenigstens einem Elektrolüfter, der die für die Verbrennung erforderliche Luft liefert;
   - wenigstens ein Sicherheits-Solenoidventil (EVS), das wenigstens einem Solenoidventil (EV1) für die Gasabgabe vorgeschaltet ist;
   - eine Vorrichtung (TR) für die Gaszündung;

   und weiterhin umfaßt:

   - einen Sensor für die Temperatur dieses zu überwachenden Mediums und einen Sensor für den Luftdruck im Brenner, jeweils mit elektrischen Kontakten (TL, PA), die an die besagte Ausrüstung angeschlossen sind;

   B) einen logischen Teil (L), bestehend aus:

   - einem Logikkreis (A RF) zur Überwachung der Flamme;
   - einem Logikkreis (t1) für das Countdown einer Vorlüftungszeit und eines Zündintervalls, in dem eine Flamme erfaßt werden soll, wobei dieser Logikkreis einen ersten Impuls ($t1_1$) am Ende der Vorlüftungsphase aussendet, so daß die Solenoidventile (EVS, EV1) der Gasabgabe geöffnet werden, und einen zweiten Impuls ($t1_2$) aussendet, mit dem das Zündintervall beendet wird und das eine derartige Stärke aufweist, daß ein erstes Abschaltrelais (BL) der Ausrüstung aktiviert wird, falls die Flamme nicht erfaßt werden sollte,

   dadurch gekennzeichnet, daß der erste Impuls ($t1_1$) ein erstes Relais (RTA) versorgt, dessen Kontakte (1RTA, 2RTA) einen Kreis schließen, der ein zweites Abschaltrelais (REV) über einen ersten, um ein Bimetall-Element gewickelten Widerstand (BLS1) versorgt, welcher mit einem umschaltbaren Kontakt (BLG1) zusammenwirkt, wobei diese Verbindung den Stopp der Ausrüstung entweder durch Ansprechen des ersten Abschaltrelais (BL) verursacht, das einen Kontakt (1BL1) in der Leistungsteil-Speiseleitung, die die Ausrüstung versorgt, öffnet, oder im Fall eines Funktionsfehlers des ersten Abschaltrelais (BL) durch Umschaltung des umschaltbaren Kontakts (BLG1), der mit dem Bimetall-Element (BLG) zusammenwirkt, das mit dem besagten Widerstand (BLS1) gekoppelt ist (Figur 6).

2. Eine Ausrüstung nach Patentanspruch 1, dadurch gekennzeichnet, daß der erste, um ein Bimetall-Element gewickelte Widerstand (BLS1) so dimensioniert ist, daß die Umschaltung des Kontakts (BLG1), der mit dem Bimetall-Element zusammenwirkt, eintritt, nach der Ausgabe des zweiten Impulses ($t1_2$) des Countdown-Logikkreises (t1) erfolgt, wenn keine Flamme vorhanden ist und das erste Abschaltrelais (BL) der Ausrüstung nicht anspricht (Figur 6).

3. Eine Ausrüstung nach Patentanspruch 1, dadurch gekennzeichnet, daß das Fehlen der Flamme, wenn der Brenner in Betrieb ist ohne Öffnung des Kontakts (TL), der mit dem die Mediumtemperatur messenden Sensor verbunden ist, die Versorgung des zweiten Abschaltrelais (BL) und des ersten, um ein Bimetall-Element gewickelten Widerstands (BLS1) bewirkt, geeignet zur Umschaltung eines Kontakts (BLG1) durch Öffnung der Kontakte (1RF, 3RF), die durch den Flammensteuerkreis (A RF) kontrolliert werden, wobei diese Kontakte die Abschaltung der Ausrüstung durch den Stopp des ersten Abschaltrelais (BL) verursachen, das wiederum den die Ausrüstung versorgenden Kontakt (1BL1) öffnet oder, sollte das zweite Abschaltrelais (BL) nicht funktionieren, durch die Umschaltung des Kontakts (BLG1), der mit dem Bimetall-Element verbunden ist, das mit dem ersten Widerstand (BLS1) zusammenwirkt und eine Umschaltzeit aufweist, die länger ist als die Ansprechzeit des ersten Abschaltrelais (Figur 9).

4. Eine Ausrüstung nach Patentanspruch 1, dadurch gekennzeichnet, daß zu Beginn des Vorgangs und bei vorhandener Flamme der Logikkreis für die Flammenüberwachung (A RF) einen ersten Kontakt (4RF) umschaltet, der gemeinsam mit einem zweiten Kontakt (2RPA2), der durch ein Relais (RPA2) umgeschaltet wird, das erste Abschaltrelais (BL) über einen zweiten, um ein anderes Bimetall-Element gewickelten Widerstand (BL2) versorgt, wobei diese Verbindung, die Abschaltung der Ausrüstung über das Ansprechen des zweiten Abschaltrelais (REV) bewirkt, das den Kontakt (1BL1), der die Ausrüstung versorgt, öffnet.

5. Eine Ausrüstung nach Patentanspruch 1, dadurch

gekennzeichnet, daß, wenn der Luftdrucksensor (PA) während der Vorbelüftungsphase Luftmangel feststellt, die Kontakte (1RPA2, 2RPA2) des Relais (RPA2), das an diesen Sensor (PA) angeschlossen ist, das erste Abschaltrelais (BL) über den zweiten, um ein anderes Bimetall-Element gewickelten Widerstand (BL2) versorgen, wobei diese Verbindung die Abschaltung der Ausrüstung durch Ansprechen des ersten Abschaltrelais (BL) bewirkt, welche den Kontakt (1BL1), der die Ausrüstung versorgt, öffnet (Figur 8).

6. Eine Ausrüstung nach Patentanspruch 1, dadurch gekennzeichnet, daß, wenn die Temperatur des zu überwachenden Mediums erreicht ist und die Flamme im Brenner weiterbrennt, nachdem das Solenoidventil für die Gasabgabe geschlossen wurde, die elektrische Versorgung des Motors (M) für den elektrischen Lüfter, der die Verbrennungsluft zuführt, andauert, wobei diese Versorgung durch Schließung der Kontakte (B1, B2) eines dritten Relais (B) gewährleistet ist, das durch die geschlossene Position eines Ruhekontakts (1E) erregt wird, welches zu einem aberregten vierten Relais (E) gehört, wobei dieses vierte Relais (E) reihengeschaltet ist mit einem dritten, um ein Bimetall-Element gewickelten Widerstand (BLG) und parallelgeschaltet mit einem geschlossenen Kontakt (2RF), der zum Logikkreis für die Flammenüberwachung (A RF) gehört, wobei diese Umschaltung den Kurzschluß des vierten, mit dem dritten Widerstand (BLG) reihengeschalteten Relais (E) ausschließt und den Ruhekontakt (1E) dieses vierten Relais (E) öffnet, um so die Versorgung des dritten Relais (B) zu unterbrechen, wobei seine offenen Kontakte (B1, B2) den Motor (M) des Elektrolüfters aberregen (Figur 10).

7. Eine Ausrüstung nach Patentansprüchen 1 oder 3 oder 6, dadurch gekennzeichnet, daß die Widerstände (BLS1, BLG), die jeweils im Fall einer Störung der Zeitgeberlogik am Ende der Vorbelüftungsphase sowie dann, wenn die Flamme nach dem Ende der Verbrennung weiterbrennt, ansprechen, um dasselbe Bimetall-Element gewickelt sind, das denselben Kontakt (BLG1) aktiviert.

Revendications

1. Un outilllage de contrôle et de surveillance pour un brûleur à gaz indiqué pour contrôler et surveiller les phases suivantes:
la préventilation de la chambre du brûleur, l'allumage de la flamme, le maintien de la dite flamme, l'extinction de la dite flamme quand on a atteint une température de référence d'un moyen à chauffer, comprenant:

A) Une partie de puissance (P) comprenant et alimentant à travers une ligne d'alimentation:

- le moteur électrique (M) d'au moins un électroventilateur fournissant l'air nécessaire pour la combustion;
- au moins une vanne solénoïde de sûreté (EVS) positionnée en amont d'au moins une vanne solénoïde (EV1) pour la distribution du gaz;
- un dispositif (TR) pour l'allumage du gaz;

et comprenant encore

- un capteur de température du dit moyen à surveiller et un capteur de la pression de l'air dans le brûleur ayant des contacts électriques correspondants (TL, PA) reliés au dit outillage;

B) une partie logique (L) comprenant:

- un circuit logique (A RF) pour la surveillance de la flamme;
- un circuit logique (t1) pour le compt à rebours d'un temps de préventilation et d'un intervalle d'allumage dans lequel la flamme sera détectée, le dit circuit logique émettant une première impulsion ($t1_1$) à la fin de la phase de préventilation de façon que celle-ci puisse permettre aux vannes solénoïdes (EVS, EV1) de la distribution du gaz de s'ouvrir, et une deuxième impulsion ($t1_2$) faisant terminer l'intervalle d'allumage et ayant une intensité telle à activer un premier relais de fermeture (BL) de l'outillage, si la flamme n'est pas détectée,

caractérisé en ce que la dite première impulsion ($t1_1$) alimente un premier relais (RTA) dont les contacts (1RTA, 2RTA) ferment un circuit alimentant un deuxième relais de fermeture (REV) au moyen d'une résistance (BLS1) enroulée sur un élément bimétallique interagissant avec un contact commutable (BLG1), la dite connexion faisant arrêter l'outillage aussi bien grâce à l'intervention du premier relais de fermeture (BL) qui ouvre un contact (1BL1) sur la ligne d'alimentation de la partie de puissance alimentant l'outillage que, en cas de panne du fonctionnement du dit premier relais de fermeture (BL), grâce à la commutation du dit contact commutable (BLG1) interagissant avec l'élément bimétallique (BLG) relié à la dite résistance (BLS1(Fig. 6).

2. Un outillage selon la revendication 1, caractérisé en ce que la dite première résistance (BLS1) enroulée

autour de l'élément bimétallique a des dimensions telles que la commutation du contact (BLG1)) interagissant avec le dit élément bimétallique a lieu après l'emission de la deuxième impulsion ($t1_2$) du dit circuit logique de compt à rebours (t1) si la flamme est absente et si le dit premier relais de fermeture (BL) de l'outillage ne s'enclenche pas (Fig. 6).

3. Un outillage selon la revendication 1, caractérisé en ce que l'absence de la flamme tant que le brûleur est en fonction sans l'ouverture du contact (TL) relié au capteur mesurant la valeur de la dite température du moyen, cause l'alimentation du dit deuxième relais de fermeture (BL) et de la dite première résistance (BLS1) enroulée autour de l'élément bimétallique, indiqué pour commuter un contact (BLG1) à travers l'ouverture des contacts (1RF, 3RF) commandés par le circuit logique de surveillance de la flamme (A RF), les dits contacts produisant le blocage de l'outillage à travers l'arrêt du dit premier relais de fermeture (BL) qui ouvre le contact (1BL1) alimentant l'outillage ou, si le dit deuxième relais de fermeture (BL) n'entre pas en fonction, à travers la commutation du contact (BLG1) relié à l'élément bimétallique interagissant avec la dite première résistance (BLS1) et ayant un laps de temps de commutation plus long que le temps d'intervention du premier relais de fermeture (Fig. 9).

4. Un outillage selon la revendication 1, caractérisé en ce que, au début du fonctionnement et si la flamme est présente, le circuit logique pour la surveillance de la flamme (A RF) commute un premier contact (4RF) qui, avec un deuxième contact (2RPA2) commuté par un relais (RPA2), alimente le dit premier relais de fermeture (BL) au moyen d'une deuxième résistance (BL2) enroulée autour d'un autre élément bimétallique, la dite connexion produisant le blocage de l'outillage à travers l'intervention du dit deuxième relais de fermeture (REV) qui ouvre le contact (1BL1) alimentant l'outillage.

5. Un outillage selon la revendication 1, caractérisé en ce que, quand le capteur (PA) de la pression de l'air détecte le manque d'air pendant la phase de préventilation, les contacts (1RPA2, 2RPA2) du relais (RPA2) reliés au dit capteur (PA) alimentent le dit premier relais de fermeture (BL) au moyen de la dite deuxième résistance (BL2) enroulée autour d'un autre élément bimétallique, la dite connexion produisant le blocage de l'outillage à travers l'intervention du dit premier relais de fermeture (BL) qui ouvre le contact (1BL1) alimentant l'outillage (Fig. 8).

6. Un outillage selon la revendication 1, caractérisé en ce que, lorsqu'on a atteint la température du dit moyen à surveiller et la flamme continue à brûler dans le brûleur après que la vanne solénoïde pour la distribution du gaz a été fermée, l'alimentation électrique du moteur (M) de l'électroventilateur fournissant l'air de combustion continue, la dite action d'alimentation étant assurée par la fermeture des contacts (B1, B2) d'un troisième relais (B) qui est excité par la position de fermeture d'un contact normalement fermé (IE) appartenant à un quatrième relais désexcité (E), le dit quatrième relais (E) étant positionné en série avec une troisième résistance (BLG) enroulée autour d'un élément bimétallique et en parallèle avec un contact fermé (2RF) appartenant au circuit logique de surveillance de la flamme (A RF), la dite commutation excluant le court circtuit du dit quatrième relais (E) positionné en série avec la dite troisième résistance (BLG) et ouvrant le contact normalement fermé (1E) du dit quatrième relais (E) de façon à interrompre l'alimentation du dit troisième relais (B), dont les contacts ouverts (B1, B2) désexcitent le moteur (M) de l'électroventilateur (Fig. 10).

7. Un outillage selon les revendications 1 ou 3 ou 6, caractérisé en ce que les résistances (BLS1, BLG), qui s'enclenchent respectivement en cas de panne de la logique du compteur de temps à la fin de la phase de préventilation et si la flamme continue à brûler après la fin de la combustion, sont enroulées autour du même élément bimétallique activant le même contact (BLG1).

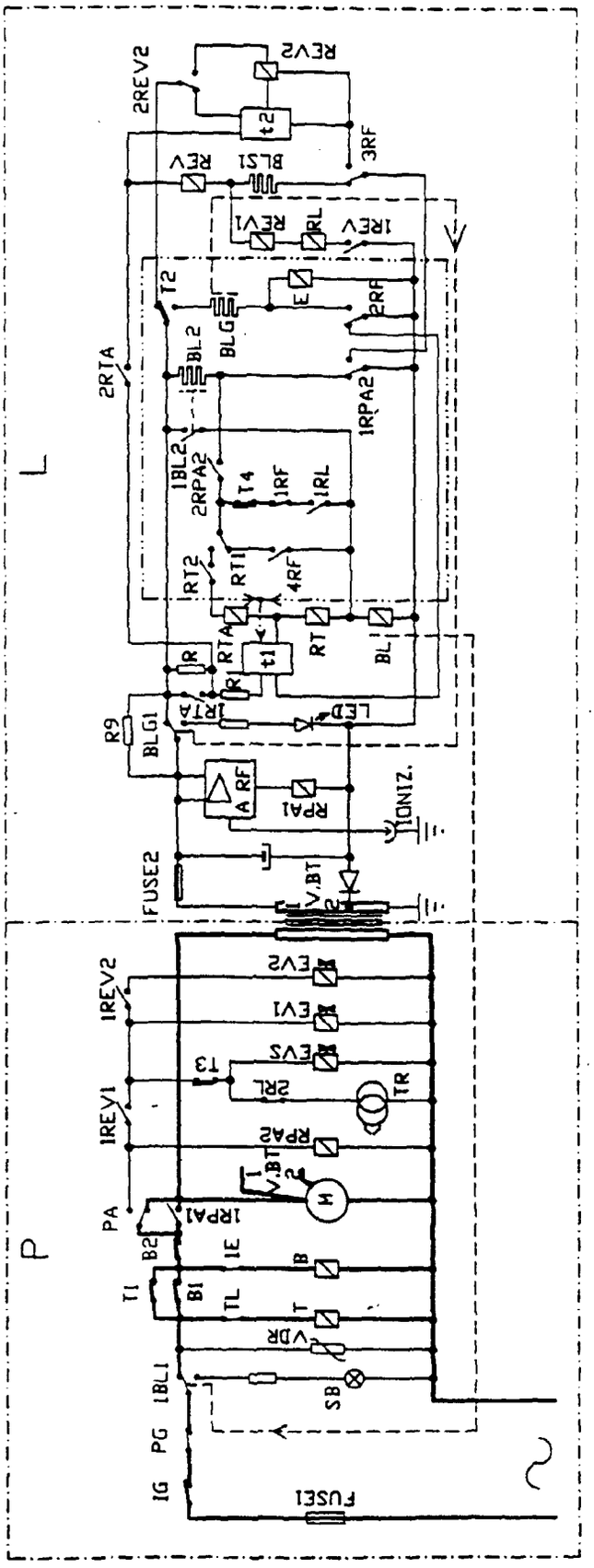
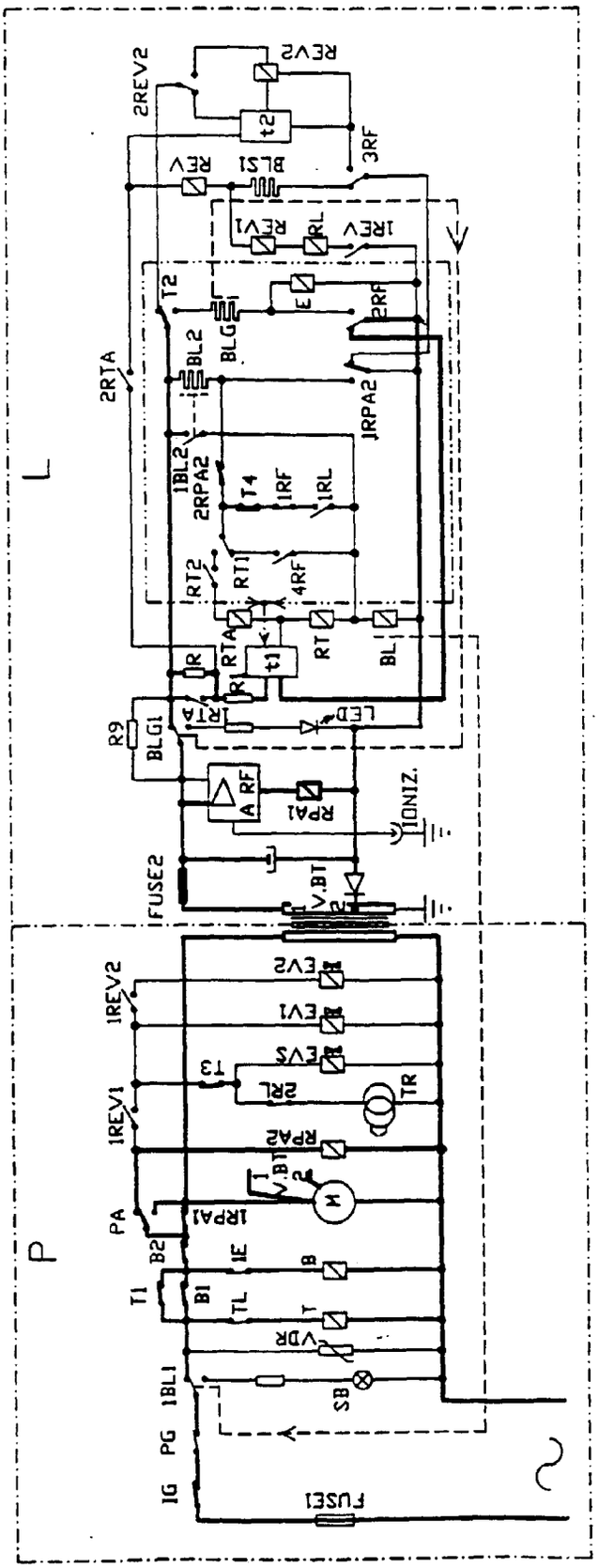

L
P
2REV2
REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
2RA
E
T2
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
t1
RT
BL
R
1RT
LED
R9
BLG1
A RF
RPA1
IONIZ.
FUSE2
V.BT
2
1
EV2
EV1
EVS
T3
2RL
TR
RPA2
1REV2
1REV1
PA
1RPA1
B2
1E
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.1


L
P
2REV2
REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
T2
E
2RF
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BL2
2RTA
JRPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
t1
RT
BL
IR
R1
R9
BLG1
LED
A RF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EV2
EV1
EVS
T3
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TR
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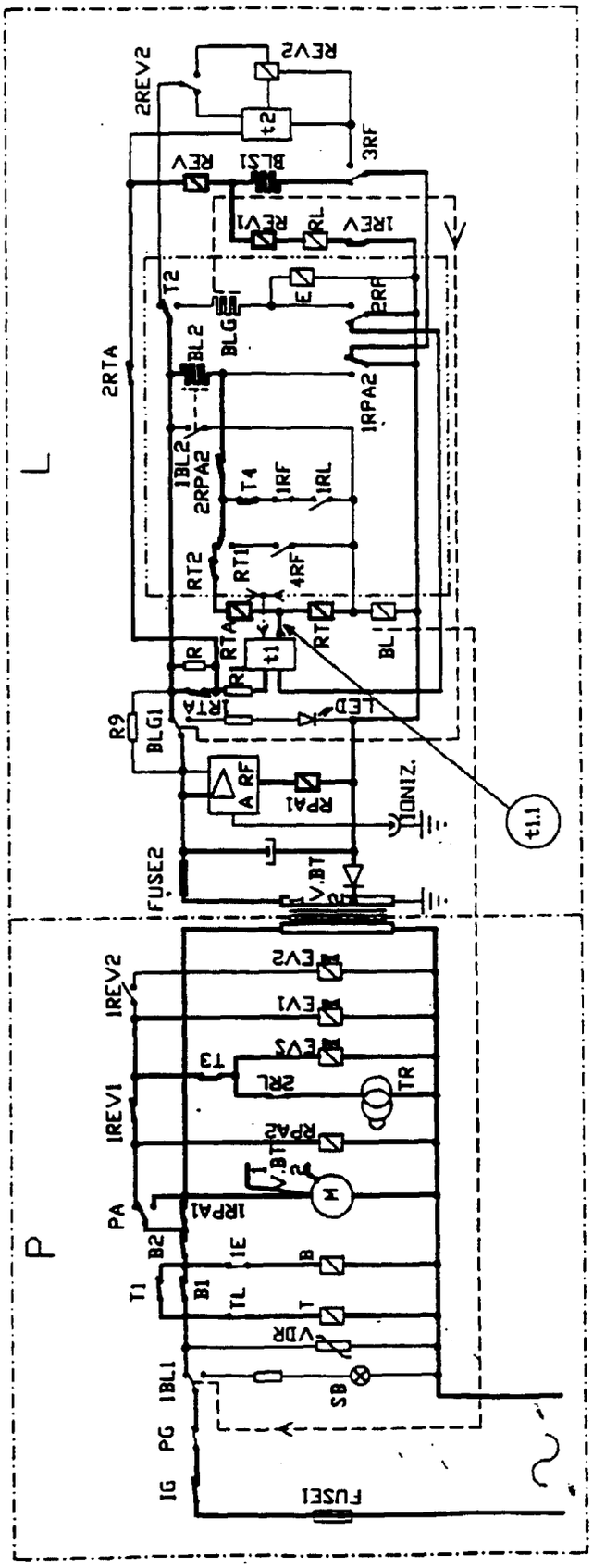
RPA2
1RPA1
PA
B2
IE
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.2


L
P
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REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
T2
E
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RT
BL
IR
RTA
t1
1R
1RTA
LED
R9
BLG1
A RF
RPA1
IONIZ.
t1.1
FUSE2
V.BT
EV2
IREV2
EV1
EVS
T3
2RL
TR
IREV1
RPA2
V.BT
M
PA
1RPA1
B2
1E
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.3

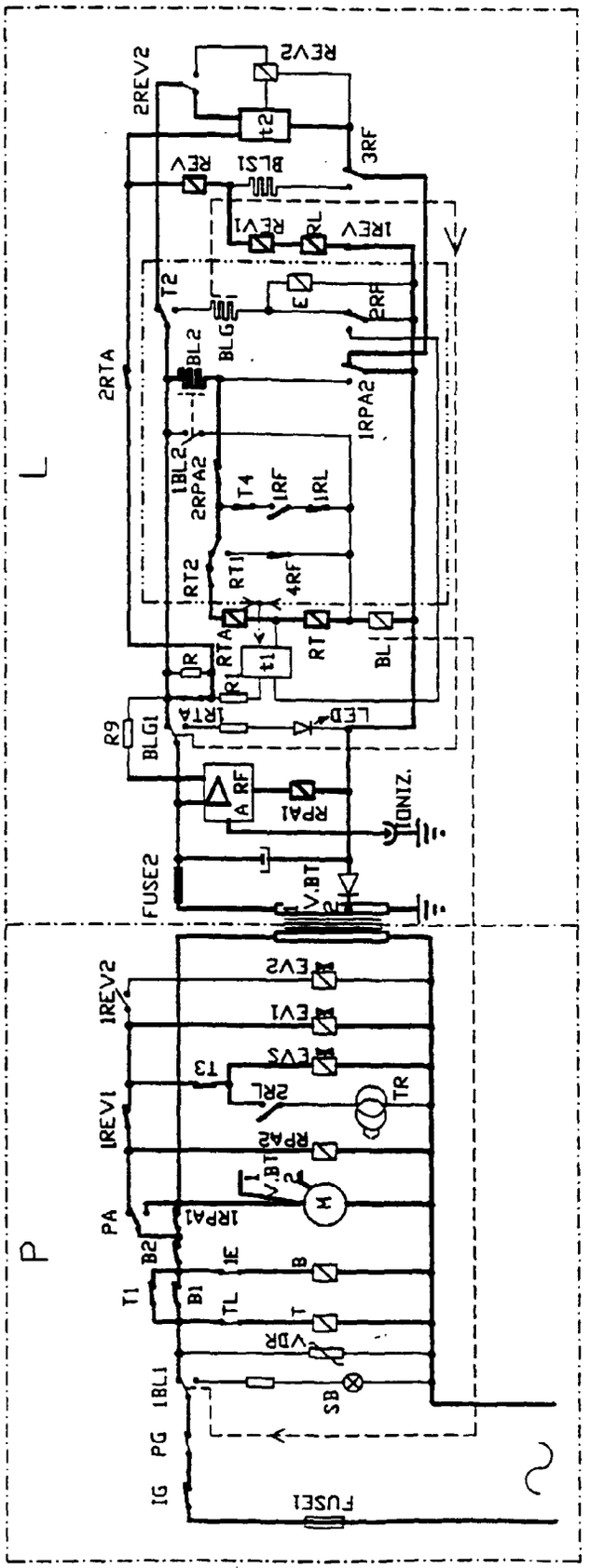
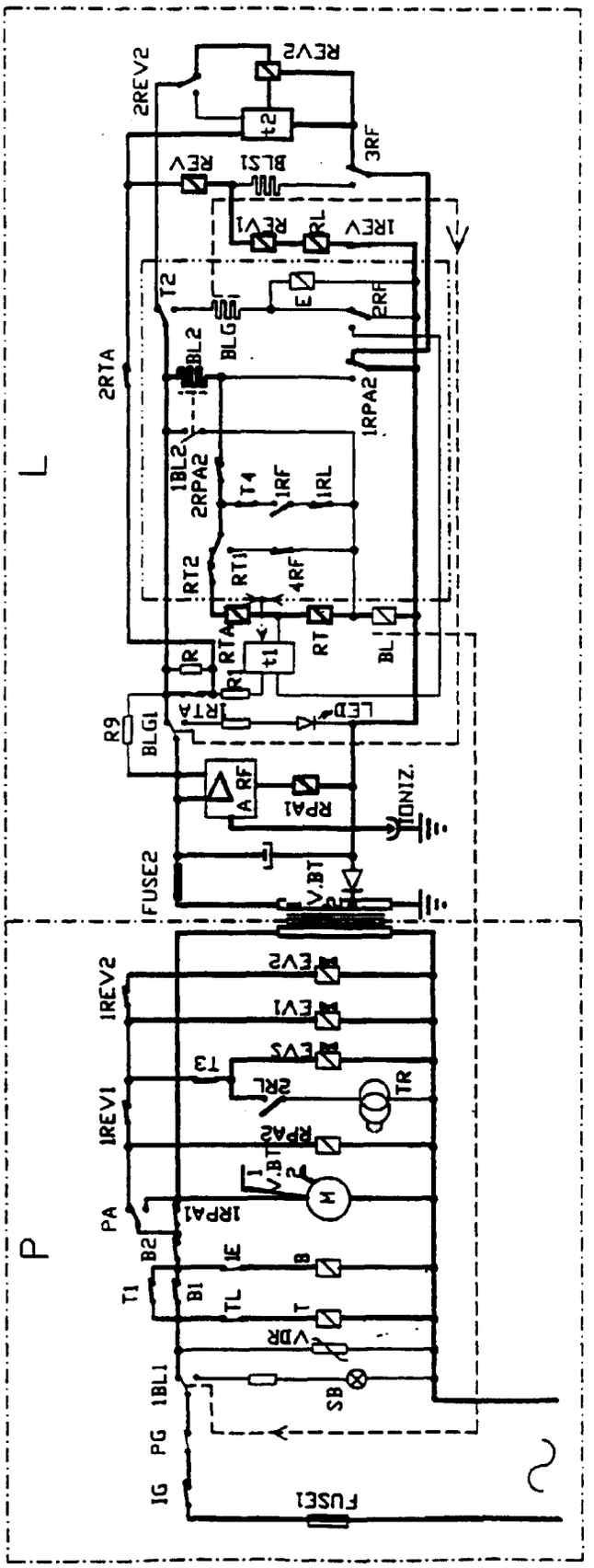

L
P
2REV2
REVS2
t2
3RF
REV
BLS1
REV1
RL
1REV
T2
E
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
IRF
IRL
RT2
RT1
4RF
RT
BL
RTA
t1
IR
R1
RT1
LED
R9
BLG1
A RF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EVS2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
V.BT2
M
PA
1RPA1
B2
1E
B
T1
B1
TL
T
VDR
SB
1BL1
PG
IG
FUSE1

FIG.4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P
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t2
3RF
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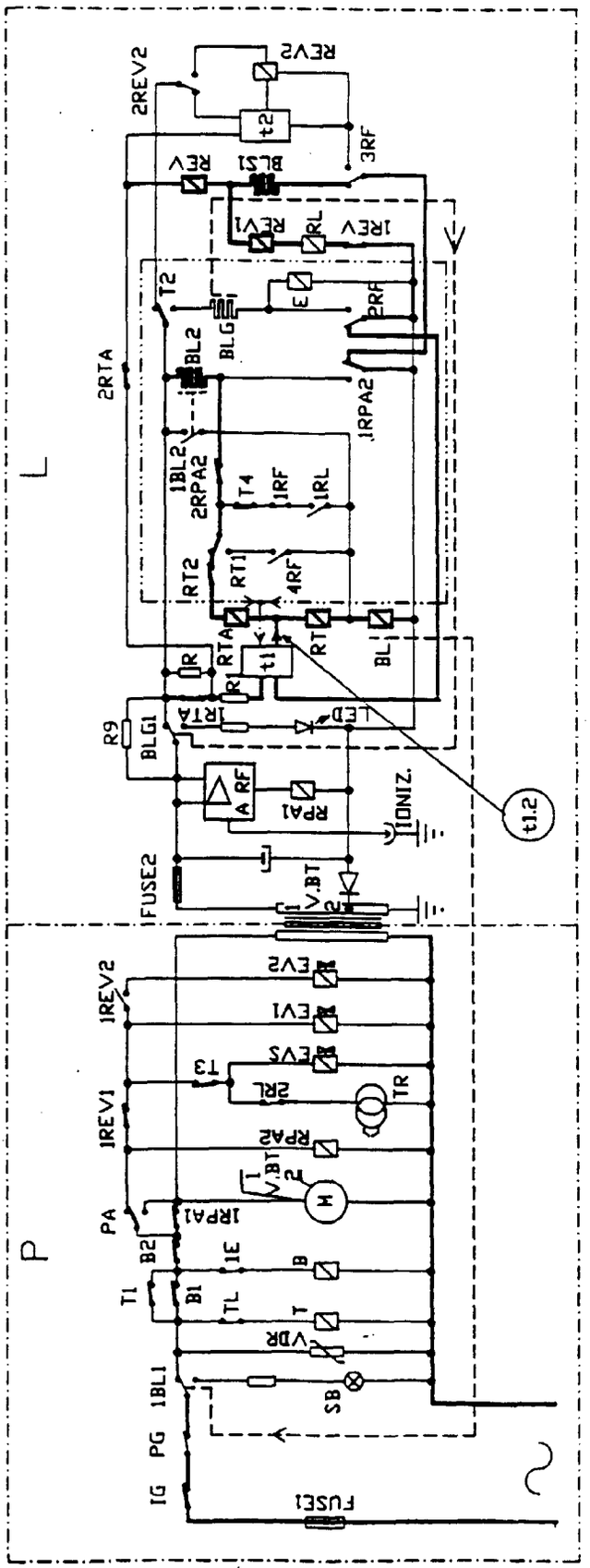
BLS1
REV1
RL
1REV
T2
E
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
t1
RT
BL
R
R1
RT3
LED
R9
BLG1
A RF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EV2
EV1
EV3
T3
2RL
TR
1REV1
RPA2
V.BT
M
PA
1RPA1
B2
IE
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.5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REVS2
t2
3RF
REV
BLS1
REV1
RL
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T2
E
2RF
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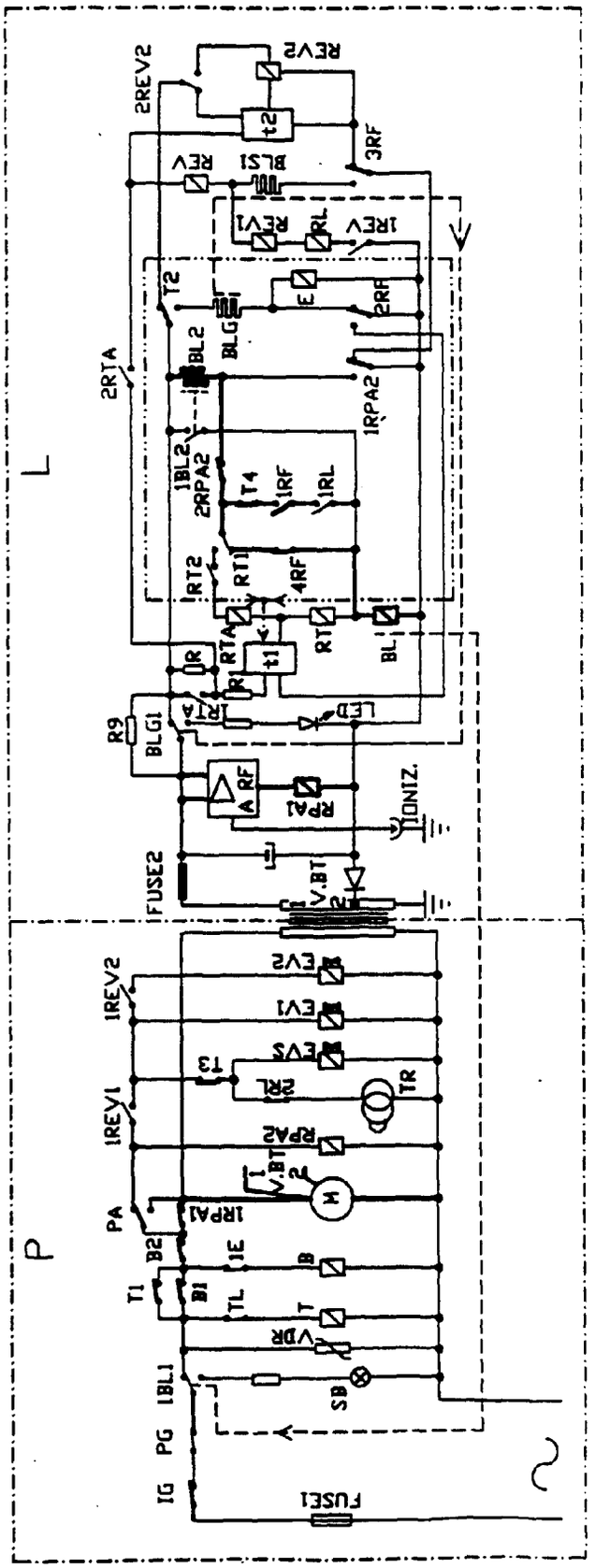
BL2
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
t1
RT
BL1
R
R1
R9
BLG1
ED
A RF
RPA1
IONIZ.
t1.2
FUSE2
V.BT
1REV2
EVS2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
1RPA1
PA
B2
1E
B
T1
B1
TL
T
VDR
SB
1BL1
PG
IG
FUSE1

FIG.6


L
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2REV2
REV2
t2
3RF
REV
BLS1
RL
1REV
T2
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL
t1
1R
R9
BLG1
LED
ΔRF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EV2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
1V.BT
M
PA
1RPA1
B2
1E
B
T1
B1
TL
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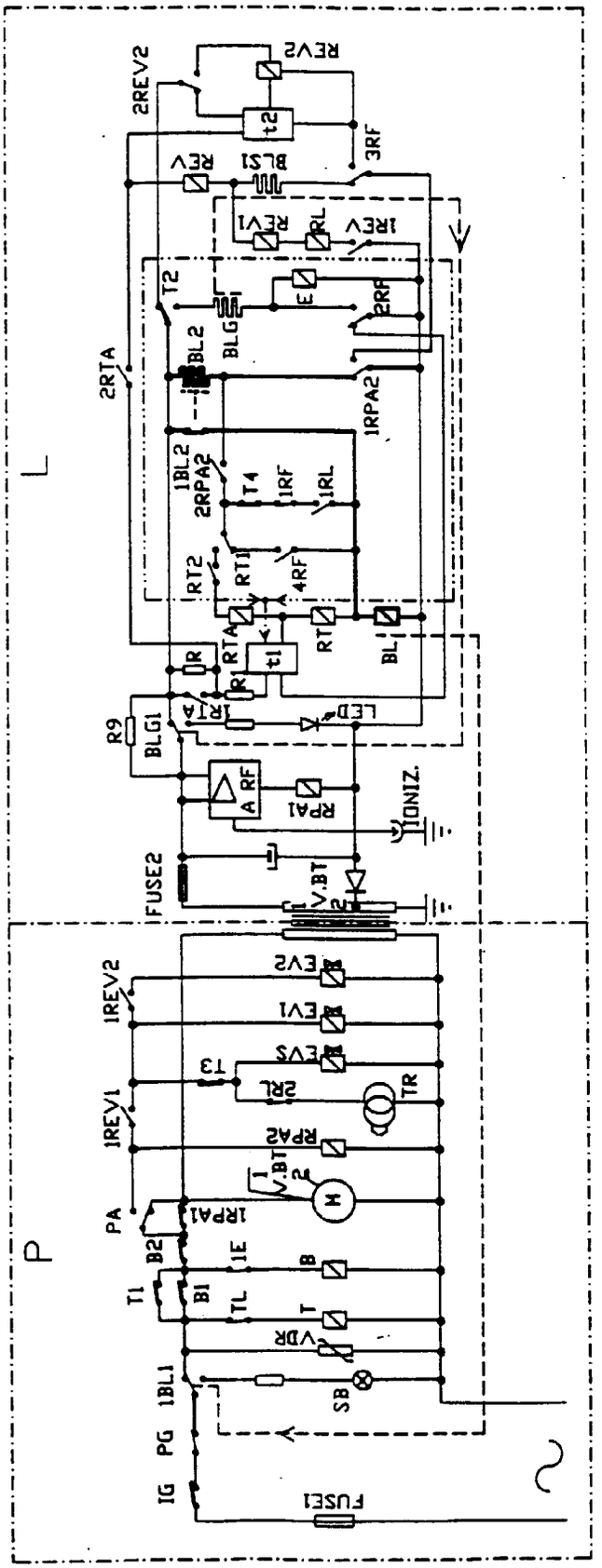
VDR
1BL1
SB
PG
IG
FUSE1

FIG.7


L
P
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REVS2
t2
3RF
REV<
BLS1
REV1
RL
1REV<
T2
E
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2RTA
BL2
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL1
t1
R
R1
1R1
LED
R9
BLG1
A RF
RPA1
IONIZ.
FUSE2
V.BT
EVS2
IREV2
EV1
EVS
T3
2RL
TR
IREV1
RPA2
V.BT
M
PA
1RPA1
B2
1E
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.8

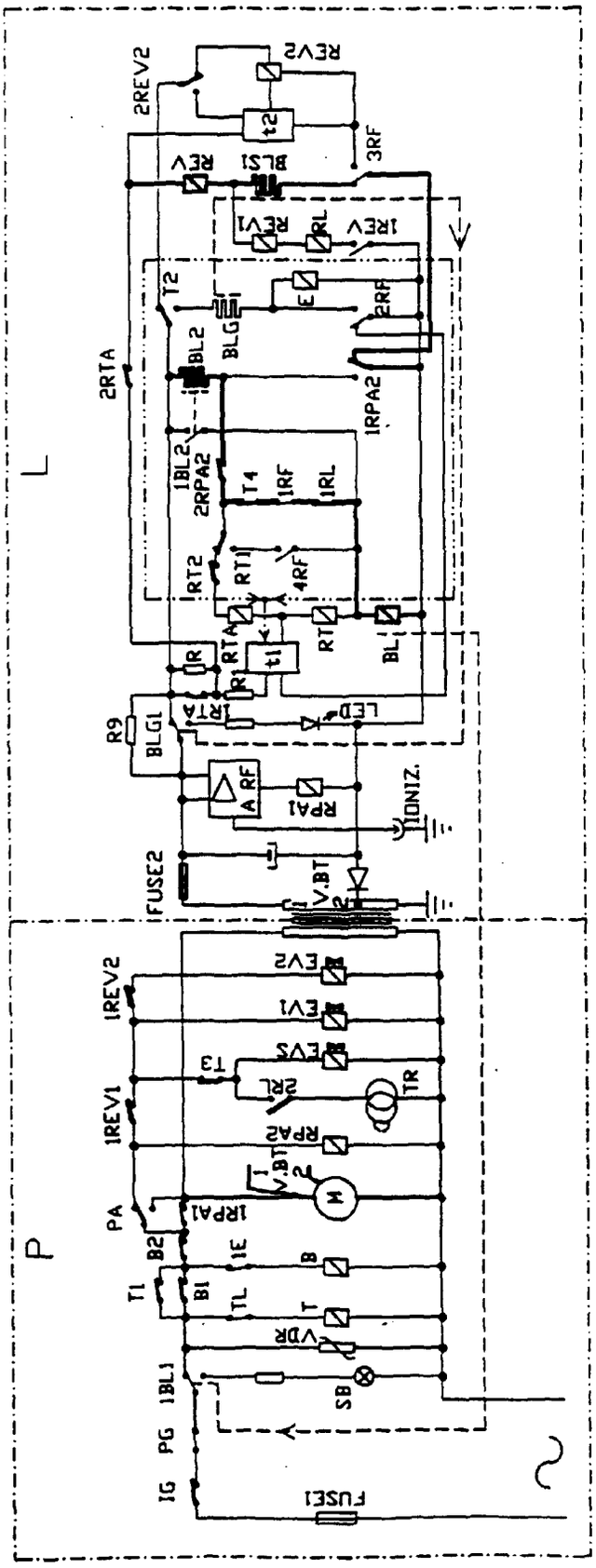
L
P
REV2
2REV2
t2
3RF
REV
BLS1
RL
REV1
1REV
T2
E
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RT
BL
RTA
t1
IR
R1
LED
R9
BLG1
RT1
A RF
RPA1
IONIZ.
FUSE2
V.BT
2
EV2
EV1
EVS
IREV2
T3
2RL
TR
IREV1
RPA2
V.BT
2
M
PA
1RPA1
B2
1E
B
T1
B1
TL
T
VDR
SB
1BL1
PG
IG
FUSE1

FIG.9

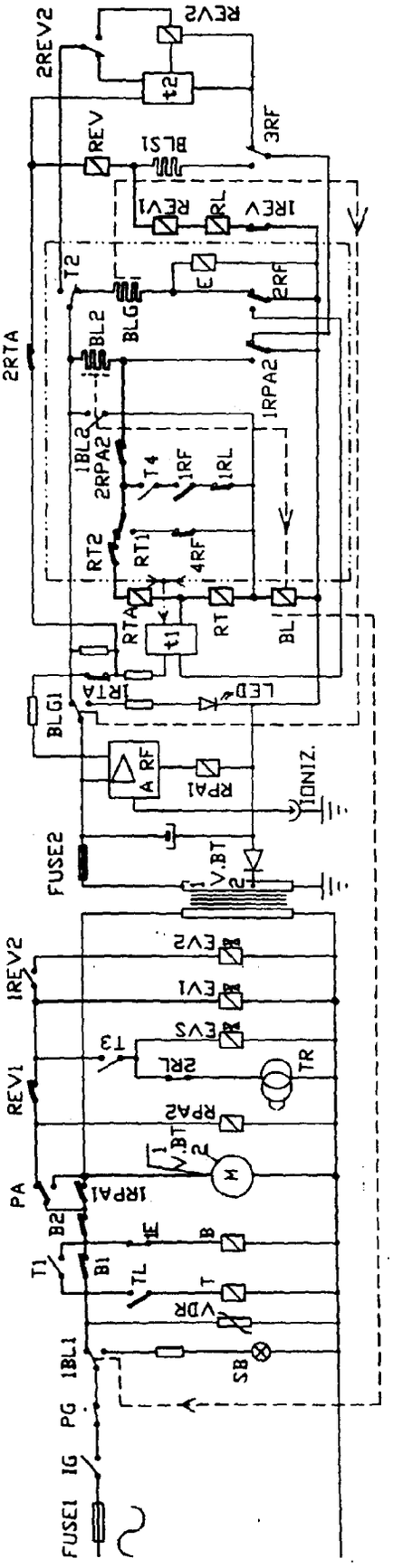
FUSE1
IG
PG
IBL1
SB
VDR
T
TL
T1
B1
B2
B
E
PA
IRPA1
RPA2
REV1
T3
2RL
TR
EV3
EV1
EV2
IREV2
V.BT
FUSE2
IONIZ.
RPA1
A RF
BLG1
RTA
LED
t1
RT
BL
RT1
RT2
4RF
1RL
1RF
T4
2RPA2
IBL2
IRPA2
2RTA
BLG
BL2
T2
2RF
E
IREV1
RL
REV1
BLS1
3RF
t2
REV2
2REV2

FIG.10