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ROTATING ELECTRIC FURNACE

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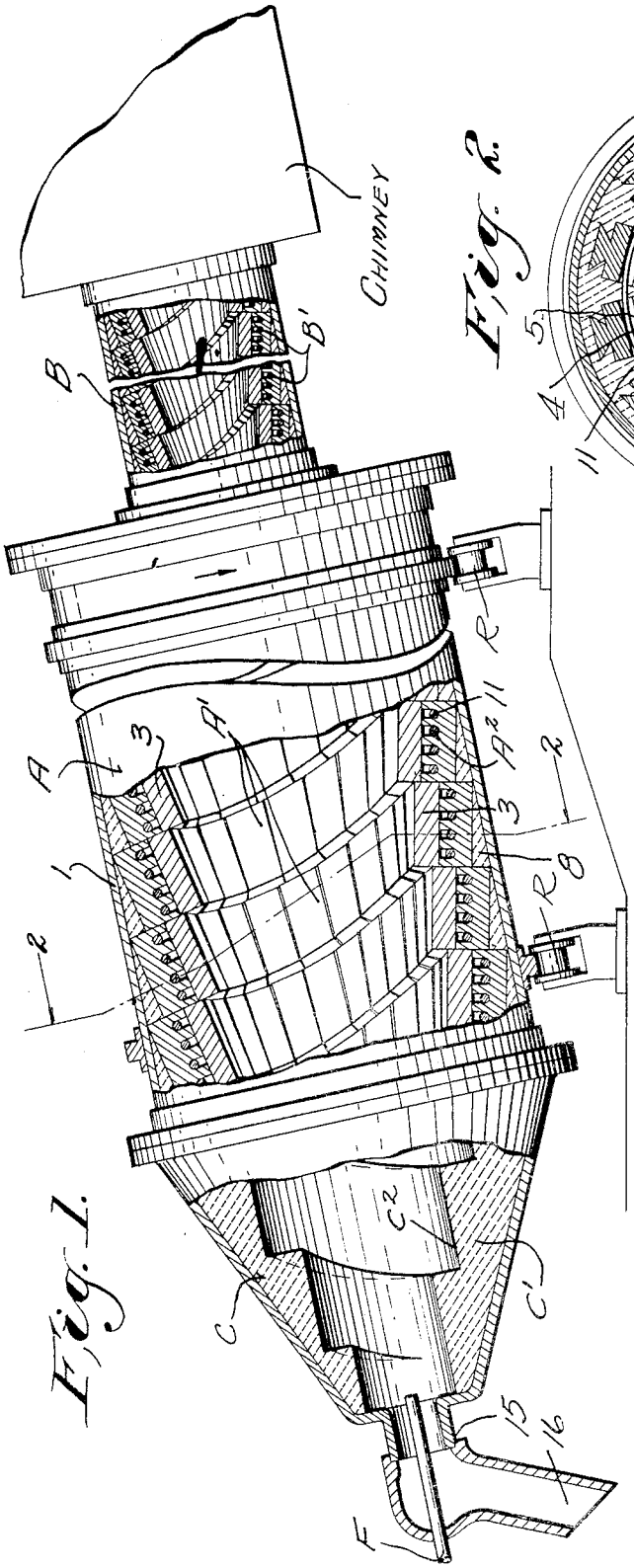


Fig. 1.

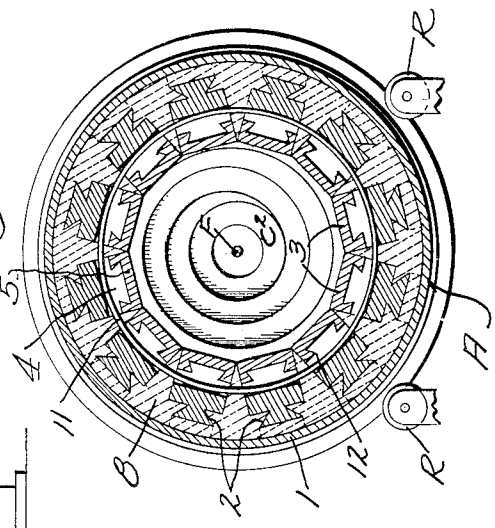


Fig. 2.

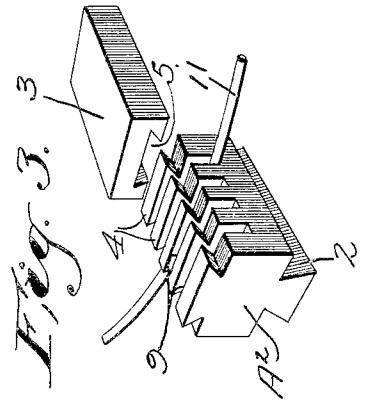


Fig. 3.

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ROTATING ELECTRIC FURNACE

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10 Claims. (Cl. 13—21)

My invention relates to improvements in rotatable electric furnaces.

The object of my invention is to provide a rotatable electric furnace for the treatment of material which may be passed through my furnace in a continuous stream, the speed of travel of which is controlled by novel means including a step-like interior surface for a generally downwardly inclined rotatable furnace body.

More particularly stated, it is the object of my invention to provide a rotatable generally cylindrical downwardly inclined furnace body wherein the interior surfaces of the furnace are in spiral step-like formation so disposed that each portion of the spiral surface as it assumes its lowermost position is horizontal.

Another object of my invention is to provide in conjunction with a furnace of the type already referred to, a conical outlet or discharge end for the furnace wherein the inner surfaces are so contoured as to speed up the discharge of the treated material.

Another object of my invention is to provide a new and improved type of electrical heating unit for an electric furnace, an important element of which is the provision of a removable replaceable heating element and cover comprising multiple units of refractory material adapted to comprise the actual lining of the electric furnace.

In the drawing:

Fig. 1 is a side elevation of my electric furnace with portions broken away and exhibiting portions of the main elements thereof in vertical section.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is an isometric view of a unit of my improved heating element.

Like parts are identified by the same reference characters throughout the several views.

My furnace consists of a main cylindrical or drum-shaped treating chamber A, which is supported in inclined position by rollers R, and into which material to be treated is fed through a preheater B. A conical discharger C is fitted to the lower or outlet end of my furnace drum A and the completely treated material passing from my furnace passes through a fitted joint at 15 into a stationary outlet spout or channel 16.

The generally tubular main body A of my furnace constitutes the framework of my rotatable electric furnace and may be made of sheet steel or other similar material 1. Within the furnace and the preheater B, I construct my stair-like series of electric heating elements A^2 which are arranged as indicated at A^1 in the form of spiral continuity of stair surfaces comprising covers 3 for my heating elements A^2. It is of importance that the lowermost surface of each of the spiral convolutions A^1 shall form step surfaces, each of which is horizontal despite the incline of the frame of the tubular main body A.

The interior of the preheater B is provided with a similar helical or spiral continuity of heating elements B^1 arranged in the same general configuration as those shown at A^2 in the furnace proper.

The conical discharger C is lined with refractory material C^1, the inner surface of which is formed in a spiral series of step-like surfaces C^2 disposed with the spiral oppositely curved with respect to the spiral of the surfaces A^1 in the furnace, my purpose being to so operate my furnace as to slow down the passage of material through the furnace proper A and to speed up the discharge of treated material through the discharger C, as will be clear from the description hereinafter set forth.

At F a conduit for passing reducing gases or other suitable substances for the treatment of material carried on in the furnace A is disposed through the outlet spout 16 and extends into the discharger, airtight relationship between the spout 16 and the discharger being maintained through the unit 15 as shown in Fig. 1. In Fig. 1 I have indicated flue connection to a chimney through which exhaust gases may be passed after their usefulness in treating material in the drum A is exhausted.

From the above description it will be seen that any material fed through the preheater B into the furnace A will, in the direction of rotation indicated by the arrow in Fig. 1, be tumbled and continuously exposed to the treating effect of gases or chemicals in the presence of the heat of the furnace for a length of time determined in part by the speed of rotation of the furnace, but primarily and principally the treatment will be controlled by reason of the retarding effect of the helical step-like formation of the interior surfaces of the furnace, since the passage of the material through the furnace will be as follows:

Frictional contact of the heated and treated material with the interior surface of the furnace will cause the material to be carried up upon the "trailing" side of the furnace wall and the force of gravity will ultimately, as to any unit of material, cause that unit to fall substantially vertically but practically in a somewhat advanced position to a point at the lowermost portion of

the curve of the helical step whereupon the particular unit of material referred to will be carried up again upon the "trailing" side of the surface and will be then returned again by gravity in a sequence of motions which may require as many as six, eight or more cycles of the material before the force of gravity brings the particular unit to the next step in the helix.

When the material has finally advanced to the discharge end of the furnace it will be deposited upon the helical surface of the discharger and since these surfaces are spirally opposite to those of the furnace, the speed of delivery toward the spout 16 will be materially increased and the material will be fairly rapidly discharged beyond the zone of treatment.

The individual heating units indicated at A^2 with their covers 3 are interlocked as indicated in Fig. 2 which shows a dove-tail lower or outer extension 2 of the unit in dovetail relationship to refractory material 8 with which the furnace 1 is lined, and the unit A^2 is likewise provided at its top surface with dove-tail extensions 4 interlocking with a slot 5 in the cover 3 which protects and locks the electric resistance wire 11 in its position in the slots 9 and provides a protective cover for each heating unit.

Because of the disposal of the various heating units in a helical formation in channel 12, the consecutive placement of the units A^2 in the channel 12 may be followed with the placement of the covers 3 and when the entire helical series of units has been placed, the last unit in position will lock the entire series.

The covers 3 may be formed of any suitable material to properly protect the heating units and the wires 11 and at the same time pass a sufficient amount of heat to the material to be treated inside the furnace.

I claim:

1. The combination with a rotatable furnace body disposed in an inclined position for advance by gravity of material to be treated, of a lining material in helical step-like formation so disposed that as each portion thereof assumes its lowermost position its surface is substantially horizontal whereby material in the furnace is retarded in the advance thereof.

2. The combination with a rotatable furnace in downwardly inclined position, of a lining for said furnace providing a continuous helical surface, the various convolutions of which are in step relationship to each other, the lowermost portions of each step being horizontal.

3. The combination with a rotatable furnace in downwardly inclined position, of a lining for said furnace providing a continuous helical surface, the various convolutions of which are in step relationship to each other, the lowermost portions of each step being horizontal, and a discharger for said furnace provided with an interior lining providing a helical configuration oppositely curved with reference to the helix of the furnace.

4. A heating element for an electric furnace comprising a body slotted to receive resistance wires, a dove-tail extension for mounting the unit in a furnace, a dove-tail extension for a cover, and a cover slotted to receive the last mentioned dove-tail extension and so disposed with reference to the body as to lock the wires in their respective slots.

5. The combination with a furnace provided with a helical arrangement of electrical heating units each comprising a heating element and a dielectric protector therefor each provided with a cover in slidable interlocking relation with the protector and comprising a portion of the lining of the furnace, the covers of the units in each succeeding convolution of the helix abutting the covers of the preceding convolution whereby to prevent the accidental displacement thereof.

6. An electric furnace including an outer cylindrical casing, dielectric material within said casing, grooves in said material for removably retaining a current carrying wire, a lining within the furnace disposed to cover said material and constructed in removable sections, the dielectric material and lining sections being interlocked to removably retain the sections in positions substantially closing said grooves whereby to protect and retain a wire therein, the lining sections interlocked with the grooved material forming a cylindrical structure braced against dislodgement from the cylindrical casing.

7. An electric furnace including an outer cylindrical casing, individually removable units of dielectric material within said casing, said units being individually grooved for removably retaining a current carrying wire, means for retaining said units in positions matching said grooves, a lining within the furnace disposed to cover said material and constructed in removable sections, said units and sections being interlocked to retain the sections in positions substantially closing said grooves whereby to protect and retain a wire within said grooves, the lining sections interlocked with the grooved material forming a cylindrical structure braced against dislodgement from the cylindrical casing.

8. In a furnace rotatable on a tilted axis, the combination of an intake passage at the higher end of the furnace, a discharge passage at the lower end of the furnace and a lining within the intermediate portion of the furnace providing a helically grooved hollow interior communicating with said passages, the grooves of the helix being tilted with respect to the axis to provide steps between adjacent grooves and the tilt of the grooves being such that the groove surfaces are substantially horizontal when rotated to their lowest position.

9. In a furnace rotatable on a tilted axis, the combination of an intake passage at the higher end of the furnace, a discharge passage at the lower end of the furnace and a lining within the intermediate portion of the furnace providing a helically grooved hollow interior, the grooves being tilted with respect to the axis to provide steps between adjacent grooves, said discharge passage being also helically grooved.

10. In a rotatable treatment chamber having a generally cylindrical shape, a discharger thereof having a discharge opening adjacent the axis thereof and a spirally helical interior surface for said discharger to elevate and advance the treated material both axially and centrally radially toward said opening.

PAUL ROSENFELDT.