Aug. 18, 1931. W. A. DARRAH 1,819,772

PROCESS OF APPLYING HEAT

Original Filed June 4, 1927

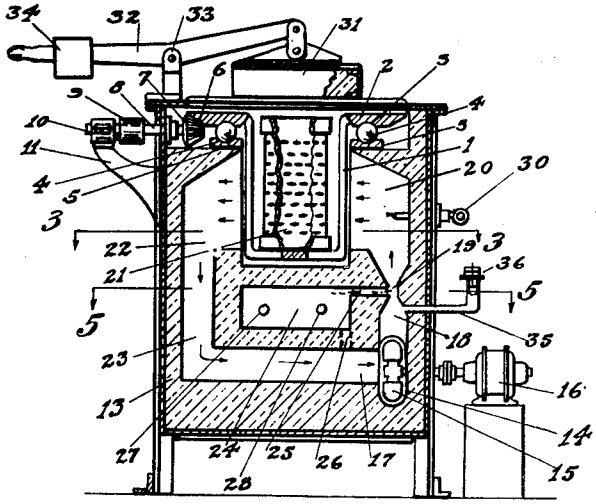


Figure 1.

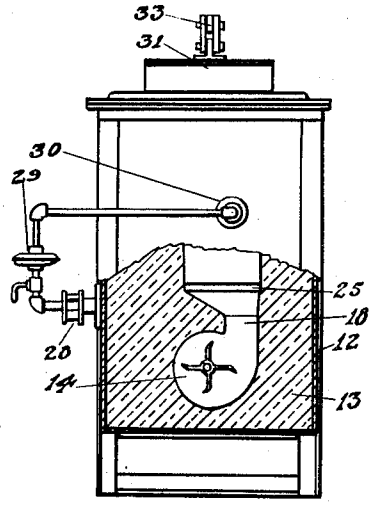


Figure 4.

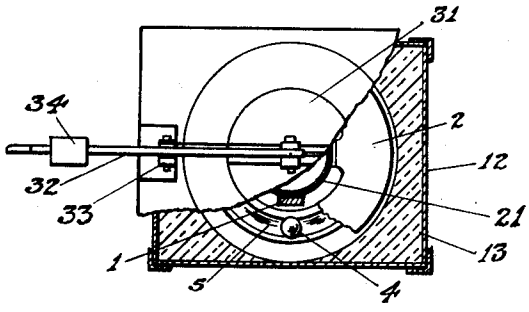


Figure 2.

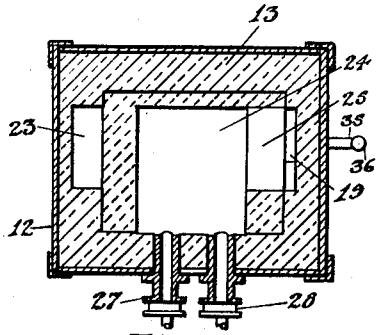


Figure 5.

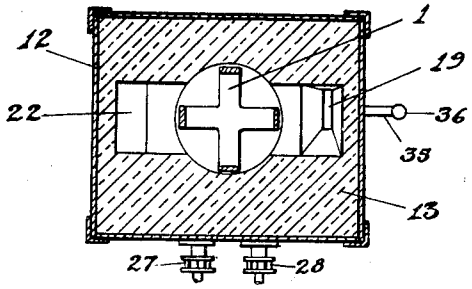


Figure 3.

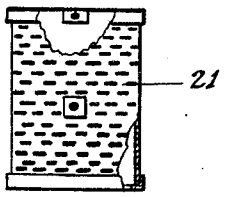


Figure 6.

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1,819,772

UNITED STATES PATENT OFFICE

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PROCESS OF APPLYING HEAT

Original application filed June 4, 1927, Serial No. 196,584. Divided and this application filed October 12, 1929. Serial No. 399,177.

This application is a division of application Serial #196,584 filed June 4, 1927.

This invention relates to equipment and methods of heat treating material and is particularly applicable to the heat treating of steel or alloys in that it permits a very uniform distribution of heat with a high degree of economy.

One application of this device is the so-called drawing or tempering of steel parts. In general, however, it may be stated that this equipment may be useful wherever it is desired to controllably and uniformly heat any substance to a specific temperature and maintain it at that temperature for an appreciable time.

Referring to the drawings:

Fig. 1 shows a vertical side elevation in section of one form of my device;

Figure 2 shows a top plan view partly in section of the same equipment;

Figure 3 shows a horizontal section along the line 3—3 of Fig. 1;

While Figure 4 shows partly in section an end elevation of the device illustrated in Figure 1,

Figure 5 shows another horizontal section of the device the section in this case being taken along line 5—5 of Fig. 1;

Figure 6 shows a detail of one form of basket which may conveniently be used with this equipment.

The equipment consists of a frame or spider (1) supported at its upper portion on a flange or rim 2 provided with a circular groove 3 arranged to roll over a series of balls 4, a co-acting circular member 5 is located beneath the balls 4 and serves as a runway or track to confine them. A series of teeth or the equivalent 6 is provided in flange 2 and arranged to engage with a driving member 7 which is mounted on shaft 8 and may be driven from pulley 9 or by any other desired means. Shaft 8 is shown turning in bearing 10 which is supported by bracket 11 attached to the outside frame or housing 12.

The housing 12 incloses an insulation or semi-refractory material 13 which is molded in such a manner as to provide a series of flues for purposes later to be described. In one portion of the refactory material 13 is molded a container or housing 14 containing a fan wheel 15 which may be driven in any desired manner as for example by motor 16.

A flue portion 17 terminating near the intake of fan 15 serves to deliver circulating gases to the fan chamber 14. The operation of the fan forces these gases out through outlet 18.

In the course of their travel the gases pass through a constriction or Venturi throat 19 and then to distributing duct 20. Distributing duct 20 is arranged to deliver circulating gases in such a manner that they travel substantially horizontally through the spider member 1 and also through a basket member 21 which is carried by said spider member 1. The basket member 21 is preferably made from perforated or expanded material or mesh in such a manner that it will hold the articles being treated without allowing them to fall out, but will at the same time permit the ready passage of the circulating gases through the basket and into contact with the material being treated. After passing through the material being treated the circulating gases leave by duct 22 which connects to flue 23 which in turn delivers the gases to flue 17 and thus to the intake of the circulating fan or blower.

The arrows show the direction of travel of the circulating gases which it will be noted is continuous in a single direction and of substantially constant volume depending upon the resistance interposed in their path.

A combustion chamber 24 constructed of proper heat resisting materials is located convenient to the circulating gases and provided with a discharge flue 25 leading to the throat or constriction of venturi 19. An alternative flue connection 26 is shown by the dotted lines as leading from the discharge chamber to the intake of the fan 17. Obviously under ordinary conditions either flue 25 or flue 26 would be employed and the one not employed would be closed. Certain advantages result from the use of each as will later be described.

Burners 27 and 28 are provided to deliver

fuel to the combustion chamber. The fuel may be gas, oil or the desired equivalent. The burners may be controlled by thermostatic valve 29 preferably operated from a thermostate 30 inserted in the discharge passage of the circulating gas. Thermostat 30 serves to maintain the temperature of the gas leaving the circulating fan at any desired constant value.

The housing 12 is to be provided with a cover 31 which may be operated in any desired manner as for example, by handle 32 pivoted on bearing 33 and provided with counterweight 34 to permit easy adjustment.

In the course of operation of this device, it will be apparent that when motor 16 is started in rotation a continuous circulation of gases will take place as described following the general direction of arrows. When the burners 27 and 28 in combustion chamber 24 are lighted, it will be noted that the products of combustion are drawn into the circulating gases either by the reduced pressure resulting from the Venturi throat 19 or through the intake of the blower 17 passing in this case through flue 26.

It will be noted that when the products of combustion travel through flue 26 into the intake of the blower the blower will be required to handle circulating gases at the maximum temperature of the device, while on the other hand, if the products of combustion pass through flue 25 instead of through flue 26 the blower will be required to handle circulating gases at the minimum or returned temperature.

An exhaust flue 35 provided with a self-closing valve 36 provides for the discharge of excess gases, thus preventing an accumulation of pressure in the system owing to the continual addition of products of combustion.

It will be evident that thermostat 30 will regulate the quantity of fuel supplied by burners 27 and 28 thus insuring a constant uniform temperature of the circulating gases when they pass through basket 21 and into contact with the material therein.

It will also be apparent from the description given that as basket 21 is rotated by means of spider member 1 and the mechanism previously described, all parts will be continuously subjected to substantially uniform treatment by the hot blast of circulating gases, thus giving a highly uniform distribution of heat throughout the mass of material within the basket.

Owing to the fact that the products of combustion are directly retained and mixed with the circulating gases very high degrees of efficiency may be secured with this equipment.

It will be apparent that many obvious substitutions may be made without departing from the spirit of this invention. For example, the basket may be constructed in any form or shape or in place of the basket I may employ a horizontal tube or I may prefer to allow the basket to remain stationary and depend on the movement of the air only, which I have found gives quite satisfactory results in many cases. Obviously the basket may be supported from a plate placed beneath it or in any other desired manner without departing from the spirit of this invention.

I have found in actual practice that equipment of this kind will serve to heat articles to the desired temperature with great accuracy and uniformity. That is to say by maintaining the circulating air at a given temperature no articles can, under any conditions, be heated higher than the temperature of the circulating air. Obviously this is a decided advantage over the performance of furnaces which depend partly upon radiant heat for thermal transfer. Such furnaces are subject to considerable overheating of some articles and underheating of other articles.

It will also be apparent that since the products of combustion are held in the circulating gases and therefore come in contact with the substances being heated, the efficiency must be very high.

In referring to a heat treating machine, I wish it to be understood that I am referring to any device in which heat is applied to accomplish a useful result. Thus I intend the term to cover such operations as roasting, drying, baking, annealing, carburizing, cooking, boiling, melting, etc., as obviously this equipment will find a wide field of application wherever a uniform and controlled temperature is required.

While I have shown a specific type of gas moving mechanism or blower, it will be understood that any satisfactory mechanism which will keep the gases in motion may be used. Further I do not wish to be restricted to any particular shape or design of container as this will obviously be varied to suit the operations being carried out. In some cases the container may be closed as for example in heating very small artices or powders. Any desired fuel may be employed and by the term "combustion chamber" I intend to indicate the space or inclosure where the combustion takes place or the products of combustion are concentrated.

Having now fully described my invention what I claim as new and wish to secure by Letters Patent in the United States, is as follows:

1. The process of heat application which consists in circulating a quantity of gases at a pressure above atmospheric through a system, creating a zone of reduced pressure in a portion of said system by means of the momentum of said gases and continuously add-

ing to said cooler circulating gases at said zone of reduced pressure a portion of hotter products of combustion.

2. The process of heat application which consists in circulating a quantity of gases through a system at a pressure above atmospheric, creating a zone of reduced pressure in said system by means of the kinetic energy of said gases and continuously adding to said cooler circulating gases at said zone of reduced pressure a portion of hotter products of combustion and exhausting a portion of said cooler circulating gases prior to adding the hot products of combustion.

3. The process of applying heat which consists in circulating a quantity of gases at a slight pressure above atmospheric in a substantially closed circuit, continuously exhausting portion of said gases, continuously creating a zone of reduced pressure by means of the kinetic energy of said gases and continuously adding a portion of hotter gases at said zone of reduced pressure caused by the kinetic energy of the said circulating gases.

4. The process of applying heat which consists in circulating a quantity of gases in a substantially closed circuit at a pressure above atmospheric, continuously creating a zone of low pressure by means of the kinetic energy of said circulating gases, continuously exhausting a portion of said gases at a point prior to the said zone of low pressure and continuously adding a portion of hotter gases at said zone of reduced pressure caused by means of the kinetic energy of the said cooler circulating gases, prior to the entry of said gases.

5. In the process of applying heat by continuously circulating gases at a pressure above atmospheric the step of raising the temperature of said circulating gases by increasing the velocity of said cooler circulating gases, thus creating a zone of reduced pressure and thereby drawing in a portion of hotter products of combustion, at said low pressure zone.

6. In the process of applying heat, the steps of continuously circulating a volume of gases at a delivery pressure above the atmosphere, continuously discarding a controlled portion of said circulating gases and subsequently continuously replacing said discarded portion by a sufficient quantity of hotter gases to maintain the desired temperature, said portion of hotter gases being drawn into said circulating gases by causing a low pressure zone due to increased velocity of the cooler circulating gases.

7. In the process of applying heat, the steps of continuously discarding a controlled portion of circulating gases above atmospheric pressure and continuously replacing said discarded portion by a sufficient quantity of hot products of combustion to maintain the desired temperature, said hot products of combustion being drawn into said circulating gases by causing a low pressure zone due to increased velocity of the cooler circulating gases.

8. In the process of applying heat by circulating gases in a closed circuit at a pressure above atmospheric, the step of drawing into said circulating gases a portion of hotter gases by raising the velocity of said cooler circulating gases and thereby reducing their pressure.

9. In the process of heating by circulating gases, the steps of exhausting a portion of said cooler circulating gases after delivering a porton of their heat, and adding a portion of hotter gases to said circulating gases immediately prior to the point of heat application, said addition of hotter gases being made in a reduced pressure zone maintained between two higher pressure zones and created by the kinetic velocity of said cooler circulating gases.

10. The process of heat application to a system which consists in circulating a quantity of heated gases in a substantially closed circuit through said system, producing a zone of reduced pressure in said system by means of the kinetic energy of said circulating gases, said zone of low pressure being bounded by a higher pressure zone on each side, and introducing a portion of hotter gases into said cooler circulating gases in said reduced pressure zone.

11. The process of heat application to a system which consists in circulating a quantity of heated gases in a substantially closed circuit through said system, producing a zone of reduced pressure in said system by means of the kinetic energy of said circulating gases said zone of low pressure being bounded by a higher pressure zone on each side, introducing a portion of hotter gases into said cooler circulating gases in said reduced pressure zone and continuously rejecting a compensating portion of said cooler circulating gases.

WILLIAM A. DARRAH.