

April 18, 1961

R. E. BUCKHOLDT
STRIP THREADING DEVICE

2,980,411

Filed Sept. 25, 1958

3 Sheets-Sheet 1

FIG. 1

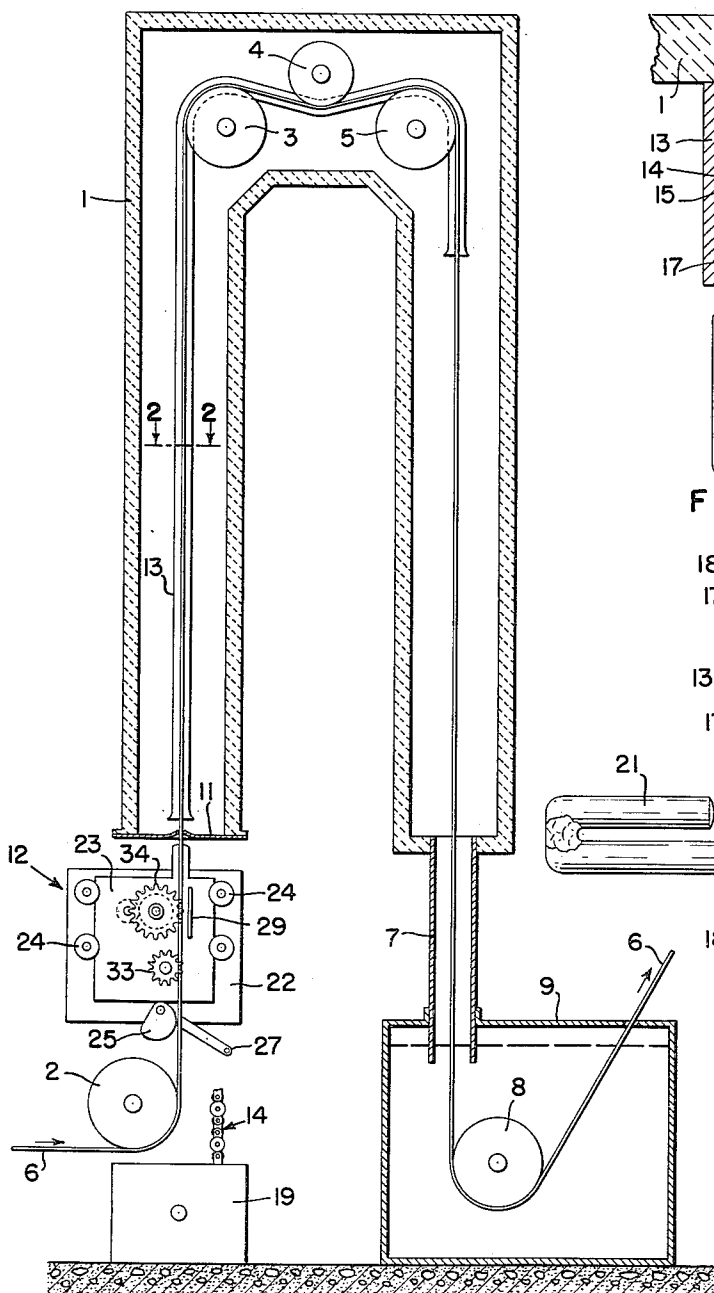


FIG. 2

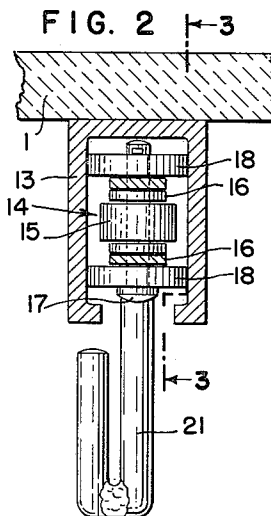
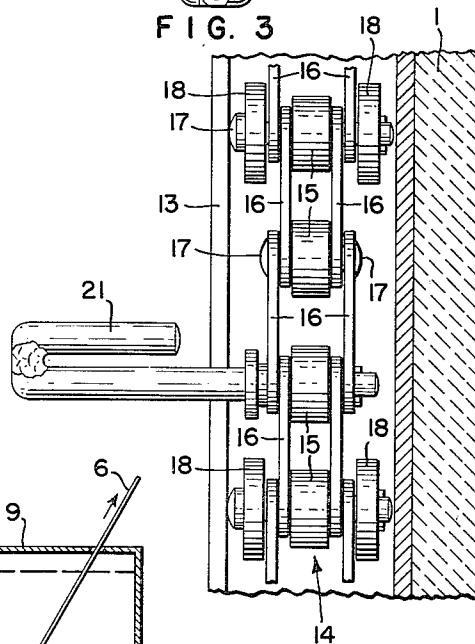


FIG. 3



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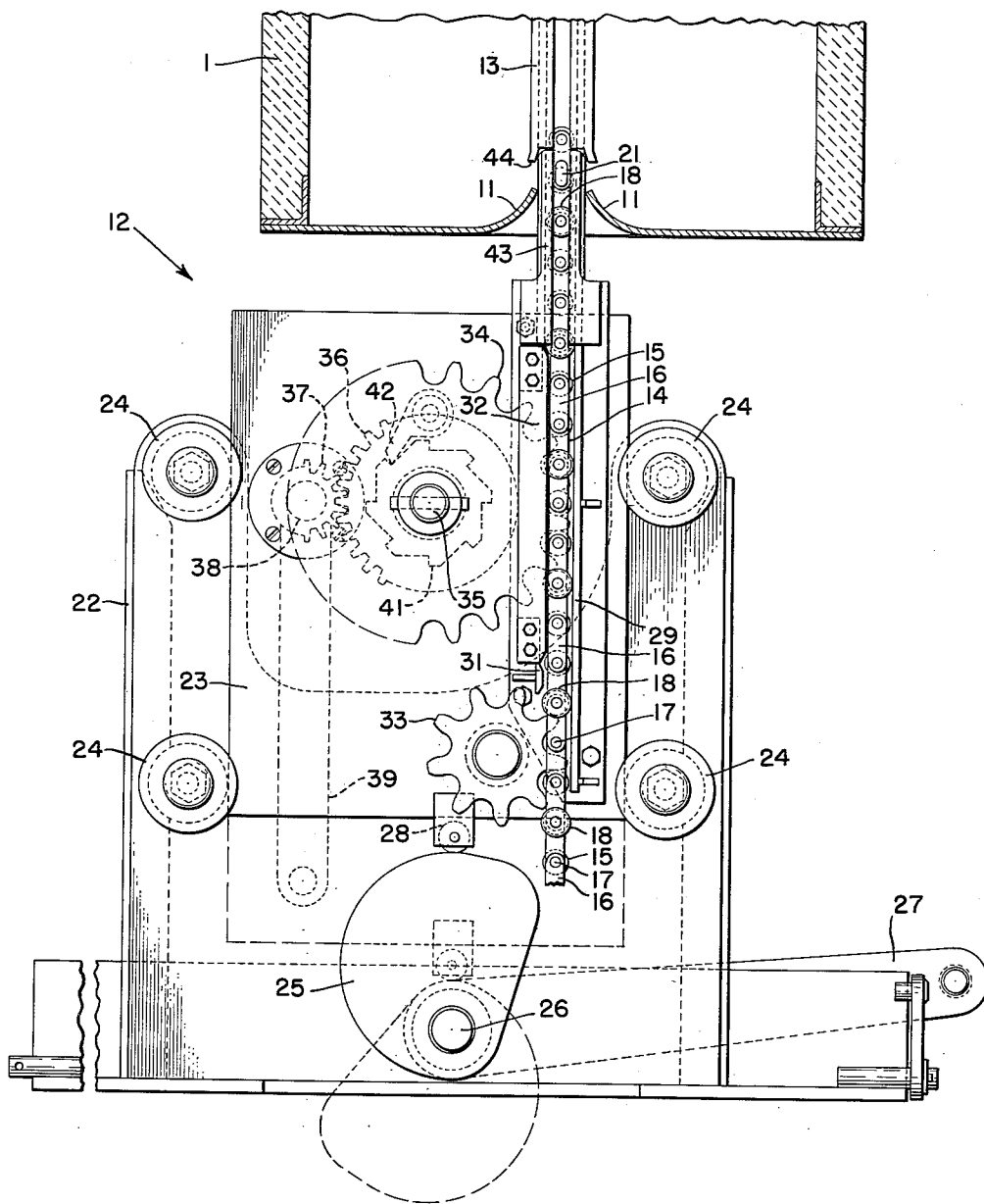
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FIG. 4



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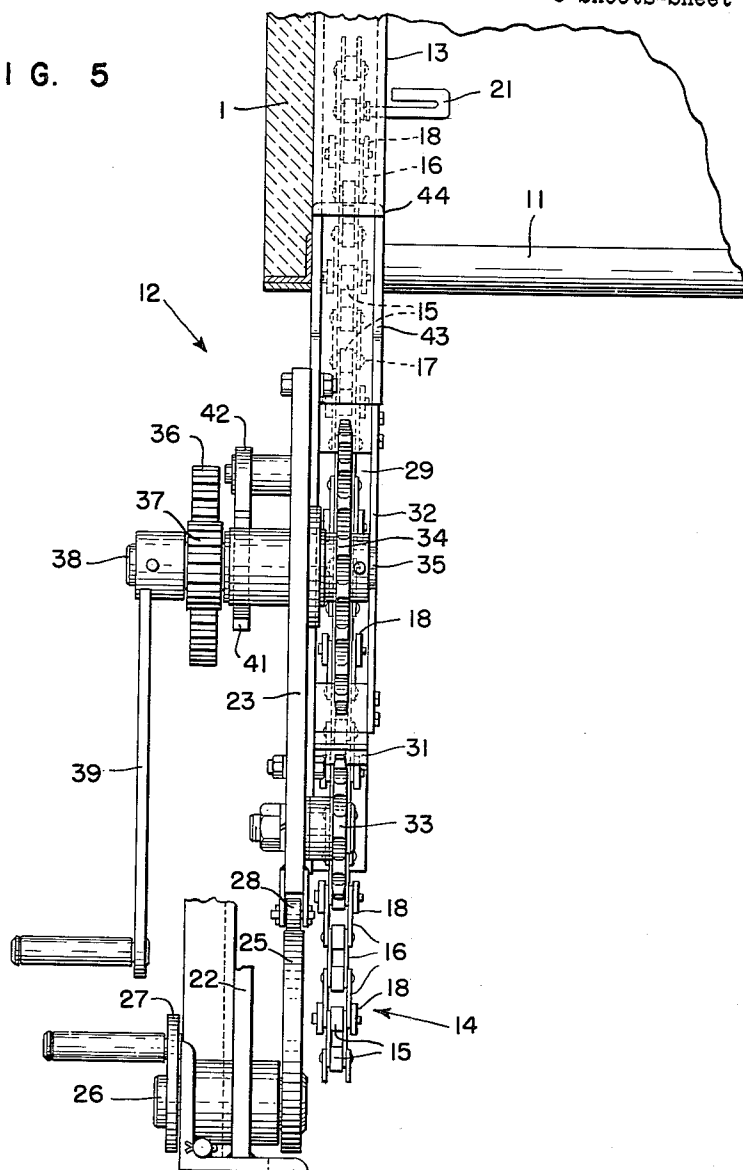
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3 Sheets-Sheet 3

FIG. 5



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2,980,411

STRIP THREADING DEVICE

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12 Claims. (Cl. 263—3)

The present invention relates to furnaces for continuously heating strip material, and more particularly to apparatus for threading the strip through the furnace.

It is customary in the continuous heating of strip material such as strip steel and brass to pass the strip through the furnace in a series of vertical passes around guide rolls. At the present time when threading the strip, sections of the furnace above and below the guide rolls are removed, and ropes or chains are lowered through the openings so made. The end of the strip is attached to the rope and drawn through the furnace. The removed sections, usually of heavy metal and refractory construction, are then replaced, and the equipment started. This is a laborious, time consuming process when starting a cold furnace in operation. It is much more difficult to accomplish when a strip break occurs in a hot furnace. Not only is a large length of strip lost, but any protective atmosphere in the furnace is lost too. This latter means that the strip heated before the atmosphere returns to normal is also unsatisfactory.

It is an object of the invention to provide apparatus for threading the lead end of a strip of material through a path. It is a further, and more specific, object of the invention to provide apparatus for threading a strip of sheet metal through a furnace. With the apparatus of the invention the threading can be accomplished even in a muffle without losing an appreciable amount of a protective atmosphere.

The apparatus of the present invention includes a chain having a strip engaging portion on the lead end thereof. The chain is forced through a guide channel following the path that the strip is to take. The chain and its driving mechanism are so constructed that they can be inserted through and withdrawn from a furnace or muffle seal with a minimum opening of the latter.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a view, partly in section, showing the apparatus;

Fig. 2 is a view on line 2—2 of Fig. 1;

Fig. 3 is a view on line 3—3 of Fig. 2;

Fig. 4 is an enlarged side view of the chain driving mechanism; and

Fig. 5 is a view taken from the left of Fig. 4.

Referring to Fig. 1, there is shown a U-shaped furnace 1 built in accordance with conventional furnace practice and heated in some desired manner such as by direct firing, convection or electrical resistance heating. The strip 6 to be heated is guided into and through the furnace by a guide roll 2 and by rolls 3, 4, and 5 that are located in the upper portion thereof. The strip 6 leaves

roll 5 and passes downwardly through the furnace, through a duct 7, and around a guide roll 8 to some point of use. The lower end of the duct and roll 8 are shown as being immersed in a quench tank 9, the liquid level of which is above the lower end of duct 7, thus sealing the furnace chamber. The entrance to the furnace is sealed by a seal 11 which may be of any conventional type, but which is shown herein as being a pair of flexible and resilient strips 11 that extend inwardly from the sides of the furnace, and which are biased by their natural resiliency against the sides of the strip in order to close the entrance. With this construction, the furnace chamber is closed so that any desired protective atmosphere may be maintained in the furnace chamber during the time that the strip is being heated.

In threading the strip initially through the furnace, it is necessary to move the strip upwardly from guide roll 2 through seal 11 and around the guide rolls 3, 4, and 5 to the other leg of the furnace and downwardly around roll 8. This is accomplished by means now to be described. This means includes a chain driving mechanism 12 that is located below the entrance of the furnace and aligned with a U-shaped guide channel 13 in the furnace chamber. This guide channel is fastened to the inner wall of the furnace and follows the path that the strip is to follow as it travels therethrough. This guide channel extends from just inside seal 11 to a point below roll 5, although it could extend to the bottom of the furnace if desired. The leading end of the strip is moved through the furnace by means of a roller chain 14 that is driven by mechanism 12 through guide channel 13. The chain may be of a conventional type including rolls 15 that are connected by links 16 and pins 17, except that every third or fourth pin extends outwardly beyond the links 16 and has on the ends thereof outboard rollers 18 of a size to be received snugly within the U-shaped guide channel 13 as shown in Fig. 2. Normally the chain is kept ready for use in a box 19 located below roll 2, with the chain being substantially aligned with guide channel 13. Fastened near the end of the chain that is first fed into the furnace and projecting therefrom is a strip engaging hook 21 to which the strip is attached and by which it is carried through the furnace.

The chain driving mechanism includes a supporting member or plate 22 that is rigidly attached to a suitable support below the entrance of the furnace. A mechanism supporting plate 23 is guided for limited vertical movement on member 22 by means of grooved rolls 24 that are journaled on member 22, the grooves of which receive the edges of plate 23. The vertical position of plate 23 with respect to member 24 is determined by a cam 25 fixed to a shaft 26 that is suitably journaled on member 22. As the cam is rotated by a handle 27, also attached to shaft 26, the cam will bear against a roll 28 on plate 23 to move plate 23 and the mechanism carried thereby between its low position of Fig. 1 and its high position of Fig. 4.

A drive sprocket 34 on plate 23 drives the chain, which is guided to and past this sprocket by a backing member 29, shorter opposed members 31 and 32, and a guide sprocket 33. Drive sprocket 34 is attached to a shaft 35 journaled in plate 23 and is driven by a gear 36 also attached to shaft 35, and a pinion 37 that is attached to a shaft 38. Shaft 38 is rotated by a crank 39 in order to rotate sprocket 34 and thereby move the chain. Reverse rotation of sprocket 34 is prevented by a ratchet 41 attached to shaft 35, the teeth of which are engaged by a pawl 42. Above this sprocket and backing plates 29 and 32, is a U-shaped guide section 43 similar in cross section to guide channel 13. The upper end of this guide section is moved through seal 11 into engagement with the flared lower end 44 of guide channel 13 as plate 23

is raised. It will be obvious that pinion 37 can be rotated by any suitable type of motor instead of by hand operated crank 38, if desired.

In the operation of the apparatus, the leading end of chain 14, which is preferably coiled around a mandrel in box 19, is moved upwardly between the guiding portions of plate 23 and into driving connection with sprocket 34. The leading end of the strip is then brought around roll 2 and attached to member 21, which is located a few links from the end of chain 14. Thereafter, crank 27 is rotated so that cam 25 will move plate 23 and the parts carried thereby including guide section 43 upwardly. When this occurs, the guide section will extend through seal 11, as shown in Fig. 4, into engagement with the lower flared end of guide channel 13. Thereafter, rotation of sprocket 34 will force the chain and the leading end of the strip carried thereby through the path to be followed by the strip around the various guide rolls. During this time it is preferred that the strip be fed forwardly at a slow speed so that the chain will only have to support its own weight and that of the strip above guide roll 2. The chain is prevented from buckling in the guide channel by the outboard rolls 18 which engage the interior of guide channel 13 as the chain is being moved upwardly. Continued forcing of the chain through the guide channel will permit its leading end to fall vertically downwardly after it leaves the right hand end of the guide. This continues until the chain and strip carried thereby have reached the bottom of quench tank 9. The chain and strip can easily be fished around roll 8 and pulled upwardly. The strip is then disconnected from member 21 and supplied to a take-up roll or some machine where it is used. While it is possible to release ratchet 41 and withdraw the chain back through guide channel 13, it is preferable to pull the chain on through the furnace and rewind it for use in a box similar to box 19 so that it will be ready for rethreading the furnace when necessary.

It will be seen with this apparatus that the seal at the entrance of the furnace is open only when actual threading is taking place and only enough to permit guide section 43 to extend therethrough. This means that a very small amount of any atmosphere maintained in the furnace during heating will be lost. Since the threading chain is not held in the hot furnace during the time that the strip is being heated, it is possible to use a chain of relatively low alloy content. In fact, a chain of cold rolled steel can be used.

As described above, the leading end of the strip is attached directly to hook 21 on the chain. This procedure will be followed when the strip is relatively narrow or is light. If the strip is relatively wide or heavy, however, it will be desirable to fasten a leader to hook 21 and thread the leader through the furnace. The strip would be attached to the leader and pulled through the furnace by some apparatus that is capable of exerting more force than can be obtained from the chain drive.

In some cases it may be desirable to reverse substantially the above procedure by having hook 21 on the following end instead of the leading end of the chain. When this is done, the chain is forced through the furnace above. After the leading end thereof has been forced through the furnace and been attached to a pulling device, the strip or a leader will be attached to the hook on the other end of the chain. Thereafter pulling the chain by hand or power will cause the strip to be threaded through the furnace.

In the above disclosure a furnace with only a simple loop and two passes of the strip has been described. It will be obvious, however, that the apparatus can be used with a furnace or cooling tower of any number of loops. It will only be necessary to provide a guide similar to guide 13 for each pass of the furnace in which the strip moves upwardly. A drive sprocket similar to sprocket 34 would be placed at the lower end and in front of each

guide. These sprockets can be driven individually or, through grooving, by a common drive shaft. In a multiple loop furnace the weight of the upwardly and downwardly extending sections of the chain in each loop will counterbalance each other. Because of the outboard rollers 18, the chain will pass through the guides and over rollers such as 3 and 5 with a minimum of friction, and will require only a minimum of driving force. Therefore the main power required is that necessary to move the leading end of the chain through each of its upwardly directed passes. This power requirement will not be much more for a multiple loop furnace than it is for the single loop furnace shown.

The description above describes the strip as being heated directly in a furnace. It will be apparent, however, that if the strip is heated in a muffle, that guide channel 13 could be fastened to the interior of a muffle as well as directly to the interior of the furnace wall. As a matter of fact, the arrangement shown herein is particularly adapted for use in muffle furnaces. The guide channel 13 takes up only a small amount of room in a muffle, and the chain is removed therefrom during the time that the heating is taking place. Furthermore, the guide shown weighs so little and puts so little strain on a muffle, that the wall of the muffle can be quite thin, thus increasing heat transfer to the strip therein.

It should be understood, of course, that any conventional end seal can be used in place of the quench described herein. The chain has sufficient rigidity to move through a seal at the end of the furnace as it is descending from roller 5. If the chain is pulled through the furnace each time a threading operation takes place, there is no reason to provide special seals at each end of the furnace which will permit two-way travel therethrough.

From the above description it will be seen that I have provided apparatus for threading a strip through a furnace or muffle which is easy to operate, and is inexpensive both initially and from a maintenance point of view.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit and scope of the invention set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. Apparatus for threading a strip of material to be heated through a furnace including a furnace having a guide roll therein over which the strip is to pass in a loop, a guide having a U-shaped section, means attaching said guide to a wall of the furnace with the guide extending from the entrance of said furnace around said roll and following the path the strip is to travel, the opening of the U facing the portion of the furnace through which the strip is to travel, a chain received in said guide and having rollers thereon engaging the legs of said U to prevent buckling and having a strip engaging portion adjacent to one end thereof with said portion projecting from said guide, drive means operative to push said chain through said guide, and means to mount said drive means adjacent to the entrance of said furnace and aligned with said guide.

2. Apparatus for threading a strip through a path comprising a guide parallel and adjacent to said path, a chain received in said guide and having a strip engaging portion adjacent to one end projecting from said guide, a sprocket wheel for driving said chain means to mount said sprocket wheel for rotation in front of and aligned with the entrance of said guide, means tangent to said sprocket wheel forming a path for said chain between said means and sprocket wheel whereby upon rotation of said sprocket wheel said chain will be moved into and pushed through said guide, and means to rotate said sprocket wheel in

5

a direction to move said end of said chain through said path.

3. Apparatus for threading a strip through a path comprising a guide channel having the same shape as and adjacent to said path, chain driving mechanism including a sprocket and a backing member to hold a chain in engagement with said sprocket, means to mount said mechanism in front of and aligned with the entrance of said guide, means to move said mechanism on its mounting means into engagement with and retract it from the entrance of said guide, a chain adapted to be received by said guide and engaged by said sprocket to be pushed through said guide, means to drive said sprocket to push said chain through said guide, and strip engaging means carried by and adjacent to the lead end of said chain.

4. Apparatus for threading a strip to be heated through a furnace including a guide channel in the furnace, a chain to be received in said channel, said chain having rollers thereon to engage the sides of said channel to prevent buckling thereof, a support adjacent to the entrance of said channel, chain moving mechanism on said support, said mechanism including a guide portion for said chain aligned with said channel, a sprocket operative to engage and push said chain through said guide portion and said channel, means to rotate said sprocket in a direction to push said chain through said guide, means to shift said mechanism on said support from a position in which said guide portion abuts said channel to a position retracted therefrom, and a strip engaging member projecting from said chain adjacent to the leading end thereof.

5. In combination, a furnace having an elongated chamber through which a strip is to move to be heated, a guide channel in said chamber parallel to the path the strip is to follow, a seal through which the strip moves at each end of the chamber, a chain operative to move in said guide channel, chain driving means having a guide portion projecting therefrom, means to mount said driving means adjacent to the entrance seal of said chamber with said guide portion aligned with said guide channel, means to move said drive means to extend said guide portion through said entrance seal into abutting relation with said guide channel whereby the chain driven thereby will be forced through said guide channel, and strip attaching means carried by said chain adjacent to the lead end thereof.

6. In combination, a furnace having an elongated chamber through which a strip to be heated is to travel along a fixed path, a guide channel in said chamber parallel to said path, a strip pulling means operative to be forced through said guide channel, said strip pulling means having a strip engaging portion projecting from the end thereof, mechanism located adjacent to the entrance of said chamber, said mechanism including means to engage said strip pulling means and force the same through said guide channel a seal across the entrance of said chamber between said guide channel and said mechanism, said mechanism including a guide portion aligned with said guide channel, and means to move said mechanism from a position in which said guide portion is outside said chamber to a position in which it extends through said seal into engagement with said guide channel thereby to direct said strip pulling means in said guide channel.

7. In combination, means forming an elongated chamber having an entrance at one end thereof, flexible seal means across said end, a guide channel extending along a path in said chamber from a point adjacent to said seal, an elongated flexible member operative to be received in and move through said guide channel, driving mechanism to force said member through said guide channel, said mechanism having a guide section adapted to engage the end of said guide channel, means to mount said mechanism beyond said end of said chamber with said guide section aligned with said guide channel, means to move

6

said mechanism from a position in which said guide section is outside said chamber to a position in which said guide section extends through said seal into engagement with said guide channel, and a strip engaging device attached to said member and projecting outwardly from the same and said guide channel.

8. Apparatus for threading a strip through a path comprising a guide channel extending parallel to said path on one side thereof, an elongated, flexible member to be received in said guide channel, said member being provided with means thereon to engage the interior of said guide channel to prevent buckling of said member, said member also being provided with a strip engaging portion projecting therefrom beyond said channel toward said path, means located adjacent to the entrance of said guide channel operable to push said member through said guide channel, and mechanism to operate said means to push whereby said flexible member will be moved along said guide channel from the entrance toward the exit thereof.

9. Apparatus for threading a strip of material through a curved path in an enclosed space which includes a guide channel extending parallel to said path, driving mechanism including a guide section, means to move said mechanism from a position in which said guide section is away from to a position in which said guide section is aligned with and engages the entrance of said guide channel, an elongated, flexible strip pulling member, said member comprising a chain having rollers thereon engaging the sides of said channel to prevent buckling thereof, sprocket means in said mechanism to engage said chain and push it through said guide section and into and through said guide channel, the strip being pulled by said chain as said chain is pushed through said path.

10. Apparatus for threading a strip through a furnace chamber having a strip path therein including a curve, a guide channel in said chamber curved to follow said path and located parallel thereto, said channel terminating at one end adjacent to the entrance of said chamber, an elongated flexible member adapted to be moved through said channel, strip pulling means on said member, a support in front of the entrance to said chamber, driving mechanism including means to engage said member and force it in one direction, means to mount said mechanism on said support in alignment with said channel whereby said member can be forced by said mechanism into and through said channel, a seal across the entrance of said chamber, a guide section for said member on said mechanism to direct said member, and means to move said mechanism on said support from a position in which said guide section is out of said chamber to a position in which said guide section extends through said seal into and in engagement with the end of said channel.

11. Apparatus for threading a strip through a furnace chamber including a guide channel in said chamber parallel to the path the strip is to follow, an elongated, flexible chain adapted to move through said channel, said chain having rollers thereon to engage the insides of said channel to prevent buckling thereof, a strip engaging device projecting outwardly from said chain adjacent to one end thereof and drive mechanism aligned with and adjacent to the entrance of said channel, said mechanism including a sprocket to engage said chain and means to rotate said sprocket in a direction to push said chain through said channel.

12. Apparatus to thread a flexible strip through a path comprising in combination a guide extending parallel to said path from adjacent to the beginning thereof toward the end, a flexible strip threading member directed along said path by said guide, driving mechanism for said member located in front of the starting point of said guide, said driving mechanism engaging said member to move it, and means to operate said driving member in a

direction to push said member from the beginning of said guide toward the end thereof.

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