

Feb. 16, 1954

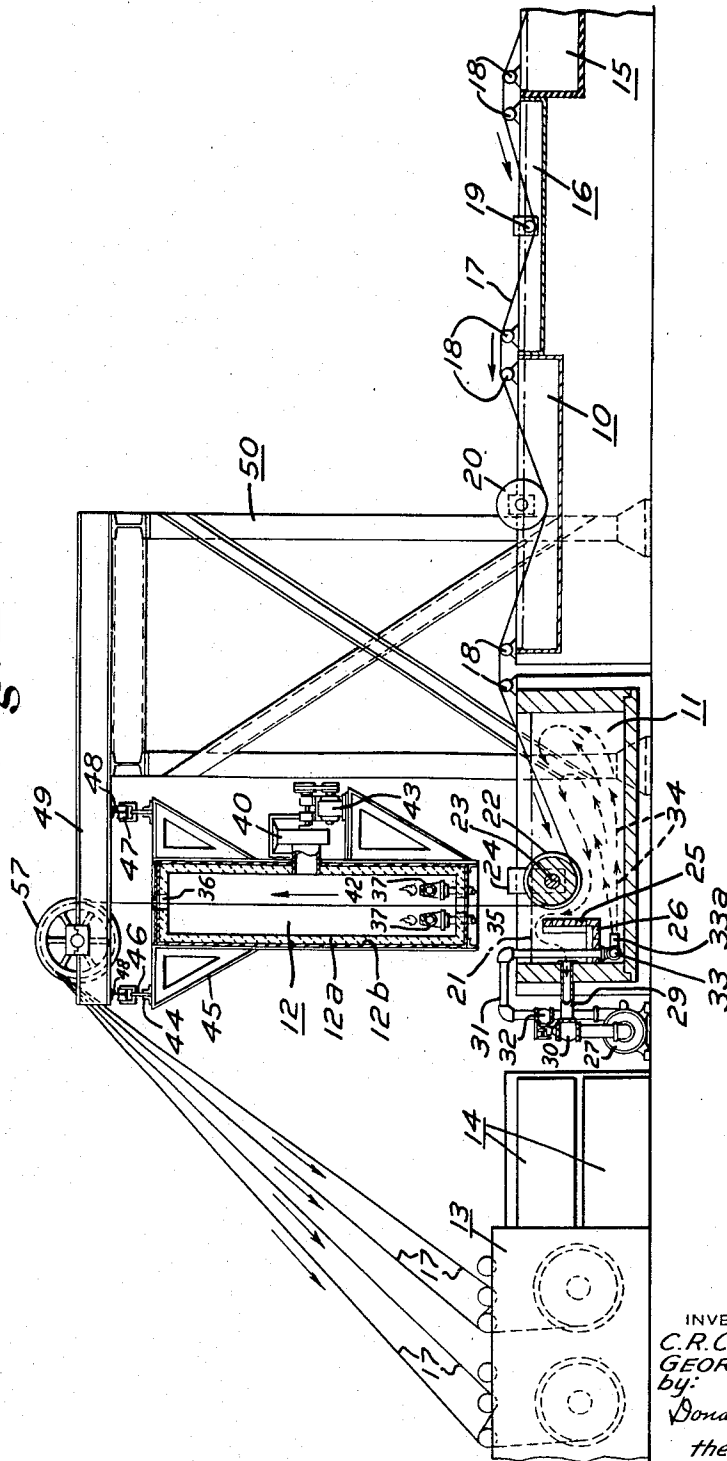
C. R. CHASE ET AL
APPARATUS FOR DRYING A LIQUID COATING
ON AN ELONGATED PRODUCT

2,669,031

Original Filed Feb. 6, 1948

3 Sheets-Sheet 1

Fig. 1



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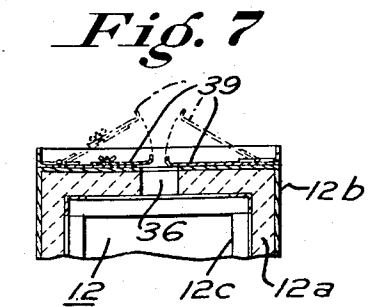
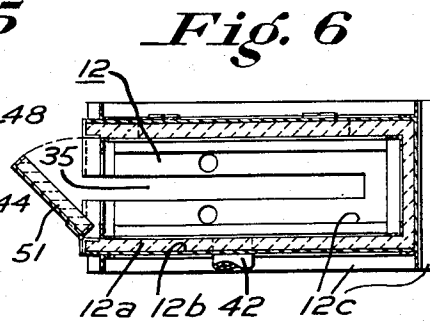
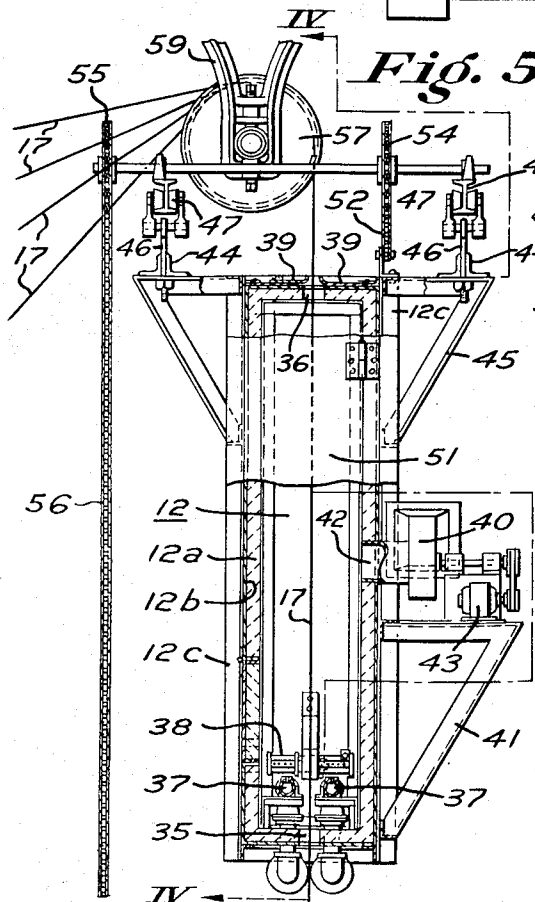
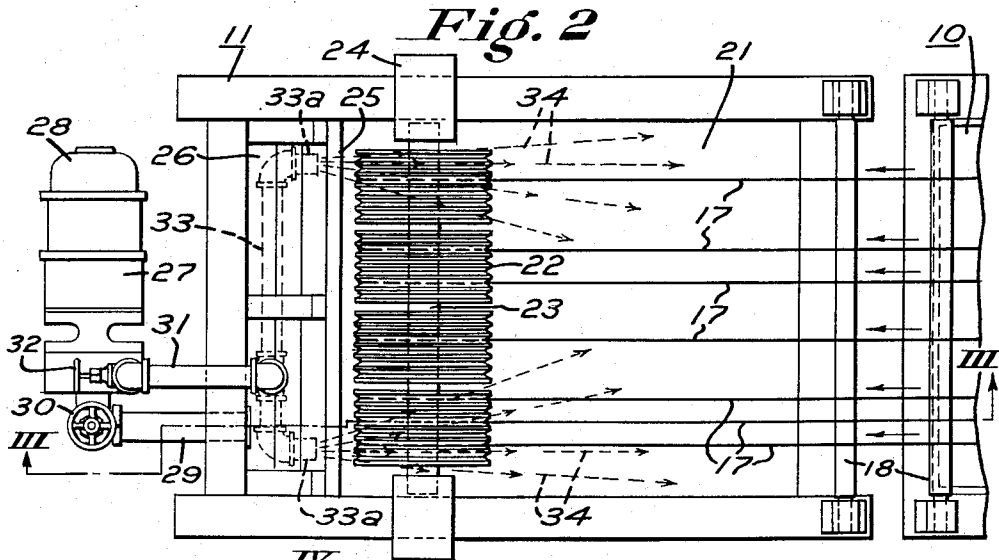
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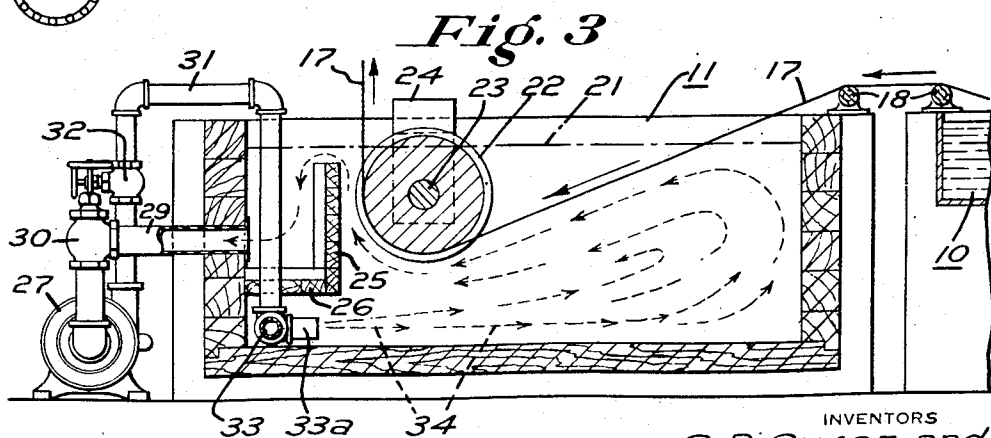
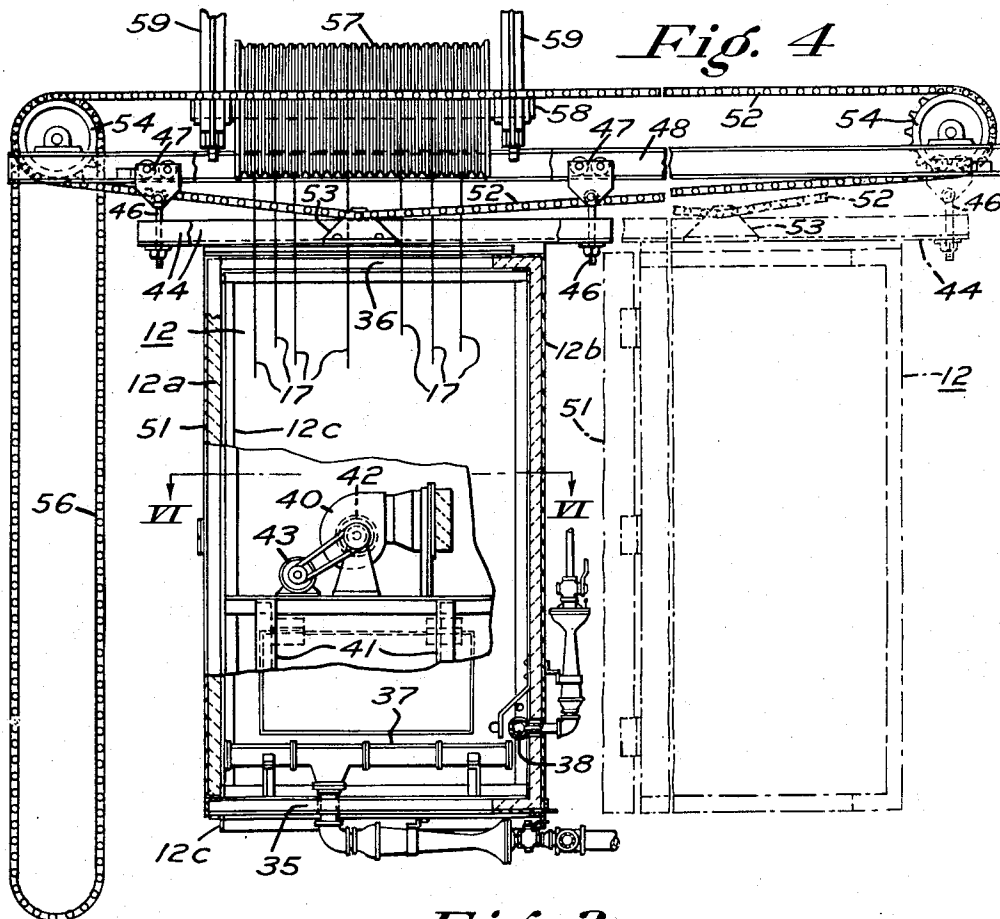
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UNITED STATES PATENT OFFICE

2,669,031

APPARATUS FOR DRYING A LIQUID COATING ON AN ELONGATED PRODUCT

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7 Claims. (Cl. 34-155)

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This invention relates to the manufacture of wire and, in particular, to apparatus for coating wire or wire rod with a film of lime or the like and baking it thereon to facilitate reduction of the wire to smaller size by drawing it through dies.

This is a division of our application Serial No. 6,708, filed February 6, 1948, now Patent No. 2,610,926 issued September 16, 1952.

The object of the invention is to provide apparatus for applying a highly uniform coating to wire in a continuous manner. This we accomplish by introducing traveling strands of wire into a coating bath and drawing them upwardly therefrom and through a vertical oven, maintaining them free from contact with supporting and guiding means until the adherent film of coating material has been thoroughly dried. While lime is referred to herein as the specific coating material contemplated, it will be evident that the invention may also be used for applying coatings of other solutions or suspensions.

It has been the practice heretofore to coat wire with lime after pickling, by dipping coils of wire in a tub or vat of slaked lime and then baking them to dry the coating. The lime coating applied by this practice is usually not uniform. If the coil turns are at all tightly assembled, the lime does not penetrate thoroughly between them, and sometimes portions of the wire are left bare. When the coils are deposited in the oven, furthermore, the lime film adhering to the turns tends to run down to the bottom of the coil by gravity, leaving a coating varying in thickness between adjacent turns or different parts of the same turn. Unless agitated, furthermore, the lime bath tends to stratify. Usually the only agitation afforded is that caused by the immersion and removal of coils so that, even if a heavy coating be acquired by the wire while deeply immersed, only a thin coating will remain after removal of the coil through the dilute upper layer of the bath.

We have invented a novel apparatus for coating wire in strand form by passing it continuously through a lime bath and drying or baking it while free from contact with adjacent strands or any supporting or guiding means. The invention is particularly adapted for use in connection with continuous patenting apparatus such as a furnace, a lead-bath for quenching and one or more pickle tanks for removing scale. In a preferred embodiment of the invention, we run the pickled wire through a cold-water bath after it has been rinsed in hot water, and then into

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a lime bath and around a sinker roll partly immersed therein. We circulate the lime bath constantly to insure uniform concentration throughout and draw the wire upwardly therefrom through a vertical oven of sufficient height to effect rapid and complete drying of the adherent film of lime. When the wire emerges from the top of the oven, it passes around a guide sheave thereabove and thence downwardly to take-up blocks. The novel apparatus we have provided for baking the coated wire includes a vertical oven fitted with heating means and having slots at the top and bottom adapted for the passage of a plurality of wires upwardly therethrough in spaced relation and free from contact with any part thereof. The oven is suspended on trolleys for movement to an out-of-the-way position, to facilitate threading the wires through the apparatus and removal of the sinker roll when necessary. A door hinged at one side permits the oven to pass around and enclose the wires when threaded.

Our improved apparatus also includes a novel form of lime tub with a baffle or dam adjacent the sinker roll to direct circulation of the lime and a pump for effecting such circulation.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating a preferred embodiment and practice. In the drawings:

Figure 1 is a central vertical section through the apparatus, parts thereof being shown diagrammatically;

Figure 2 is a plan view of the lime tub;

Figure 3 is a central vertical section therethrough, showing a portion of Figure 1 to enlarged scale;

Figure 4 is a vertical transverse section through the drying oven;

Figure 5 is a central vertical section through the oven showing a portion of Figure 1 to enlarged scale;

Figure 6 is a transverse horizontal section through the drying oven with parts omitted; and

Figure 7 is a partial section showing a portion of Figure 5 to enlarged scale, illustrating the details of hinged dampers mounted on top of the oven.

In describing the invention it will be convenient first to refer to the apparatus in detail and then to explain how it functions.

Referring for the moment to Figure 1, the apparatus comprises generally a cold-water wash tank 10, a lime tub 11, a drying oven 12 and a

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group of take-up blocks 13 driven by conventional means indicated diagrammatically at 14. If the apparatus be installed in conjunction with continuous patenting apparatus, it will be disposed beyond the last acid pickling tank 15 and the warm-water rinse tank 16 of the latter. In any event, a plurality of wire strands 17 are drawn through the several pieces of apparatus successively in the direction indicated by the arrows, by the tension exerted by the take-up blocks. In moving from the tank 15 to the tank 16, the strands pass over guide rollers 18. Similar rollers are disposed between the tank 16 and the tank 10 and between the tank 10 and the tub 11. In traversing the tank 16 the strands pass under a hold-down roller 19 journaled therein. The tank 10 is provided with a hold-down roller 20.

The tub 11 (see Figures 2 and 3) may be of any suitable construction, e. g., timbers bolted together and is adapted to contain a lime bath, the surface of which is indicated at 21. Hold-down or "sinker" sheaves 22 are rotatable on a shaft 23 extending transversely of the tub and supported in hanger brackets 24 depending from the sides thereof. The sheaves 22 have V-grooves spaced axially therealong for receiving individually the strands entering the bath after passing over the guide roller 18 at the right-hand end thereof and maintaining them in spaced relation as they are drawn up from the bath through the oven 12. As clearly shown in Figure 1, the sheaves 22 have their greater portion immersed in the bath.

In order to maintain the bath of a substantially uniform character and prevent the settling out of the solid phase, we maintain a substantially constant circulation thereof along a predetermined path. To this end, a dam or baffle 25 is disposed transversely of the tub adjacent the sheaves 22. The dam extends upwardly from a floor or deck 26 in the left-hand end of the tub spaced a short distance above the bottom thereof. The dam is of such height that its crest is an inch or so below the surface of the bath. A centrifugal pump 27 driven by motor 28 has its inlet connected by a pipe 29 including a valve 30 to the space between the dam 25 and the left-hand end of the tub, above the deck 26. The outlet from the pump is connected by a pipe 31 including a valve 32 to a header 33 extending across the left-hand end of the tub below the deck 26 and provided at its ends with nozzles 33^a adapted to deliver jets longitudinally of the tub and close to the bottom thereof, as indicated at 34.

When the pump is in operation, it induces a circulation of the lime in the tub, as indicated by the dotted arrows, i. e., from left to right along the bottom of the tub, upwardly at the right-hand end thereof and from right to left adjacent the surface of the bath, thence downwardly around the sheaves 22, upwardly between them and the dam 25 and over the crest of the latter to the outlet pipe 29. It will be apparent that the jets 34 create considerable agitation of the bath as it circulates through the right-hand end thereof. The portion of the bath between the sheaves 22 and dam 25 by comparison is relatively quiescent. By reason of the circulation and agitation, all parts of the bath have substantially the same amount of suspended solids, in this case calcium hydroxide, the liquid being water. As a result, the wire strands passing around the sheaves 22 and emerging substantially

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vertically from the bath acquire an adherent film of lime which is uniform among the several strands and from point to point along each strand.

The oven 12 (see Figures 4 through 7), through which the strands ascend on emerging from the lime bath, is an elongated box-like chamber disposed vertically, the walls of which are composed of suitable insulating or refractory lining 12^a laid up in a binding composed of metal sheathing plates 12^b secured to a frame of structural members 12^c. The bottom of the oven has an entrance slot 35 extending across the width thereof. The top of the oven has a similar exit slot 36. Tubular burners 37 extend across the width of the oven at the bottom thereof, one on each side of the slot 35. A pilot burner 38 with a spark-gap igniter extends through one side wall of the oven at a level slightly above the burners 37. The burners are connected to any convenient source of fuel gas through inspirator tubes and are provided with suitable control valves.

It will be apparent that the burners 37 heat the interior of the oven effectively by radiation and convection, the combustion gases passing upwardly through the oven and out through the slot 36 maintaining a natural draft of secondary air through the inlet slot 35. This draft is controlled by damper plates 39 (see Figure 7) hinged to the top of the oven and having their free edges partially overlying the slot 36. One of the dampers is composed of two lapped sections adjustably connected by bolts passing through slots therein and provided with wing nuts. This permits adjustment of the extent to which the free edge of the damper overlies the outlet slot. The hinged mounting of the dampers permits them to swing upwardly to provide the necessary clearance in case they are engaged by a splice joining successive lengths of a wire strand.

Before lighting the burners, the oven is purged of air by an exhaust fan 40 mounted on brackets 41 secured to one side of the oven. The inlet of the fan is connected to an outlet 42 in the oven wall and the fan is driven by a motor 43 mounted on brackets 41.

The oven is mounted for traveling movement from a position over the tub 11, as shown in Figure 1, to an out-of-the-way position laterally spaced from the tub, as indicated in chain lines in Figure 4. The oven is preferably suspended from beams 44 by brackets 45 secured thereto and to the frame members of the oven binding. The beams 44 are carried by hanger rods 46 depending from trolleys 47. These trolleys are adapted to travel along spaced rails 48. The rails may be supported in any convenient manner. In Figure 1 they are illustrated as secured to cantilever beams 49 extending laterally from a supporting framework 50 of structural members. If the roof trusses of the building in which the apparatus is installed are of sufficient capacity, however, it is usually more convenient to suspend the trolley beams directly therefrom. The mounting of the oven 12 for lateral movement to an out-of-the-way position facilitates threading the wire strands through the apparatus and gives ready access to the tub 11 for removal of the sheaves 22 when necessary. In order to permit the oven to clear the wire strands when properly threaded, one side wall is in the form of a hinged door 51, as shown in Figure 6. The entrance and exit slots 35 and 36 extend through the edge of the bottom and

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top of the oven, respectively, on the side on which the door is mounted.

The oven 12 may be moved from one position to another by manual effort directly applied. For more convenient operation, however, an actuating chain 52 is provided having its ends secured to a gusset 53 fastened to one of the beams 44 and trained around spaced sprockets 54 mounted on shafts journaled on the rails 48. The shaft of the sprocket nearer the central plane through the lime tub also has a sprocket 55 thereon around which an endless operating chain 56 is trained. This chain is of such length as to hang down within reach of an operator standing on the floor.

Guide sheaves 57 having V-grooves spaced axially therealong are disposed above the oven 12 and are adapted to receive the wire strands emerging therefrom and support them as they travel downwardly toward the take-up blocks 13. The sheaves are journaled for rotation on a shaft 58 which may be supported in any desired manner, e. g., on the beams 49, as shown in Figure 1, or by hangers 59 depending from the roof trusses, as shown in Figures 4 and 5.

In using the apparatus described above, a plurality of wire strands 17 are introduced into the lime bath 21 in tub 11. Total immersion is effected by guiding the strands into the bath over and around the supporting roller 18 at the entrance thereof and under and around the hold-down or "sinker" sheaves 22. As shown in Figure 1, the angle made by the entering strands with the surface of the bath is less than 45°. The bath is maintained at a temperature of from 180° to 220° F. by any convenient heating means, such as immersed steam pipes and preferably has a solids content of from 8 to 15%. In case the wire to be coated is delivered directly from a continuous patenting apparatus, the cold-water wash tank 10 is preferably supplied with water at a temperature of from 50 to 65° F., in order to improve the adherence of the lime to the wire as it passes through and out of the bath.

After passing around sheaves 22, the wires travel upwardly from the bath in a vertical path through the drying oven 12. By drawing the wire strands vertically from the bath in a portion thereof which is relatively quiescent, i. e., the space between sheaves 22 and the dam 25, the adherence of a film of maximum thickness for the existing concentration of the bath is assured. Since the bath is of substantially uniform character throughout, there is no tendency for the film to be partly washed off or diluted as the wire emerges from the path. The reduced velocity of the bath adjacent the point of emergence of the wire strands, furthermore, tends to prevent the film disposed on the wires from being washed therefrom. As the wires ascend vertically from the bath, any excess lime adhering thereto runs downwardly along the wires by gravity, thus tending to render the density of the film uniform at all points along each wire.

The film adhering to the wire strands is dried and baked as they pass upwardly through the oven 12. The oven is preferably maintained at about 400° F. although this temperature may be varied considerably. An oven operated at this temperature is capable of satisfactorily drying the lime coating on wire passing therethrough at speeds of about 100 ft. per minute. It will be observed that the strands are maintained in spaced-apart relation to each other and free

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from contact with any guiding or supporting means during their ascent through the oven.

The strands are stretched between the sinker sheaves 22 and the guiding sheaves 57 so that the film of lime adhering to the wires as they pass around the former and upwardly out of the bath is fully dried and baked on by the time the latter is engaged. In fact, the drying and baking are effected to an extent such that the bending of the wires around the sheaves 57 does not cause any noticeable flaking off of the coating.

It will be apparent from the foregoing that the invention herein disclosed is characterized by numerous advantages over the prior practice of coating wire with lime. In the first place, the invention makes it possible to apply a lime coating of much greater uniformity than is obtainable with the method used heretofore. Each point of each wire strand is subjected to practically identical conditions of lime pick-up and drying and there is no contact with the wire between final emergence from the coating bath and complete drying of the adherent film. As a result, bare or uncoated spots on the wire strands are wholly eliminated. By reason of the uniform coating, the subsequent drawing of the wire may be carried out at a higher rate than heretofore with less die wear. In fact, the life of the dies is increased from 25% to 50%. At the same time the resulting product is superior in quality and finish to that made of wire limed by the batch process. This results from the fact that the absence of bare spots prevents bright spots on the finished wire which are subject to scratching. The coated wire is delivered directly from the sheaves above the oven to the take-up blocks, thus eliminating the possibility of abrasion by contact with intermediate guide rollers.

The advantage of the traveling mounting of the drying oven in facilitating threading and giving ready access to the sinker sheaves has already been mentioned. The construction and arrangement of the lime tub and the continuous circulation of the bath contribute in an obvious manner to the application of a highly uniform coating to the wire strands traversing it. The tub and drying oven, furthermore, are of simple construction so that their initial cost is not large and the maintenance thereof almost negligible.

Although we have illustrated and described but a preferred embodiment of the invention, it will be recognized that changes in the arrangement and details of construction and operation may be made without departure from the spirit of the invention or the scope of the appended claims.

We claim:

1. Apparatus for treating wire or the like comprising an elongated drying oven disposed vertically and having transverse entrance and exit slots in its bottom and top, respectively, and an opening in one side from top to bottom communicating with said slots and affording clearance between the wire and oven on sidewise movement of the latter, brackets extending from the sides adjacent that having said opening and overhead trolleys secured to said brackets supporting said oven for sidewise movement along the line of said slots.

2. In a wire-treating apparatus including vertically spaced sheaves between which the wire travels in a vertical path, the combination therewith of a vertically elongated box-like oven between said sheaves enclosing a portion of said path, said oven having transverse slots in its

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bottom and top for passage of the wire, both said slots extending through one side of the oven, and means suspending the oven from above for traveling movement along the line of said slots to an out-of-the-way position laterally of said path, said one side of the oven having means adapted to clear the wire on such movement.

3. Apparatus as defined by claim 2 characterized by said suspending means including spaced rails mounted above the oven and trolleys traveling thereon to which the oven is secured.

4. Apparatus as defined by claim 3 characterized by an endless chain having a run substantially parallel to said rails and secured at one point to said oven, and means for causing travel of the chain whereby to move the oven along said rails.

5. Apparatus as defined by claim 2 characterized by said last-mentioned means including an opening in said one side of the oven extending from top to bottom thereof and communicating

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with said slots and a door normally closing the opening.

6. Apparatus as defined by claim 2 characterized by a damper effective partially to close the slot in the top of the oven.

7. Apparatus as defined by claim 2, characterized by an exhaust fan mounted on one side of the oven and communicating with the interior thereof.

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