To all whom it may concern:

Be it known that I, Thaddeus F. Baily, a citizen of the United States, residing at Alliance, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Methods of Annealing, of which the following is a specification.

This invention relates to a method of heating and cooling the material in annealing hoods and the objects of the improvement are to provide a method whereby inert gas is circulated through a plurality of annealing hoods in different steps of operation, whereby the heat from a hood which is at a high temperature may be utilized in heating other hoods which may be operating at the same time at a lower temperature, while in the same manner the cooling action of material in certain of the hoods may be accelerated by circulating the inert gas from a hood which is nearly cooled, to a hood of a higher temperature.

The process embodying the invention may be attained with an apparatus such as illustrated in the accompanying drawing, in which—

Figure 1 is a diagrammatic plan view of a plurality of annealing hoods with means for circulating an inert gas through certain of the hoods for the purpose of utilizing heat from one hood to assist in raising the temperature of another hood and to accelerate the cooling of certain of the hoods;

Fig. 2, a similar view showing a later position of the apparatus; and

Fig. 3, a sectional view of a heater adapted for combustion to superheat the inert gas in order to maintain the temperature of the materials in the “soaking” hood and to raise the temperature of the materials in the hood which is finishing heating.

Similar numerals refer to similar parts throughout the drawing.

A plurality of annealing hoods are indicated conventionally at A, these hoods being arranged in a series and numbered from 1 to 7 inclusive, the hood numbered 1 being shown at the extreme left, the other hoods being arranged in order from left to right.

In carrying out the invention, each of the hoods A may be connected with a pair of spaced passages B and C forming an inlet and outlet respectively for each hood, whereby the inert gas may be circulated through the hoods as will be later described.

In the position shown in Fig. 1, the hood 1 is heating from 600° to 900° and the hood 2 is just starting to heat to 600°. The hood 3 in this position is cold and in condition for loading or unloading. The hood 4 is cooling down from 900° to 600° and the hood 5 has just started to cool from 1400° to 900°. The hood 6 is soaking at an even temperature of 1400° and the hood 7 is finishing the heating from 900° to 1400°.

In this position of the apparatus, the hood 3 which is cold and in position for loading or unloading, is disconnected from the other hoods as well as the hood 6, which is soaking at the maximum temperature, and the hood 7 which is finishing the heating, preparatory to soaking at the maximum temperature.

Each of the hoods 6 and 7 is provided with a connecting pipe D connecting the passages B and C thereof, whereby these two may be cut out of communication with the general circulating system. A duct E is located parallel to the ends of the hoods and provided at intervals with outlets F by means of which any of the hoods may be connected thereto.

In the position shown in Fig. 1, the passage B of the hood 1 which is heating from 600° to 900° is connected to the duct E as by a detachable pipe G and the passage C of the hood 5 which is cooling from 1400° to 900°, is connected to the other end of the duct as by the detachable pipe H.

The passage C of the hood 1 is connected to the passage B of the hood 2 as by a similar detachable pipe I, the passage C of the hood 2 being connected to the passage B of the hood 4 by a detachable pipe section J in which is located a fan K.

The passage C of the hood 4 is connected to the passage B of the hood 5 by a detachable pipe section L. A complete circulation is thus provided through the hoods 1, 2, 4 and 5, returning from the hood 5 to the hood 1 through the duct E. An inert gas may be thus circulated through the hoods 1, 2, 4 and 5 by means of the fan K in the direction of the arrows shown in Fig. 1.

The hoods may be heated in any desired manner and for the purpose of illustration, electrodes M are shown which may be detachably connected to the electric wires N. In the position shown in Fig. 1, only the electrodes of the hoods 6 and 7 are connected in the circuit.

Instead of using the electric heating...
means for heating the hoods which are "soaking" and "finishing heating." The heater Q such as shown in Fig. 3, which may be in the form of a portable gas heating device, may be detachably connected to these hoods for heating the inert gas before it passes through these hoods.

A separate fan or other means may be used to provide the necessary circulation or these hoods may be connected with the general circulating system. It may also be desirable to operate this equipment when using the electric heating means for the "soaking" and "finishing heating" hoods by having these hoods in the general circulating system.

The hoods 1 and 2 are heated to temperatures of 900° and 600° respectively by the heat which is withdrawn from the hood 5, which has started to cool, while the hood 4 is cooled from 900° down to 600° by drawing the gas directly from the hood 2 at not over 600° and forcing it into the hood 4. In Fig. 2 is shown the next position of the operation. At this point the hood 1 is finishing heating from 900° to 1400°, the electrodes thereof being connected to the electric circuit.

This hood, therefore may be cut out of communication with the other hoods, a detachable pipe section D connecting the passages B and C thereof. The temperature in the hood 2 has also been raised and this hood is now heating from 600° to 900°, the passage B thereof being connected by the pipe section G with the duct E. The hood 3 has been loaded and is heating up to 600° and is connected by the pipe section I to the hood 2. The hood 4 has cooled and is in position for unloading and loading and is cut out from communication with the other hoods.

The pipe section J containing the fan K connects the passage C of the hood 3 with the passage B of the hood 5, which is cooling from 900° to 600° and the passage C of this hood is connected by the pipe section L with the passage B of the hood 6, which has started to cool from 1400° to 900°.

The passage C of the hood 6 is connected by the pipe section H with the other end of the duct E, whereby a complete circulation of inert gas is produced through the hoods 2, 3, 5 and 6 in the same manner as above described regarding the hoods 1, 2, 4 and 5.

The hood 7 has reached the maximum heat and is soaking, and the passages B and C thereof may be connected together by the pipe section D, cutting this hood out of communication with the hoods through which the inert gas is being circulated. Or this hood may be put into a separate communicating system, as above described.

In this position the hood 1 and 7 may be heated as by the electrical connection of the electrodes therein to the line wires, or by the gas heater, while all of the other hoods will be disconnected from said wires or heater, only the waste heat being circulated through the hoods.

It will be understood that this operation may be carried on indefinitely in the manner above described, the annealing operation progressing from left to right through the several hoods.

Although the best results are probably obtained by circulating the inert gas through the hoods in the manner illustrated, it may be desirable to also communicate the hoods which are "finishing heating" and "soaking" in the general circulation of inert gas.

I claim:

1. The method of annealing which consists in circulating gas through hoods of high temperature and through hoods of a lower temperature to raise the temperature of material in the last named hoods.

2. The method of annealing which consists in circulating gas through hoods of a low temperature and through hoods of a higher temperature to lower the temperature of material in the last named hoods.

3. The method of annealing which consists in circulating an inert gas through hoods of low temperatures which are heating and then through hoods of higher temperatures which are cooling.

4. The method of annealing which consists in circulating an inert gas through a series of hoods of high temperatures which are cooling and then through a series of hoods of lower temperatures which are heating.

5. The method of annealing which consists in circulating an inert gas through hoods which have reached or passed their maximum temperature into hoods that have not reached their maximum temperature, the heat thus absorbed from the material having reached its maximum temperature being used in raising the temperature of the material that has not reached its maximum temperature.

6. The method of annealing which consists in circulating an inert gas through hoods which have reached or passed their maximum temperature into hoods that have not reached their maximum temperature, the heat thus absorbed from the material having reached its maximum temperature being used in raising the temperature of the material that has not reached its maximum temperature, and supplying heat by auxiliary means for bringing the partially heated material to the maximum temperature.

7. In a series of annealing hoods, means for circulating inert gas through a series
of hoods that have reached the annealing temperature, thereby cooling said hoods and the contents and means for forcing said heated inert gas through hoods containing material that is being brought up to temperature, the heated gases giving up their heat to the hoods that have not yet reached their maximum temperature.

8. The method of annealing which consists in circulating gas through a series of hoods of successively lower temperatures which are heating and then through a series of hoods of successively higher temperatures which are cooling.

9. The method of annealing which consists in circulating gas through a series of hoods of successively higher temperatures which are cooling and then through a series of hoods of successively lower temperatures which are heating.

In testimony that I claim the above, I have hereunto subscribed my name.

THADDEUS F. BAILY.