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CONTRIVANCE FOR TREATING MATERIALS WITHIN
A GAS ATMOSPHERE OF INCREASED PRESSURE
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Fig. 1

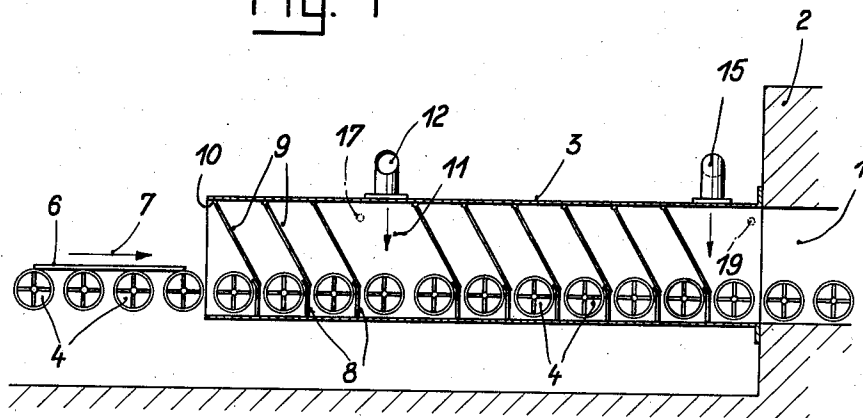


Fig. 2.

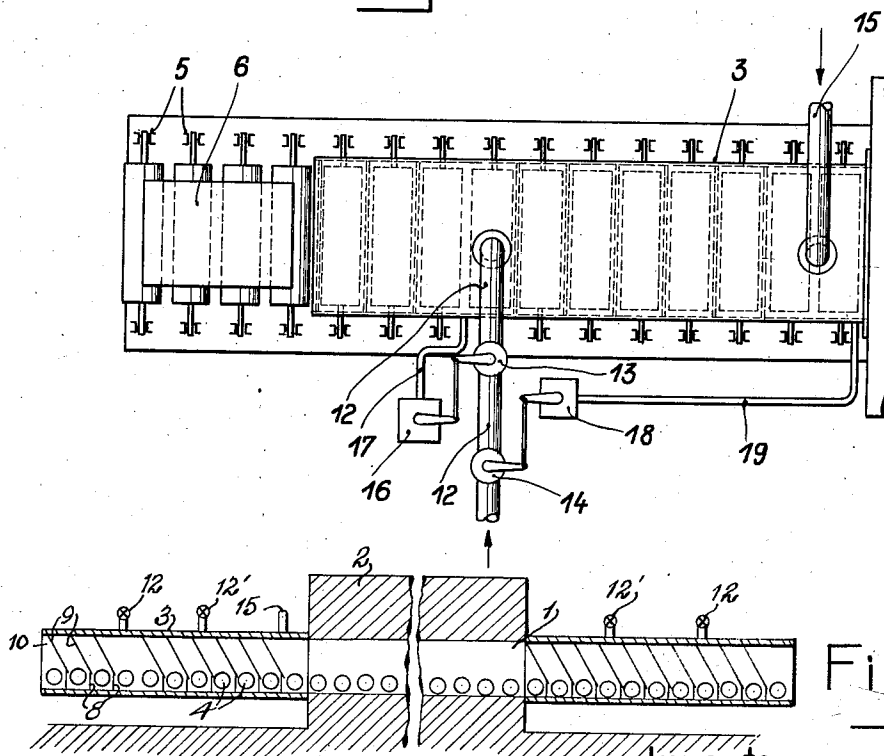


Fig. 3.

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CONTRIVANCE FOR TREATING MATERIALS
WITHIN A GAS ATMOSPHERE OF IN-
CREASED PRESSURE

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4 Claims. (Cl. 263—1)

The present invention relates to a method and apparatus for the treatment of materials at superatmospheric pressures, such as for instance furnaces for annealing iron sheets in an atmosphere consisting of a suitable protecting gas, said gas being held at a certain superatmospheric pressure and more particularly to an apparatus and method which are operated continuously, so that the material to be treated enters and leaves the apparatus in a continuous manner.

It is known to improve the quality of iron sheets or other materials by annealing them in an atmosphere consisting of a suitable inert or reducing gaseous medium, such medium being hereinafter called "protecting gas." The apparatus commonly used for such treatment comprises means for annealing and cooling the material in such a way that the temperature of the material is progressively raised and thereafter decreased at a predetermined rate. The inner chambers of such apparatus are filled with the protecting gas—the gas being held at a certain super-atmospheric pressure, so that air is prevented from entering the treating chamber.

Annealing plants through which goods are continuously carried are often provided at the entrance and at the exit with locks. Those locks consist of a chamber which is closed at opposite sides by doors—one of those doors being arranged on the side towards the annealing room and the other door on the side towards the open air. The goods to be annealed will be introduced from outside into the lock-chamber, then the outer door will be closed, the inner door opened, and the goods carried into the annealing chamber.

Seals in the form of such locks are disadvantageous in that each time the outer door is opened, air enters the lock-chamber, and tends to enter the annealing room, filled with the protecting gas when the inner door of the lock-chamber is opened. In order to prevent the air from flowing from the lock-chamber into the annealing chamber, the lock-chamber has to be freed from air by blowing protecting gas through it before the inner door is opened. Such procedure, however, involves considerable losses of valuable protecting gas.

It is advantageous to provide the entrance and exit of continuous annealing furnaces and the like with an automatic multiple seal consisting of a series of movable flaps which are opened by the goods themselves as they pass through the series of flaps, and which close after the passage of the goods.

The main object of the present invention is to provide such improvements which will reduce to a minimum the losses of valuable protecting gas in the operation of apparatus such as annealing furnaces or the like provided with multiple seals such as described.

The multiple seal with movable flaps comprises a row of chambers at the entrance and exit of the heating or annealing chamber or furnace which is filled with protecting gas under pressure. The several chambers in the row are separated from each other by movable flaps which are fairly gas-tight. If there is a super-atmospheric pressure in the annealing chamber a very small quantity of gas may flow through the seals, corresponding with the small difference of pressure between the adjacent chambers but a free flow of gas through the series of flaps, corresponding to the total difference of pressure between the annealing chamber and the open atmosphere, cannot occur. Further the arrangement of a number of separating walls or flaps at the entrance and at the exit of the furnace serves to prevent the whirling and mixing of the protecting gas with the atmospheric air. In the use of the multiple seals of the kind heretofore known, a certain loss of protecting gas cannot be avoided such gas escaping from the annealing chamber through the multiple seals into the open air, especially if a high pressure is maintained in the annealing chamber. The present invention aims to avoid even these small losses of protecting gas, or at least to reduce them as much as possible.

My invention consists principally in maintaining in the spaces or chambers of the multiple seal a pressure, lower than the pressure in the annealing or cooling chamber but higher than atmospheric pressure. Preferably my invention involves the introduction of a suitable gas, for instance air or waste gases at a superatmospheric pressure into one or several of the sealing chambers. The pressure of the said gas to be introduced is adjusted in such a way that the difference of pressure between the annealing chamber which is filled with protecting gas and the chamber or chambers into which the said air or waste gas is introduced is kept as low as possible.

A still further feature of my invention is that gas (air or waste gas, etc.) under super-atmospheric pressure is introduced into the space between two movable flaps of the series which lie nearer to the atmosphere side of the seal than

to the side towards the annealing and cooling chamber.

With the above and other objects and features of my present invention in view, I will now describe a preferred embodiment of my invention on the lines of the accompanying drawing, in which—

Figure 1 is a vertical section through the entrance of an annealing furnace for iron sheets and other goods according to the invention.

Figure 2 is a plan-view of the device according to Figure 1.

Figure 3 is a vertical sectional view through the apparatus showing both the inlet and outlet chambers, and certain optionally usable multiple gas conduits.

In the drawing the annealing chamber of the furnace is marked 1. The annealing chamber 1 is formed in the usual way of refractory brick-work 2. The annealing chamber 1 is connected with a passage 3, the cross-section of which is substantially the same as that of the annealing chamber 1.

Within the annealing chamber 1 and the passage 3 and in front of the latter are arranged a series of conveyor rolls 4 which rotate in bearings 5 arranged outside the passage 3, the shafts of said conveyor rolls 4 being sealed against the walls of the passage in a suitable manner. The conveyor rolls 4 form a so-called roller-bed. If the rolls 4 are turned in clock-wise direction and an article, for instance a metal plate 6 (see Figures 1 and 2) is placed on the rolls 4, then the article 6 is moved in the direction of arrow 7 through the passage 3 and the annealing chamber 1.

Within the passage 3 and between the rolls 4 are provided separating walls 8 which are of such a height, as may be seen from Figure 1, that the article which is placed on the rolls 4 may be moved without touching the separating walls 8.

Each wall 8 cooperates with a movable flap 9 which is hung from the roof of the passage 3. The lower edge of each movable flap 9 rests on the upper edge of the corresponding separating wall 8 which is somewhat bent. Each movable flap turns on a horizontal axis 10. The flaps 9 extend entirely across the passage 3 and fit snugly against the walls of the passage in order to provide a proper seal for the gases.

The flaps 9 are arranged in such a way that they are moved counter-clockwise by the goods travelling through the passage 3 in the direction of the arrow 7, whereby a gap between the upper edges of the separating walls 8 and the conveyor rolls 4 respectively and the lower edge of the flaps 9 is formed, through which the goods are carried. As soon as any particular article passes beyond a particular flap 9, said flap swings automatically downwards and rests again against the corresponding walls 8 thereby closing that portion of the passage 3.

As may be seen from Figure 1, quite a number of flaps 9 are arranged in the passage 3 in such a way that the goods to be annealed pass beneath the individual flaps successively.

The part of the passage 3 in which the flaps 9 are arranged is preferably of such a length that there are always some flaps fully closed whilst the goods are entering the annealing furnace. In this way there will be avoided a direct connection between the annealing chamber 1 and the atmosphere.

The annealing chamber 1 is kept filled with

a protecting gas which is supplied at a super-atmospheric pressure through the pipe 15, in order to prevent air or oxidizing gases from entering the annealing chamber. In the device according to the invention this pressure will not result in the escape of any considerable amount of protecting gas into the atmosphere, as the individual flaps 9 operate as a throttling device. In this way the difference of pressure between the spaces filled with protecting gas and the atmosphere is gradually reduced to zero within the series of flaps. For instance there is a certain pressure maintained in the annealing chamber 1, the pressure between the first two flaps 9 seen from the annealing chamber 1 is a little smaller and in the next individual chamber between the second and the third flap the pressure is a little lower again and in this way the pressure is reduced gradually until in the last individual chamber between the flap before the last one and the last flap, the pressure will only be a small amount above the atmosphere. Consequently, between the individual chambers of the passage 3 there will be only a very small difference of pressure and therefore only a very small quantity of the protecting gas will flow from one individual chamber into the next one, even during the lifting of the flaps by the goods.

According to the invention, the flow of protecting gas through the series of flaps provided at the entrance and at the exit of the plant may be further reduced by the introduction of a suitable gas under controlled pressure into a suitable space within the series of flaps. Preferably there will be used air or waste gas for this purpose.

As will be seen from the drawing, there is a tube 12 connected with the chamber 11 which chamber is situated between the third and the fourth flap from the atmospheric end of the passage 3 (see Fig. 1). Into this tube 12 air or waste gas will be blown under super-atmospheric pressure. The tube 12 is controlled by the regulating valves 13 and 14.

It may be pointed out that it is of advantage to arrange this space 11 to which is introduced a suitable gas under pressure in such a way that the number of flaps between the said space 11 and the annealing chamber 1, or the effectiveness of such flaps as sealing means, or both the number and effectiveness of the flaps, will be greater than that of the flaps between the space 11 and the open air. Consequently, the throttling effect of the row of flaps arranged between the annealing chamber 1 and space 11 will be greater than the throttling effect of the flaps between the space 11 and the open air.

There is a delivery pipe 15 for protecting gas arranged in the passage 3 near the annealing chamber.

The regulating valve 13 is connected with a governor 16 which is connected with the chamber 11 by the pipe 17. The governor 16 is adapted to be actuated by the pressure existing in space 11, and to move the regulating valve 13 in such a way that a definite pressure is normally maintained in the space 11. The regulating valve 14 is connected with a governor 18, the latter being connected with the annealing chamber 1 by the pipe 19. The governor 18 operates the regulating valve 14 in such a way that the pressure in the pipe 12 beyond the regulating valve 14 never rises above the pressure in the annealing chamber 1, even though the pressure in the treating chamber 1 should inadvertently be

lowered below the normal constant pressure maintained in the chamber 11.

The valves 13 and 14 and the corresponding governors 16 and 18 are arranged in such a way that normally a definite super-atmospheric pressure is maintained, in the space 11 the pressure in space 11, however, never exceeding the pressure in the annealing chamber 1.

The waste gas or air introduced under pressure into the space 11, can therefore never pass through the series of flaps into the annealing chamber.

For instance the governors 16 and 18 may be adjusted in such a way that there will be a super-atmospheric pressure of 2 mm. water gauge in the annealing chamber and a pressure of 1.9 mm. water gauge in the chamber 11. Therefore, the difference of pressure between the annealing chamber 1 and the space 11 is 0.1 mm. water gauge. Consequently, the flow of protecting gas from the annealing chamber into the space 11 will be very small.

By far the greater part of the gases which leave the space 11 and flow into the open air, therefore, will consist of waste gas or air which has been introduced into the space 11 through tube 12, whilst a very small quantity only of the protecting gas may pass from the annealing chamber 1 through the row of flaps arranged between the annealing chamber 1 and the space 11 into the latter one and from there into the open air and consequently the loss of protecting gas in using the arrangement according to my invention is reduced to a minimum.

Instead of providing only one of those individual chambers with a pipe for the introduction of waste gas or air, several of the individual chambers between the flaps may be provided with special pipes for the introduction of waste gas or air, as suggested by the valved conduits 12 and 12' in Figure 3.

In the drawing exemplifying the invention, there is an annealing furnace which is provided with a roller bed for the transport of the goods. Instead of a roller bed there may be used any other suitable kind of conveyor since the type of conveyor is not of the essence of the invention.

Various changes may be made in the details disclosed in the foregoing specification without departing from the present invention and the advantages thereof.

I claim:

1. Apparatus for continuously treating materials in a gaseous medium under super-atmospheric pressure with a minimum of loss of said medium, comprising a treating chamber filled with said gaseous medium, means for maintaining said gaseous medium in said chamber at a super-atmospheric pressure, entrance and exit passages opening into said chamber for permitting movement of the material to be treated into and out of said chamber, closure means arranged in each of said passages, each of said closure means comprising a series of longitudinally spaced flaps normally substantially closing said passage, dividing said passage into a plurality of small antechambers, and successively displaceable upon movement of said material through said passages, means for introducing a second gaseous medium also under super-atmospheric pressure which is not greater than the pressure of said first named gaseous medium in the treating chamber, into one of said antechambers between certain adjacent flaps of each

of said closure means, said last named introducing means being the only means of access to said passage other than past said flaps, in order to maintain the super-atmospheric pressure in said antechamber and in the other antechambers intervening between that one and the treating chamber, there being a plurality of said intervening antechambers; and control means directly responsive to the pressure in said treating chamber and controlling only the inlet means for said second gaseous medium for maintaining the pressure in said antechambers below that of said treating chamber, whereby flow of said second named gaseous medium into said treating chamber from said antechambers is prevented.

2. Apparatus for continuously treating materials in a gaseous medium under super-atmospheric pressure with a minimum of loss of said medium, comprising a treating chamber filled with said gaseous medium, means for maintaining said gaseous medium in said chamber at a super-atmospheric pressure, entrance and exit passages opening into said chamber for permitting movement of the material to be treated into and out of said chamber, closure means arranged in each of said passages, each of said closure means comprising a series of longitudinally spaced flaps normally substantially closing said passage, dividing said passage into a plurality of small antechambers, and successively displaceable upon movement of said material through said passages, means for introducing a second gaseous medium also under super-atmospheric pressure which is not greater than the pressure of said first named gaseous medium in the treating chamber, into one of said antechambers between certain adjacent flaps of each of said closure means, said last named introducing means being the only means of access to said passage other than past said flaps, in order to maintain the super-atmospheric pressure in said antechamber and in the other antechambers intervening between that one and the treating chamber, there being a plurality of said intervening antechambers; and pressure control means for maintaining the pressure of said second named gaseous medium in said antechambers at a normally constant level not greater than the predetermined maximum pressure of said first named gaseous medium introduced into the treating chamber, and further supplemental pressure control means, this last named means being subject to the pressure in said treating chamber for varying the pressure of said second named gaseous medium in said antechamber upon a possible variation in the treating chamber pressure, whereby flow of said second named gaseous medium into said treating chamber from said ante-chambers is prevented, even upon inadvertent variation in the pressure in said feeding chamber.

3. In a method of treating materials in a gaseous medium without substantial loss of said medium, wherein said materials are continuously passed through a treating chamber and subdivided inlet and outlet chambers, the steps of introducing said gaseous medium into said treating chamber and maintaining it at a super-atmospheric pressure therein, introducing another gas, the escape of which is of less consequence than that of the first named gas into said inlet and outlet chambers only, and maintaining successive divisions thereof at super-atmospheric pressure somewhat below that of

the treating chamber, whereby loss of said first named medium by leakage through said inlet and outlet passages is minimized.

4. In a method of treating materials in a gaseous medium without substantial loss of said medium, wherein said materials are passed into a treating chamber through a subdivided inlet chamber, the steps of introducing said gaseous medium into said treating chamber and main-

5 taining it at a super-atmospheric pressure therein, introducing another gas, the escape of which is of less consequence than that of the first named gas into said inlet chamber, and maintaining successive divisions thereof at pressures somewhat below that of the treating chamber, whereby loss of said first named medium by leakage through said inlet passage is minimized.

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