Aug. 4, 1959 C. T. HANNUM ET AL 2,898,101

HEAT TREATING FURNACE HAVING DOUBLE-ENDED CHAIN CONVEYOR

Filed Dec. 5, 1956 2 Sheets-Sheet 1

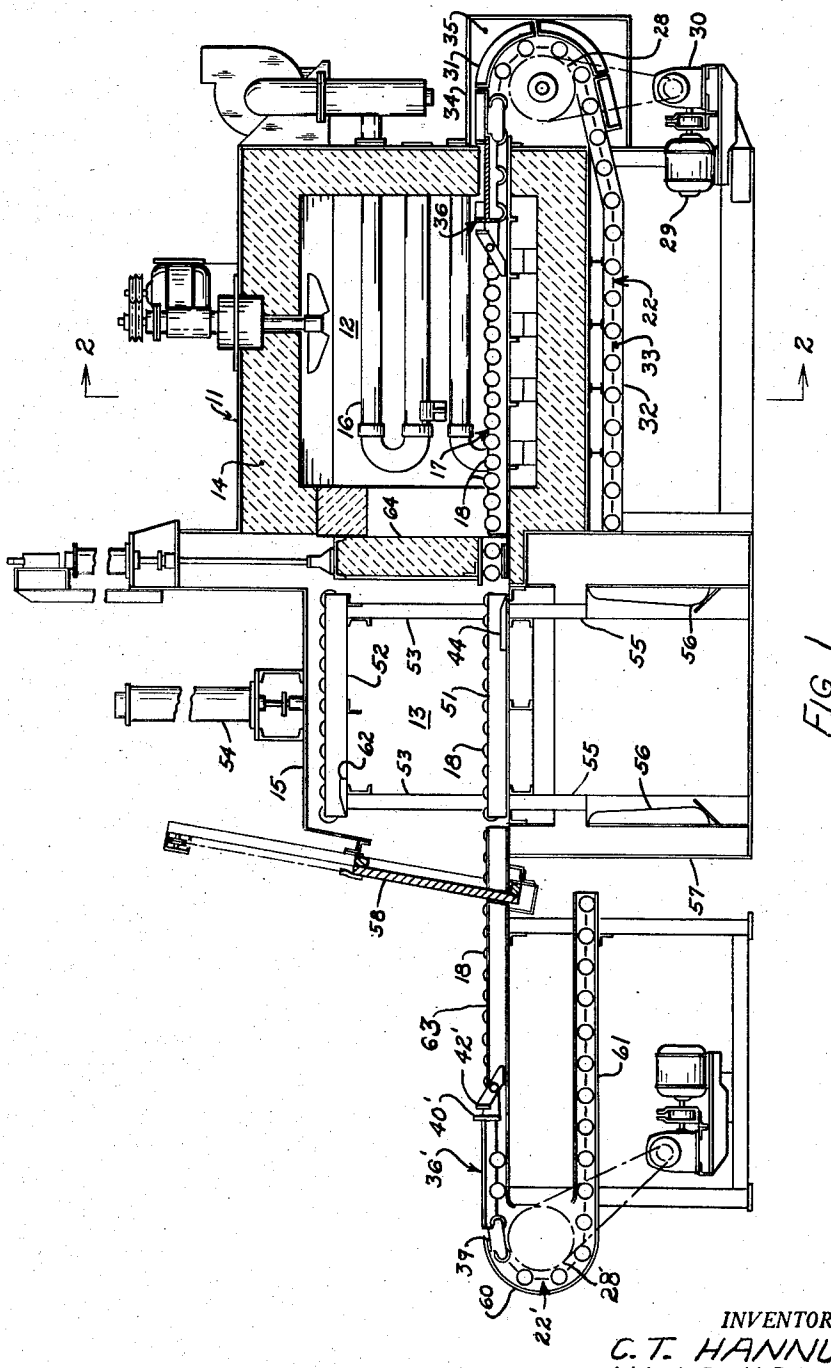


FIG 1

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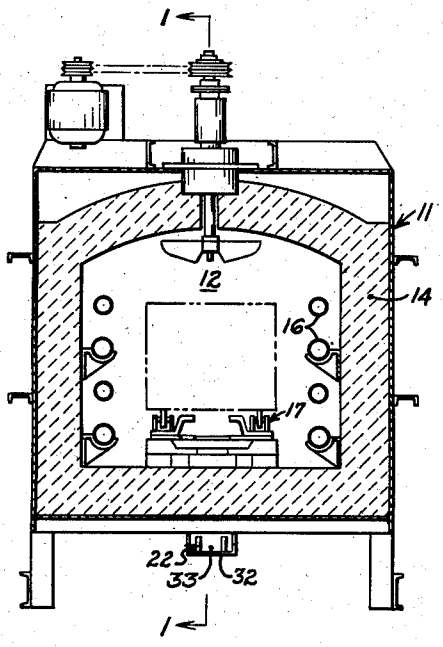


FIG 2

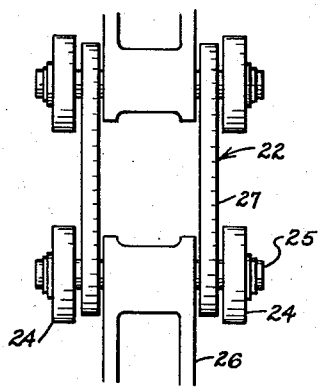


FIG 4

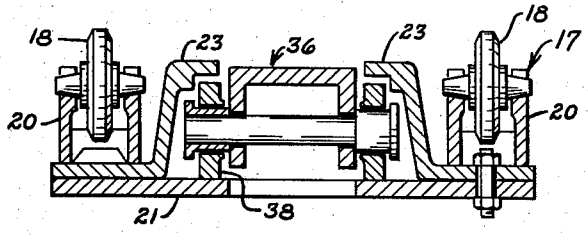


FIG 3

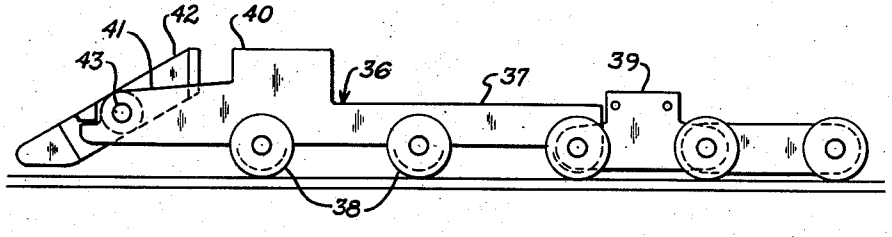


FIG 5

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Patented Aug. 4, 1959

2,898,101

HEAT TREATING FURNACE HAVING DOUBLE-ENDED CHAIN CONVEYOR

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Application December 5, 1956, Serial No. 626,488

6 Claims. (Cl. 266—4)

This invention pertains to a conveyor for heat-treating furnaces and more particularly to a chain conveyor for the same with means associated therewith for pushing and pulling the work to be heat-treated.

The atmospheric batch-type furnace with a vestibule outside the charge-discharge opening and which contains a quench tank below the opening is extremely popular in the heat-treating field. This is principally due to the fact that this type of furnace is compact and can be used with a variety of heat-treating processes including carburizing, nitriding, hardening, carbon restoration, and annealing.

Such furnaces, however, present a problem concerning adequate means for charging and discharging the work since the work must be charged and discharged through the same opening and the area over the quench tank must be kept unobstructed for vertical movement of the quench elevator. A commonly used apparatus consists of one or more retractable hooked rods extended through the vestibule opening to grasp the work tray and which are usually adequate for manual operation but are not readily adaptable for automatic operation. Also, the rods require that a considerable area of clear space be maintained in front of the furnace so that the retraction of the rods will be unobstructed. Other types of charge-discharge apparatus have also been tried with only moderate degrees of success.

Accordingly, a new and novel conveyor has been developed that operates from the front and/or rear end of the furnace automatically. The new conveyor has automatic releasable means for engaging and disengaging the trays carrying the work and further does not obstruct the operation of the quench elevator.

For further consideration of the invention, its advantages and novelty, refer to the following portion of the specification, the appended claims, and the accompanying drawing.

In the drawing:

Figure 1 is a cross-sectional view on line 1—1 of Figure 2 of apparatus embodying the invention,

Figure 2 is a cross-sectional view on line 2—2 of Figure 1,

Figure 3 is an enlarged, cross-sectional view of a portion of Figure 2, and

Figures 4 and 5 are detailed views of other portions of the apparatus of Figures 1 and 2.

Referring to the drawing, the furnace 11 comprises a heating chamber 12 and vestibule chamber 13, the former being formed by refractory wall 14 and the latter by metal wall 15. Chamber 12 is heated by radiant tubes 16 placed on both sides of the roller conveyor 17 which consists of two lines of rollers 18 supported in holders 20 on platform 21. A trough is formed between the holders by platform 21 and members 23 in which chain 22 and cart 36 rests. The chain is prevented from buckling downwardly by platform 21 and upwardly by members 23.

Chain 22 comprises wheels 24, pairs of which are connected by axles 25; links 26 and 27 interconnect the axles in a linear manner. The chain meshes with a sprocket 28 driven through motor 29 and reducer 30 outside the rear end of chamber 12. The outer end of the chain is directed by guides 31 into an elongated receptacle 32, forming volume 33, located beneath the chamber 12. Receptacle 32 communicates with a housing 34 forming chamber 35 encompassing sprocket 28. The entire chain is thus enclosed in a gas-tight space comprising chamber 12, volume 35, and volume 33, and an atmosphere gas may thus be maintained in chamber 12 with a minimum of leakage.

A push-pull cart 36 is attached to the upper end of chains 22 through link 39 and comprises a cast body 37 to which three pairs of wheels 38 are attached. The body has a projection 40 which is of sufficient height to contact a tray on rollers 18. The body also has a horizontally extending arm 41 to which a rotatable dog 42 is attached by pivot 43. The lower end of dog 42 is heavier so as to maintain the opposite end in an upward, engageable position with a projection of the tray except when the lower end is moved upwardly by cam 44. Instead of a projection, a recess or hole in the tray may be provided into which the upper end of the dog projects.

Cam 44 is located on the rearward end of a platform 51 which is located below a second platform 52, both containing rollers 18 and being interconnected by bars 53. The unit forms an elevator which is vertically moved by a hydraulic or pnuematic piston 54 and directed by guides 55 and 56 into quench tank 57.

From this elevator, work may be removed through vestibule door 58 by means of manually operated hooked rods or by a second chain similar to the one at the rearward end of the furnace. The chain 22' is identical to chain 22 except being somewhat shorter in length. It is driven by another sprocket 28' and rides in a similar trough. The cart 36' and its components are likewise similar. The chain is guided here, around the sprocket, by a fabricated metal sheet 60 and has a receptacle 61 which need not be gas tight. The lower end of dog 42' of chain 22' is pushed upwardly by a cam 62 located at the forward end of upper platform 52.

In operation, a tray of work to be heat-treated is placed on charge table 63 and chain 22' is moved forwardly. Projection 40' of the chain then contacts the forward edge of the tray until it reaches the end of its forward travel near the forward end of platform 52 which is lowered into alignment with the rollers 18 on the charge table and in the heating chamber. At this point, the chain is retracted, leaving the tray on platform 52. The upper end of dog 42' is depressed by cam 62 so that the dog cannot catch on the tray and withdraw it. Door 58 is then closed, door 64 opened, and chain 22 advanced toward the forward end of the furnace until dog 42 engages the tray. This chain is then withdrawn to the rear end of the heat treating chamber, leaving the tray properly positioned on rollers 18 in the chamber. At the end of the treating period and with door 64 again opened, chain 22 is advanced and the tray pushed back into vestibule 13 by means of projection 40. The tray then rests on platform 51 which has been raised. Chain 22 is again withdrawn and is free of the tray since the upper portion of the dog 42 is lowered by means of cam 44. The platforms are again lowered so that the work is immersed in the quenching medium and platform 52 is again at the level of the charge table and furnace hearth. While the work is being quenched another tray of work may be charged into the furnace if desired. Platform 52 is raised after the quenching period is over and the tray is discharged from platform 51 by chain 22' and dog 42' which remains in its upward

position when the chain is advanced and engages the tray when the chain is reversed.

It may be seen through the above illustration that the invention provides a quick, efficient means for transporting work in, into, and out of a furnace and allows a tray to be charged while a previously heat-treated tray of work is being quenched. Maximum output may thus be achieved with a given furnace.

The foregoing has been intended to serve in an illustrative and not a limiting sense, the only limitation being in accordance with the scope of the claims appended hereto.

We claim:

1. A heat-treating furnace comprising: a heating chamber; means for heating said chamber; a door controlled opening at the front end of said chamber; a quench tank outside said chamber and below said opening; first conveying means for slidably supporting work in chamber; a trough in said chamber parallel to the direction of travel of the work to be heat treated; a quench elevator having an upper position and a lower position, the latter being in said quench tank; second conveying means for slidably supporting work on said elevator, said second means being aligned with said first conveying means when said elevator is in its upper position; a conveying chain extending through an opening in the back of said chamber, with a first end in said chamber and a second end outside said chamber, said first end being located in said trough; a sprocket located outside the back end of said chamber and enmeshing said chain between its ends; a projection on said first end and extending above the level of the conveying means; a releasable dog associated with said first end and spaced from said projection in a direction toward the front end of said chamber, one end of said dog extending above the level of said conveying means when in its normal position; and a cam on said elevator for releasing said dog, whereby said cam will lower that end of said dog extending above said conveying means when said chain is driven by said sprocket toward the charge end of the furnace and release said dog from engagement with a tray when said chain is withdrawn.

2. Apparatus according to claim 1 characterized by a gas-tight housing outside said chamber which encloses said sprocket and that portion of said chain outside said chamber.

3. In a heat-treating furnace having a heating chamber; means for heating said chamber; a door controlled opening at the front end of said chamber; a quench tank outside said chamber and below said opening; first conveyor means for supporting and moving work in said chamber; a quench elevator having lower and upper platforms which are parallel and in spaced relationship with one another; means for moving said elevator in a vertical manner between an upper and lower position, said lower platform being aligned with said conveyor means when said elevator is in its upper position and said upper platform being aligned with said conveyor means and said lower platform being in said quench tank when said elevator is in its lower position; the improvement which comprises: guide means adapted to be located in said chamber parallel to the direction of travel of work to be heat treated; a conveying chain extending through an opening in the back end of said chamber, with a first end in said chamber and a second end outside said chamber, said first end being associated with said guide means which guides and prevents the chain from buckling; a sprocket located outside the back end of said chamber and enmeshing said chain between its ends; a projection on said first end and extending above the level of the conveying means; a releasable dog associated with said first end and spaced from said projection in a direction toward the front end of said chamber, one end of said dog extending above the level of said conveying means when in its normal position; means for reversibly driving said sprocket; and cam means attached to the rear portion of said lower platform for releasing said dog from engagement with a tray of heat-treated work when said cam means is in contact with said dog.

4. Apparatus according to claim 3 characterized by a charge table located on the side of said quench tank opposite the heating chamber; second conveyor means on said charge table aligned with said first conveyor means; second guide means parallel to the direction of travel of work on said charge table; a second conveying chain, the first end of which is associated with said second guide means, said second chain being guided and prevented from buckling by said second guide means; a second sprocket located adjacent the front of said charge table and enmeshing said second chain; second means for reversibly driving said second chain; a second projection on said first end of said second chain and extending above the level of said second conveyor means; a second releasable dog affixed to said first end of said second chain and spaced from said projection toward said chamber, one end of said dog extending above the level of said second conveyor means when in its normal position; and second cam means attached to the forward portion of said upper platform for releasing said dog from engagement with a tray of work to be heat-treated when said second cam means contacts said second dog.

5. A heat-treating furnace comprising: a heating chamber; means for heating said chamber; a door controlled opening at the front end of said chamber; a vestibule outside of and attached to the front end of said chamber; conveying means for slidably supporting work in said chamber; guide means located in said chamber parallel to the direction of travel of work to be heat treated; a double-ended conveying chain extending through an opening in the back of said chamber with a first end in said chamber and a second end outside said chamber, said first end being located in said guide means; a sprocket located outside the back end of said chamber enmeshing said chain between its ends; a projection on the first end of said conveying chain to engage work on the conveying means; a releasable dog attached to the first end of said conveying chain and spaced from said projection in a direction toward the front end of said chamber, said dog having a normal work engaging position, and means within said vestibule for selectively releasing said releasable dog, said means being externally operable, whereby when said chain is advanced from the rear of the heating chamber toward the vestibule to discharge work from the chamber said means may be operated to release said dog and the chain can be returned to said chamber leaving the work in said vestibule, and when said chain is advanced from the heating chamber into the vestibule to extract work from said vestibule, the releasable dog will remain in its normal position to engage the work so that the work will be pulled from the vestibule into said chamber when the chain is returned thereto.

6. Apparatus according to claim 5 and comprising an elevator located within said vestibule, said elevator having lower and upper platforms which are parallel and in spaced relationship with one another; externally operable means for moving said elevator in a vertical manner between an upper and lower position, said lower platform being aligned with said conveying means when said elevator is in its upper position and said upper platform being aligned with said conveying means when said elevator is in its lower position; and wherein said means for releasing said releasable dog comprises a cam attached to the rear portion of said lower platform whereby when said chain is advanced from the rear of the heating chamber toward the vestibule with the elevator in its upper position, the cam will contact and release said releasable dog, and the chain can be returned to said chamber leaving the work in said vestibule, and

when said chain is advanced from the heating chamber into the vestibule with the elevator in its lower position, the releasable dog will remain in its normal position to engage the work so that the work will be pulled from the vestibule into said chamber when the chain is returned thereto.

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