(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 793 059 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.09.1997 Bulletin 1997/36

(51) Int. Cl.[6]: **F23N 5/20**, F23N 5/24

(21) Application number: **97107692.2**

(22) Date of filing: **05.10.1993**

(84) Designated Contracting States:
CH DE FR GB IT LI

(30) Priority: **07.10.1992 IT VI920148**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
93116050.1 / 0 591 910

(71) Applicant:
R.B.L. RIELLO BRUCIATORI LEGNAGO SPA
I-37045 Legnago (VR) (IT)

(72) Inventor:
The designation of the inventor has not yet bee n filed

(74) Representative: **Bonini, Ercole**
c/o STUDIO ING. E. BONINI SRL
Corso Fogazzaro 8
36100 Vicenza (IT)

Remarks:
This application was filed on 12 - 05 - 1997 as a divisional application to the application mentioned under INID code 62.

(54) Control and monitoring equipment for gas burners

(57) The invention discloses a control and monitoring equipment for gas burners which, when the figure of the reference temperature of the medium to be monitored has been reached, if the flame continues to burn in the burner after the safety gas solenoid valve has been de-energized, the feeding of the motor (M) of the electric fan supplying air for the combustion continues, said feeding being insured by the closing of the contacts (B1, B2) placed before the motor (M) of the electric fan, before a first relay (B) belonging to the power circuit and which is excited by the closing of a normally closed contact (1E), wherein said normally closed contact belongs to a second de-energized relay (E) inserted in the logic part of the equipment, said second relay (E) being placed in series to a first 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), the feeding of the motor (M) ceasing when the flame goes out because of the commutation of the contact (2RF) belonging to the flame monitoring logic circuit (A RF).

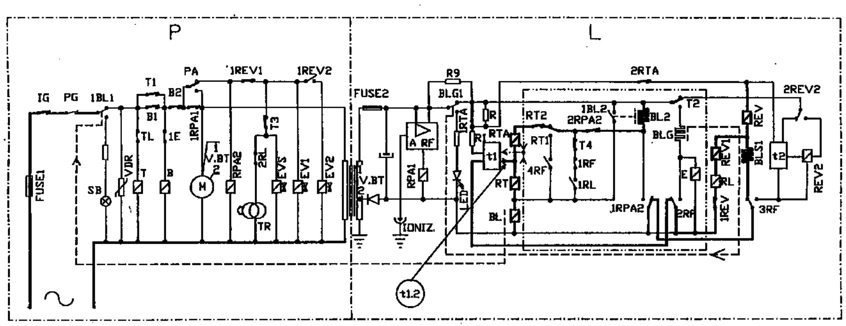

FIG.6

EP 0 793 059 A2

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 pre-set 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.

European safety rules foresee an other safety device which provides a check of sealing of the gas valves. Said check can be provided before the cycle of the burner starts or when the reference figure of the physical pre-set value has been reached. When in the equipment there are two valves of gas in series, the purpose of checking said valves is to verify that at least one valve is sealed. If one of the valves does not seal, the gas equipmet shuts off.

This kind of check system presents at least two drawbacks.

The first one drawback is that this check system uses expensive devices, expecially for burners of low capacity.

Another drawback consists in the fact that, when the reference figure of the physical value (i.e. temperature of the water) is reached and the flame of the burner does not stop, said check monitoring devices shut down preventing the burner to work.

In this circumstance due to the lack of the right quantity of the combustion air, the flame can stop, but the gas continues to flow; this is a high dangerous situation because the gas unburnt can accumulate in the combustion chamber and can explode.

The purpose of the invention is to overcome the afore said drawbacks.

The main purpose of the invention is to carry out a control and monitoring equipment for a gas burner which permits the working prefixed of the fan of the burner, if the flame remains after the shut down of the electrovalve which controls the flow of the gas when the prefixed temperature of the water of the heater is reached.

In such a way it is ensured the connect amount of the air to support the flame.

Another purpose to be reached is that the control and monitoring equipment stops the motor of the fan of the burner after the disappearance of the flame.

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.

According to the invention when the temperature of the medium to be monitored has been reached, if the flame keeps on burning in the burner after the interruption of the power to the solenoid valve for the gas safety, the electric feeding of the motor of the electric fan supplying the combustion air keeps on, said feeding action being insured by the closing of the contacts placed above the motor of the electric fan of a first relay belonging to the power circuit and excited by the closed position of a normally closed contact. Said normally closed contact belongs to a de-energized second relay inserted in the logic part of the equipment and placed in series to a first resistance wound around a bi-metallic element and in parallel with a closed contact belonging to the flame monitoring logic circuit. The feeding of the motor of the electric fan stops when the flame for the commutation of the contact belonging to the flame monitoring logic circuit disappears. Said commutation excluds the short circuit of the aforesaid second relay placed in series to said first resistance and opens the normally closed contact of said second relay so as to interrupt the feeding of said first relay and the open contacts of which de-energize the motor of the electric fan.

Advantageously, the afore-said 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 bimetallic 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 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 open, 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 diagram 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 $t1_1$, 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 bimetal. 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 1REV1 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 bimetallic 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 operation 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 out.

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 predetermined 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 gas burners suited to control and monitor the following steps: 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 fur-

ther including:

- a sensor (TL) of the temperature of said medium to be monitored and a sensor of the air pressure (PA) 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 the pre-ventilation time and of a 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 step 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 when the temperature of said medium to be monitored has been reached, if the flame keeps on burning in the burner after the interruption of the power to the solenoid valve for the gas safety, the electric feeding of the motor (M) of the electric fan supplying the combustion air keeps on, said feeding action being insured by the closing of the contacts (B1, B2) placed above the motor (M) of the electric fan of a first relay (B) belonging to the power circuit and excited by the closed position of a normally closed contact (1E), said normally closed contact belonging to a de-energized second relay (E) inserted in the logic part of the equipment, said second relay (E) being placed in series to a first 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), the feeding of the motor (M) of the electric fan stopping when the flame for the commutation of the contact (2RF) belonging to the flame monitoring logic circuit (A RF) disappears, said commutation excluding the short circuit of said second relay (E) placed in series to said first resistance (BLG) and opening the normally closed contact (1E) of said second relay (E) so as to interrupt the feeding of said first relay (B), the open contacts (B1, B2) of which de-energize the motor (M) of the electric fan (Fig. 10).

2. An equipment according to claim 1, characterized in that, when the monitoring temperature has been reached and in case of flame ignition, the commutation of the contact (BLG1) interacting with the bi-metallic element around which said first resistance (BLG) is wound, causes the de-energizing of a relay (REV1), the contact (1REV1) of which will open by closing the solenoid valve (EV1) for the distribution of the gas still opened.

3. An equipment according to claim 1, characterized in that said first impulses ($t1_1$) sent out by the logic circuit (t1) at the end of the pre-ventilation step, feed a first relay (RTA) belonging to the logic part of the equipment, the contacts (1RTA, 2RTA) of which close a circuit feeding a second shutdown relay (REV) through a second resistance (BLS1) wound around 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 first shutdown relay (BL), through the commutation of said commutable contact (BLG1) interacting with the bi-metallic element (BLG) coupled with said second resistance (BLS1) (Fig. 6).

4. An equipment according to claim 3, characterized in that said second 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 impulses ($t1_2$) of said count down logic circuit (t1) if the flame is absent and if said shutdown relay (BL) of the equipment fails to intervene (Fig. 6).

5. 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 valve of said medium temperature, causes the feeding of said shutdown relay (BL) and a second 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 shutdown relay (BL) fail to operate, through the commutation of the contact (BLG1) connected with the bi-metallic element interacting with said second resistance (BLS1) and having a commutation period of time which is longer than the time of intervention of said shutdown relay (Fig. 9).

6. 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 (RPA1) excited by said flame monitoring logic circuit, feeds said first shutdown relay (BL) through a third 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 (Fig. 7).

7. An equipment according to claim 1, characterized in that, when the sensor (PA) of the air pressure during the pre-ventilation step 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 third resistance (BL2) wound around a 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).

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

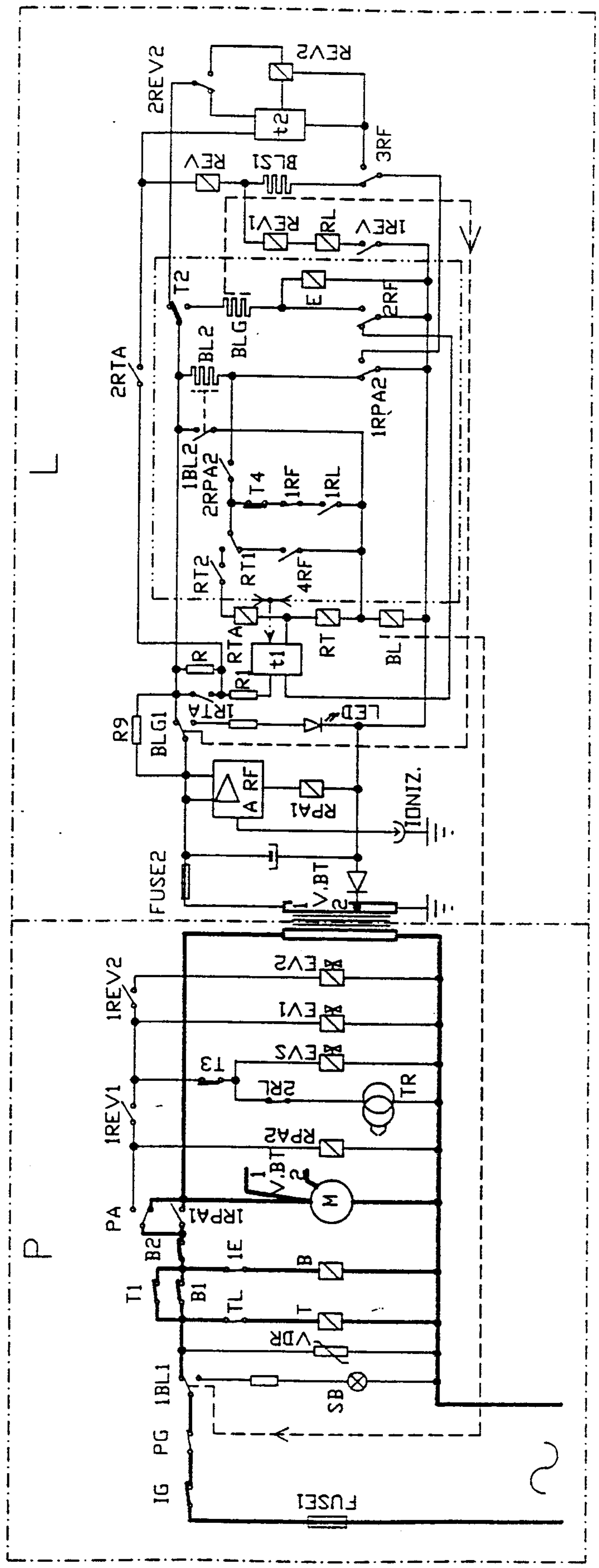
L
P
2REV2
REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
2RTA
T2
BL2
BLG
E
2RF
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
t1
RT
BL
R
R1
1RTA
LED
R9
BLG1
RF
A
RPA1
IONIZ.
FUSE2
V.BT
1
2
1REV2
EV2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
PA
1RPA1
M
B2
1E
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.1

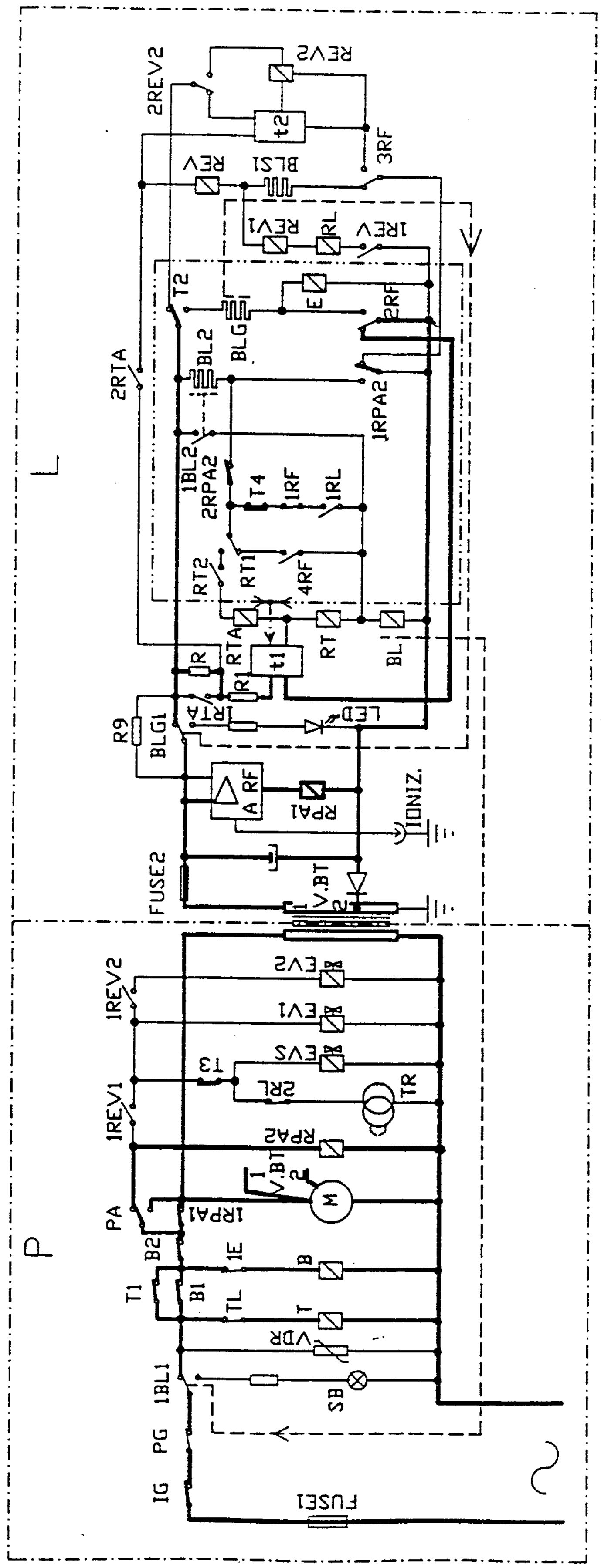
P
L
FUSE1
IG
PG
1BL1
SB
VDR
T
TL
T1
B1
B
1E
B2
PA
1RPA1
M
V.BT
RPA2
1REV1
2RL
TR
T3
EVS
EV1
1REV2
EV2
FUSE2
V.BT
IONIZ.
RPA1
A
RF
R9
BLG1
LED
1RTA
R1
R
t1
RTA
RT
BL
RT2
RT1
4RF
2RPA2
1BL2
T4
1RF
1RL
2RTA
BL2
BLG
1RPA2
T2
E
2RF
REV1
RL
1REV
REV
BLS1
3RF
t2
2REV2
REV2

FIG.2

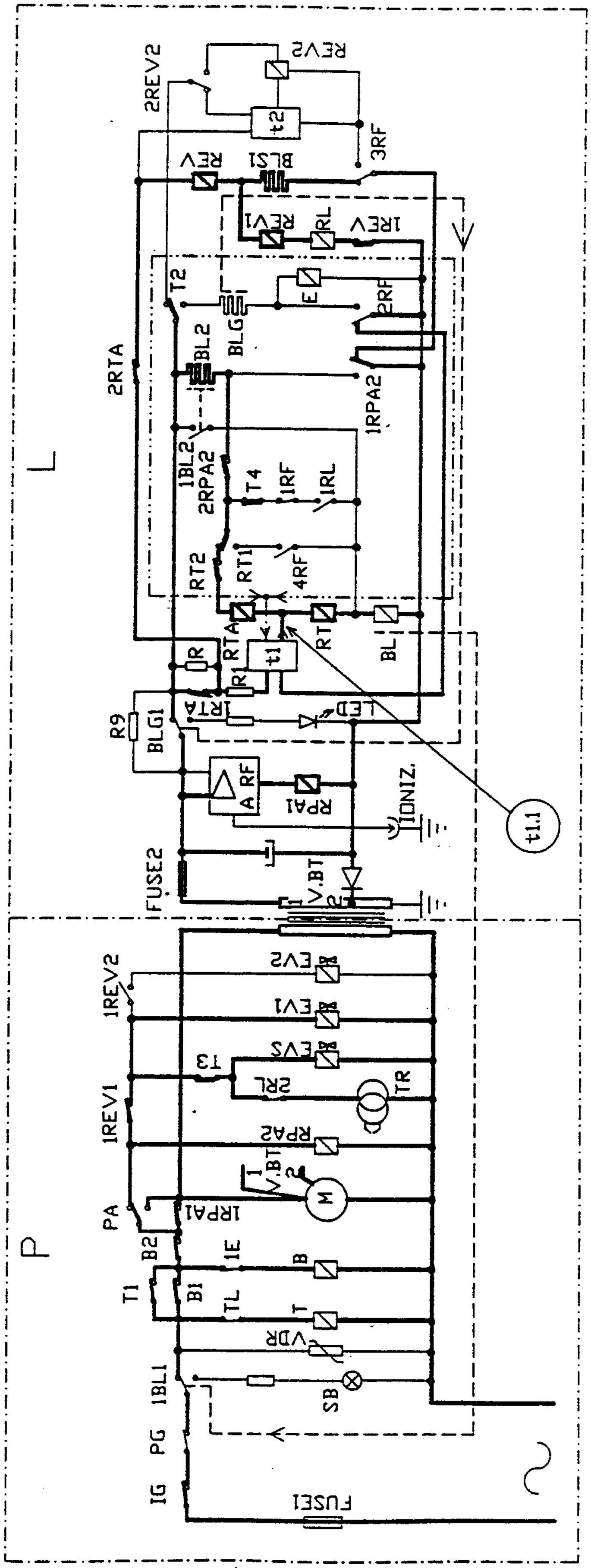
P
L
IG
PG
1BL1
SB
VDR
T1
B1
B2
TL
T
1E
B
PA
1RPA1
M
V.BT
RPA2
1REV1
2RL
TR
T3
EVS
EV1
1REV2
EV2
FUSE1
FUSE2
IONIZ.
RPA1
A RF
R9
BLG1
1RTA
LED
R1
R
RTA
t1
RT
BL
t1.1
RT2
RT1
4RF
2RPA2
1BL2
T4
1RF
1RL
2RTA
BL2
BLG
1RPA2
T2
E
2RF
REV1
RL
1REV
REV
BLS1
3RF
t2
REV2
2REV2

FIG.3

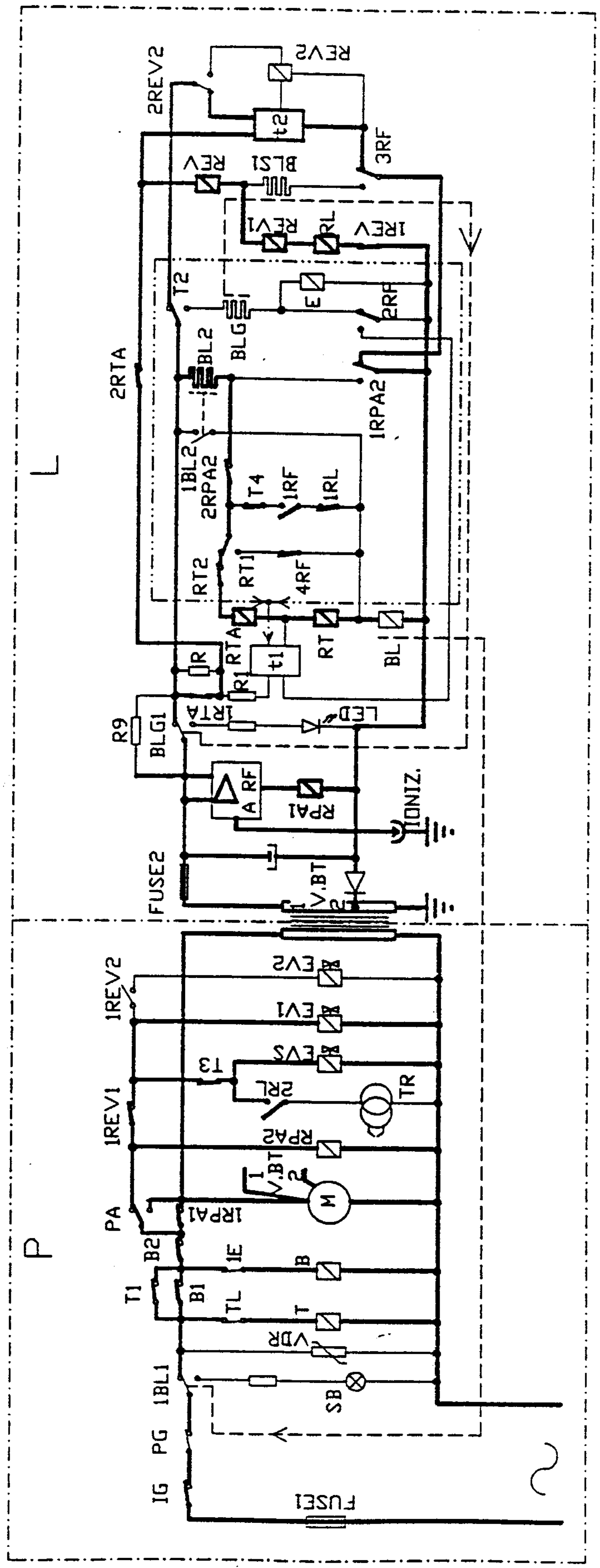
L
P
2REV2
REV2
t2
REV
BLS1
3RF
REV1
RL
1REV
T2
E
2RF
2RTA
BL2
BLG
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL
R
t1
R1
R9
BLG1
1RTA
LED
A
RF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EV2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
PA
1RPA1
M
B2
1E
B
T1
B1
TL
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.4

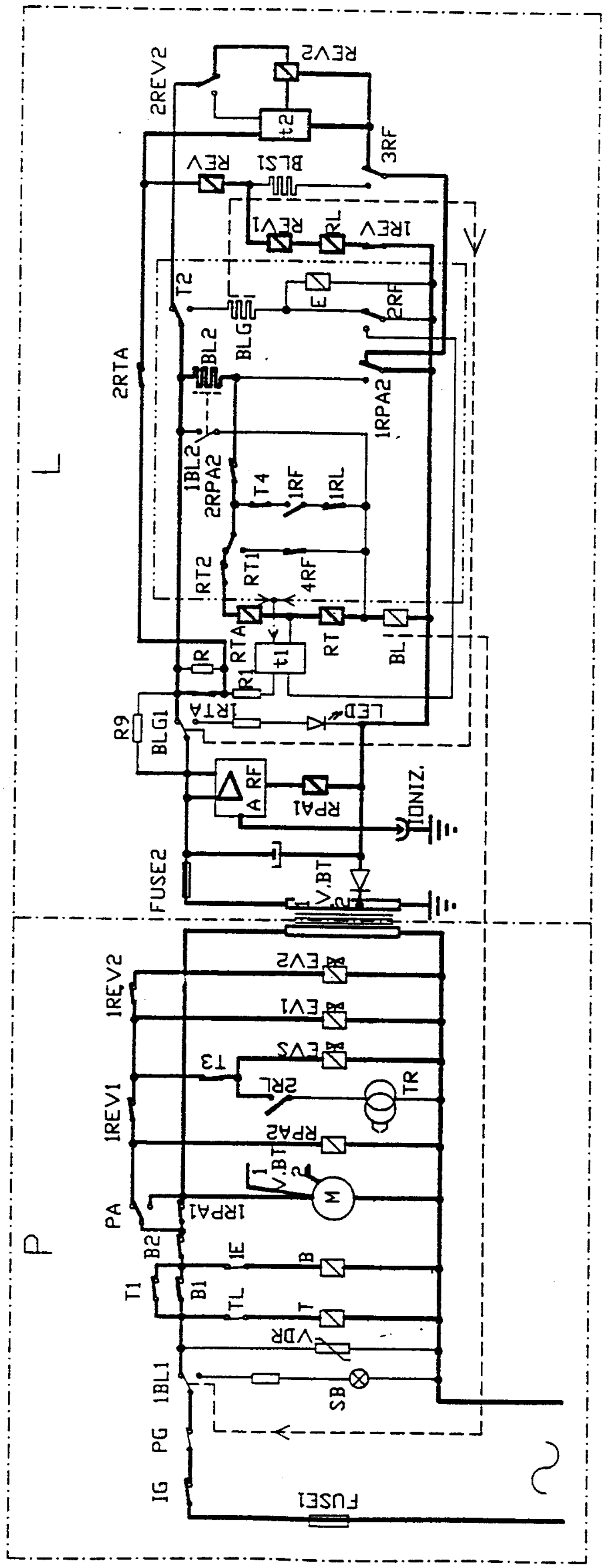
L
P
2REV2
REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
T2
E
2RF
BLG
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL
R
t1
R1
1RTA
LED
R9
BLG1
RF
RPA1
IONIZ.
FUSE2
V.BT
1REV2
EV2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
PA
1RPA1
M
B2
T1
B1
IE
TL
B
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.5

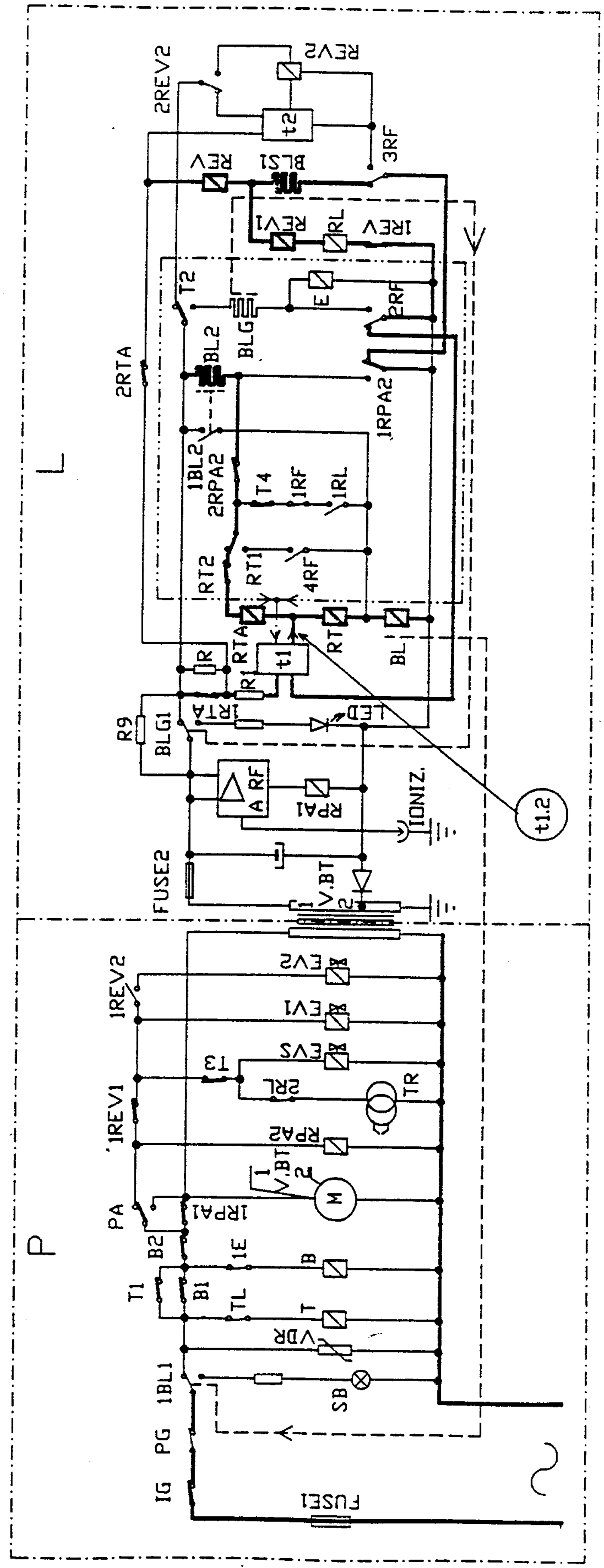
P
L
FUSE1
IG
PG
1BL1
SB
VDR
T
TL
B
1E
B1
B2
T1
PA
1RPA1
M
V.BT
RPA2
1REV1
2RL
TR
T3
EVS
EV1
1REV2
EV2
FUSE2
V.BT
IONIZ.
RPA1
A RF
BLG1
R9
1RTA
LED
R1
R
t1
RTA
RT
BL
t1.2
RT2
RT1
4RF
2RPA2
T4
1RF
1RL
1BL2
BL2
2RTA
1RPA2
BLG
T2
E
2RF
REV1
RL
1REV
BLS1
REV
3RF
t2
2REV2
REV2

FIG.6

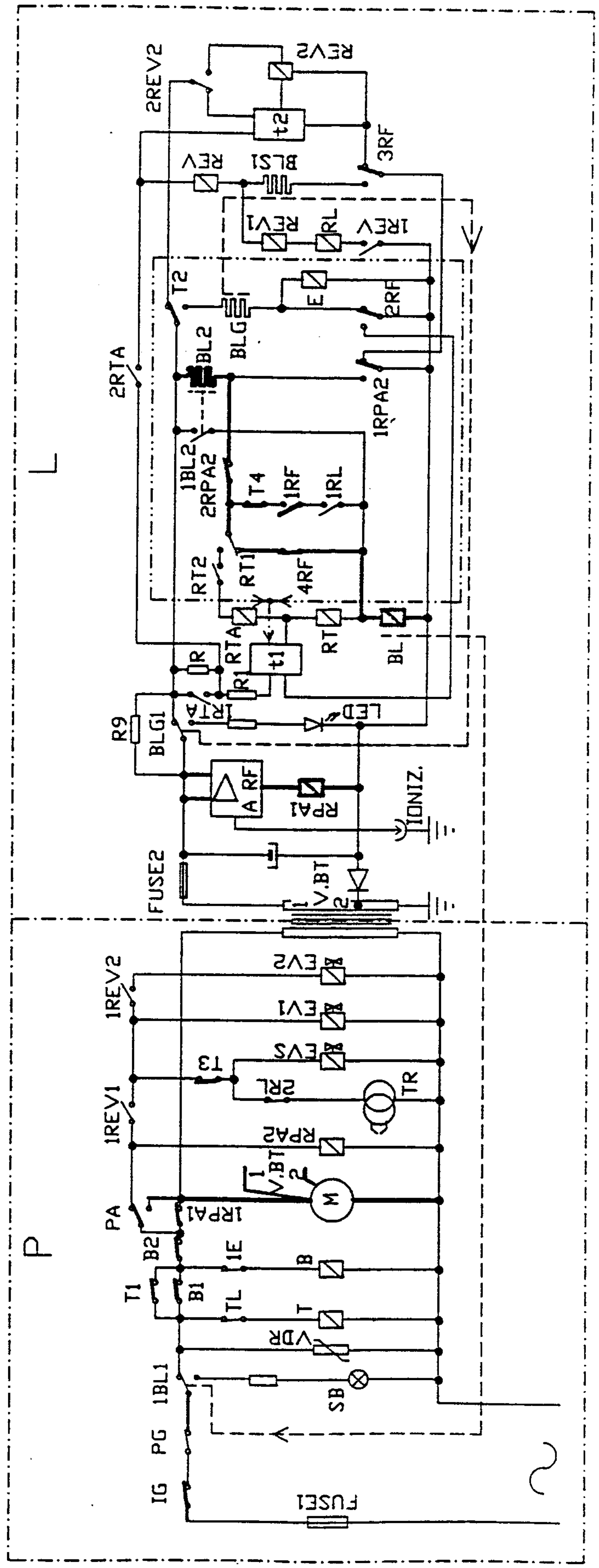
P
L
IG
PG
1BL1
T1
B1
B2
TL
1E
PA
1RPA1
1REV1
1REV2
T3
2RL
SB
VDR
T
B
M
V.BT
RPA2
TR
EVS
EV1
EV2
FUSE1
FUSE2
IONIZ.
RPA1
A RF
BLG1
R9
1RTA
LED
R1
R
RTA
t1
RT
BL
RT2
RT1
4RF
1BL2
2RPA2
T4
1RF
1RL
BL2
BLG
1RPA2
2RTA
T2
E
2RF
REV1
RL
1REV
REV
BLS1
3RF
t2
REV2
2REV2

FIG.7

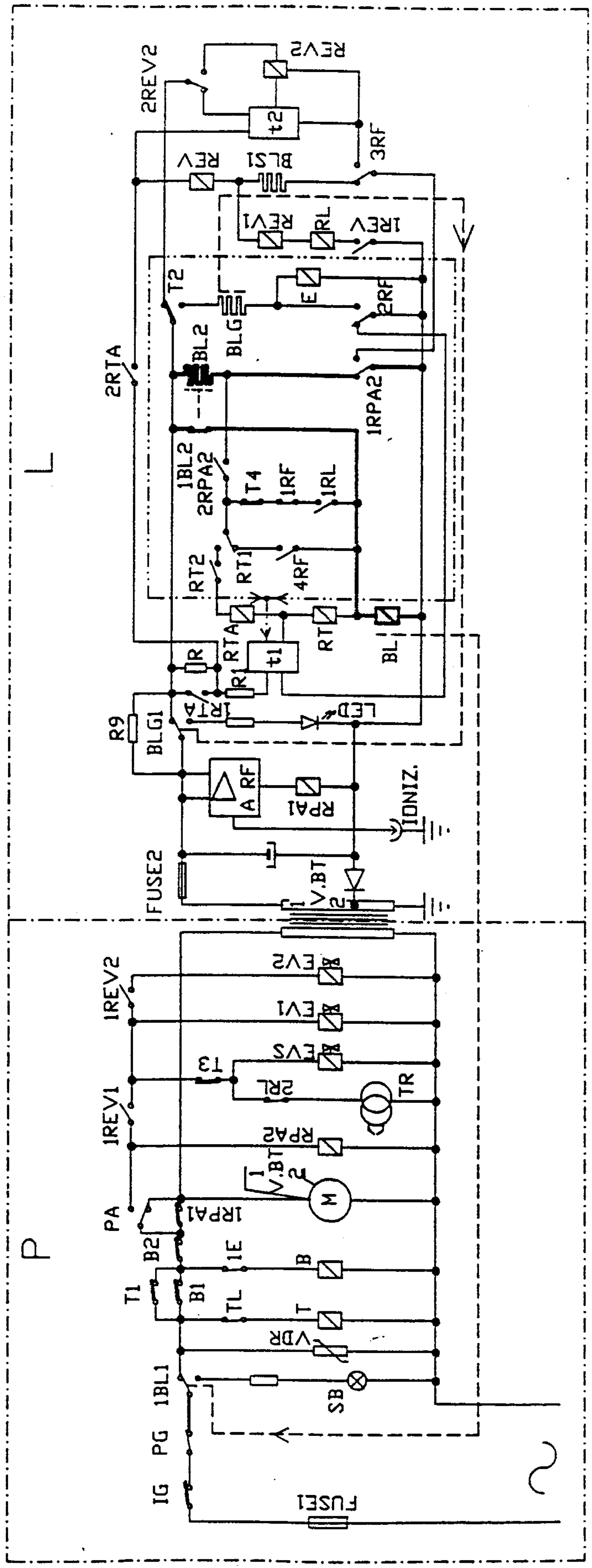
L
P
REV2
2REV2
t2
3RF
REV
BLS1
REV1
RL
1REV
2RTA
T2
E
2RF
BL2
BLG
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL
t1
R
R1
1RTA
LED
R9
BLG1
RF
A
RPA1
IONIZ.
FUSE2
V.BT
EV2
EV1
EVS
T3
2RL
TR
1REV2
1REV1
RPA2
PA
1RPA1
M
B2
1E
T1
B1
TL
B
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.8

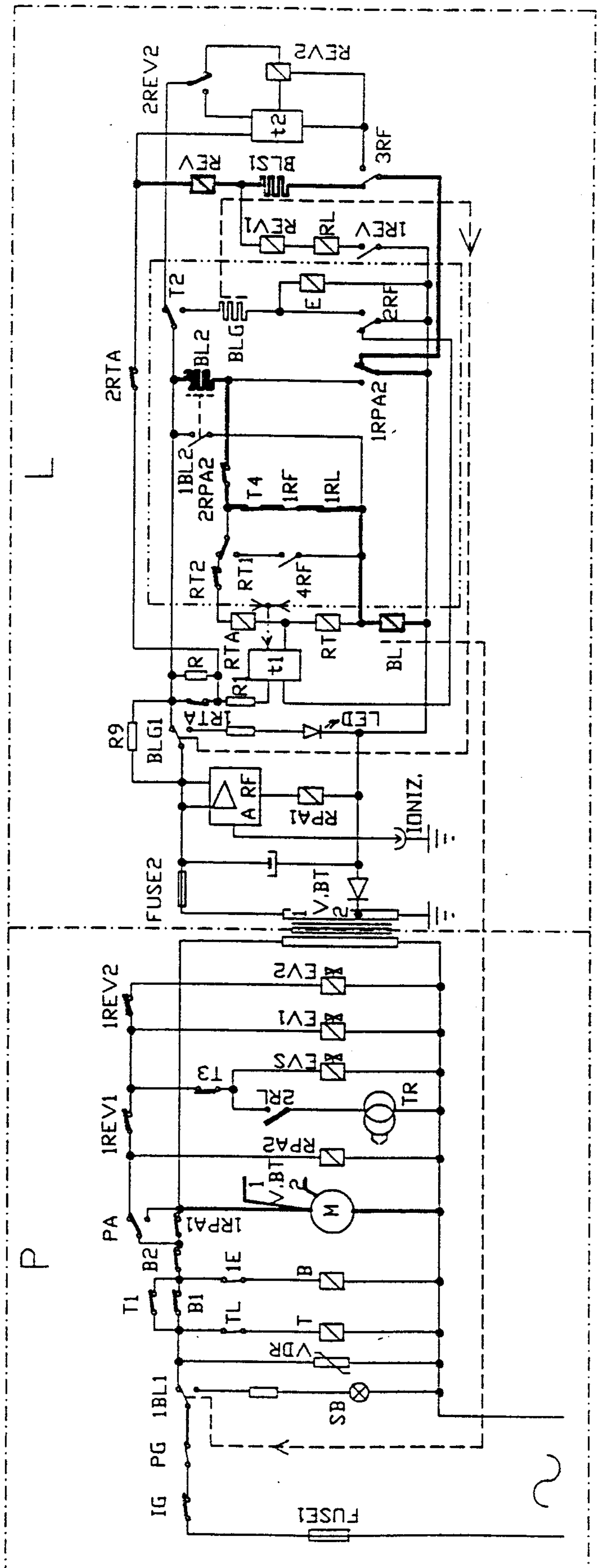
L
P
REV2
2REV2
t2
REV
BLS1
3RF
REV1
RL
1REV
T2
BLG
E
2RF
BL2
2RTA
1RPA2
1BL2
2RPA2
T4
1RF
1RL
RT2
RT1
4RF
RTA
RT
BL
R
R1
t1
1RTA
LED
R9
BLG1
RF
A
RPA1
IONIZ.
FUSE2
V.BT
EV2
1REV2
EV1
EVS
T3
2RL
TR
1REV1
RPA2
M
PA
1RPA1
B2
T1
B1
1E
TL
B
T
VDR
1BL1
SB
PG
IG
FUSE1

FIG.9

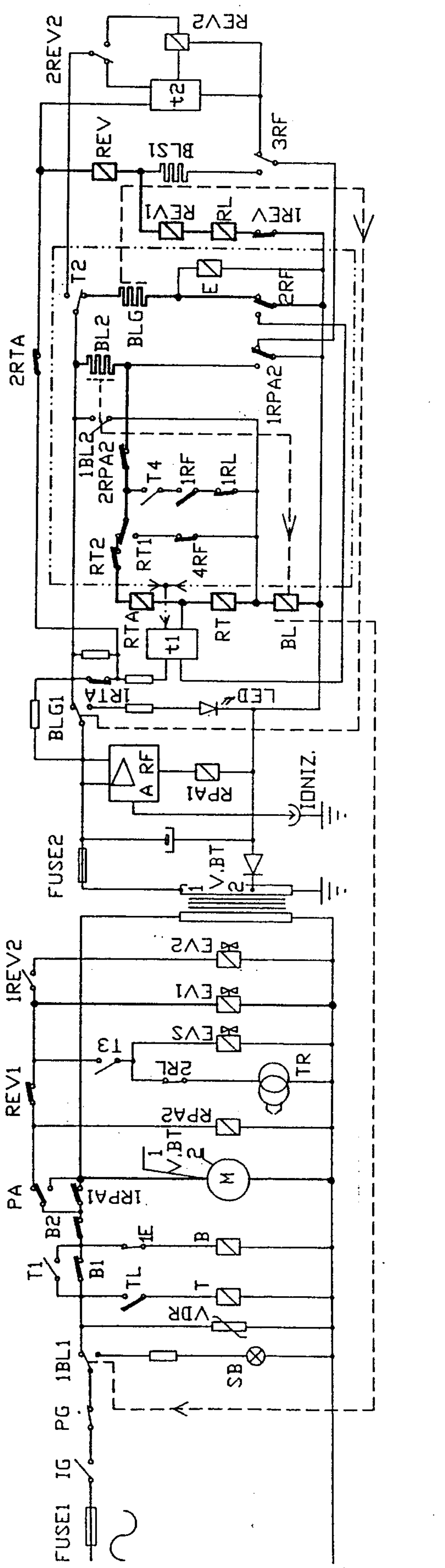
FUSE1
IG
PG
1BL1
T1
TL
B1
B2
1E
PA
1RPA1
REV1
1REV2
T3
2RL
EVS
EV1
EV2
TR
RPA2
M
V.BT
B
T
VDR
SB
FUSE2
RPA1
IONIZ.
A
RF
BLG1
1RTA
LED
RTA
t1
RT
BL
RT2
RT1
4RF
2RPA2
T4
1RF
1RL
1BL2
BL2
BLG
1RPA2
2RTA
T2
E
2RF
REV1
RL
1REV
REV
BLS1
3RF
t2
REV2
2REV2

FIG.10