April 17, 1951 F. T. COPE ET AL 2,549,666

STRIP THREADING APPARATUS

Filed Jan. 11, 1949 3 Sheets-Sheet 1

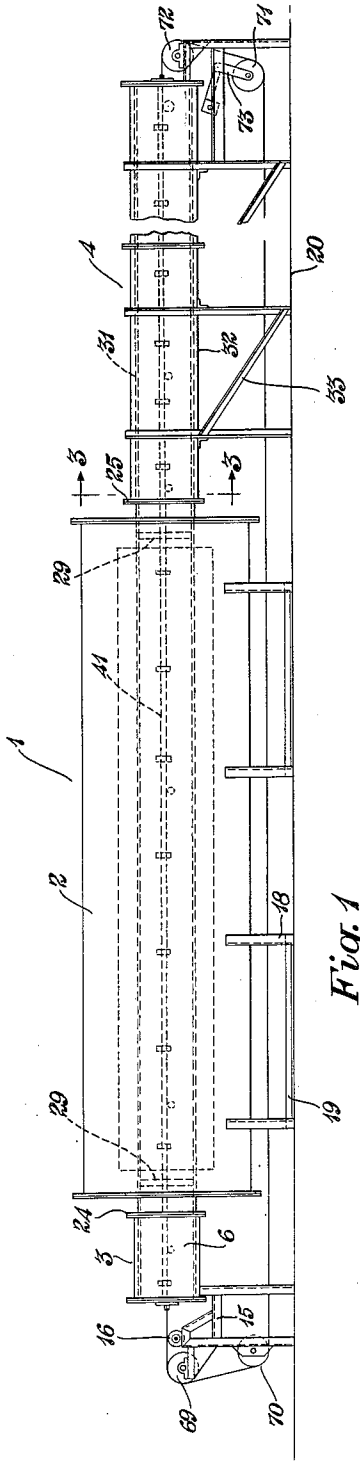


Fig. 1

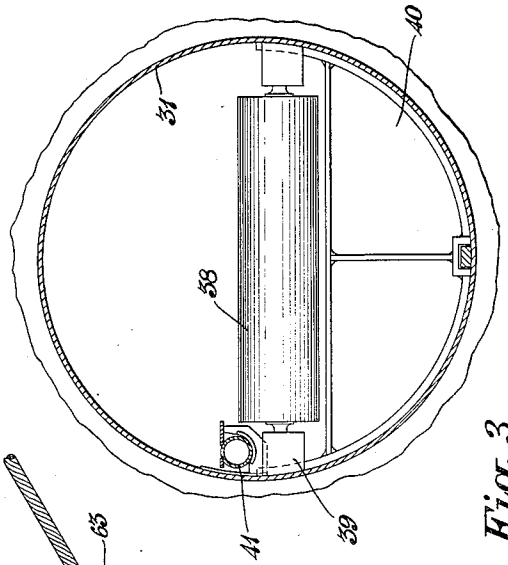


Fig. 3

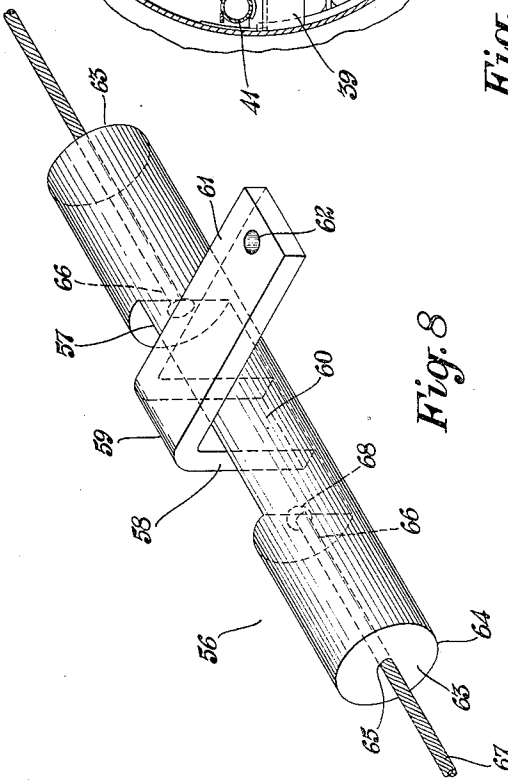


Fig. 8

INVENTORS
Frank T. Cope and
Kenneth U. Wirtz
BY Fraser and Bishop
ATTORNEYS

April 17, 1951 F. T. COPE ET AL 2,549,666

STRIP THREADING APPARATUS

Filed Jan. 11, 1949 3 Sheets-Sheet 2

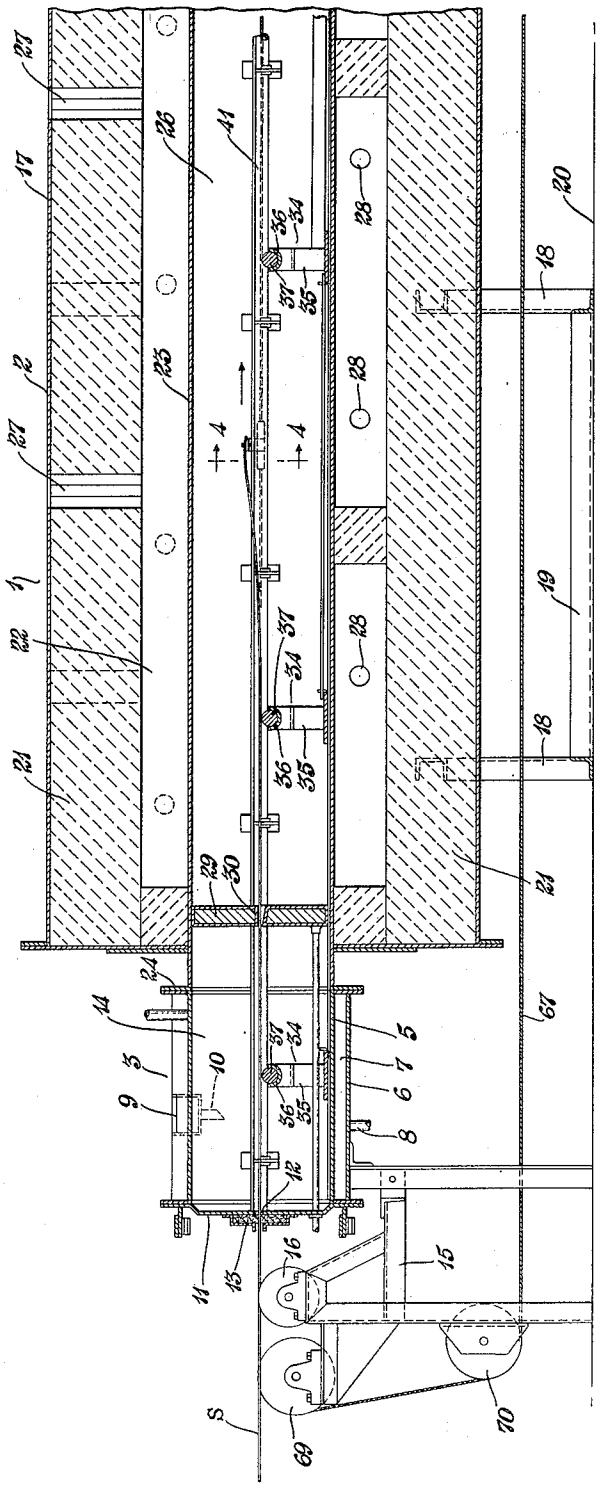


Fig. 2

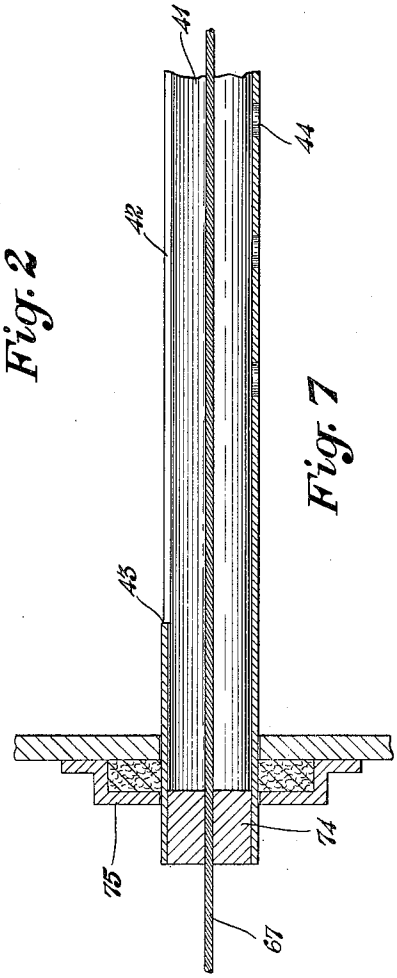


Fig. 7

INVENTOR.
Frank T. Cope and
Kenneth U. Wirtz
BY Frease and Bishop
ATTORNEYS

April 17, 1951 F. T. COPE ET AL 2,549,666

STRIP THREADING APPARATUS

Filed Jan. 11, 1949 3 Sheets-Sheet 3

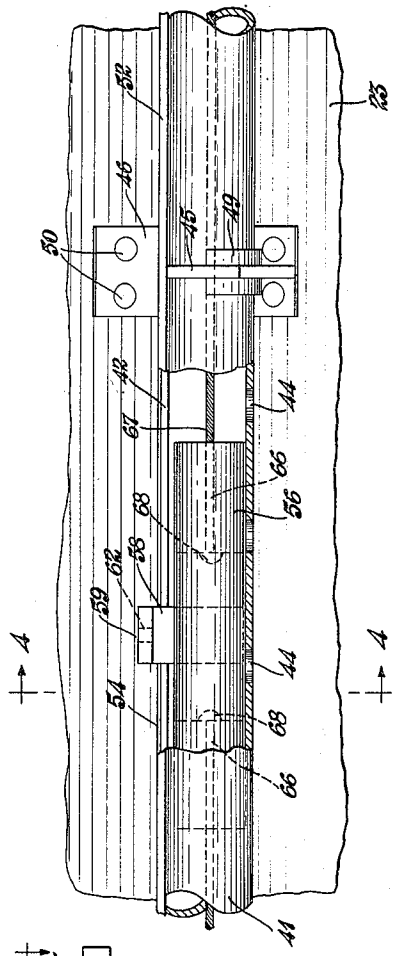


Fig. 6

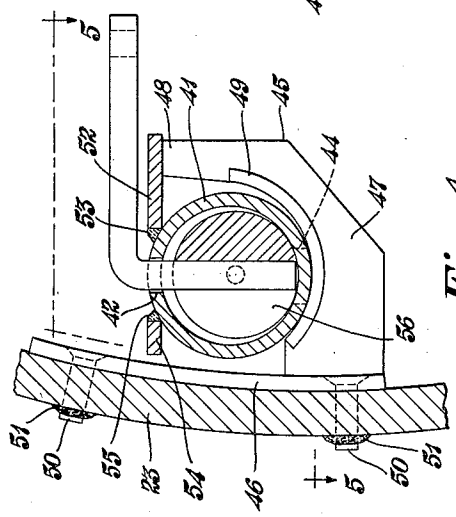


Fig. 4

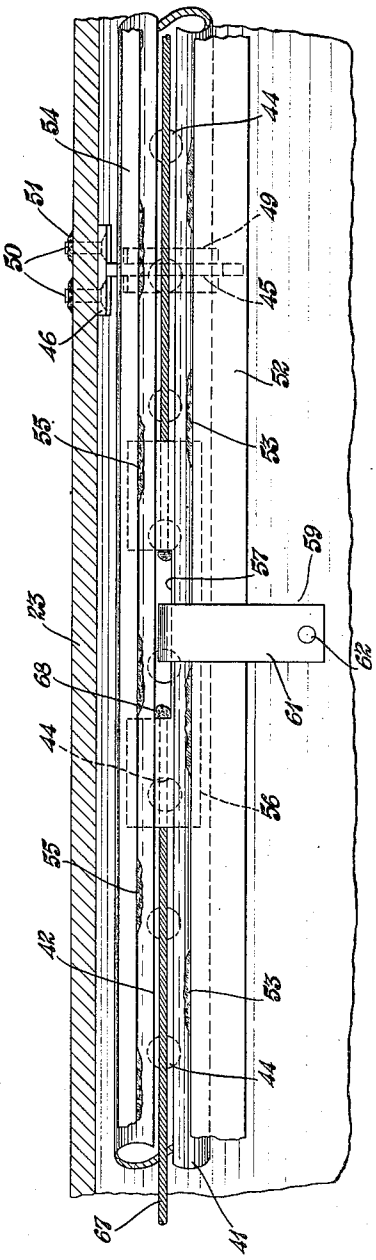


Fig. 5

INVENTOR.
Frank T. Cope and
Kenneth U. Wirtz
BY Fraser and Bishop
ATTORNEYS

Patented Apr. 17, 1951 2,549,666

# UNITED STATES PATENT OFFICE

2,549,666

## STRIP THREADING APPARATUS

Frank T. Cope and Kenneth U. Wirtz, Salem, Ohio, assignors to The Electric Furnace Company, Salem, Ohio, a corporation of Ohio

Application January 11, 1949, Serial No. 70,354

10 Claims. (Cl. 263—3)

1

The invention relates generally to furnaces and more particularly to apparatus for threading strip material and the like through a continuous furnace such as, for example, a furnace constructed and operated for the continuous bright annealing of strip steel and the like.

Continuous furnaces are used by various steel producers and fabricators for continuously bright annealing stainless steel strip. Such furnace installations normally include a muffle type heating chamber, an entrance vestibule and a cooling tunnel. The chambers of the entrance vestibule, heating furnace and cooling tunnel are maintained filled with a special atmosphere devoid of oxygen so that the strip surfaces are maintained bright during the annealing operation. Sometimes baffle members are interposed between the entrance vestibule and heating furnace, and the heating furnace and cooling tunnel. Such a furnace is generally disclosed in the Frank T. Cope application, Serial No. 37,205, filed July 6, 1948.

For various reasons the over-all length of such a furnace installation, that is of the entrance vestibule, heating furnace and cooling tunnel, is becoming longer and longer in new installations.

The continuous annealing of strip metal in such a furnace requires a first strip length to be threaded through the furnace, and succeeding strip lengths then are joined, end to end, to enable continuous operation. Sometimes a number of strip strands are passed side by side through such a continuous annealing furnace. Very frequently the strip material being treated is stainless steel and of extremely light gauge. Such strip material sometimes breaks in being passed continuously through the annealing furnace. This requires rethreading the furnace.

Early continuous bright annealing furnace installations were relatively short in length, and the difficulty of threading a strip through such a furnace was not serious. However as furnace installations of this type have become increasingly longer, it has become increasingly more difficult to thread a strip therethrough.

Various means have been proposed and used for threading strips through such furnaces but such means have either been complete failures or completely unsatisfactory. In some instances, a lead member has been shot through the furnace with a projectile. Nevertheless, such an expedient cannot be used where the furnace installation includes baffle members having relatively small communicating slots or openings between successive chambers.

In another instance a trough has been provided extending along and within the furnace muffle and a jointed rod with a hook dragging the threading strip was intended to be pushed along the trough. Unfortunately, the section of the muffle in the heating chamber would warp so that the trough section attached thereto would move out of alignment with trough sections in the entrance vestibule and cooling tunnel sufficiently that it was impossible to push the jointed threading rod along the trough throughout the length of the installation.

2

Because of these difficulties, when a strip has broken during furnace operation, in certain instances it has been necessary to shut down and cool the furnace, and then to send a man through the various chambers of the installation dragging a lead strip therethrough.

Thus a serious and unsolved problem exists in the art which is becoming more aggravated as furnace lengths are increased. These difficulties and the unsolved problem cause undesirable interruptions in the continuous processing of strip steel and seriously hamper efficient operation.

Accordingly it is a primary object of the present invention to provide a new strip threading apparatus for a continuous strip treating furnace such as a bright annealing furnace.

Furthermore, it is an object of the present invention to eliminate difficulties heretofore encountered in threading a strip to be treated through a continuous strip treating furnace installation.

Also it is an object of the present invention to provide a new strip threading apparatus for a furnace for continuously bright annealing light gauge stainless steel strip having a muffle type heating chamber provided at one end with an entrance vestibule and at the other end with a cooling tunnel.

Moreover, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace including a continuous threading tube extending throughout the length of the furnace installation through which a bobbin is confined and passed to drag a strip attached to the bobbin through the furnace.

Likewise, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace having a strip threading tube extending throughout the length of the furnace, in which the strip threading tube may be moved from time to time, endwise, to minimize warpage distortion of the threading tube due to extended heating thereof at relatively high temperatures.

Furthermore, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace having a strip threading tube extending entirely therethrough, through which tube a bobbin is passed to drag a strip for threading the furnace, in which the threading tube is constructed and arranged so that passage of the bobbin therethrough cannot be blocked because of normal tube warpage, or the accumulation in the threading tube of dirt, scale and other foreign material, and in which the bobbin and tube are constructed so that the bobbin cleans the threading tube in passing therethrough.

Also, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace including a threading tube and a bobbin movable therethrough, in which the bobbin has a member extending to a location exterior of the tube for securing the strip to be threaded to the bobbin, and in which means is provided for preventing the bobbin from getting out of the tube or "jumping the track."

Moreover, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace utilizing a threading tube extending through the furnace muffle and mounting means for the tube, which present minimum resistance to the uniform exterior heating of the muffle.

Also, it is an object of the present invention to provide a new strip threading apparatus for a continuous furnace, including a threading tube extending entirely through all of the successive chambers of the furnace installation and to the exterior thereof at either end of the installation, in which the threading tube is constructed so that the ends thereof may be sealed against gas leakage from the furnace interior through the tube to the external atmosphere.

Furthermore, it is an object of the present invention to provide a new method of threading strip material and the like through a continuous furnace.

Finally, it is an object of the present invention to provide a new apparatus for threading strip material and the like through a continuous furnace, particularly a furnace for bright annealing light gauge stainless steel strip, which is extremely easy to construct and operate, which is effective and fool-proof in use, which enables the ready threading of a strip through a very long furnace installation without shutting down or cooling the furnace, which overcomes the foregoing prior art difficulties, which solves long-standing problems in the art, and which obtains the many new results and advantages herein set forth.

These and other objects and advantages apparent to those skilled in the art from the following description and claims may be obtained, the stated results achieved, and the described difficulties overcome, by the processes, methods, steps, procedures, discoveries, principles, apparatus, combinations, parts, sub-combinations and elements which comprise the present invention, the nature of which is set forth in the following general statement, a preferred embodiment of which—illustrative of the best mode in which applicants have contemplated applying the principles—is set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the present improvements in



apparatus for threading strip material and the like through a continuous furnace may be stated in general terms as preferably including, in a muffle type furnace having a preferably metal retort heating chamber therein with baffles at either end of the heating chamber and having an entry chamber ahead of the heating chamber and a cooling tunnel beyond the heating chamber, and also having a special atmosphere devoid of oxygen maintained in said entry, heating and cooling chambers; a series of threading tube support members located within and along the muffle tube throughout the entry, heating and cooling chambers, a preferably cylindrical threading tube having a slot extending lengthwise of the tube substantially throughout the length thereof located in and extending continuously throughout the length of the entry, heating and cooling chambers and movably supported by said support members, a bobbin located and confined in the tube and movable lengthwise thereof, means on said bobbin extending through said slot to the exterior of the tube for attaching thereto the end of a strip to be threaded through the furnace, means for moving the bobbin in either direction through the tube, said last-mentioned means extending beyond the ends of the tube for manipulation, and means for sealing the bobbin-moving means at the ends of the tube to prevent leakage of furnace atmosphere through the tube to the exterior of the furnace.

By way of example, a preferred embodiment of the improved strip threading apparatus is illustrated in the accompanying drawings forming part hereof wherein:

Figure 1 is a diagrammatic side elevation, with parts broken away, of a furnace installation equipped with the improved strip threading apparatus of the present invention;

Fig. 2 is an enlarged longitudinal section of the entry chamber and a portion of the heating chamber of the apparatus illustrated in Fig. 1;

Fig. 3 is a fragmentary section looking in the direction of the arrows 3—3, Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view taken as on lines 4—4, Figs. 2 and 6, illustrating the construction of the improved threading tube, bobbin, and tube support members of the present invention;

Fig. 5 is a fragmentary top plan sectional view of the parts shown in Fig. 4, looking in the direction of the arrows 5—5, Fig. 4;

Fig. 6 is a fragmentary side elevation view of certain of the parts shown in Figs. 4 and 5;

Fig. 7 is a fragmentary section of the entrance end of the improved threading tube showing the gas seal therefor; and

Fig. 8 is an enlarged perspective view of the bobbin used in the improved strip threading apparatus.

Similar numerals refer to similar parts throughout the various figures of the drawings.

A continuous furnace for bright-annealing stainless steel strip and the like is generally indicated at 1 and includes a muffle-type heating furnace 2, an entrance vestibule 3 and a cooling tunnel 4. The equipment may have an over-all length of as much as one hundred feet or more. The entrance vestibule 3 preferably includes inner tubular preferably circular metal walls 5 and outer spaced walls 6, forming a compartment 7 which may be maintained filled with water or other cooling liquid introduced through pipe 8 and which may overflow at 9 to drain 10.

The entry end of entrance vestibule 3 is closed by a door plate 11 having a narrow slot opening 12 therein, through which a strip S, such as stainless steel strip, being treated may be passed. Preferably felt sealing means 13 are mounted on the door plate 11 having upper and lower felt strips engaging the upper and lower surfaces of the strip S so as to effectively seal the opening 12 and prevent the entry of atmospheric air into chamber 14 formed by inner vertibule wall 5.

An entrance support 15 including roll 16, preferably formed of asbestos cloth discs, is provided ahead of entrance vestibule opening 12, the strip S passing over or being supported by roll 16 as it passes into the bright-annealing apparatus.

Referring more particularly to Fig. 2, the muffle-type furnace 2 preferably comprises a circular shell 17 suitably reinforced and supported by structural steel members 18 and 19 on the floor 20. The furnace is preferably lined with suitable insulating refractory material 21 to provide a circular heating chamber 22 within which is located a horizontally-extending preferably circular or tubular metal retort furnace muffle 23, preferably formed of heat-resisting alloy metal, such as nickel-chrome-iron. Muffle 23 is provided with flanged ends 24 and 25 which may be connected in any usual gas-tight manner, respectively, with the entrance vestibule 3 and the cooling tunnel 4. A chamber 26 is formed in the interior of the muffle tube 23 wherein the strip S is heated.

Suitable openings 27 may be provided in the refractory walls 21 of the furnace 2 to serve as flues or to receive thermocouples and other regulating and control equipment, not shown.

The heating chamber 22, surrounding the muffle 23, is heated by a number of fuel burners 28 which preferably are gas burners, although any suitable type of fuel may be used. The gas, or other fuel, and air for combustion, may be supplied by any usual suitable equipment, not shown.

A baffle member 29 is located within muffle tube 23 near each end thereof, and each baffle member 29 is preferably formed with a slotted opening 30 therethrough, through which the strip S may be passed.

The cooling tunnel or duct 4 is formed with inner cylindrical metal shell walls 31 and spaced outer walls 32 supported in a suitable manner as at 33 on floor 20. A chamber is thus formed between the walls 31 and 32 which is maintained filled with cooling liquid, such as water, introduced and drained from the chamber in a manner similar to the introduction and drainage of cooling water in chamber 7 of entrance vestibule 3.

Strip support means generally indicated at 34 are located at spaced intervals within the entrance vestibule 3, a portion of muffle 23 and along cooling tunnel 4. The strip support means 34 may be of the construction illustrated in Fig. 2 comprising bracket or pedestal members 35 having trough-like portions 36 at the top thereof in which rods 37 are received. Alternately, if desired, as illustrated in Fig. 3 which shows the first roll beyond the muffle chamber 26 in cooling tunnel 4, strip-supporting rolls 38 may be journalled for ready rotation in suitable, preferably self-aligning bearings 39 on the pedestal support 40. Where rods 37 are used, they may be, and preferably are, formed of graphite. If rolls are used, they must be light in weight and must be provided with smoothly-finished surfaces and with proper bearings for extremely easy rotation.

In accordance with the present invention a continuous threading tube 41 is mounted within and extends throughout the length of the entrance vestibule 3, the heating furnace 2 and the cooling tunnel 4, the baffle openings 30 being shaped at one end to permit the tube 41 to extend through the baffles from chamber to chamber. The threading tube 41 is preferably cylindrical and is formed at its top with a slot 42 extending lengthwise substantially throughout the length of the tube 41. The slot 42 terminates at 43 short of the ends of the tube 41 as illustrated in Fig. 7 for a purpose to be later described. Holes 44 are provided at spaced intervals in the bottom of the tube 41 for permitting dirt or other foreign material to be cleared from the interior of the tube.



Support members generally indicated at 45 are located at spaced intervals within the vestibule wall 5, the muffle wall 23 and the cooling tunnel wall 31 for mounting the threading tube 41. Each support or carrier member 45 (Figs. 4, 5 and 6) is provided with a mounting plate or flange 46, a generally L-shaped bracket portion 47 terminating in an upright finger 48, and a curved saddle flange 49 extending longitudinally of the tube 41 from each side of the bracket portion 47. The mounting plates 46 of the support members 45 are rigidly secured or mounted in any desired manner on walls 5, 23 and 31. This may be accomplished by the use of pins 50 extending through plate 46 and wall 23 (Fig. 4), the extended end of each pin 50 being welded at 51 to the exterior of the wall 23.

The spacing between support members 45 is sufficiently close to avoid sagging of the tube 41 when heated. The saddle flanges 49 provide an extended surface support for the tube 41 so as to distribute the load and reduce the possibility of distorting the bottom wall of the tube 41 where supported, while the tube is subjected to continued heating.

A bearing strip 52 is welded at 53 to the top of the tube 41 adjacent the slot 42 and extends throughout the length of the tube 41. A similar strip 54 is welded at 55 to the top of the tube adjacent the other side of slot 42. These strips 52 and 54 are preferably located in coplanar relation and form outturned flanges adjacent the edges of slot 42. The flange strip 52 rests on the top of the finger 48 of each support member 45 so as to prevent rotation of tube 41 in a clockwise direction (Fig. 4). Any tendency of the tube 41 to rotate in a counterclockwise direction is prevented by the strip flange 54 striking the mounting flanges 45 of support members 45. Thus, the strip flanges 52 and 54 in cooperation with the support members 45 hold the tube 41 in such position that the slot 42 therein is always at the top of the tube.

However, the tube 41 is free to be moved endwise by sliding on saddle flanges 49. This movable mounting of tube 41 is important in order that the tube can be shifted endwise from time to time to compensate for any sag which may tend to develop in the tube incident to extended exposure to heating at high temperatures. When the slot 42 is located at the top of the tube, any sag in the tube that may develop will have a tendency to close the slot 42, but this is prevented by the presence of the strip flanges 52 and 54 which strengthen and stiffen the tube walls adjacent the slot 42.

Also in accordance with the present invention, a bobbin member generally indicated at 56 (Fig. 8) is mounted for movement to and fro within

the threading tube 41. The bobbin 56 is elongated and preferably generally cylindrical in form, and has a diameter somewhat smaller than the interior diameter of the threading tube 41 as well shown in Fig. 4. A notch 57 is formed in the central portion of bobbin member 56 and one leg 58 of an L-shaped bracket 59 is fixedly mounted on the reduced central portion 60 of the bobbin member 56.

When the bobbin 56 is located in the threading tube 41 (Fig. 4) the leg 58 of L-shaped bracket 59 extends substantially vertically upwardly through tube slot 42, and the other leg 61 of the bracket 59 projects substantially horizontally toward the interior of the chambers formed by walls 5, 23 and 31. An aperture 62, or other means, is provided at the end of bracket leg 61 for connection to the leading end of a strip to be threaded through the furnace.

The ends 63 of the bobbin member 56 are preferably formed with sharp corners 64 so that as the bobbin is moved to and fro along threading tube 41, the bobbin ends will dislodge or scrape dirt and other foreign material which may form in, or become lodged in, threading tube 41. As such material is scraped by the bobbin, it falls from the threading tube through the holes 44 provided therein.

Longitudinal apertures 65 are also formed in the end portions of the bobbin member 56 through which the ends 66 of a cable 67 may be passed, the cable ends being welded or otherwise secured as at 68 to the bobbin member (Fig. 5). The cable 67 extends endlessly from the rear end of the bobbin (Figs. 1 and 2) along threading tube 41 to the exterior of the furnace, around pulleys 69 and 70 at the entrance end of the furnace 1, beneath the installation to the exit end of the cooling tunnel, around pulleys 71 and 72 into the cooling tunnel, and back to the front end of the bobbin 56, to provide endless means for moving the bobbin 56 back and forth within threading tube 41. Any usual tensioning device may be provided to take up slack in cable 67, such as by mounting pulley 71 on a counterweighted bell-crank 73. The cable 67 may be moved by pulling on the same by hand, or by providing cranks on any of pulleys 69, 70, 71 and 72, or by providing power means for mechanically moving the cable.

Although the pushing and pulling means for passing the bobbin 56 back and forth within threading tube 41 has been illustrated as being a flexible cable 67, it is understood that the member 67 may be a solid wire member or a flat wire member. In case a flat wire member is used, its stiffness may be such that only one end of the flat wire need be attached to the bobbin member 56 and the other end thereof can be wound on a reel at the exterior of one end of the furnace. Unreeling the reel will push the bobbin from one end of the furnace to the other, and winding up the reel will pull the bobbin from the other end of the furnace to the one.

The cable or other pulling means 67, the bobbin 56, the threading tube 41 and strip members 52 and 54 thereon, and the support members 45 are all made of a heat-resisting alloy metal, such as the material from which the furnace muffle 23 is formed.

As previously indicated, the slot 42 (Fig. 7) terminates short of the ends of the threading tube 41 so that the special atmosphere within the furnace chambers will not leak out of the furnace and so that atmospheric air cannot leak into the furnace. A stuffing box 74 is provided within each end of the threading tube 41 surrounding the cable 67 passing therethrough. Another stuffing box 75 is mounted in the door plate 11 of the entrance vestibule around the end of threading tube 41. This permits the tube 41 to be moved endwise from time to time to compensate for sag. Stuffing boxes 74 and 75 likewise prevent gas or air leakage into or out of the furnace chambers.

The improved strip threading apparatus may be used in the following manner:

In initially threading the furnace installation or in event of breakage of a strip being treated in the furnace, that portion of bobbin conveyor cable 67 in the furnace is moved to the left (Fig. 2) until the bobbin 56 is located in the threading tube 41 within the entrance vestibule 3. The entrance vestibule door 11 may be opened and the leading end of a new strip or of a pilot strip to be threaded through the furnace is attached at 62 to the bobbin bracket 59. The bobbin conveyor 67 is then moved in the direction of the arrow in Fig. 2 along the threading tube thus dragging the leading edge of the strip being threaded, as shown in Fig. 2, through the installation until the bobbin 56 reaches the exit end of the cooling tunnel 4. At this time, a door at the end of cooling tunnel 4 may be opened and the leading edge of the strip S detached from the bobbin and pulled outside of the cooling tunnel, when operation of the furnace for continuously treating strip material may be commenced or resumed.

At this time, the bobbin 56 may be pulled back to a location within the entrance vestibule if desired, and the bobbin 56 may be moved back and forth through the threading tube 41 at intervals in order to clear the threading tube of dirt. Similarly, the threading tube itself may be moved endwise from time to time to compensate for any sag which may develop.

In accordance with the present invention, the improved strip threading construction has a number of advantageous features. The construction of the bobbin member 56 and the threading tube 41 is such that the bobbin is confined in and cannot accidentally get out of the threading tube or, in other words, "jump the track." Because of the tubular construction of the threading tube 41, the complementary cross-sectional shape of the bobbin of smaller size, and the connection of the bobbin with a flexible conveyor member, the bobbin can move in a path having some curvature, in other words, through warped portions of the threading tube. This is important because warpage of the threading tube 41 may occur incident to continued and extended exposure to heating at high temperatures. Further, this advantage is present regardless of the manner or direction in which warpage may occur since the bobbin, in being relatively short, can go around warp curves in any direction.

Although the bobbin itself is confined within the threading tube 41 so that it can always be moved to and fro therein, nevertheless, the bracket member 59 extends through the slot 42 to the exterior of the threading tube 41 and to a point within the furnace chambers so that a strip or other member to be threaded through the furnace can be attached thereto. Also, as indicated, passage of the bobbin along the threading tube 41 cleans the passage therein and permits through passage of the bobbin at all times without blockage.

In addition, as previously described, the threading tube 41 is constructed in such a manner, by the provision of the continuous flange members 52 and 54, that the slot 42 cannot become narrowed or closed which would prevent movement of the bobbin bracket 59 along slot 42.

Furthermore, the bobbin construction permits a threading tube of a preferably round or cylindrical shape to be used, and such a tube presents a minimum resistance to the uniform retort heating of the muffle chamber within muffle 23 from the exterior firing chamber 22 of furnace 2.

Accordingly, the present invention provides a fundamentally new and different apparatus and procedure for threading a strip through the extended passages of an elongated continuous strip treating furnace installation particularly of the bright annealing type; eliminates difficulties heretofore encountered in threading a strip through such a furnace; provides for threading such furnace without shutting down or cooling the furnace; provides a construction which may be operated and used irrespective of the occurrence of minor warpage distortion of the threading apparatus incident to extended exposure to heating at high temperatures; provides a construction utilizing a threading tube and bobbin which are self-cleaning in operation, in which the passage of the bobbin cannot be blocked, and in which the bobbin cannot be removed from the threading tube; provides a construction which presents minimum resistance to uniform exterior heating of the furnace muffle; and overcomes prior art difficulties, solves long-standing problems, and obtains the many new results and advantages set forth.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are utilized for descriptive purposes herein and not for the purpose of limitation and are intended to be broadly construed.

Moreover, the description of the improvements is by way of example, and the scope of the present invention is not limited to the exact details set forth.

Having now described the features, discoveries and principles of the invention, the operation and procedures carried out, the arrangements and new apparatus, and the advantageous, new and useful results obtained thereby; the new and useful processes, methods, steps, procedures, discoveries, principles, apparatus, combinations, parts, sub-combinations and elements, and mechanical equivalents obvious to those skilled in the art are set forth in the appended claims.

We claim:

1. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated tubular treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube mounted on said support members within and extending longitudinally through said tubular chamber, a bobbin confined for movement in said tube having a portion extending to the exterior of the tube engageable within the tubular chamber with a strip to be threaded therethrough, and means for moving the bobbin in either direction through said tube.

2. Apparatus for threading a strip through a continuous heating furnace including, walls forming a plurality of elongated communicating tubular treatment chambers through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chambers, a threading tube mounted on said support members within and extending continuously longitudinally through said tubular chambers, a bobbin confined for movement in said tube having a portion extending to the exterior of the tube engageable within the tubular chamber with a strip to be threaded therethrough, and means for moving the bobbin in either direction through said tube.

3. Apparatus for threading a strip through a continuous heating furnace including, walls forming an enlongated tubular treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube mounted on said support members within and extending longitudinally through said tubular chamber, there being a slot formed in the tube extending substantially throughout the length of the tube, a bobbin confined for movement in said tube, a member mounted on said bobbin extending through said slot having a portion exterior of the tube engageable within the tubular chamber with a strip to be threaded therethrough, and means for moving the bobbin in either direction through said tube.

4. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated tubular treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube extending longitudinally through said chamber longitudinally movably supported within said tubular chamber on said support members, means for preventing rotation of said tube on said support members, a bobbin confined for movement in said tube having a portion extending to the exterior of the tube engageable within the tubular chamber with a strip to be threaded therethrough, and means for moving the bobbin in either direction through said tube, whereby the tube may be moved endwise at intervals to compensate for sag.

5. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube extending longitudinally through said chamber supported on said support members, outturned flange means extending lengthwise of said tube at the top thereof engageable with said support members to prevent rotation of the tube, a bobbin confined for movement in said tube having a portion extending to the exterior of the tube engageable with a strip to be threaded, and means for moving the bobbin in either direction through said tube.

6. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube mounted on said support members extending longitudinally through said chamber, there being a slot formed in the top of the tube extending substantially throughout the length of the tube, outturned flange means extending

longitudinally the tube adjacent the edges of the slot, a bobbin confined for movement in said tube, a member mounted on the bobbin extending through said slot having a portion exterior of the tube engageable with a strip to be threaded, and means for moving the bobbin in either direction through said tube, whereby said flange means stiffens the tube walls to prevent closure of the slot by tube warpage.

7. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated treatment chamber through which a strip to be treated is continuously passed; support members mounted at spaced intervals in said chamber; each support member including a mounting plate, a bracket member terminating in an upright finger, and saddle flange means extending from each side of the bracket member; a threading tube extending longitudinally through said chamber supported on said saddle flange means, there being a slot formed in the top of the tube extending substantially throughout the length of the tube, outturned flange means extending longitudinally of the tube at the top thereof at either side of said slot engageable with said mounting plates and upright fingers, a bobbin confined for movement in said tube, a member mounted on the bobbin extending through said slot having a portion exterior of the tube engageable with the strip to be threaded, and means for moving the bobbin in either direction through said tube; whereby the tube may be moved endwise at intervals to compensate for sag, whereby the tube flange means prevent rotation of the tube and hold the tube in such position that the slot is always at the top of the tube, and whereby the tube flange means stiffen the tube walls to prevent closure of the slot by tube warpage.

8. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber; each support member including a mounting plate, a generally L-shaped bracket portion terminating in an upright finger, and a curved saddle flange on the bracket portion; a cylindrical threading tube extending longitudinally through said chamber supported on the curved saddle flanges of said support members, outturned flange means on the tube engageable with the support members to prevent rotation of the tube, an elongated cylindrical bobbin confined for movement in said tube having a smaller diameter than the interior diameter of the tube, a member mounted on the bobbin extending to the exterior of the tube engageable with a strip to be threaded, and means for moving the bobbin in either direction through said tube.

9. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, a threading tube mounted on said support members extending longitudinally through said chamber, there being a series of apertures formed in the bottom of said tube, an elongated bobbin confined for movement in said tube, the ends of the bobbin being provided with sharp corners, a member mounted on the bobbin and extending to the exterior of the tube engageable with the strip to be threaded, and means for moving the bobbin in either direction through said tube, whereby when the bobbin is moved through the tube the sharp end edges thereof clear foreign matter from within the tube through said apertures.

10. Apparatus for threading a strip through a continuous heating furnace including, walls forming an elongated tubular treatment chamber through which a strip to be treated is continuously passed, support members mounted at spaced intervals in said chamber, each support member having a curved saddle portion extending longitudinally of the chamber, a threading tube extending longitudinally through said chamber longitudinally movably supported on said longitudinally extending saddle portions, a bobbin confined for movement in said tube having a portion extending to the exterior of the tube engageable within the tubular chamber with a strip to be threaded therethrough, and means for moving the bobbin in either direction through said tube, whereby the tube may be moved endwise at intervals to compensate for sag.

FRANK T. COPE.
KENNETH U. WIRTZ.

**REFERENCES CITED**

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 461,954 | Force | Oct. 27, 1891 |
| 890,314 | Thompson | June 9, 1908 |
| 1,856,444 | Sutton | May 3, 1932 |
| 1,890,449 | Berry | Dec. 13, 1932 |
| 2,333,579 | Renkin | Nov. 2, 1943 |