No. 876,183. PATENTED JAN. 7, 1908.

J. A. HERRICK.

ANNEALING FURNACE.

APPLICATION FILED MAR. 17, 1905.

3 SHEETS—SHEET 1.

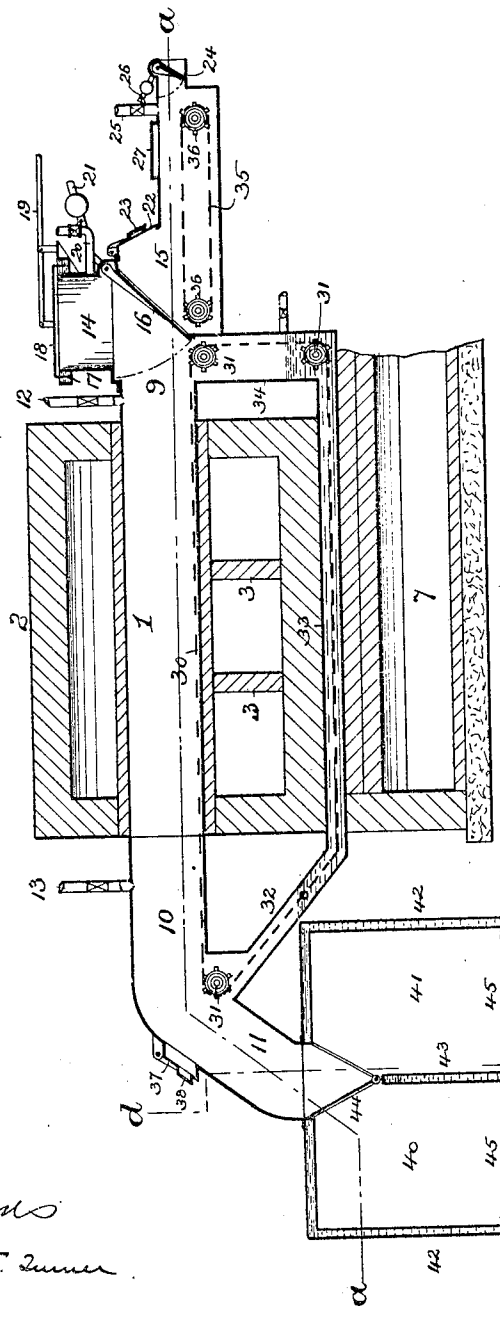

FIG 1

WITNESSES:

Titus Kebrons

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3 SHEETS—SHEET 2.

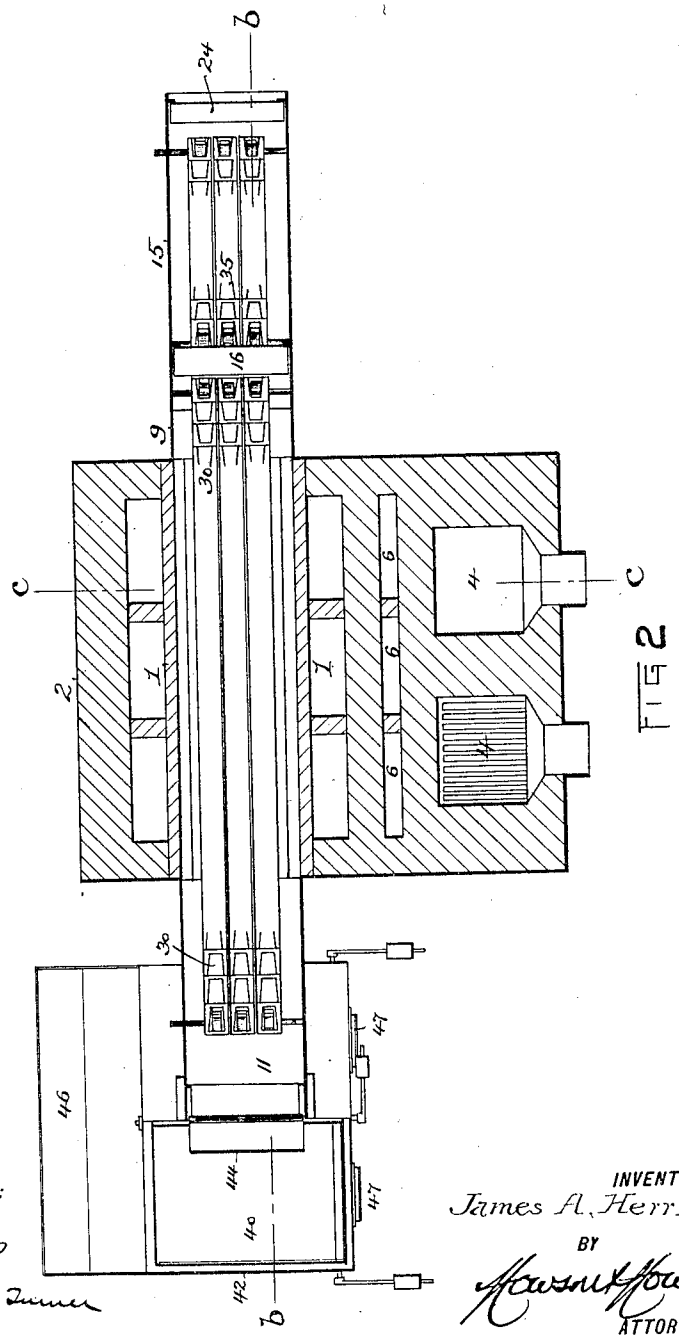


FIG 2

WITNESSES:

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3 SHEETS—SHEET 3.

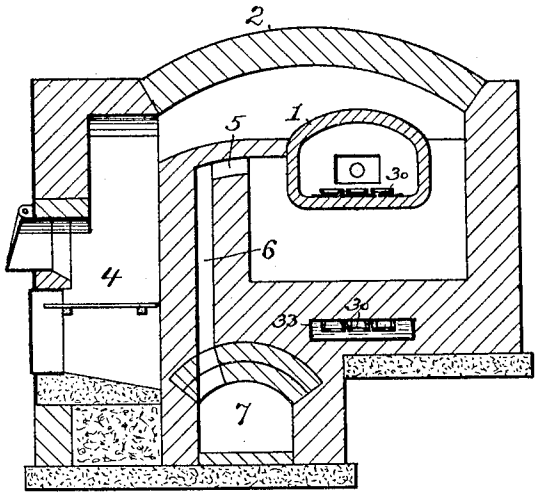


FIG 3

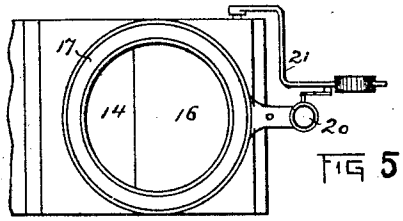


FIG 5

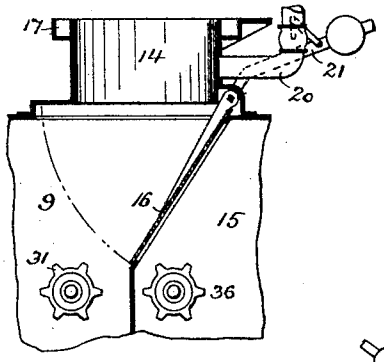


FIG 6

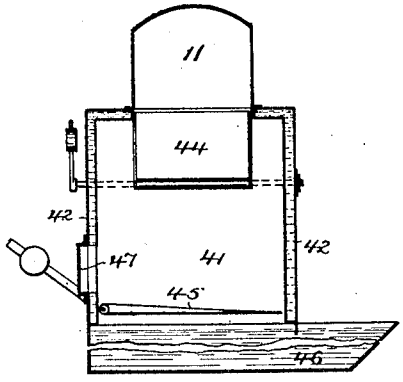


FIG 4

WITNESSES:

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# UNITED STATES PATENT OFFICE.

JAMES A. HERRICK, OF PHILADELPHIA, PENNSYLVANIA.

## ANNEALING-FURNACE.

No. 876,183. Specification of Letters Patent. Patented Jan. 7, 1908.

Application filed March 17, 1905. Serial No. 250,659.

*To all whom it may concern:*

Be it known that I, JAMES A. HERRICK, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Annealing-Furnaces of which the following is a specification.

My invention relates to that class of annealing furnaces in which the objects to be annealed are subjected to heat while maintained in a non-oxidizing atmosphere, the object of my invention being to provide simple and convenient means for charging the various materials to be annealed into a closed muffle without admission of external air and for transferring such materials through the muffle automatically, ejecting the same when properly heated, and subjecting them to quick or gradual cooling and final treatment without danger of stain or scaling.

This object I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which

Figure 1 represents a longitudinal section, on the line *b*—*b* of Fig. 2, of annealing apparatus constructed in accordance with my invention; Fig. 2 is a sectional plan view on the line *a*—*a* of Fig. 1; Fig. 3 is a transverse section on the line *c*—*c* of Fig. 2; Fig. 4 is a transverse section on the line *d*—*d* of Fig. 2; Fig. 5 is an enlarged plan view of the charging end of the muffle or retort, and Fig. 6 is an enlarged vertical sectional view of the same.

The prime object in all closed annealing systems is to treat the materials perfectly while excluding the atmospheric air during all stages of the operation, and different forms of fixed or movable closed retorts have been devised with the view of attaining this result, none of which, so far as I am aware, have been perfectly satisfactory, one objection being the expensive and cumbersome machinery employed, which is liable to accident and is difficult to adjust and repair, and another objection being that different metals require different treatment and different forms of apparatus. I aim to overcome these objections in my improved apparatus by the use of an air lock or charging compartment at the inlet end of the retort, in connection with a system of internally disposed but externally driven conveyers, and by the use of an air-tight hood at the delivery end of the muffle, whereby the materials, after being heated, are delivered to one or more air-tight cooling chambers where they can be cooled gradually and from which they can be removed when finished, or from which they may be dipped in pickling or other fluids, either after they have become cooled or partially cooled, or in the fully heated condition in which they are discharged from the retort.

Referring to the drawings, 1 represents a retort, which may be made of any suitable refractory material and of any desired size and form, this retort being so mounted in the furnace 2 that the ends of the retort are firmly supported upon and built into the end walls of the furnace, the retort being also, if desired, supported at various points throughout its length by walls 3 of refractory material, as shown in Fig. 1.

In the present instance two fire-places 4 are shown at the front of the furnace structure, the products of combustion passing first over the top of the retort, then down along one side of the same, thence across the bottom of the retort between the supporting walls 3, thence up along the opposite side of the retort and thence through passages 5 and 6 to a discharge flue 7. The retort being thus enveloped in products of combustion, provision is afforded for uniformly heating the same throughout its entire extent to any desired temperature, without the risk of overheating its contents or injuring them by direct contact with the products of combustion. Instead of direct coal firing any acceptable system of uniformly heating the retort 1, as for instance by means of oil or gas, may be employed.

At its charging end the retort has a projecting neck 9, and at its delivery end a projecting neck 10, with downwardly bent outer end 11, as shown in Fig. 1. With the receiving neck of the retort communicates a pipe 12, suitably valved, and with the delivery neck of the retort communicates a similarly valved pipe 13, and through these pipes steam or other non-oxidizing fluid may be admitted to the retort in order to drive the air therefrom in the first instance, and to maintain a non-oxidizing atmosphere within the retort during the continuance of the annealing operation.

Projecting upwardly from the receiving neck 9 of the retort is a charging structure 14, and projecting outwardly from said receiving neck 9 is another charging structure 15, and between these two charging structures is a pivoted and swinging valve 16, which

can be adjusted to the position shown by full lines in Fig. 1 when it is desired to cut off communication between the receiving neck 9 of the retort and the charging structure 15 and open communication between said neck 9 and the charging structure 14, or it can be raised to a horizontal position so as to cut off communication between the neck 9 and the charging structure 14 and open communication between said neck and the charging structure 15. The charging structure 14 has, around the top, a sealing trough 17 for containing water, sand, or other sealing agent, into which dips a depending flange around the periphery of a cap or cover 18, which can be raised or lowered by manipulating a lever 19.

A valved pipe 20 communicates with the interior of the charging structure 14 and the stem of this valve is connected to a counter-balanced arm 21 projecting from the pivot shaft of the valve 16, so that when said valve is lowered to the position shown in Fig. 1 flow through the pipe 20 will be permitted, such flow being cut off when the valve 16 is raised to a horizontal position.

The charging structure 15 has an end portion in line with the retort 1, and this end portion is provided with a swinging valve or cover 22 with peep hole 23, so that the conditions within the retort may be observed when the valve 16 is raised. At the extreme outer end of the charging structure 15 there is an opening normally closed by a swinging valve or door 24, and said charging structure is also provided with a pipe having a valve whose stem is connected to a counter-balanced arm 26 projecting from the shaft of the valve 24, so that when the latter is closed the valve in the pipe 25 will be open, and vice versa. In the top of the charging structure 15 is a man-hole 27, which provides for access to the interior of said charging structure independently of the access provided by the swinging valve or door 24.

Extending through the retort 1 and its charging and delivery necks 9 and 10, is an endless conveyer 30, which is guided, supported, and driven by means of suitable sprocket wheels 31, and this endless conveyer also passes through extensions 32, 33, and 34, forming a depending continuation of the retort, whereby the conveyer is contained wholly within the retort, and always works in the non-oxidizing atmosphere maintained therein during the continuance of the annealing process. The extensions 33 and the lower portions of the extensions 32 and 34 of the retort may be filled with water for the purpose of cooling the conveyer during the return passage of the same from the delivery end to the charging end of the retort.

An endless conveyer 35, mounted upon driving sprocket wheels 36, is contained in the charging structure 15 of the retort, the upper run of said conveyer 35 being flush with, or slightly above, the level of the upper run of the main conveyer 30, and being, by preference, driven at a slightly greater surface speed than said main conveyer.

The delivery neck 10 of the retort has an opening normally closed by a swinging valve or door 37 with peep hole 38, so that conditions within the retort may be observed from the delivery end of the same as well as from the charging end.

The depending end 11 of the delivery neck 10 of the retort communicates with a duplex chamber 40, 41, which has a water jacket 42, the two other chambers being separated by a water-cooled hollow partition 43, and on the top of the partition is mounted a swinging valve or gate 44, which can be adjusted either to the position shown in Fig. 1, so as to direct the discharge from the neck 11 into the chamber 41, or can be reversed so as to direct said discharge into the chamber 40.

Each of the chambers 40 and 41 has, at the bottom, a pivoted and tiltable platform 45 for receiving, supporting, or dumping the material fed into said chamber, and both chambers are sealed at the bottom by means of water or other sealing agent contained in a sealing trough 46 into which the contents of either chamber 40 or 41 can therefore be discharged by tilting its platform 45 and from which the materials can be readily removed. Each chamber 40, 41, also has a suitably closed opening 47 at one side through which the contents of said chamber can be removed, without dumping them into the sealing trough, when such removal is desired.

The method of operation of my improved furnace is as follows. The sealing trough 46 being properly filled with water or other sealing agent and the fires started, the retort is heated to the proper temperature and the air is then expelled therefrom by means of the steam or other non-oxidizing fluid, which also expels air from the charging structure 14 or 15, depending upon the adjustment of the valve 16. If a charge is to be introduced through the structure 14 the valve 16 is raised to the horizontal position so as to cut off communication between said structure and the retort, the cover 18 is then lifted and the charge is deposited upon the valve 16, and the cover 18 re-applied. The valve is then lowered so as to direct the charge to the moving conveyer 30 in the bottom of the retort, whereby the said charge is conveyed forwardly into the retort so as to make room for a fresh charge, such air as may have been contained in the charging structure 14 being discharged through the pipe 20 as soon as the valve in the same has been opened by the lowering of the valve 16, owing to the fact that the steam or other non-oxidizing fluid is main-

tained under slight pressure in the retort, and hence serves to prevent any inflow of air into said retort during the continuance of the annealing operation. If strips, bars, or other articles which cannot be conveniently charged through the structure 14 are to be annealed, the charging structure 15 is utilized, the bars, strips, or other articles being introduced through the opening at the end of the structure 15 and deposited upon the conveyer 35, the swinging valve or door 24 closing as soon as the articles have been inserted. The valve 16 being raised, the articles are carried forwardly by the conveyer 35 and are deposited upon the main conveyer 30, whereby they are carried through the retort. Air is expelled from the charging structure 15 through the pipe 25 when the valve 16 is raised, so that no inflow of air into the retort at this point is possible. If the articles, after being heated are to be slowly cooled, they may be discharged into either of the chambers 40 or 41, deposited upon the platform 45 at the bottom of said chamber, and permitted to accumulate in the chamber until it becomes full, whereupon the valve 44 may be reversed and the discharge directed into the other chamber, which may also be permitted to become full, the articles in the other chamber having meantime cooled so they can be withdrawn through the opening 47 of said chamber, and the chambers being thus used alternately as long as may be desired, or the articles after having cooled or partially cooled in either of the chambers 40 or 41 may be dumped into the water or other sealing fluid in the trough 46 by tipping the platform 45 at the bottom of said chamber or platforms may be tipped at the beginning of the operation and the heated articles thereby dropped directly from the neck 11 through either of the chambers 40 or 41 into the liquid in the sealing trough, which liquid may be of a character to effect the pickling or other finishing of the articles.

It is obvious that the number of retorts contained in the furnace may be multiplied, as may also the firing chambers, and it is also obvious that in some cases the delivery neck 11 of the retort may discharge directly into the sealing trough without the interposition of the cooling chambers 40 and 41, and that the charging chamber 14 can be closed at the top by an automatic swinging valve or cover instead of by a hand actuated cover of the kind shown and described. Each charging chamber constitutes, in connection with the valve 16, an air lock at the charging end of the retort, that is to say, a chamber which is cut off from communication with the atmosphere when open to the retort, since the pipes 20 and 25 provide only for the escape of the steam or other non-oxidizing fluid from the retort, and do not permit of an inflow of air.

Having thus described my invention, I claim and desire to secure by Letters Patent:—

1. An annealing furnace having a heated retort with a dry air lock having a water-sealed cover at the inlet end through which material can be charged into the retort.

2. An annealing furnace having a heated retort with a double air lock at the inlet end through either of which materials can be charged into the retort.

3. An annealing furnace having a heated retort provided at its inlet end with a double air lock, and a valve interposed between the two locks so as to operate in conjunction with either.

4. An annealing furnace having a heated retort with an air lock having a water-sealed cover at the inlet end, said air lock being provided with an escape pipe through which air may be forced from the lock by a non-oxidizing fluid within the retort, substantially as specified.

5. An annealing furnace having a heated retort with an air lock at the inlet end, said air lock having a discharge pipe, a valve for opening and closing communication with the air lock, and a connection between said valve and the valve in the discharge pipe, substantially as specified.

6. An annealing furnace having a heated retort, a conveyer wholly within the same, an air lock at the inlet end of the retort, and a supplementary conveyer situated below said air lock, substantially as specified.

7. An annealing furnace in which are combined a heated retort, a plurality of receiving chambers at the delivery end of said retort, and means for directing the discharge from said retort into either of said chambers, substantially as specified.

8. An annealing furnace in which are combined a heated retort, a plurality of water-sealed receiving chambers at the delivery end of said retort, and means whereby the discharge from the retort can be directed to either of said chambers, substantially as specified.

9. An annealing furnace in which are combined a heated retort, a water-sealed chamber at the delivery end of said retort, and a tilting platform contained in said chamber above the seal, substantially as specified.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JAMES A. HERRICK.

Witnesses:
E. R. LOUGHERY,
JOS. H. KLEIN.