

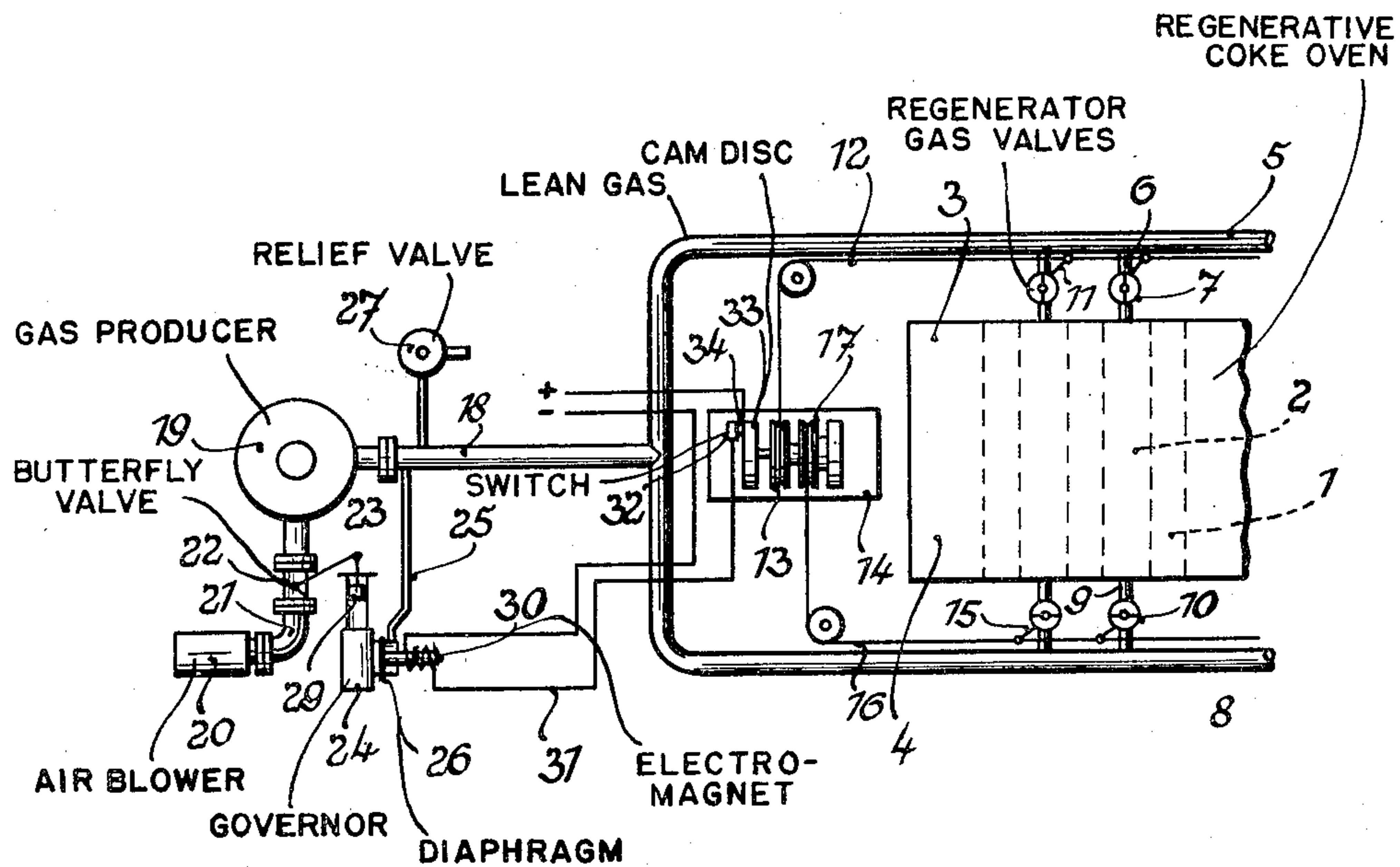
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REVERSING MACHINES FOR REGENERATIVE OVENS

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## REVERSING MACHINES FOR REGENERATIVE OVENS

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1 Claim. (Cl. 202—141)

This invention relates to apparatus for supplying lean gas to regeneratively operated ovens of the kind which are heated by lean gas (i. e. gas of low calorific value), such as, for instance, coke ovens for the production of coke and gas, the lean heating gas being fed directly from a gas producer to the oven without the use of an intermediate gas-holder and the introduction of air into the gas producer being regulated by a valve, e. g. a butterfly valve, which is adjusted—through the medium of a governor—according to the pressure in the lean gas supply pipe lines.

The reversal of the regenerative heating system in such ovens is usually effected in the following manner. First of all the gas supply to one set of regenerators is cut off, and the gas supply to the other set of regenerators which were formerly filled with the waste heat and combustion gases is opened only after a short interval has elapsed during which all the lean gas still contained in the first mentioned set of regenerators flows off into the heating flues after which the air and waste-heat valves of both regenerator sets are adjusted accordingly.

During this interval between the two stages of feeding the gas to the oven the pressure in the gas pipe lines steadily increases so that the said governor closes the said valve so far that only a comparatively small amount of air is introduced into the gas producer, that is to say, only the amount of air strictly necessary for the continuation of the gasification process in the producer. The heating gas which is generated at this particular period is released into the external air.

After the said interval, the gas supply to the regenerators is resumed and consequently the pressure in the gas pipe lines undergoes a sudden and substantial drop owing to the prevailing lower pressure in the flues of the oven. However, the gas pressure controlled valve in the air supply conduit to the gas producer can only follow this sudden decrease in gas pressure very slowly because in the usual arrangement the gas pressure must first actuate the control member of the said valve governor. This delay is particularly evident and disadvantageous in the case of hydraulically operated governors as commonly used and which are of the type in which the gas pressure imparts impulses to a diaphragm whereby a needle valve is controlled in such a manner that a hydraulically operated piston causes the said air regulating valve to move in one or the other direction.

In other words, between the opening of the gas valves and the full opening of the air regulating valve a partial vacuum prevails in the gas conduits and this is all the more pronounced the greater the length of pipe lines between the gas producer and the oven. This wave of low pressure may even extend to the gas producer itself so that a reduction in pressure ensues in this producer above the fuel bed until the governor has fully responded to the changed conditions and the air-supply-regulating valve is fully opened. Such a state of low or negative pressure in the gas producer might eventually lead to admission of air by suction through the liquid seal of the rotary

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distributor in the gas producer, thereby possibly causing an explosion.

The object of the present invention is to avoid the entrance of the gas producer of such a wave of low or negative pressure in the gas pipe lines extending between the producer and the oven by providing automatic actuating means for the said air-supply-regulating valve which will open, preferably fully, such valve before the gas producer is reached by the said low pressure wave which is created at the junction of the gas conduit with the oven flues.

In accordance with the invention there is provided apparatus for supplying lean gas to a regeneratively operated oven, such apparatus being of the kind in which the gas is fed directly from a gas producer to the oven without the use of an intermediate gas holder and wherein the supply or introduction of air to the gas producer is regulated by a valve, e. g. a butterfly valve, which is adjusted through the medium of a governor according to the pressure in the lean gas supply pipe lines to the oven, and wherein are provided electro-magnetically operated actuating means adapted automatically to open or further to open the said air-supply-regulating valve through the intermediary of the said governor and just before the gas supply to the said regenerators is resumed after each of the intervals between the cutting off of the gas supply to one set of the regenerators and the supply of gas to the other set of regenerators; and an electric switch unit for achieving the energising and operation of the said electro-magnetic means to open or further to open said air-supply-regulating valve, such switch unit being adapted for operation from the reversing machine which controls the operations of all the gas reversing valves of the regenerative heating system of the oven whereby the operation of the said air-supply-regulating valve can be effected through the said electro-magnetically operating means at the appropriate times.

According to a further aspect of this invention there is provided apparatus for supplying lean gas to a regeneratively operated oven, such apparatus being of the kind in which the gas is fed directly from a gas producer to the oven without the use of an intermediate gas holder and wherein the supply or introduction of air to the gas producer is regulated by a valve, e. g. a butterfly valve, which is adjusted through the medium of a governor according to the pressure in the lean gas supply pipe lines to the oven and wherein are provided electro-magnetic means adapted to cause the opening or further opening of the said air-supply-regulating valve to admit or increase the admission of air to the said producer immediately before the opening of each group of lean gas supply or reversing valves of the regenerative heating system of the oven, the energising of the said electro-magnetic means in order to cause the said opening or further opening of the said air-supply-regulating valve being effected automatically through the operation of electrical switching means provided for the purpose, the said switching means being adapted to be actuated from the gas or reversing valve operating machine which controls the reversing of all the said gas valves of the regenerative heating system of the oven, whereby the energising of the said electro-magnetic means is effected at the said times in dependence on said reversing machine.

According to a still further aspect of this invention there is provided a lean gas heated regeneratively operated oven, e. g. a coke oven battery of the type specified and wherein the lean gas is fed directly from a gas producer to the oven without the use of an intermediate gas holder and wherein the supply or introduction of air to the gas producer is regulated by a valve, e. g. a butterfly valve, which is adjusted through the medium of a governor according to the pressure in the lean gas supply pipe lines



to the oven and wherein is provided electro-magnetically operated actuating means adapted automatically to open or further to open the said air-supply-regulating valve through the medium of the valve control member of the said governor and just before the opening of each group of lean gas supply or reversing valves of the regenerative heating system of the oven, switch means for controlling the energising of the said electro-magnetically operated actuating means, and switch control means operated by or from the gas or reversing valve-reversing machine of the oven for actuating said switch to energise the said electro-magnetically operated actuating means in order to effect the said opening of the air-supply-regulating valve just before the opening of the said gas or reversing valves of each group.

The operative connection between said electro-magnetic actuating means-controlling switch and the said reversing machine may comprise a cam or the like, e. g. a cam disc having tappets or bosses provided thereon and which establish, at the appropriate time, contact with, or close, live electric contacts connected to the electro-magnet, whereas they break the circuit controlled by said contacts after the air-supply-regulating valve has been fully opened and the gas pressure has been fully re-established after the reversing operation is completed.

The said cam is constructed or the said contact making bosses or tappets or the like are disposed on the cam disc in such a manner that the electrical impulse is imparted to the electro-magnet i. e. actuating means shortly before the gas valves are opened in order to ensure that at, or immediately after the opening of the gas or reversing valves, the full gas pressure is available from the producer. Once this full gas pressure is obtained the magnet can be brought back into its initial position simultaneously with the last operation in one reversing cycle of the reversing machine during which the said cam or cam disc is caused to be disengaged from the cooperating electro-magnet controlling contact means.

One embodiment of the invention is diagrammatically illustrated, by way of example, in the accompanying drawing.

In this drawing the coke oven battery is represented in plan, consisting of a row of adjacent coking chambers 1 alternating with the heating flues or walls 2. The regenerators are disposed beneath the coking chambers but are not shown in the drawing. Those regenerators which are located beneath one longitudinal half of the oven battery serve to pre-heat the gas and air, whereas those regenerators which are located beneath the other half of the oven battery serve to store the heat of the waste gases.

For the purpose of explaining the present invention it is assumed that the regenerators associated with the battery side 3 are used to pre-heat the gas and air flowing therethrough. The lean gas is fed to these regenerators through a pipe line 5 extending along said side 3 of the oven battery and connected to the individual regenerators by a number of smaller ducts or channels 6 each of which includes a gas or reversing valve 7. At the operative stage being described these valves 7 are open.

On the other side of the battery, i. e. on side 4 in the drawing, a gas line 8 is similarly connected to the corresponding regenerators of this side by ducts or channels 9, each including a gas or reversing valve 10 (similar to the valves 7).

The valves 7 are provided with levers 11 which are connected to a chain or chains or similar flexible pulling elements 12 guided over a pulley 13 or like guide means to the reversing machine 14. Similarly the valves 10 are provided with levers 15 which are in turn connected with the reversing machine 14 by a chain or chains 16 or like flexible means guided over another pulley 17 or like guide means.

The reversing machine 14 actuates the valves 7 and 10 in an operative cycle including pre-determined time inter-

vals between the individual valve adjustments in such a manner that the valves 7 on side 3 of the battery are closed when valves 10 on the opposite side 4 of the battery are opened and vice versa. All the other valves for the control of introduction of air and waste heat gases respectively are actuated in a similar manner by the same reversing machine.

The gas lines 5 and 8 are connected to a main pipe line or gas conduit 18 through which the gas is fed directly from the gas producer 19. The combustion air is introduced into this gas producer 19 through a pipe 21 including a blower device 20. A butterfly valve 22 is located within the pipe 21 and is connected by a rod or rods 23 to a governor 24. This governor 24 is controlled by the gas pressure and is therefore connected with the gas conduit 18 by means of pipe 25. If the pressure in the gas conduit 18 is high it is transmitted by line 25 to a control diaphragm 26 of the governor 24 thereby causing the piston 29 to move the butterfly valve 22 by means of the rod connection 23 so that the flow of air is restricted; and vice versa. In this way it is ensured that the correct amount of gas is produced at all times.

If, at the reversal of the heating system, the gas valves 7 located on side 3 of the battery are closed first, the gas pressure in the lines 5, 6 and 18 will rise owing to the fact that no gas is consumed at this particular stage, whilst generation from the producer is continued. A relief valve 27 is provided in the gas conduit 18 which will release some of the gas into the external air after a certain pressure has been reached. The remaining increased pressure will still be sufficient to act on the valve 22 located in the air feeding pipe 21 so that only the very minimum amount of air is fed to the producer.

After the gas valves 7 have been closed and after the necessary interval has elapsed during which all the gas contained in the regenerators of side 3 of the battery has been consumed, the gas valves 10 can be opened and, the reversing valves for waste-heat and air being adjusted accordingly, preheating takes place in the regenerators located on side 4 of the battery. For this purpose the full gas pressure is again required in the heating system. However, as only a very small amount of gas will have been generated in the producer during the said interval the said full pressure is not immediately available. Consequently the heating flues suck the gas from lines 8, 18 thus creating a negative pressure in these lines. It is through this negative pressure that the governor 24 receives an impulse to open the butterfly valve 22 whereby the diaphragm 26 acts upon a needle valve (not shown in the drawing) thereby applying hydraulic pressure to the underside of the piston 29 and causing the valve 22 to be fully opened.

In order to make the requisite full gas pressure available immediately upon the opening of the gas valves an electro-magnet 30 is associated with the governor 24, said magnet acting either on the diaphragm 26 or directly upon the needle valve (not shown) which controls the piston 29. An electric connection 31 leads from this electro-magnet 30 to an electric contact element or elements 32 which is disposed on the reversing machine 14, this contact element 32 being within acting range of a cam disc 33 having tappets or bosses 34 which engage with said contact element or elements 32 upon rotation of the disc.

The cam tappets or bosses 34 are connected to an electric power source. The second conductor leads directly to the winding of the magnet 30 both as shown in this drawing.

The cam disc 33 is adjusted in such a manner that upon rotation of the reversing machine 14 the cam tappets or bosses 34 will engage the contact element or elements 32 at the correct time, i. e. after the closing of the gas valves 7 is completed and shortly before the gas valves 10 are opened, so as to cause the magnet 30 to actuate the governor 24 immediately and thereby to effect the full open-



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ing of the butterfly valve 22. This contact engagement is timed so that the valve 22 in the air-feed pipe 21 to the gas producer is already fully opened when the gas valves 10 are about to be opened, thereby making the full amount of gas pressure available at the correct time.

The invention is similarly applicable in combination with governors for the supply of air to gas producers, which governors are gas pressure actuated and related to bell valves instead of the butterfly type of valve used in the above described construction.

The invention as herein above set forth is embodied in particular form and manner but may be variously embodied within the scope of the claims hereinafter made, and the right to make subsequent claims is expressly reserved.

What we claim is:

In a gas distribution system for firing a regeneratively operated oven with lean gas in which the gas is fed by a lean gas feed line directly from a gas producer to groups of regenerators of the oven without the use of an intermediate gas holder, and wherein the supply of air to the gas producer for lean gas making is regulated by a valve which is adjusted through the medium of a governor according to the pressure in the lean gas supply pipe line to the oven regenerators, and wherein a reversing machine controls the periodic reversal of all the lean gas valves of the regenerative heating system of the oven to close

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the lean gas valves of one group and open the lean gas valves of the other group of regenerators, the combination of: electro-magnetic means for operating the closing and opening of said air-supply regulating valve for admission of air to said gas producer; and electrical switch means for energizing said electro-magnetic means to cause the automatic closing and opening of said air supply regulating valve, said switch means being actuated by the reversing machine immediately before the closing and opening of each group of lean gas supply reversing valves by the reversing machine, for cutting off the air supply to the producer before cutting off the gas to the oven and for starting the air supply to the producer before starting the supply of gas to the oven.

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