April 8, 1941. H. BLOUNT ET AL. 2,237,648

APPARATUS FOR HEAT TREATING ARTICLES

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FIG. 1

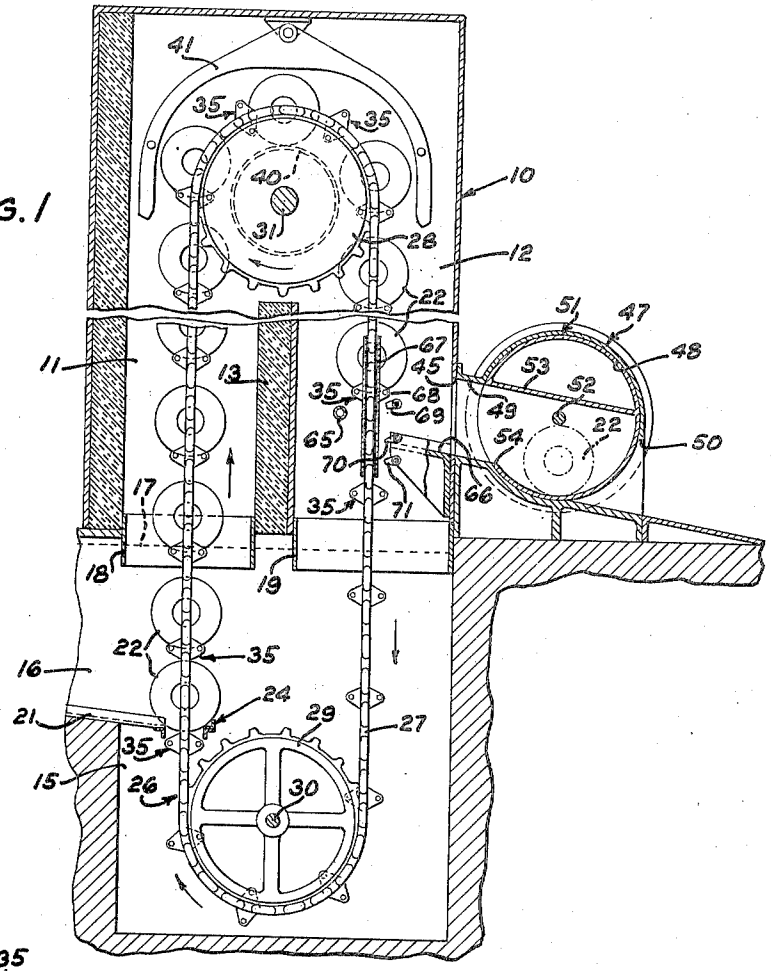


FIG. 4

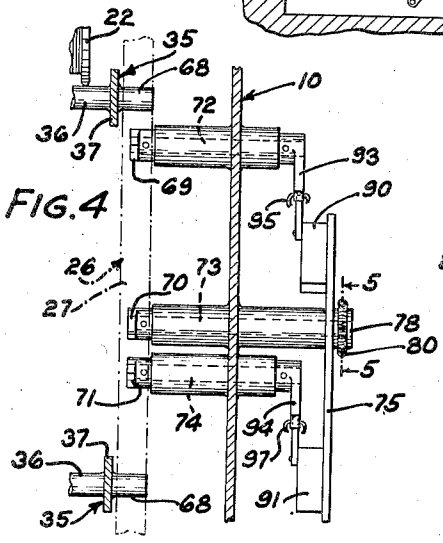
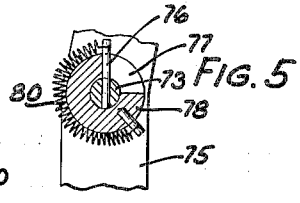


FIG. 5



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APPARATUS FOR HEAT TREATING ARTICLES

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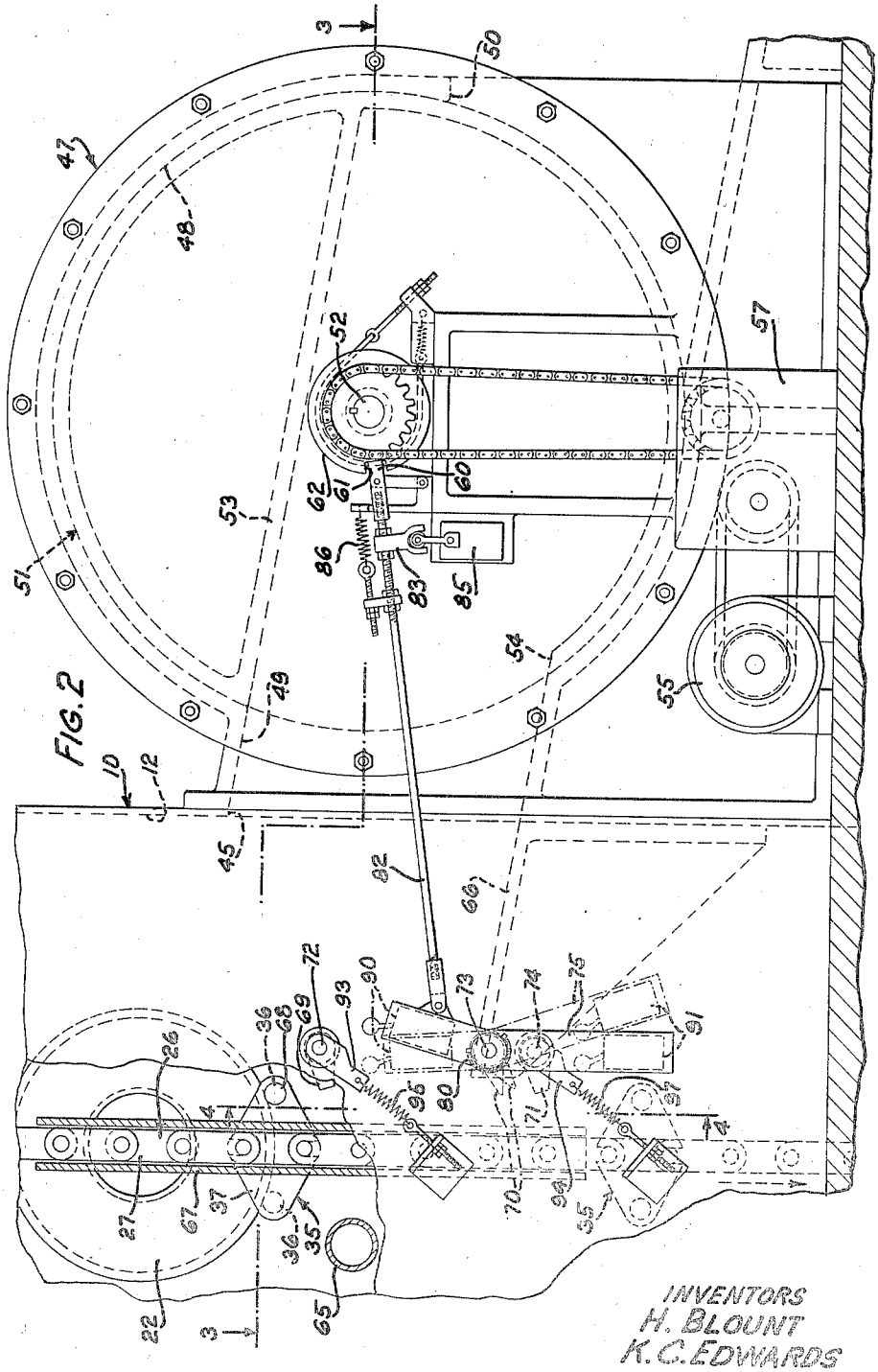


FIG. 2

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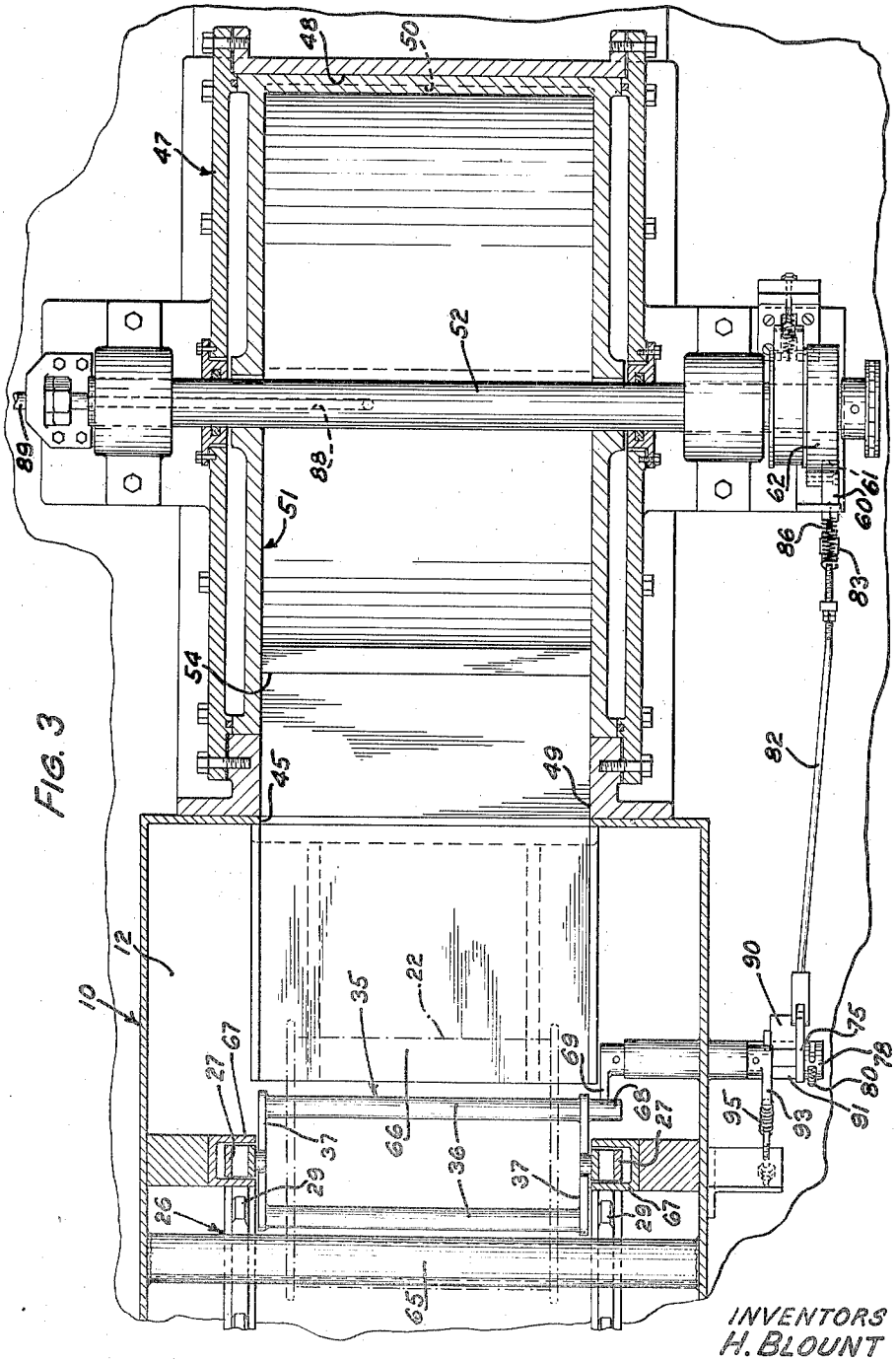


FIG. 3

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APPARATUS FOR HEAT TREATING ARTICLES

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Application May 3, 1939, Serial No. 271,474

7 Claims. (Cl. 214—21)

This invention relates to apparatus for heat treating articles, and more particularly to a discharging mechanism for a copper wire annealing apparatus.

Objects of the invention are to provide a simple, inexpensive and efficient discharging mechanism for heat treating apparatus of the type above referred to.

One embodiment of the invention contemplates the provision of mechanism for automatically discharging spools of copper wire from an annealing furnace, in which a continuously moving conveyor carries the spools first through a heating chamber and then through a cooling chamber from which the spools are discharged through a rotary discharge drum controlled by the conveyor. The drum operates within a cylindrical chamber having separated spool entrance and discharge openings arranged so that at all times one or the other of the openings is closed by the drum. Means is provided for continuously purging the drum with steam to exclude outside air, and mechanism is provided for automatically stopping the spool conveyor upon failure of the drum to operate in timed relation with the conveyor.

Other features and advantages of the invention will become apparent from the following detailed description when read in conjunction with the accompanying drawings, in which—

Fig. 1 is a vertical sectional view, partly broken away, of a copper wire annealing apparatus equipped with a discharging mechanism embodying the features of the invention;

Fig. 2 is an enlarged front elevational view, partly in section, of the discharging mechanism;

Fig. 3 is a plan section on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary detail section on line 4—4 of Fig. 2, and

Fig. 5 is an enlarged detail section on line 5—5 of Fig. 4.

Although not limited thereto, the invention is herein illustrated and described as embodied in a copper wire annealing apparatus comprising an annealing furnace 10 having vertical heating and cooling chambers 11 and 12, respectively, which are separated by a vertical partition 13, as shown somewhat conventionally in Fig. 1. The upper end of the partition is spaced below the upper end of the furnace so as to provide a connecting passage between the upper ends of the two chambers. Below the furnace a loading or charging pit 15 is provided which has a tunnel or loading trench 16 communicating therewith, only a portion of which is shown in Fig. 1. The pit and trench are maintained filled with water to the level indicated by the broken lines in 17 in Fig. 1, and the open lower ends of the heating and cooling chambers have skirt portions 18 and 19, respectively, which project downwardly into the pit and well below the water level, thus sealing the lower ends of the two chambers against ingress of air.

Attached to the bottom of the loading trench is a track 21 along which spools 22, containing copper wire to be annealed, are adapted to roll onto a loading platform 24 disposed within the pit 15 below the heating chamber 11. A continuously moving endless conveyor 26 is provided for automatically lifting the spools from the loading platform and for carrying them upwardly through the heating chamber 11 and then downwardly through the cooling chamber 12. This conveyor, in the illustrated embodiment of the invention, comprises a pair of spaced endless chains 27, 27, each of which travels around upper and lower sprocket wheels 28 and 29, respectively. The upper sprocket wheels are mounted in the upper end of the furnace within the connecting passage between the upper ends of the heating and cooling chambers. The lower sprocket wheels are mounted within the pit 15, below the level of the loading platform, as shown in Fig. 1. As further shown in Fig. 1, the lower sprocket wheels are mounted on a horizontal idler shaft 30 and the upper sprocket wheels are mounted on a horizontal driving shaft 31. An electric motor (not shown) may be provided for driving the shaft 31, whereby the conveyor chains are caused to continuously travel upwardly through the heating chamber and downwardly through the cooling chamber.

A plurality of equi-distantly spaced spool carriers 35, 35 are mounted between and attached at their opposite ends to the two conveyor chains 27. Each of the carriers comprises a pair of horizontal bars 36, 36 which extend between the conveyor chains on opposite sides thereof and are rigidly interconnected at their ends by end plates 37, 37, as best shown in Fig. 3.

The spools are carried upwardly through the heating chamber by the conveyor carriers, being supported upon and between the spaced bars 36 thereof. As each carrier passes around the upper sprocket wheels 28 the spool is automatically transferred therefrom to the preceding carrier by rolling over a drum 40 (Fig. 1) interposed between the upper sprocket wheels. An inverted U-shaped guard 41 is provided for preventing

accidental displacement of the spools as they are carried around the upper sprocket wheels.

The heating chamber may be heated to and maintained at the required temperature by any suitable means (none shown) and any suitable cooling means, preferably a series of water sprays (not shown), may be provided within the cooling chamber for efficiently cooling the spooled wire during its passage therethrough. By the time the spools arrive near the lower end of the cooling chamber, the wire has been cooled to a temperature sufficiently low to prevent deleterious oxidation. Near the lower end of the cooling chamber a discharge opening 45 is provided in the outer wall thereof, through which the spools are discharged from the chamber.

In accordance with an important feature of the present invention, mechanism is provided for automatically discharging the spools of annealed wire from the cooling chamber of the furnace without permitting outside air to enter the furnace. This mechanism comprises a discharge housing 47 having a cylindrical discharge chamber 48. The discharge chamber has a spool entrance opening 49 registering with the discharge opening 45 of the furnace, and a spool discharge opening 50 substantially diametrically opposite the spool entrance opening. A cylindrical discharge drum 51 is mounted for rotation within the discharge chamber by being keyed to a horizontal shaft 52 which is rotatable in the front and rear walls of the discharge housing 47. The discharge drum is formed with an internal reinforcing web or partition 53 and has a peripheral opening 54 adapted to register with either the spool entrance opening 49 or the spool discharge opening 50 of the discharge chamber. The drum is arranged to be rotated by an electric motor 55 (Fig. 2) through a suitable speed reducing mechanism 57. A spring pressed latch bar 60 is adapted to engage a peripheral notch 61 in a cam 62 fixed to the drum shaft to hold the drum in a position in which its opening 54 registers with the discharge opening 45 of the furnace and the spool entrance opening 49 of the discharge chamber.

Mounted within the lower end of the cooling chamber 12 opposite the discharge opening 45 is a fixed abutment, preferably in the form of a rigid horizontal bar or pipe 65, which is positioned in the path of the downwardly moving spools. As each of the spool carriers moves downwardly, the spool supported thereon strikes this bar, whereby the spool is rolled out of the carrier and onto an inclined shelf 66 which guides the spool into the discharge drum 51. Vertical guide channels 67, 67 are provided in the lower portion of the cooling chamber for guiding the conveyor chains 27, whereby lateral displacement of the carriers is prevented while the spools are discharged therefrom. The spools come to rest within the discharge drum in the position indicated by the broken lines in Fig. 1.

As each carrier moves downwardly through the lower portion of the cooling chamber a forwardly projecting lug 68 thereon engages and operates, in succession, three rock arms 69, 70 and 71 (Figs. 2 and 4) attached to vertically spaced horizontal rock shafts 72, 73 and 74, respectively. The upper and lower rock arms 69 and 71 operate safety mechanisms for automatically stopping the spool conveyor 26 upon failure of the discharge drum to operate in timed relation with the conveyor, as hereinafter described more in detail. It will be seen as the detailed description progresses that during normal operation of the discharge mechanism nothing results from the actuation of rock arms 69 and 71 by the spool carrier lugs 68.

The intermediate rock arm 70, as stated above, is attached to rock shaft 73 (Fig. 4) which is journaled in suitable bearings secured to or integral with the front wall of the furnace. One end of this rock shaft projects exteriorly from the furnace wall and a vertical lever 75 is pivotally mounted thereon intermediate its ends. A pin 76 (Fig. 5) is fixed to the rock shaft and extends through an arcuate slot 77 in a hub portion 78 of the lever. A spring 80 normally urges the rock shaft counterclockwise, thus holding the pin against one end of the slot, as shown in Fig. 5. The pin and slot connection permits a limited amount of clockwise movement of rock arm 70 relative to the lever. This permits running the conveyor backwardly, if desired, for the purpose of making repairs or adjustments, in which case the rock arm would be swung in a clockwise direction by the spool carrier lugs 68, but the lever 75 would not be operated.

The rock arm 70 and rock shaft 73 are turned counterclockwise (Fig. 2) by the forwardly projecting lug 68 of each of the spool carriers as they continue to move downwardly after the spools are ejected therefrom. A counterclockwise movement is thus imparted to the lever 75. The upper end of this lever is operatively connected to latch bar 60 by a connecting rod 82 so that counterclockwise movement of the lever withdraws the latch bar from the holding cam notch 61. As the latch bar is withdrawn from the notch, arm 83 on the latch bar rod operates a limit switch 85 which starts the drum driving motor 55, causing a counterclockwise rotation of the drum. When the drum has made approximately one-half of a revolution, the drum opening 54 (Fig. 1) is in alignment with the discharge opening 50 of discharge chamber 48, and the spool rolls out of the drum and into the room.

After discharging the spool the drum continues to rotate in a counterclockwise direction until it makes one complete revolution, whereupon the latch bar is returned by a spring 86 (Fig. 2) into locking engagement with the cam notch 61, thus positively stopping the drum and locking it in position to receive the next spool. The return movement of the latch bar, of course, also operates switch 85 to stop the drum driving motor and causes the return of lever 75 and rock arm 70 to their original positions in time for the next spool carrier to repeat the cycle just described.

The discharge drum is constructed and arranged within the discharge chamber 48 so that at all times it serves as an air excluding closure member for either the spool discharge opening 45 of the furnace or the spool discharge opening 50 of the discharge chamber. To this end, suitable gaskets or the like are employed, as shown in Fig. 3, to provide air excluding joints between adjoining portions of the discharge housing, the drum and the drum shaft. To further exclude the entrance of outside air into the annealing furnace, especially during the discharging of the spool from the discharge drum, the drum is continuously purged with live steam which is introduced through a longitudinal bore 88 (Fig. 3) in the drum shaft to which is connected a steam supply pipe 89.

As mentioned above, safety mechanisms are provided for automatically stopping the spool conveyor 26 upon failure of the discharge drum

to operate in timed relation with the conveyor. These mechanisms comprise two normally closed limit switches 90 and 91 (Figs. 2 and 4), which are mounted upon the upper and lower end portions, respectively, of lever 75. These switches are connected in the operating circuit of the conveyor driving motor (not shown) so that it may be stopped by opening either one of the switches. The upper switch 90 is adapted to be opened by a switch operating arm 93 on rock shaft 72 only when the switch supporting lever 75 is in the position indicated in broken lines in Fig. 2, that is, when the latch bar 60 is in its retracted position. Similarly, the lower switch 91 is adapted to be opened by a switch operating arm 94 on rock shaft 74 only when the switch supporting lever is in the position shown in full lines, that is, when the latch bar is in locking position.

Normally, at each time that rock arm 69 is actuated by a spool carrier, the discharge drum is in position to receive a spool and the latch bar is engaged in the holding cam notch 61. Therefore, the upper switch 90 is normally out of the path of switch operating arm 93 when the latter is swung counterclockwise upon actuation of the rock arm by a spool carrier. The switch, therefore, is not opened and the spool conveyor continues in motion. As soon as the lug 68 of the spool carrier slides past the rock arm 69, the rock arm and the associated switch operating arm are returned by a spring 95 to their original positions in time to be operated by the next spool carrier. If, after making a partial revolution, the discharge drum should stop or fail to make a complete revolution in time to receive the next spool, the latch bar would, of course, be in its retracted position and, therefore, upper limit switch 90 would be in position to be opened by arm 93 upon actuation of rock arm 69 by the next spool carrier, whereby the conveyor driving motor would be stopped automatically. It should be understood that the rock arm 69 should be positioned in advance of spool ejector bar 65 so that it will be operated by each of the spool carriers in time to stop the conveyor and prevent the discharging of any spools therefrom in the event that the discharge drum is not properly positioned to receive a spool.

Normally, at each time that a carrier engages and actuates the lower rock arm 71, the latch bar 60 is in its retracted position and, therefore, the lower limit switch is out of the path of switch operating arm 94 when the latter is swung counterclockwise (Fig. 2). The lower switch, therefore, is not opened and the spool conveyor continues in motion. As soon as each carrier lug 68 slides past the rock arm 71, the rock arm and the associated switch operating arm are returned by a spring 97 to their original positions in time to be operated by the next spool carrier. If, for any reason, the discharge drum should fail to start rotating upon the retraction of the latch bar and the simultaneous operation of switch 85, the latch bar and the switch supporting lever 75 would be returned by spring 86 to their original positions as soon as the spool carrier lug 68 has moved past the rock arm 70. This would occur in time to cause the lower switch 91 to be opened by arm 94 upon actuation of rock arm 71 by the spool carrier lug, whereby the conveyor driving motor would be stopped. The rock arm 71, of course, should be positioned so that it will be operated by each of the spool carriers in time to stop the conveyor and prevent the discharging of any spools therefrom in the event that the discharge drum fails to operate.

It is believed that the operation of the spool discharging mechanism of the present invention will be clearly understood from the foregoing description. The operation of discharging the annealed spools from the annealing furnace is rendered entirely automatic by the use of this mechanism which is operated in synchronism with and under the control of the continuously moving spool conveyor. Also, by means of the above described safety mechanisms, the spool conveyor is automatically stopped upon failure of the discharging mechanism to operate in proper timed relation with the conveyor.

It is to be understood that the invention is not limited to the particular embodiments thereof herein illustrated and described, but is capable of other applications within the scope of the appended claims.

What is claimed is:

1. In an apparatus for heat treating articles, a treating chamber, a continuously moving conveyor for carrying articles through said chamber, means for discharging treated articles from said chamber, a rotary drum for receiving discharged articles, said drum having an inlet opening adapted to communicate with the interior of said chamber, means for rotating said drum, and means rendered effective automatically upon failure of said drum rotating means for stopping said conveyor.

2. In an apparatus for heat treating articles, a treating chamber having a discharge opening, a rotary drum for sealing said opening, said drum having an inlet opening adapted to communicate with said chamber through said discharge opening, means including a conveyer for transferring treated articles from the chamber to the drum, means for rotating the drum in timed relation with said conveyer, and means controlled by said drum for stopping said conveyer when said drum fails to operate in timed relation with said conveyer.

3. In an apparatus for heat treating articles, heating and cooling chambers, an endless conveyor having a series of spaced carriers for carrying articles through said chambers, means for discharging treated articles from said cooling chamber, movable means operable in timed relation with the movement of the conveyor for receiving discharged articles, means under the control of said carriers for actuating said receiving means in timed relation with the movement of the conveyor, and means under the control of said receiving means for stopping the conveyor upon failure of said receiving means to operate in timed relation with the movement of the conveyor.

4. In an apparatus for annealing spooled wire, heating and cooling chambers, a conveyor having a series of spool carriers for carrying spools of wire through said chambers, a spool discharging drum having a spool entrance opening adapted to communicate with the interior of the cooling chamber, means for transferring spools from the conveyor carriers to the discharging drum, and means controlled by the conveyor carriers for rotating the drum to discharge the spools therefrom.

5. In an apparatus for annealing spooled wire, heating and cooling chambers, a continuously moving conveyor having a series of spool carriers for carrying spools of wire through said chambers, a rotary drum for receiving spools from said cooling chamber, means for operating said drum in predetermined timed relation with the movement of the conveyor, and means ren-

dered effective automatically for stopping said conveyor upon failure of said receiving means to operate in predetermined timed relation with the movement of the conveyor.

6. In an apparatus for annealing spooled wire, heating and cooling chambers, a conveyor having a series of spool carriers for carrying spools of wire through said chambers, a rotary drum for receiving spools from said cooling chamber, means controlled by said carriers for rotating the drum in predetermined timed relation with the movement of the conveyor, and means actuated by said carriers under the control of the receiving drum for stopping the conveyor upon failure of said drum to operate in said timed relation with the movement of the conveyor.

7. In an apparatus for annealing articles, heating and cooling chambers, a continuously moving conveyor having a series of carriers for carrying articles through said chambers, means for discharging annealed articles from said cooling chamber, a rotary drum for receiving the discharged articles, means for rotating the drum to discharge the articles therefrom, means actuated by the carriers for operating said drum rotating means in timed relation with the movement of the conveyor, and means actuated by said carriers under the control of the drum for stopping the conveyor upon failure of said drum to operate in said timed relation with the movement of the conveyor.

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