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ROTARY SINTERING FURNACE.

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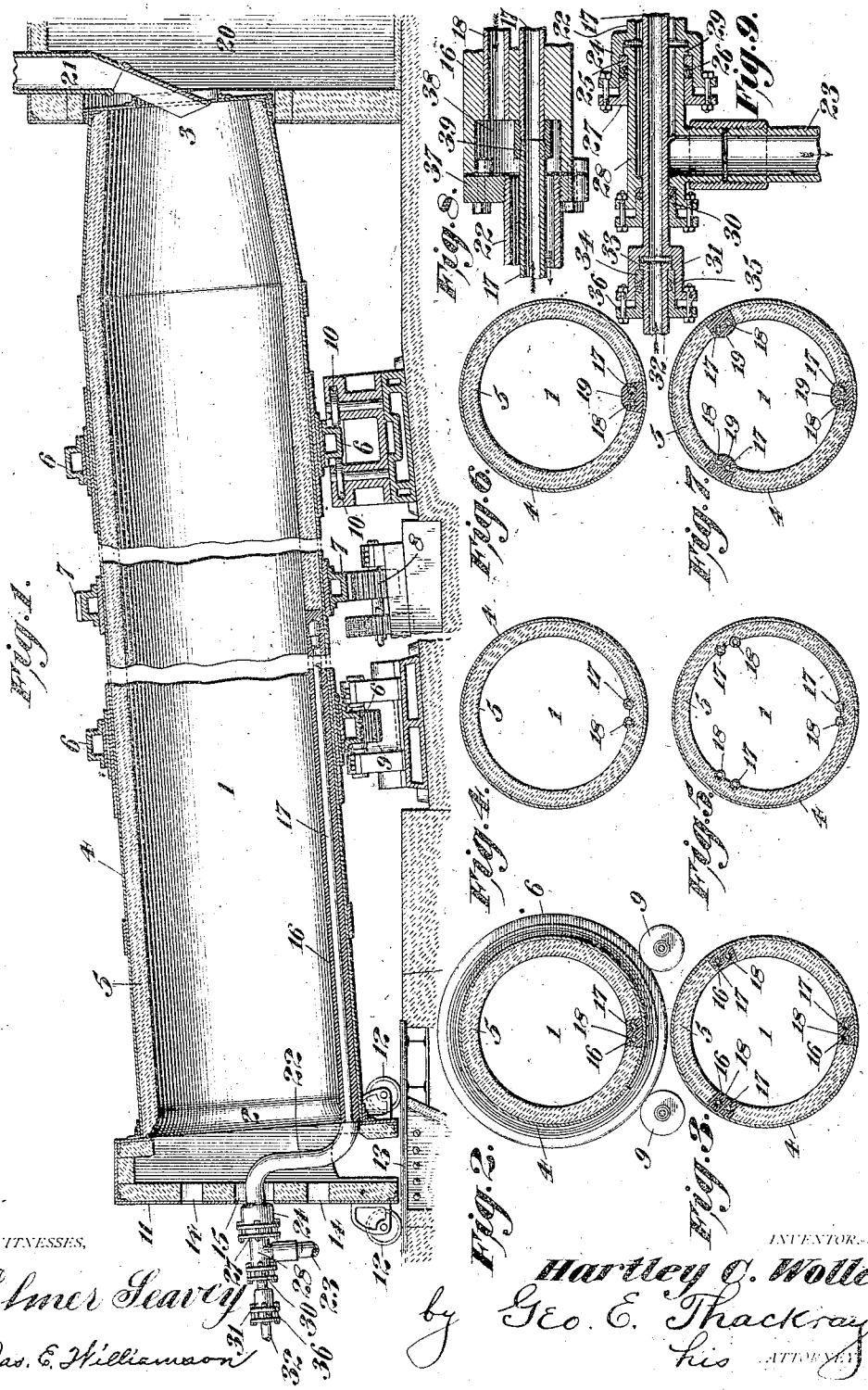

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

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ROTARY SINTERING-FURNACE.

1,005,396. Specification of Letters Patent. Patented Oct. 10, 1911.

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To all whom it may concern:

Be it known that I, HARTLEY C. WOLLE, a citizen of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Sintering-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in sintering furnaces for metallurgic or other use with special reference to means for preventing the accumulation of rings or other masses of sintered, agglomerated or clinkered material therein.

In order to simplify the description and the drawings, I will describe and illustrate my invention in connection with a rotary, cylindrical furnace of considerable length, the axis of which is slightly inclined from the horizontal, the body of the furnace being adapted to revolve while the fire or heat from any suitable source is admitted into the lower interior end of the same and the products of combustion are discharged at the upper end; meanwhile the materials to be sintered are charged into the upper end, and pass through the furnace by the revolution and inclination thereof, and are discharged at the lower end.

My furnace is practically adapted for use in sintering or agglomerating blast furnace flue dust, fine ores, or other materials into lumps or nodules, by subjecting the same to increasing temperature as they pass through the furnace, this agglomerating being accomplished by the fritting or semi-fusion of the main constituents of the materials or of the impurities contained therein, thereby forming the pulverulent materials into nodules or particles of appreciable size by the combined action of heat and agitation in connection with the other particles of similar materials.

In the operation of such furnaces it has been discovered, that under certain conditions, there will be an accumulation of fused or semi-fused material in certain localities, in some cases forming a ring-like mass of somewhat irregular contour, until it becomes so great that it interferes with, and blockades the passage of, the materials and the gases through the furnace. This necessitates shutting down of the furnace for the removal of the accumulation which causes expense and delay.

My invention consists generally in providing a cool strip of material inserted longitudinally of the lining of the furnace, the surface of said cool strip being continuous with the surface of the lining or projecting above the same, as may be desired. This cool strip which I call the cooler, will prevent, by reason of its coolness, the accumulation of sintered material thereon.

The accumulation of sintered material will therefore not form in the shape of a continuous ring, but will leave a gap or break at the cooler. The accumulation will then somewhat resemble an arch, but without the keystone thereof so that, as the furnace revolves, the accumulation will fall down to the bottom thereof and be carried out with the other sintered material in due course of the operation.

I consider that one cooler, inserted longitudinally of the furnace throughout that portion of its length where the conditions and temperature are such as to cause the accumulation previously referred to, will be sufficient, but I also have arranged to use two such coolers, or I may use three or even more, located in different portions of the furnace as indicated in drawings accompanying this specification. I may also make the surface of the cooler flush with the interior of the lining, or I may make it project slightly above the same, being careful in this latter case to form the projections in such a way that their surfaces are not on radial lines, but form a wider angle so that in case any material should accumulate on the linings between two coolers it would not be wedged between the surfaces of the coolers, as there will be a clearance to enable the material to drop down as the furnace is revolved.

Having thus given a general description of my invention, I will now, in order to make the matter more clear, refer to the sheet of drawings accompanying this specification, and in which like characters indicate like parts.

Figure 1 is a vertical sectional elevation of my improved rotary furnace which is broken into three parts for convenience of illustration, as the furnace is preferably very long. Fig. 2 is a cross section through the lower end of my furnace showing the

shell, the lining, one form of my cooler, and the circulating pipes within the cooler; also showing one of the tires and wheels upon which it runs. Fig. 3 is an arrangement of the lower end of the furnace in which, however, I provide three coolers instead of one. Fig. 4 is a cross section of the lower end of my furnace showing my cooling pipes, without a cooling block surrounding the same. Fig. 5 is an arrangement similar to Fig. 4, except that I provide three sets of cooling pipes, instead of one. Fig. 6 is a cross section of the lower part of the furnace showing my cooler of modified form, the block or body of which projects beyond the lining of the furnace. This form is useful in some cases for preventing the accumulation of materials in the furnace. Fig. 7 shows a style of cooler similar to that shown in Fig. 6, except that I use three coolers in this case. Fig. 8 is a cross sectional plan of the lower end of my cooler showing the construction of the same and the manner of attaching the discharge and supply pipes or conduits to the same. Fig. 9 is a vertical cross section through the exterior pipe or conduit connections showing the manner in which they are made, so that the furnace may revolve while the supply and discharge pipes are maintained in operative connection with the cooler.

Referring now to the various characters of reference on the drawings:—1 indicates the body of the furnace which is of general cylindrical form with a tapered upper portion indicated at 3, the lower portion of the cylindrical furnace being indicated at 2, and is curved or beveled so as to readily discharge the materials therefrom.

The metallic cylindrical shell of the furnace is indicated at 4, the refractory lining of which may be of bricks or other material as indicated at 5. The annular tires on which the furnace is mounted and revolves are indicated at 6, and 7 is an annular gear wheel secured to the shell of the furnace, meshing with the driving pinion 8 which latter is connected to any suitable source of power for revolving the furnace as desired.

The anti-friction wheels on which the tires 6 revolve, are indicated at 9, while 10 represents anti-friction side bearings resting against the sides of upper tire 6 to maintain the furnace in position longitudinally.

The removable front hood is indicated at 11 this being lined with refractory material as shown, and adapted to cover the lower end of the furnace when in operation. The hood 11 is mounted on truck wheels 12 which are carried by the track 13 this arrangement being for the purpose of removing the hood longitudinally from the furnace so as to have access to the interior of same when desired. Openings in the front of the hood for the passage of oil or other fluid, and air for combustion are indicated at 14, while 15 is a central opening in line with the axis of the cylinder through which my cooling pipes 17 and 22 are passed.

16 represents my cooler extending longitudinally of the furnace and forming part of the refractory lining thereof. The form of cooler indicated by 16 is made of cast iron or other suitable material in which circulating pipes or conduits 17 and 18 are formed or embedded.

In Fig. 2, one cooler with one pair of circulating pipes or conduits 17 and 18 is shown, while in Fig. 3, three similar coolers are indicated.

In Fig. 4 the circulating pipes or conduits 17 and 18 are shown resting on the refractory lining, but without the cast box surrounding the same as under certain conditions these circulating pipes or conduits will serve the purpose.

In Fig. 5 three pairs of similar circulating pipes or conduits are shown as these may be useful under certain conditions of service.

In Fig. 6 a modified form of cooler is indicated at 19, the cross-section of this being in the shape of a trapezoid with a superimposed trapezoidal projection rising above the surface of the refractory lining of the furnace. The angles of the sides of this projection are comparatively flat so that the distance between the projecting corners of the adjoining coolers as shown in Fig. 7, is greater than that between the bottoms of the adjoining coolers, so that any material which might tend to accumulate between two adjoining coolers would not be wedged therein, but will readily drop out as the furnace revolves.

In Fig. 6 I show one cooler 19 with circulating pipes 17 and 18 inclosed therein, while in Fig. 7 I show three such coolers.

The stack or chimney connection is indicated at 20, and 21 is a chute through which flue-dust, fine-ores or other materials are fed to the furnace. I provide a cooling pipe or conduit 22 which enters the furnace on the axial line thereof and then extends on a radial line to the furnace shell and is there connected with the cooler 16 as shown in detail in Fig. 8.

The exterior supply pipe is indicated at 32 and this is stationary, while the discharge-pipe 23 is also stationary, this arrangement being made to provide a proper mechanical way for the supply and discharge of a cooling medium, such as air or water, to and from my coolers or circulating pipes. In order that the furnace may revolve and the cooler, at the same time, be supplied with cooling medium, I provide revoluble but fluid tight connections from the stationary supply pipe and the stationary discharge-pipe to the corresponding circulating pipes of my cooling arrangement.

On the end of the pipe or conduit 22 I provide a stuffing-box 24 in which is seated a metallic ring 25 beveled as shown and above which is a compressible or soft metal packing 26 secured and maintained in place by the gland 27. A pipe-section 28 is fitted within the stuffing-box 24, said pipe-section being provided with an annular projection 29 at the end thereof. This annular projection abuts against the removable metallic ring 25 which thereby enables the pipe to resist the longitudinal pressure of the cooling medium and thereby maintains the joint in proper position. A gland is indicated at 30 which surrounds the body portion of the interior supply pipe 17 operating within a stuffing-box provided with bolts as indicated. The outer end of the interior supply pipe 17 is provided with a stuffing box 31 and has secured therein a metallic ring 34, one side of which is flat and the other beveled as indicated. The stuffing-box, 31 is provided with packing 35 and a gland 36 adjusted thereto by bolts as indicated.

32 indicates the supply pipe which is provided with an annular enlargement 33 which abuts the metallic ring 34 and thereby prevents the pressure of the cooling medium from forcing the pipe 32 out of place. By means of the arrangement just described, water, air, or other cooling medium is supplied to the cooler through the stationary pipe 32 and discharged therefrom through the stationary pipe 23, while the supply pipe 17 and the discharge pipe 22 are permitted to revolve with the furnace, thereby maintaining the connections for the passage and circulation of the cooling medium.

Referring now to Fig. 8, 16 represents the lower end of one form of my cooling construction, 17 the supply pipe secured therein, the two portions of which, however, are united by a right and left threaded coupling as shown at 39, whereby the pipes or conduits 17 and 22 can be conveniently connected to and disconnected from the cooler 16. 18 represents the discharge pipe which is secured within the casting 16 and adapted to discharge the cooling medium into an irregular space 38 formed in the end of the cooler 16, this space 38 also connects with the annular space around the supply pipe 17 between the inner wall of the outlet pipe 22 and the outer wall of the supply pipe 17 mounted axially therein. 37 is a flange secured by bolts as shown to the end of the casting 16 and into which flange the pipe 22 is secured as indicated.

By means of the construction shown in Fig. 8, my supply and discharge pipes 17 and 22 respectively, can be connected to the circulating pipes or conduits 17 and 18 of my cooler. The arrangement of the pipe 17 within the pipe 22 on the axial line of the furnace cylinder provides a convenient means of supplying circulating cooling fluid through my cooler.

Although I have shown and described my improvements in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention or as pointed out in the claims.

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

1. In a rotary sintering furnace, provided with a refractory non-metallic lining, a narrow metallic cooler arranged longitudinally therein having separate supply and discharge conduits and provided with circulating means for supplying a cooling medium thereto and discharging the same therefrom, said cooler extending only through the regions of sintering temperature in said furnace, whereby the accumulation of sintered material is prevented, substantially as described.

2. In a rotary furnace a cooling apparatus arranged longitudinally therein, separate supply and discharge conduits within said cooler and means arranged on the axial line of the furnace for maintaining connection between said conduits and exterior supply and discharge pipes communicating therewith.

3. In a rotary sintering furnace, provided with a refractory lining, a narrow metallic cooler mounted longitudinally therein, comprising a portion forming part of the furnace lining in the region of the sintering temperature therein and provided with circulating conduits therethrough, and means arranged on the axial line of the furnace for maintaining said conduits in connection with exterior stationary supply and discharge conduits.

4. In a cylindrical rotary furnace provided with a non-metallic refractory lining, a narrow metallic cooler arranged longitudinally therein, separate circulating passages in said cooler, supply and discharge conduits arranged exteriorly of the furnace on the axial line thereof and provided with revoluble joints, whereby connection is maintained between said circulating passages and exterior supply and discharge conduits.

5. In a rotary furnace of the character described, a narrow metallic cooler mounted longitudinally therein, comprising a body forming a portion of the refractory lining of said furnace and provided with separate circulating conduits therein, said conduits being connected on the axis of the furnace with suitable sources for the supply and discharge of a cooling medium therethrough.

6. In a rotary furnace a cooler arranged

longitudinally therein, the body portion of said cooler being embedded in the furnace lining and provided with a double inclined projection above said lining, the surfaces of said projection being disposed at a less angle than the radial lines of the furnace, whereby a clearance is provided to permit accumulated material to drop from said lining.

7. In a rotary sintering furnace a refractory lining of the character described, a narrow metallic cooler mounted longitudinally therein in the region of the sintering temperature of the materials treated, and provided with means for circulating a cooling medium there-through, whereby the accumulation of sintered material within the furnace is prevented.

8. In a rotary sintering furnace, provided with a refractory lining, a plurality of narrow metallic coolers arranged longitudinally therein in the region of the sintering temperature of the materials treated, supply and discharge conduits in said coolers, means arranged on the axial line of said furnace for supplying a cooling medium to said coolers and discharging the same therefrom, whereby the accumulation of sintered material is prevented.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

HARTLEY C. WOLLE.

Witnesses:
D. M. Stackhouse,
E. S. Wright.