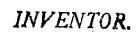


W. B. COOLEY

Belt Conveyer

Filed April 1, 1931

3 Sheets-Sheet 1



William B. Cooley,
BY *John C. Brady*
ATTORNEY.

May 17, 1932.

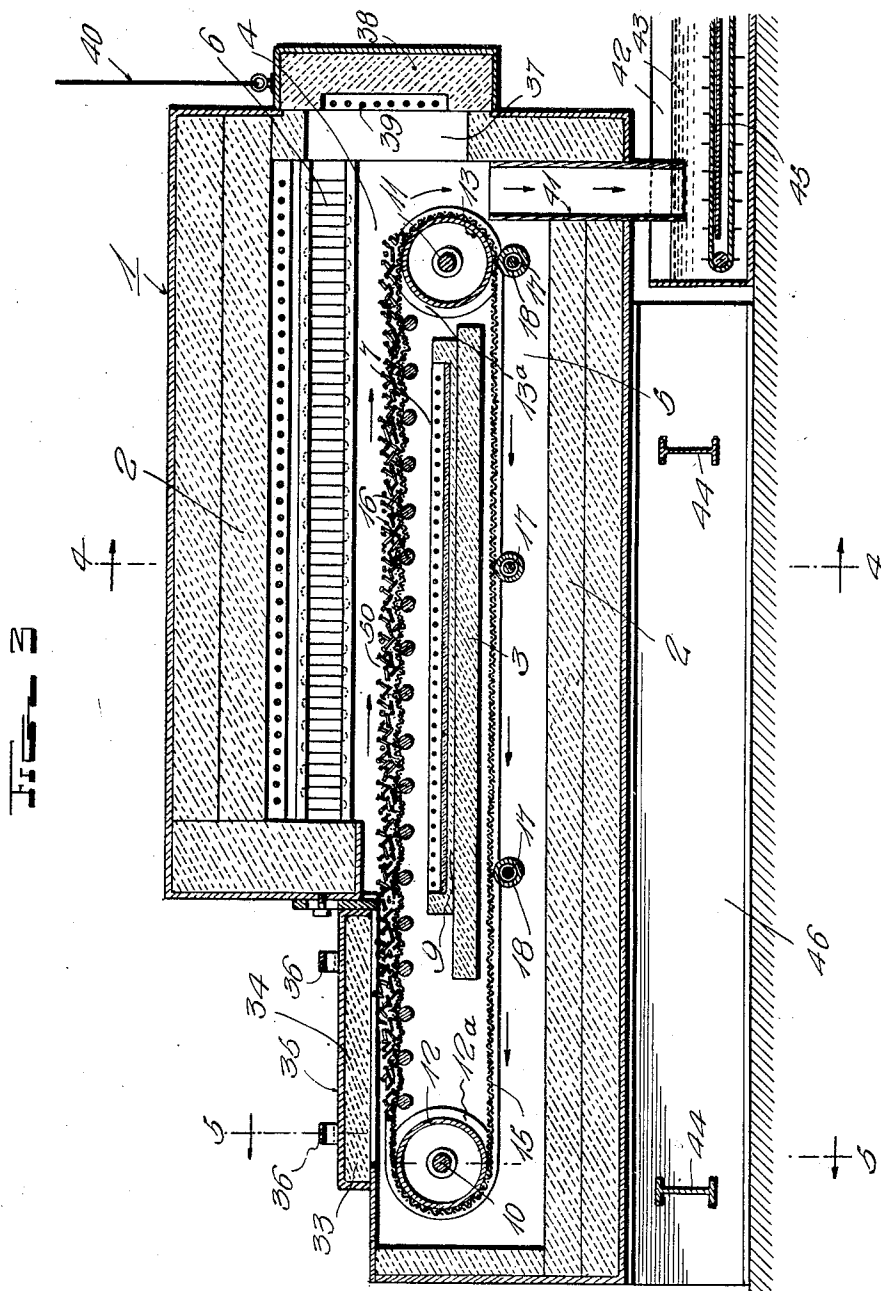
W. B. COOLEY

1,858,764

BELT CONVEYER

Filed April 1, 1931

3 Sheets-Sheet 2



INVENTOR.
William B. Cooley,
BY John O. Brady
ATTORNEY.

May 17, 1932.

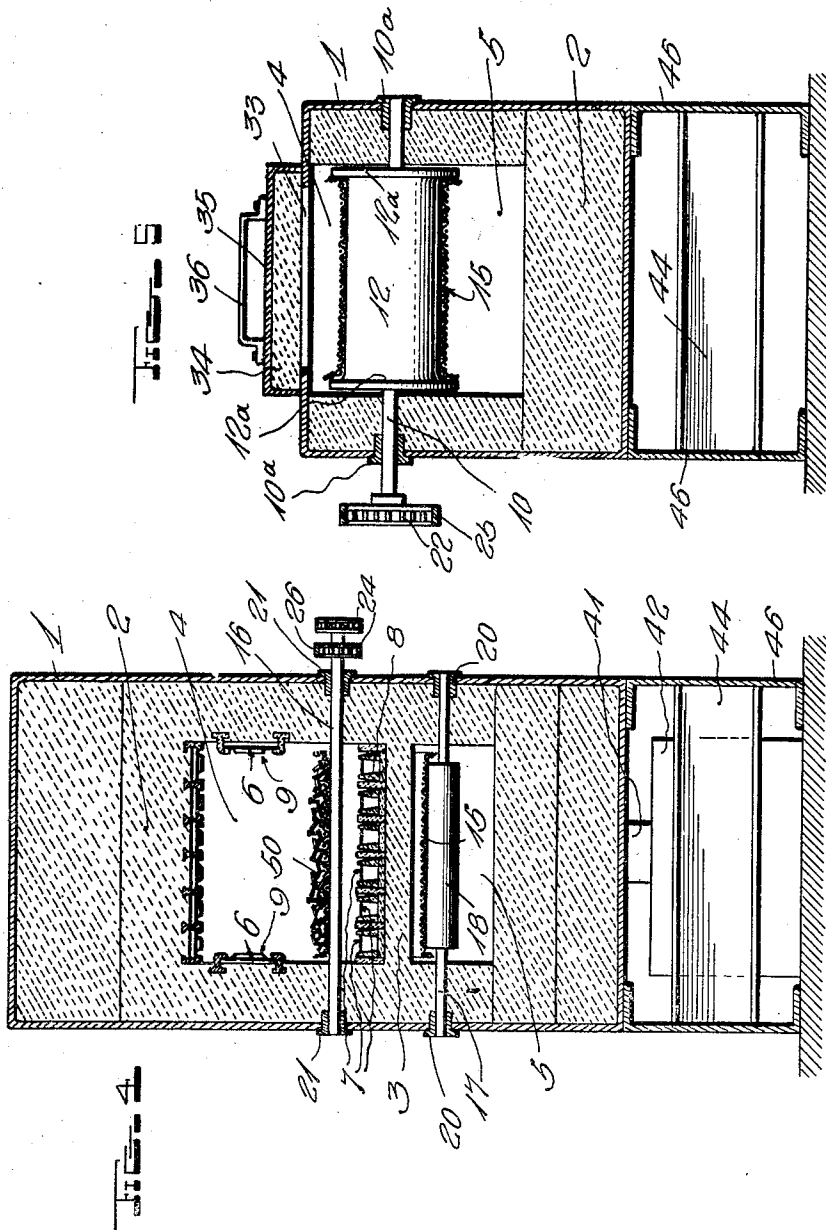
W. B. COOLEY

1,858,764

BELT CONVEYER

Filed April 1, 1931

3 Sheets-Sheet 3



INVENTOR.
William B. Cooley,
BY John C. Brady
ATTORNEY.

UNITED STATES PATENT OFFICE

WILLIAM B. COOLEY, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO HEVI DUTY ELECTRIC COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN

BELT CONVEYER

Application filed April 1, 1931. Serial No. 526,936.

My invention relates broadly to electric furnaces and more particularly to a conveyer furnace of the floating belt type for the continuous heat treatment of small parts.

5 One of the objects of my invention is to provide a construction of floating belt type of conveyer furnace in which small parts may be subjected to heat treatment, the conveyer being arranged to receive material outside of the heating chamber and discharge 10 the material after the heat treatment process at a position adjacent the remote end of the heat treatment chamber.

15 Another object of my invention is to provide a construction of floating belt type of conveyer furnace having means for advancing the belt from a position outside of the heating chamber adjacent the charging end of the furnace to a position within the heating chamber at which the material may be 20 discharged from the belt, provision being made for the uniform distribution of heat throughout the furnace chamber.

25 Still another object of my invention is to provide a construction of floating belt type conveyer furnace wherein material may be subjected to a condition of agitation throughout the period of movement thereof from a position outside of the furnace chamber to 30 a discharge position within the furnace chamber, under conditions of uniform distribution of heat in the furnace chamber.

Other and further objects of my invention reside in the construction of endless belt 35 conveyer furnace as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, wherein:

40 Figure 1 is a side elevation of the conveyer furnace of my invention; Fig. 2 is a plan view of the conveyer furnace shown in Fig. 1 with the charging cover at one end of the furnace partially broken away to show the 45 endless conveyer adapted to receive the small parts to be subjected to heat treatment; Fig. 3 is a longitudinal sectional view taken through the furnace of Figs. 1 and 2; Fig. 4 is a transverse sectional view through the 50 furnace on line 4—4 of Fig. 3; and Fig. 5

is a transverse sectional view through the furnace on line 5—5 of Fig. 3.

In my copending application Serial No. 365,122, filed May 22, 1929, I have described 55 a construction of conveyer type furnace of which my present invention is an improvement. In my present invention, I arrange the floating belt conveyer in such manner that the belt extends beyond the limits of the 60 heat treatment chamber within a projecting portion of the furnace designed to permit the introduction of small parts through a charging door in the furnace directly upon the floating belt for the advancement of the parts 65 through the furnace chamber at a uniform temperature to a discharge position.

The use of the conveyer furnace for the quantity heat treatment of small parts meets a large demand in production processes. 70 When such parts are heated in small batches, it is difficult to maintain uniformity. Considerable labor is involved in the heat treatment of small batches and the heat economy by such a process is small.

75 However, in the floating belt type of furnace of my present invention, hearth plates are eliminated and the bottom heating elements disposed beneath the conveyer arranged to radiate heat directly through the conveyer to the work and by constant revolution heated 80 portions of the rolls which support the conveyer are continually in contact with the conveyer. Unusually rapid heating results which is reflected directly in high economy and minimum scale. Another important 85 effect is a relatively small chamber for a given rate of production, while proper distribution of the heating units insures uniform hardness of the parts treated.

Referring to the drawings in detail, reference character 1 designates a heavy steel 90 shell for the furnace which is suitably reinforced and supported along its entire length by heavy structural beams. The foundation for the furnace consists of longitudinally 95 extending channels 46 braced by laterally extending beams 44. The loading section of the furnace is built integral with the heating chamber of the furnace and provides a unit structure of great strength. The side walls, 100

the ends, and the top and bottom of the furnace are constructed of insulation sheets, slabs and bricks indicated at 2 providing a laminated wall, the materials being selected for their heat resisting qualities at high, medium and low temperatures. This structure provides a maximum resistance to heat flow through the furnace wall. A central transversely extending refractory support is provided within the furnace chamber as indicated at 3 dividing the furnace chamber into a heat treatment chamber 4 and a return chamber 5. In order to obtain uniform temperature in the furnace chamber 4, I provide heating elements 6 on the top and side walls of the furnace chamber as shown. Supported upon the transversely extending refractory 3, I provide heating elements 7 to which the endless belt conveyor 15 is directly exposed. The construction of the heating elements 6 and the reflector plates 9, with respect to which the heating elements 6 are mounted, are set forth more fully in Letters Patent to Edwin L. Smalley, No. 1,768,865, dated July 1, 1930, while coils 7 and refractories 8 are more fully set forth in Letters Patent to Edwin L. Smalley, No. 1,762,701, dated June, 10, 1930. By reason of the arrangement of the heat treatment chamber 4 and the return chamber 5 and the manner of mounting the resistor 7 for directly heating the endless belt 15, the heat lost by the conveyor is reduced to a minimum.

The conveyor 15 consists of a woven mesh belt of the floating reinforcement type and is composed of high grade heat resisting nickel-chromium alloy wire. It is of $\frac{3}{16}$ mesh and will support work of this diameter without it catching in the mesh. Upturned edges prevent the work from dropping off at the sides, the edges being sufficiently flexible to pass around the driving drums 12 and 13. When installed, the two ends of the belt are joined to form an endless belt, and in case of removal, is as readily disconnected at any convenient point.

The drums 12 and 13 are carried by rotatable shafts 10 and 11, respectively, which are journaled at 10a and 11a in the walls and shell of the furnace structure. In order to provide a substantial support for the woven belt 15, I arrange a multiplicity of roller members 16 journaled in the side walls and shell of the furnace as designated at 21, the rollers being disposed within the upper portion of the furnace and within the heat treatment chamber 4 above the resistors 7. Within the return chamber 5, I provide a multiplicity of rotatable shafts 17 carrying rollers 18 adapted to support the return portion of the conveyor 15 and prevent sagging or dragging of the conveyor over the bottom hearth of the furnace. The rotatable shafts 17 are journaled in the furnace shell

as represented at 20. The shafts 10 and 11 carry sprocket wheels 22 and 23 as shown which are linked by chains 25 with the sprocket wheels 24 on the ends of the rotatable shafts 16. The sprocket wheels 24 on the ends of shafts 16 are disposed in staggered relation for effecting a simultaneous multiple drive of the several shafts 16 through the interconnecting chains 26 as shown in Figs. 1 and 2. A drive chain 27 connects with one of the sprocket wheels 24 and driving sprocket 28 carried by shaft 29 supported on the top of the furnace shell 1 as indicated in Fig. 2. Shaft 29 carries bevel gear 30 on the end thereof to which bevel gear 31 is meshed and driven from shaft 32. The charging end of the furnace projects beyond the heating portion of the furnace and is provided with a charging aperture 33 beneath which the woven belt 15 moves. The charging aperture may be closed by a cover 35 containing a refractory portion 34 serving to provide a heat tight closure for the furnace when not being loaded. Handle members 36 are provided to enable the cover to be readily removed and restored in closed position. The discharge end of the furnace is provided with an aperture 37 closed by a door 38 containing a heating element 39. Suitable means such as hoisting cable 40 may be provided for opening the movable door 38. A discharge chute is provided at 41 adjacent the end of the belt 15 extending into a quenching tank 42 containing the quenching liquid shown at 43 in the tank. The discharge chute 41 actually extends below the top of the tank 42 with the bottom end of the chute sealed by the quenching liquid. A conveyor 45 is shown in the quenching tank 42 for moving the material which is discharged thereon. It will be observed that the small parts which are to be subjected to heat treatment are deposited upon the conveyor through the charging aperture 33. The small parts are represented in the drawings by reference character 50. The belt 15 is sufficiently flexible and resilient to establish catenaries between the roller 16 and as the material passes along the belt there is an agitation of these parts. The opposite edges of the belt 15 are confined in position between the flanges 12a and 13a of rollers 12 and 13, respectively, as indicated in Figs. 3 and 5, although the belt is free to travel over and drop between the spaced rollers 16. The catenaries in the conveyor 15 between the rollers 16 form undulations so that any one transverse section of the belt proceeds through the furnace in wave-like projection. This wave-like motion causes a slight tumbling action to small parts of the charge on the belt. This action is sufficient to prevent adjacent parts of the charge being constantly in one contact with respect to each other during the travel of the parts through the

furnace. It is a well recognized condition that small parts, when otherwise progressed through furnaces, are apt to "freeze" together due to any cause such as a slight formation of scale bridging from one piece to another. This has existed to such an extent when heat treating small flat pieces with the flat faces in contact and pushing a mass of such pieces through the furnace as to cause a "freezing" of pieces to such an extent as to require a knock-off device at the discharge point to break up such contact.

The rollers 16 and 18 are nickel-chromium having a low heat conductivity so that the heat loss by conduction is negligible. The drums 12 and 13 also are constructed of nickel-chromium, preferably for working in high temperatures. Because of the fact that the conveyer is not subjected to dragging friction, the life of the conveyer is limited only by a normal durability of the alloy constituting the belt. The drive for the conveyer which connects to shaft 32 may consist of a motor, a speed reducer, and variable speed transmission mounted above the furnace and connected to the rollers as shown.

Scale on steel at temperatures causing oxidation increases rapidly by a prolonged exposure in scale causing temperatures. Owing to the fact that in the furnace of my invention I have shown and described an apertured belt the heat release from the heating elements 7 beneath the conveying portion of the belt 15 augments the rapidity of heating that portion of the charge resting directly on the belt while portions of the charge not in direct contact with the belt are quickly heated from the heating elements in the arch and side walls of the heating chamber as shown. Scale that does accumulate on the bottom hearth is easily removed.

The removable cover at 35 is used during the non-operating periods of the furnace and particularly in heating up the furnace as, for example, after a night or week-end shut down. The cover when disposed in position on the furnace substantially closes the furnace chamber.

The furnace construction of my invention has been found to be highly practical and successful in operation, and while I have described one of the preferred embodiments of my invention, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. An electric furnace comprising a shell, a refractory lining for said shell, a flanged rotatable drum mounted within said shell adjacent each end thereof, a horizontally extending partition in said shell between said

drums, roller members disposed above and below said partition and disposed in lines substantially tangent to the upper and lower peripheries of said drums, an endless flexible conveyer carried by said drums and supported by said roller members and conforming to the shape of said flanged drum, heating elements disposed within said refractory lining above said conveyer, a charging aperture located adjacent one end of said conveyer, and heating elements disposed beneath the conveying portion of said conveyer for the uniform heat treatment of articles disposed on said conveyer through said charging aperture.

2. An electric furnace comprising a longitudinally extending enclosing chamber structure, a pair of rotatable drums each having laterally projecting end flanges thereon, a multiplicity of laterally extending roller members, a flexible endless belt apertured conveyer carried by said rotatable drums and troughed to conform with the flanges on the ends of said drums, said belt being supported on said roller members, a laterally extending wall dividing said chamber into upper and lower portions, said wall being disposed between the upper and lower portions of said conveyer, and heating elements carried by said division wall and within the upper portion of said chamber for subjecting material on said conveyer to heat during the course of the passage of the material through the furnace.

3. An electric furnace comprising an enclosing casing, rotatable drums disposed laterally within said casing one adjacent each end thereof, a multiplicity of laterally extending roller members journaled laterally of said casing intermediate said drums, said roller members being disposed in upper and lower planes, an endless conveyer operative over said drums and having the upper portion thereof supported by the roller members in one plane, and the lower portion thereof supported by roller members in a lower plane, the rollers in the upper plane being so spaced and said endless conveyer being sufficiently flexible and having such slack that catenaries are established between the roller members on the upper level under the weight of a load imposed upon the conveyer, said enclosing casing being cut off on a low level adjacent one end of the furnace for loading the conveyer and extending upwardly above the conveyer adjacent the central portion and opposite end of the furnace for providing a heating chamber therein, and heating means disposed within said chamber and beneath said conveyer.

4. An electric furnace comprising an enclosing casing including a low horizontal end portion and an elevated central and opposite end portion, electric heating means disposed in said central and opposite end

portion and forming a heating chamber, a flexible endless conveyer mounted within said furnace and movable in a substantially horizontal plane immediately beneath a charging door in said low horizontal portion and through said central and opposite end portion of the furnace, and intermediate roller members for supporting said flexible conveyer in said substantially horizontal plane with substantial slack throughout the length of said conveyer, whereby said conveyer is formed into a series of catenaries in the course of the movement thereof over said rollers for successively and continuously agitating the material carried by the conveyer during the movement of the conveyer through the heat treatment chamber.

In testimony whereof I affix my signature.

WILLIAM B. COOLEY.

20

25

30

35

40

45

50

55

60

65