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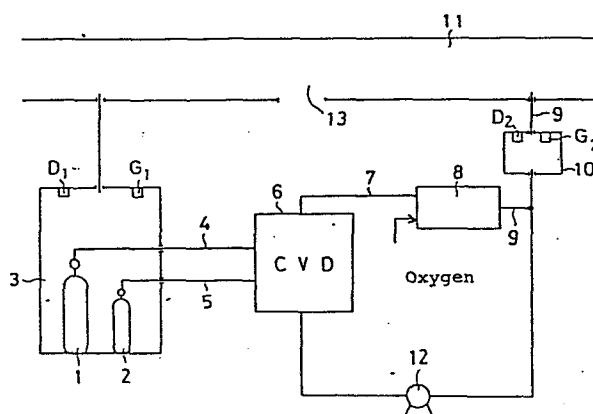
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57) This invention relates to an alarm and control system for semiconductor manufacturing plants which is capable of detecting the leaking processing gas both in gaseous state and in a state that it is generating combustion products as a result of its reaction with oxygen in air and combustion, and of performing adequate controls before or in incipient stage of fire.



Alarm and Control System for Semiconductor
Manufacturing Plants

The present invention relates to an alarm and control system for semi-conductor factories or the like which can detect a fire or the leakage of treatment gases which are generated during the manufacturing process in a very large-scale integration (LSI) factory and also suitably controls the manufacturing process as well as a protection device such as fire extinguishing equipment.

In semi-conductor factories for very LSI's, etc. which have recently been making rapid progress, at the time of applying an isolation film to a silicon wafer a silane gas is utilized, but such a treatment gas is not only poisonous, but also dangerous since when the concentration

of the gas becomes 2 to 5% or more it reacts to oxygen in the air to be ignited and burn. In fact, a fire has occurred in a certain LSI factory possibly caused by leakage of this gas, and brought about enormous losses.

In view of such a situation the present invention aims at providing an alarm and control system for semi-conductor factories or the like which can detect leaked treatment gas whether in the state of the gas itself or in the state of products of combustion as a result of combustion due to its reaction to oxygen in the air so that an appropriate control can be carried out either before the occurrence of or at the initial stages of a fire.

The present invention will be explained below in reference to the attached drawings concerning its one embodiment as utilized in a CVD (Chemical Vapor Deposition) apparatus as well as/used at the time of applying an associated apparatuses insulation film to a semi-conductor wafer.

In Fig. 1, the reference numeral 1 is a silane gas cylinder, 2 is an ammonia gas cylinder, 3 is a housing to house these cylinders, 6 is a nitride film forming device (CVD) to form an insulating film on a semi-conductor wafer by supplying silane and ammonia gases through pipes 4 and 5 respectively, 8 is a scavenging device which forcedly oxidizes, namely to treat by combustion the unreacted silane gas discharged from the device 6 through a pipe 7 with oxygen being supplied, 10 is a

detection box provided between pipes 9 to monitor the state of the gas to be discharged to an exhaust duct 11 from the : scavenging device 8, 12 is a vacuum pump to make the CVD 6 vacuous, and 13 is an exhaust vent for the room air. The housing 3 and the detection box 10 are provided with gas detectors G_1 , G_2 , respectively, to detect the leakage of the treatment gases such as silane gas, etc. and fire detector D_1 and D_2 , respectively, to detect the products of combustion from the burning of the gases. As the gas detectors G_1 , G_2 , although a photoelectric type gas detector in which the light scattered by the gas particles is detected can be used, a gas detector as disclosed in Japanese Laid Open Patent Publication No. 14380/1980 is preferably utilized in the embodiment shown here which operates on the basis of such phenomena that when a metal oxide semi-conductor which contains platinum black in the composition of stannic oxide known by the above patent as a detecting element for carbon monoxide, is aged in an atmosphere of silane gas it responds to low concentrations of silane gas of 0.2 to 0.5% and above. As the fire detector to detect the products of combustion even though a photoelectric or ionization type smoke detector can be utilized, judging from the characterizing curves shown in Fig. 3 wherein the outputs of these detectors and the concentration of the combustion products of the silane

gas are illustrated as the ordinate and the abscissa, respectively, the ionization smoke detector (b) has a more effective than the photoelectric type smoke detector (a) in detecting the products of combustion of the silane gas, the former detecting the generation of the products of combustion earlier than the latter. As shown in Fig. 2, among the gas and fire detectors G_1 , G_2 and D_1 , D_2 , the gas detector G_1 and the fire detector D_1 provided in the housing 3 are connected to a first OR-circuit OR_1 , and the gas detector G_2 and the fire detector D_2 provided in the detection box 10 are connected directly and through an inverter I respectively to a second OR circuit OR_2 , the outputs of the OR_1 , and OR_2 being connected to a third OR-circuit, OR_3 , and the output of OR_3 is connected to a relay means which appropriately controls the manufacturing process of the semi-conductor or a device for prevention of disasters such as a fire alarm or a fire extinguishing device.

Operation of the apparatus described above is as follows.

The nitride film forming device 6 has semi-conductor wafers contained therein, and after it is made vacuous by the vacuum pump 12, the silane and ammonium gas cylinders 1 and 2 are opened to supply the silane and ammonia gases to the device 6, whereby nitride films necessary for the semi-conductor wafers, i. e. insulating films are made to be generated thereon. The gases which contain the unreacted gases

after the treatment are forcibly oxidized in the
scavaging device 8 and discharged from the
exhaust duct 11 through the pipe 9 as a safe gas.

In this state, should silane gas leak from
the silane gas cylinder 1 in an amount that is of a
degree insufficient to react to oxygen in the air.

and to burn, the gas detector G_1 is operated
to detect the gas itself. If a large amount of silane
gas leaked from the silane gas cylinder 1, and

the gas promptly reacts to the oxygen and
burns, the fire detector D_1 is operated by the products of
combustion through the OR-circuits, i. e. OR_1 and OR_3
so that a control means not shown is operated which
controls a device for prevention of disasters such as a
fire alarm, a fire extinguishing device^{or} the manufacturing
process. As to the detection box 10, during normal
operation of the scavaging device 8, the burnt
out products of combustion are discharged to the exhaust
duct 11 through the pipe 9. Therefore, neither the gas
detector G_2 nor the fire detector D_2 operate the OR-circuit. OR_2
because of operation of the inverter. Should the

silane gas be discharged without being treated due to
trouble in the scavaging device 8, either the
gas detector G_2 directly or the fire detector D_2 through
the operation of the inverter I operate the OR-circuit,

OR₂, so that a relay means not shown is operated which controls the manufacturing process or a device for prevention of disasters such as a fire alarm, a fire extinguishing device, or the like.

Although in the above embodiment the gas detector and the smoke detector are separately provided the two detectors may be integrally constituted and the circuit shown in Fig. 2 may be incorporated with them.

As stated above, the present invention reveals such an effect as providing an alarm and control system for semi-conductor factories or the like in which since at locations where poisonous and inflammable treatment gases are used such as in a semi-conductor manufacturing process etc. gas detectors to detect leakage of the treatment gases themselves and fire detectors to detect the products of combustion resulting from combustion of the gases are provided so that either type of leakage of the gases can be dealt with, allowing an appropriate control before or at the early stages of fire breaking out.

Brief Description of the Drawings

Fig. 1 is a schematical view of one embodiment of the present invention, Fig. 2 is its circuit diagram, and Fig. 3 is the characteristic curves of a photoelectric type smoke detector and an ionization type smoke detector.

Claims

1. An alarm and control system for semi-conductor factories or the like characterized in that at locations where poisonous and inflammable treatment gases such as silane gas, etc. are used as in the manufacturing process of semi-conductors, etc. gas detectors to detect the leakage of said treatment gases and fire detectors to detect products of combustion of said treatment gases are provided, and that any changes in output of either said gas detectors or said fire detectors cause an alarm to issue and the control of a protection device such as a fire extinguishing device as well as the control of said manufacturing process of said semi-conductors, etc.
2. An alarm and control system for semi-conductor factories or the like as claimed in claim 1 wherein a fire detectors which have inverters provided at their outputs and said gas detectors are installed in an exhaust duct.

3. An alarm and control system for semi-conductor factories or the like as claimed in claim 1 wherein said gas detectors and said fire detectors are installed in a housing in which cylinders of said treating gases are housed.
4. An alarm and control system for semi-conductor factories or the like as claimed in any one of claims 1 to 3 wherein the detecting element of said gas detector comprises a metal oxide semi-conductor.
5. An alarm and control system for semi-conductor factories or the like as claimed in any one of claims 1 to 3 wherein said fire detector is an ionization type smoke detector.

Fig. 1

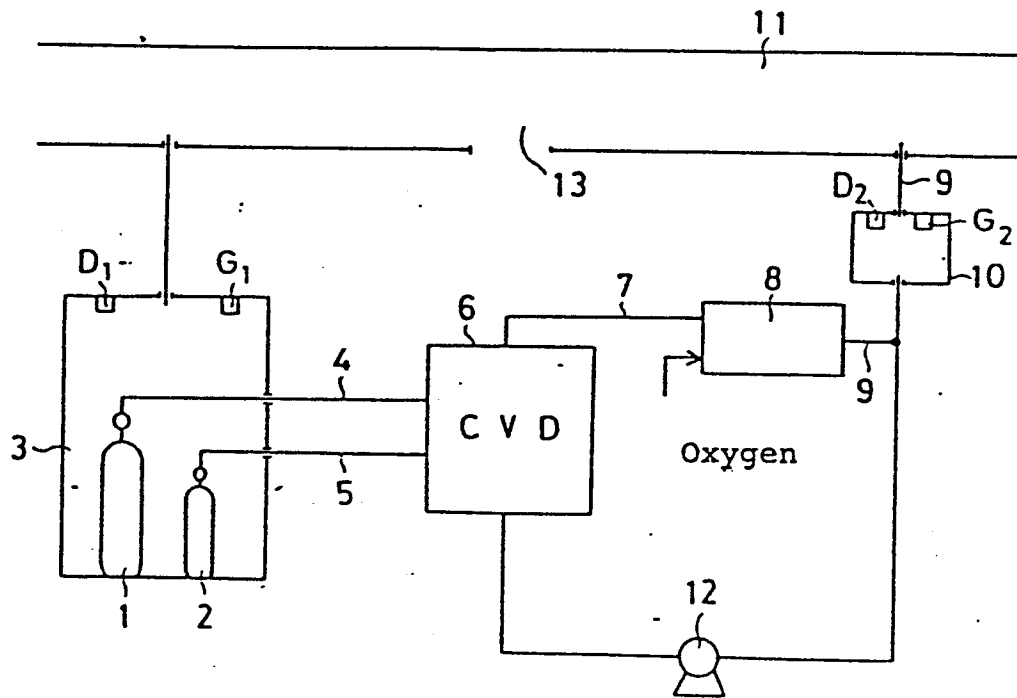


Fig. 2

