Jan. 15, 1952 J. F. SCHRUMN 2,582,462

PROCESS FOR ATMOSPHERIC CONTROL

Original Filed Sept. 10, 1943 2 SHEETS—SHEET 1

FIG. 1.

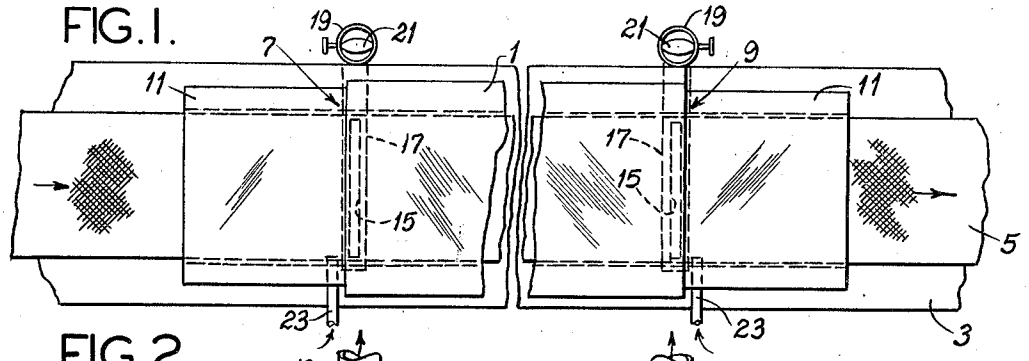


FIG. 2.

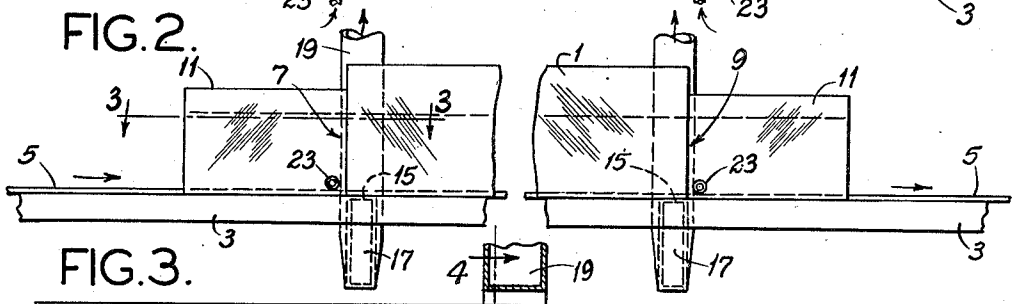


FIG. 3.

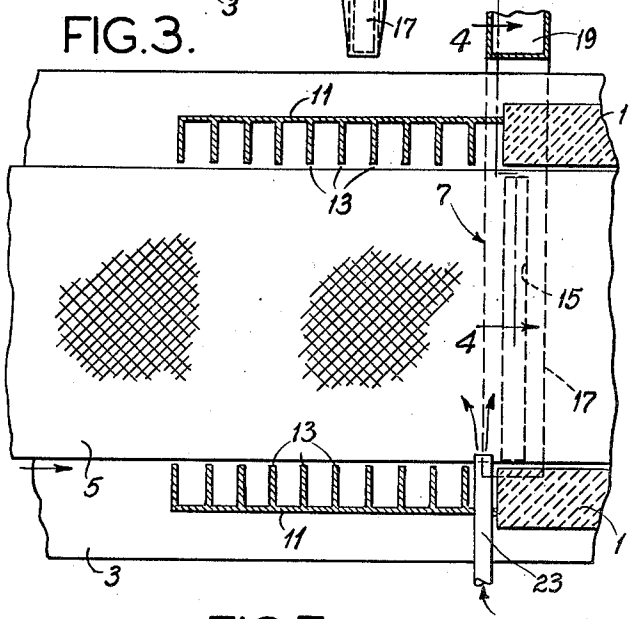


FIG. 4.

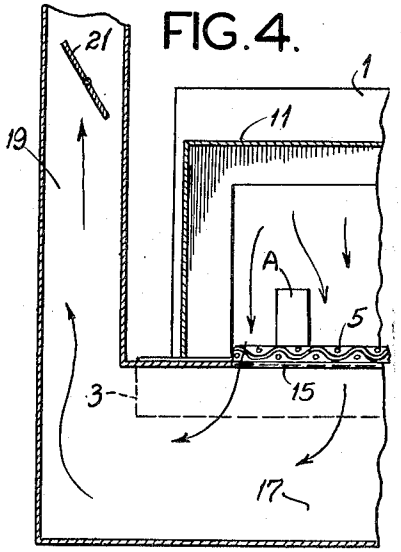
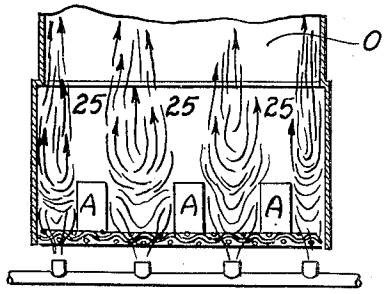


FIG. 7.



Jewett F. Schrumn
Inventor
Haynes and Koenig
Attorneys

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FIG.5.

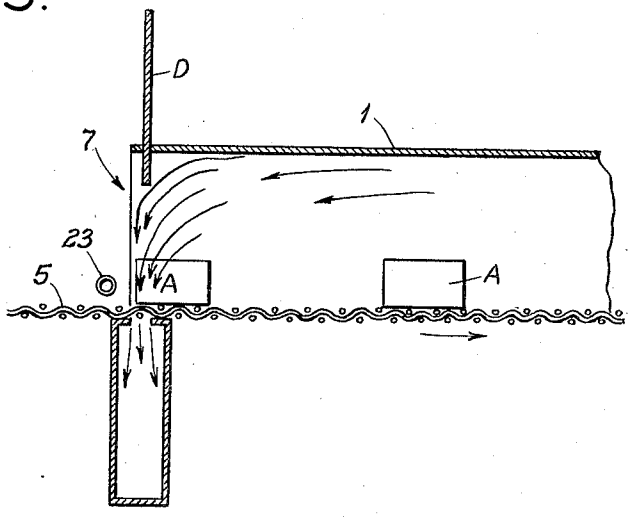


FIG.6.

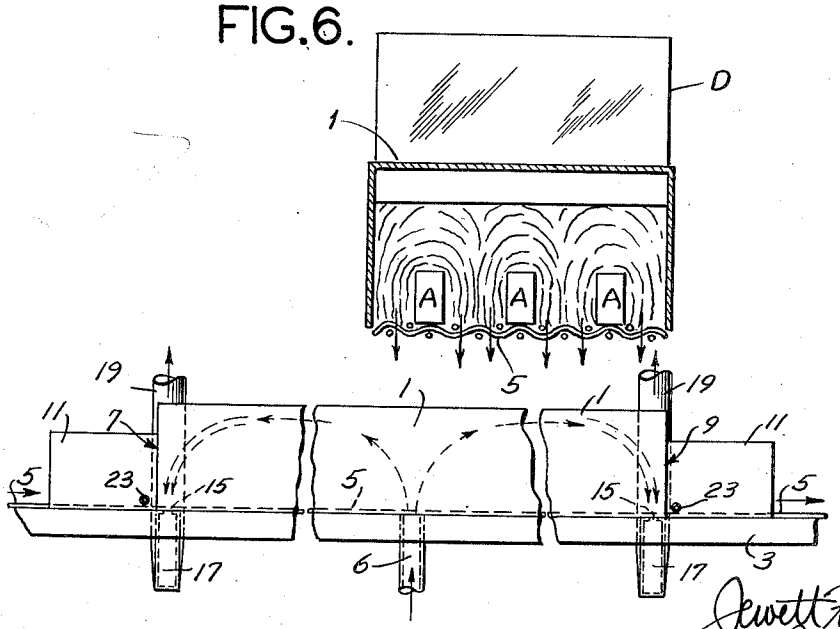


FIG.8.

Jewett F. Schrumn
Inventor
Haynes and Koenig
Attorneys

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PROCESS FOR ATMOSPHERIC CONTROL

Jewett F. Schrumn, Reno, Nev., assignor to Metals & Controls Corporation, Attleboro, Mass., a corporation of Massachusetts

Original application September 10, 1943, Serial No. 501,753. Divided and this application July 19, 1947, Serial No. 762,047

4 Claims. (Cl. 263—52)

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This invention relates to a process for atmospheric control, and with regard to certain more specific features to processes for reaction or treating in chambers, including furnaces, lehrs and the like.

This application is a division of my copending application Serial No. 501,753, filed September 10, 1943, issued as Patent 2,430,191, November 4, 1947.

Among the several objects of the invention may be noted the provision of an atmospheric control for furnaces and other reaction chambers which allows articles to be introduced and removed from said apparatus without upsetting the desired atmospheric control; the provision of processes of the class described which positively maintain atmospheric control in respect to articles passing through the treating chamber throughout their entire traverse; the provision of processes of this class which accomplish the end with a substantial saving in the materials which provide the controlling atmosphere; and, the provision of processes of the class described which are effective in drafty locations of the furnace entrance or exits. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the steps and sequence of steps, and features of manipulation, which will be exemplified in the processes hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a plan view of the invention;

Fig. 2 is a side elevation drawn to the same scale as Fig. 1;

Fig. 3 is a horizontal section taken on line 3—3 of Fig. 2, but on an enlarged scale;

Fig. 4 is a vertical section taken on line 4—4 of Fig. 3, being on said enlarged scale;

Fig. 5 is a diagrammatic longitudinal sectional view on a reduced scale illustrating a modification and certain principles of operation of the invention;

Fig. 6 is a diagrammatic vertical section viewed from the left of Fig. 5 and illustrating certain operating characteristics;

Fig. 7 is a view similar to Fig. 6 illustrating certain operating characteristics of certain prior art; and,

Fig. 8 is a side elevation illustrating the central part of a treating chamber of this invention.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

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An atmospheric heat-treating furnace, which furnishes an example of one application of the invention, is one in which articles are either placed in, or passed through, the furnace and electrically or otherwise heated in the presence of a blanketing mass of a reducing (non-oxidizing) atmosphere (gas). The purpose of this is to bring the articles up to a desired heat-treating temperature and at the same time to avoid oxidation such as would occur if the articles were heated in an atmosphere of oxidizing gas such as air. Generally (and such an example is used herein), the work is sent through the furnace on a continuously endless belt. This, of course, implies the necessity for an inlet and an outlet to the furnace for introducing and removing the work. The reducing gas, such as for example partially burned fuel gas, is introduced in substantial volume at some mid-point of the furnace and allowed to run out at the inlet and outlet. At the inlet and outlet it is generally collected by some type of offtake, burned and disposed of to the outside atmosphere.

It has always been the purpose completely to muffle the articles in the reducing gaseous atmosphere as long as they are at an oxidizing temperature, and, usually for some time therebefore and thereafter.

A prior difficulty was that the hot gas, in escaping from the furnace inlets or outlets, tended to rise from the bottom of the furnace. Oxidizing air took its place and crept back into the furnace along its bottom for a distance great enough often to reach articles of high enough temperature to oxidize them. This difficulty has been magnified by disturbing currents of air which tended to puff oxidizing air into the furnace against the internal gas pressure. To minimize the difficulties, the internal gas pressure was raised by increasing its flow, which led to waste.

Another solution suggested for the difficulty has been to provide an offtake just above the inlet or outlet (as the case may be) with a flame curtain playing from below and arising into the upward offtake. Through this flame curtain the articles passed in entering and leaving the furnace, but it was found that the passing articles themselves blocked off the flame curtain, leaving openings through which the oxidizing air could enter and creep back into the furnace to cause oxidation. The gas supply to the curtain was also wasteful. All this will be further elucidated

later, in connection with the drawings. Furthermore, none of the prior solutions adequately prevents the unstable conditions that always occur at an entrance or exit under drafty, variable-pressure, or similar surrounding conditions.

Referring now more particularly to the drawings, there is indicated at numeral 1 the muffle part of the furnace built upon a support 3 and through which passes an open-mesh belt 5. This belt supports the articles to be carried through the furnace. It is to be understood that the muffle compartment of the furnace 1 is provided with suitable electric or other heating means and also with a suitable inlet 6 (Fig. 8) for the muffling or the reducing gas which is to form the muffling ambient reducing atmosphere for the articles which are passing through on the belt 5. The heating elements, being known, are therefore not shown.

At numeral 7 is indicated the entrance portion of the furnace and at 9 the outlet or exit portion. From these extend outside tunnel-like hoods 11, carrying interior spaced fins 13. These interiorly finned hoods substantially guard the entrance 7 and exit 9 from the effect of ambient atmospheric draft and pressure disturbances, so that the effects desired at the entrance 7 and exit 9 are not substantially disturbed. The fins 13 have the effect of bringing about turbulence in any air that tends to enter through the tunnels and to destroy its entering motion in friction. That is, it breaks up streamline progress of air toward the furnace opening. In addition, the tunnel itself forms a cover for the opening guarding it from the direct influence of outside cross currents.

It must be understood that, although the baffled entry guard tunnels 11 form a part of the invention alone, or in combination with the parts subsequently to be described, nevertheless these baffled tunnels may be eliminated and the features to be described hereinafter will still be operative on their own merits. These important features are as follows:

Just beneath the entrance 7, also beneath the outlet 9, and below the moving belt 5 are arranged laterally elongate gas offtake slits 15 communicating downwardly with crosswise manifolds 17. These manifolds 17 in turn communicate with vertical flues 19 controlled by dampers 21. These flues rise to form stacks providing an induced draft, or they may pass to suitable suction apparatus for maintaining the desired draft. The important point is that the muffle gases from the furnace are drawn downward from their naturally elevated positions at the inlet and outlet, then through the belt 5 and down through the openings 15.

As indicated in Figs. 3 and 4, each opening 15 substantially spans the wire belt 5. Small pilot-light gas nozzles 23 just outside of the slits 15 serve to keep the descending cascading mass of muffle gas ignited. It will be appreciated that ignition does not proceed back into the furnace 1, for lack of oxygen therein. Oxygen required for igniting the descending gas at the slits 15 is provided by outside air entering the tunnels 11. This air creeps in gradually without undue disturbance in view of the baffles 13. It will be understood that the same igniting effect is obtained from the outside air when the tunnels 11 are dispensed with, as is possible under quiet ambient atmospheric conditions.

In Figs. 5 and 6 is diagrammatically shown the entrance end of an alternative without the tunnels 11, wherein like numerals designate like parts.

Operation is as follows:

The furnace 1 is heated and the reducing gas is introduced therein in quantity enough to displace the air therein and to flow towards its ends. This gas tends to rise. The induced draft effect through the manifold 17 and the flue 19 causes said gas to descend at the inlet 7 and outlet 9 to cascade down into the inlet slits 15, thus presenting a downwardly flowing curtain of gas. The outer surface of this downwardly flowing gas is ignited from the pilot burners 23, combustion being supported by adjacent outside air. The flame curtaining effect is diagrammatically indicated in Figs. 5 and 6 (Fig. 6 is a left-end view of Fig. 5); wherein it will be seen that no opening occurs through the curtain for entry of air even as articles A pass.

In Fig. 7 is shown a diagram corresponding to Fig. 6 but representing the prior art. It shows what occurs with a rising flame curtain as heretofore used with a flue outlet O at the top of the furnace inlet or outlet and a rising flame curtain from a burner slot at the bottom. In this case, open regions 25 occur around passing articles A through which outside air proceeds back into the furnace. In addition, if a substantially large gas flow is not maintained, the gas, as it proceeds outward, lifts from the conveyor 5. This is due to its heated condition which makes it light. The spaces 25 afford passage for air into the specified space beneath the gas. It will be noted from Fig. 6 that the passages 25 are eliminated and from Fig. 5, that behind the curtain there can be no oxidizing air. It is all positively blocked off.

The invention not only completely blocks off all entry of air into the furnace and thus eliminates any possibility of oxidation of heated products therein, but also effects a substantial saving in the gas used. This is because, as indicated above, under the old condition air entry could be somewhat minimized by increasing the rate of gas flow so as to cause a greater sweeping action toward the inlet and outlet of the furnace. Since minimization of air entry was a desired end, this waste of gas was resorted to. The present invention avoids it and only enough gas is used to fill the furnace so as to maintain article coverage without the necessity for an excess to maintain the old higher pressure needed at the inlet and outlet.

The purpose of the damper controls 21 is to accommodate the draft to various conditions. For example, more draft is required in the offtake at the front 7 of the furnace than at the rear 9, because the furnace is generally operated hotter at this end. This requires more suction draft effect to draw down the resulting lighter gases as they tend to emerge at the top of the furnace inlet.

In Figs. 5 and 6 a sliding control door D is used which may be adjusted to minimize the outlet or inlet area according to the size of the passing articles. It is to be understood that such doors may be applied at the inlet and outlet 7 and 9 of Figs. 1–4. Such doors are old and the invention is operable independently of them.

It is to be understood that the invention is applicable to heated normalizing lehrs, as well as to furnaces per se, where such lehrs are used in association with an interior reducing atmosphere. It is also applicable to box-type furnaces and non-heated gas-treating compartments in general.

It is also to be understood that the elements of the invention are independently applicable to furnace inlets or outlets.

The term "special atmosphere" is used herein with the meaning often attributed to it in the art, namely, a gaseous atmosphere or vapor at ambient temperature, above or below ambient temperature, and comprising gas or gases for various treating purposes such as oxidizing, reducing, and other chemical reactions. The term includes the term "controlled atmosphere," which often denotes a reducing atmosphere at elevated temperature.

A special atmosphere may include simply poisonous non-combustible gases which would require no ignition of the descending curtain part at the opening 15. It would also include gases used in other treating compartments, such as for gasing fruits where the present principles of producing a descending gas curtain are applicable.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above processes without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. The process of controlling the atmosphere in a work-treating chamber which has an opening for introducing or removing work, comprising continuously introducing into the chamber a gas other than air for treating work in the chamber, and continuously drawing off the gas from within the chamber in such manner as to provide an air-excluding curtain consisting substantially only of said gas flowing across the opening while maintaining the chamber filled with said gas.

2. The process of controlling the atmosphere in a work-treating chamber which has a generally vertical opening for introducing or removing work, comprising continuously introducing into the chamber a gas other than air for treating work in the chamber, and continuously withdrawing said gas from within the chamber in such manner as to provide an air-excluding uninterrupted curtain consisting substantially only of said gas flowing downward across the opening

by maintaining subatmospheric pressure in an offtake extending completely across the bottom of the opening, while maintaining the chamber filled with said gas.

3. The process of controlling the atmosphere in a work-treating furnace having a generally vertical opening for introduction or removal of work, comprising continuously introducing into the furnace a reducing gas, and continuously withdrawing said gas from within the furnace downward across the full width of the opening to provide a downwardly flowing air-excluding curtain consisting substantially only of said gas extending completely across the opening by maintaining a subatmospheric pressure in an offtake extending completely across the bottom of the opening, while maintaining the furnace filled with said gas.

4. The process of controlling the atmosphere in a work-treating furnace having a generally vertical opening for introduction or removal of work, comprising continuously introducing into the furnace a combustible reducing gas, continuously withdrawing said gas from within the furnace downward across the full width of the opening to provide a downwardly flowing air-excluding curtain consisting substantially only of said gas extending completely across the opening by maintaining a subatmospheric pressure in an offtake extending completely across the bottom of the opening, while maintaining the furnace filled with said gas, and igniting the curtain of gas to provide a flame curtain.

JEWETT F. SCHRUMN.

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