Various attempts had been made as measures for solving these problems of the PSA-type oxygen concentrator. Patent Document 2 discloses a PSA-type oxygen concentrator which realizes reduction in electric power consumption of the apparatus by changing the supply capacity of a compressed air supply device such as a compressor and the like based on a value detected by an oxygen concentration detector for oxygen gas to control oxygen concentrations at a constant value.

Patent Document 1: Japanese Patent Laid-open Publication No. 2006-141896

Patent Document 2: Japanese Patent Laid-open Publication No. 2007-000340

Patent Document 3: Japanese Patent Laid-open Publication No. 2002-253675

Disclosure ~~of the Invention~~

Problems to be Solved by the ~~Invention~~Disclosure

With the PSA-type oxygen concentrator utilizing an adsorbent, when a raw material air supply volume from a compressed air supply device such as a compressor and the like and an adsorption process sequence are constant, an oxygen concentration of a concentrated oxygen gas thus obtained generally changes depending on environmental (supplied air) temperature. When the temperature is high due to properties of an adsorbent, the amount of the nitrogen adsorbed by the adsorbent decreases, and thus nitrogen breaks through to decrease the oxygen concentration of a product. When the temperature is low, although the amount of nitrogen adsorbed by the adsorbent increases, the oxygen concentration of a product decreases due to insufficient nitrogen desorption caused by a decrease in adsorption speed.

In recent years, as shown in Patent Document 1, a method has been proposed, in which highly concentrated oxygen is secured by changing the capacity of a

In the apparatus described in Patent Document 3, when a product flow rate decreases due to flattening of a tube and the like, an oxygen concentration transiently increases and thus control is performed to decrease the capacity of the compressed air supply device such as a compressor and the like. When the tube recovers from flattening and the product flow rate returns to normal under this condition, the capacity of the compressed air supply device such as a compressor becomes insufficient, on the contrary, to decrease the oxygen concentration and thus oxygen concentration abnormality alarm which is essentially unnecessary may be activated.

In addition, when a flow rate sensor which detects an oxygen flow rate is provided in apparatus such as that described in Patent Document 3 and an oxygen flow rate is adjusted using a flow rate adjustment device such as a proportional valve and the like based on a value detected by the flow rate sensor, an oxygen supply volume may be higher than the oxygen flow rate to be essentially inhaled by a patient, if the flow rate sensor cannot detect a flow rate exactly or the flow rate adjustment device cannot adjust a flow rate exactly. Since an oxygen concentration decreases when an oxygen flow rate to be isolated increases, control is performed to increase the capacity of a compressed air supply device such as a compressor and the like in order to compensate the reduction. When a product flow rate returns to normal, electric power consumption may increase unduly to increase economic burden to a patient.

Means to Solve the Problems

The present ~~invention~~disclosure is to provide an oxygen concentrator which attempts to reduce electric power consumption by decreasing the capacity of a raw material air supply device, which provides highly concentrated oxygen to a patient by low electric power consumption stably regardless of increase/decrease in environmental temperature

sensor be set at a set flow rate ± 10% and that the capacity of the compressed air supply device is not allowed to change when a detected flow rate is +10% or higher or -10% or lower.

In addition, as the oxygen concentration sensor used in the oxygen concentrator, a zirconia-type sensor and an ultrasonic-type sensor are generally used, and as the flow rate sensor, an ultrasonic-type sensor and a heat wire-type sensor are generally used.

In other words, the present ~~invention~~disclosure is as follows.

According to a first aspect, there is provided an oxygen concentrator provided with an adsorption bed filled with an adsorbent selectively adsorbing nitrogen relative to oxygen and a compressed air supply device supplying compressed air to the adsorption bed, adsorbing and eliminating nitrogen in raw material air to produce unadsorbed oxygen and supplying an oxygen gas at a predetermined flow rate by a flow rate setting device, comprising: an oxygen concentration sensor detecting a concentration of an oxygen gas produced, a flow rate sensor measuring an oxygen gas flow rate, the oxygen concentrator performing a control increasing/decreasing a supply airflow volume of the compressed air supply device based on a detected oxygen concentration value to maintain an oxygen concentration at a predetermined concentration, and a flow rate dependent control device configured to perform a control that does not allow the supply airflow volume of the compressed air supply device to change when the value detected by the flow rate sensor is outside a predetermined range.

According to a second aspect, there is provided an oxygen concentrator provided with an adsorption bed filled with an adsorbent selectively adsorbing nitrogen relative to oxygen and a compressed air supply device supplying compressed air to the adsorption bed, adsorbing and eliminating nitrogen in raw material air to produce unadsorbed oxygen and supplying an oxygen gas at a predetermined flow rate by a flow rate setting device, comprising: an oxygen concentration sensor detecting a concentration of an oxygen gas produced by the oxygen concentrator, a temperature sensor measuring an environmental temperature, a flow rate sensor measuring an oxygen gas flow rate, the oxygen concentrator performing a control increasing/decreasing a supply airflow volume of the compressed air supply device based on a detected oxygen concentration value to maintain an oxygen concentration at a predetermined concentration, a control device configured to perform a control that does not allow the supply airflow volume of the compressed air supply device to decrease when the temperature sensor detects a value lower than a predetermined lower temperature limit of the threshold during running of the oxygen concentrator, and the control device is further configured to perform a flow rate dependent control that does not allow the supply airflow volume of the compressed air supply device to change when the value detected by the flow rate sensor is outside a predetermined range.

(1) An pressure swing adsorption-type oxygen concentrator provided with an adsorption bed filled with an adsorbent selectively adsorbing nitrogen relative to oxygen and a compressed air supply device supplying compressed air to the adsorption bed, adsorbing and eliminating nitrogen in raw material air to produce unadsorbed oxygen and supplying an oxygen gas at a predetermined flow rate by a flow rate setting device, wherein

the oxygen concentrator is composed of

an oxygen concentration sensor detecting a concentration of an oxygen gas produced by the oxygen concentrator, and

a temperature sensor measuring an environmental temperature;

the oxygen concentrator is a pressure swing adsorption-type oxygen concentrator characterized by performing a control which increases/decreases a supply airflow volume of the compressed air supply device based on a detected oxygen concentration value to maintain an oxygen concentration at a predetermined concentration, and being equipped with a temperature dependent control device controlling a supply airflow volume of the compressed air supply device based on a value detected by the temperature sensor when the value detected by the temperature

oxygen concentrator.

(12) The oxygen concentrator described in (10) or (11), wherein the control device is a device performing a control that makes a supply airflow volume of the compressed air supply device to be higher than a supply airflow volume corresponding to an oxygen concentration value detected by the oxygen concentration sensor, regardless of the value detected by the oxygen concentration sensor when the temperature sensor detects a value lower than a predetermined lower temperature limit of the threshold on start-up of the oxygen concentrator.

(13) The oxygen concentrator described in any of (1) to (12), wherein the oxygen concentration sensor is a zirconia-type oxygen concentration sensor or an ultrasonic-type oxygen concentration sensor.

Effect of the Present ~~Invention~~Disclosure

According to the present ~~invention~~disclosure, a highly concentrated oxygen can be provided constantly to a patient independently of environmental temperature by an oxygen concentrator performing control with which a supply airflow volume of a compressed air supply device is increased/decreased based on a value detected by an oxygen concentration sensor which detects an a oxygen gas concentration to maintain an oxygen concentration at a predetermined concentration, which concentrator has a temperature sensor which measures a gas temperature (environmental temperature), and depending on a detected temperature value, a decrease in supply volume of the compressed air supply device is not allowed, and airflow is supplied in a volume higher than a supply airflow volume corresponding to a detected oxygen concentration value on start-up so that an excessive decrease in supply air volume at low temperatures can

be prevented.

Further, according to the present ~~invention~~disclosure, reduction in oxygen concentration and unduly elevation in electric power consumption are prevented even when a tube is flattened or when the flow rate sensor and/or the flow rate adjustment device do not work normally by providing a flow rate sensor which measures an oxygen gas flow rate and performing control which does not allow increase/decrease in supply volume of the compressed air supply device depending on a detected flow rate value in the oxygen concentrator in which a supply airflow volume of the compressed air supply device is increased/decreased based on a value detected by the oxygen concentration sensor which detects oxygen gas concentration to maintain an oxygen concentration at a predetermined concentration.

Brief Description of Drawings

Figure 1 is a schematic constitutional diagram of the oxygen concentrator according to the present invention.

Figure 2 is a schematic explanatory diagram of the control of the present invention.

Figure 3 is a schematic constitutional diagram of another aspect of the oxygen concentrator according to the present invention.

Explanation of Numerals

1. Oxygen concentrator

3. User (patient)

101. External air intake filter

103. Compressor