June 16, 1959 C. L. PETERSON 2,890,874

HEAT TREATING FURNACE FOR FILAMENTARY PRODUCTS

Filed Oct. 17, 1956 2 Sheets-Sheet 1

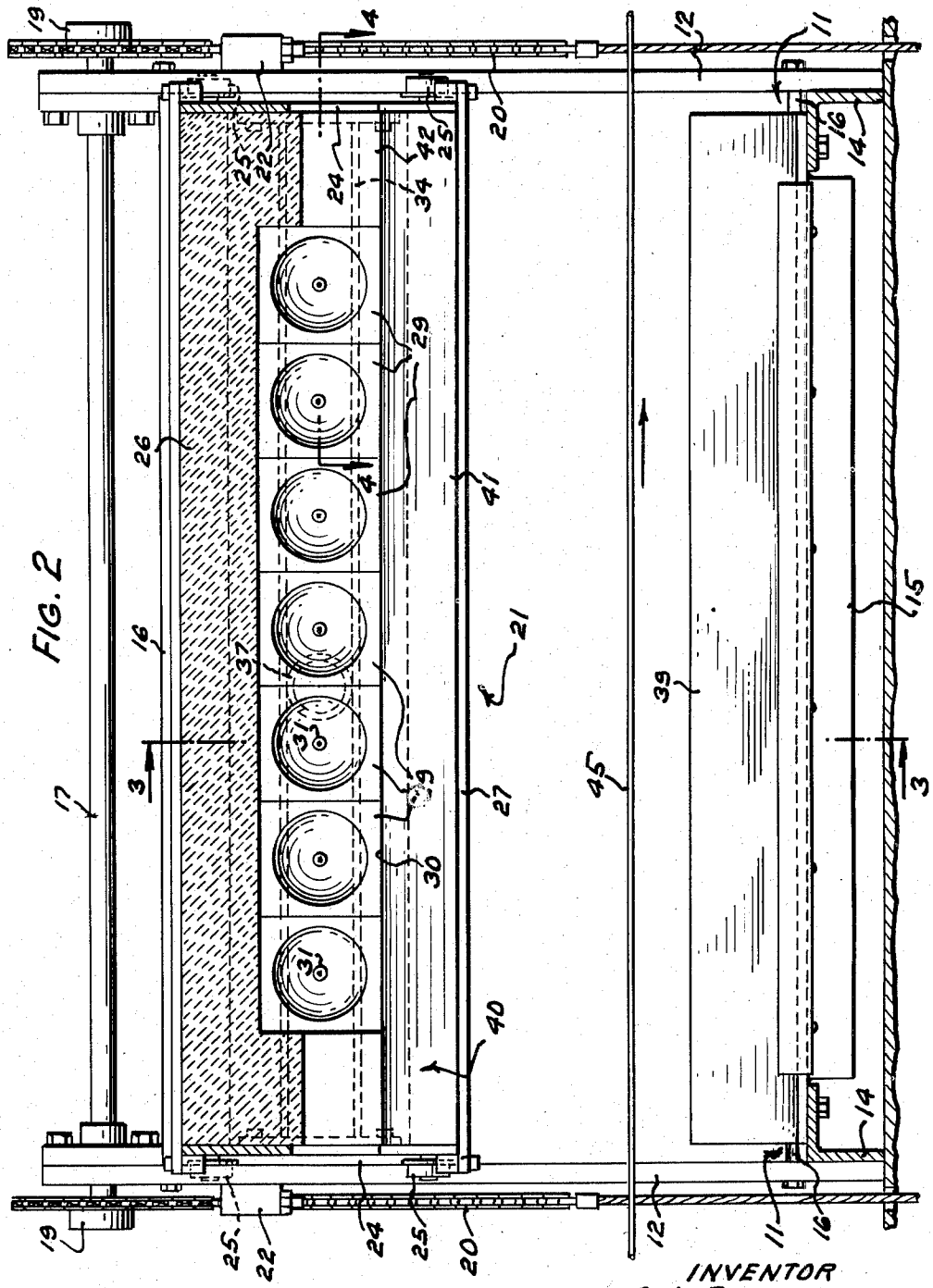


FIG. 2

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FIG. 1

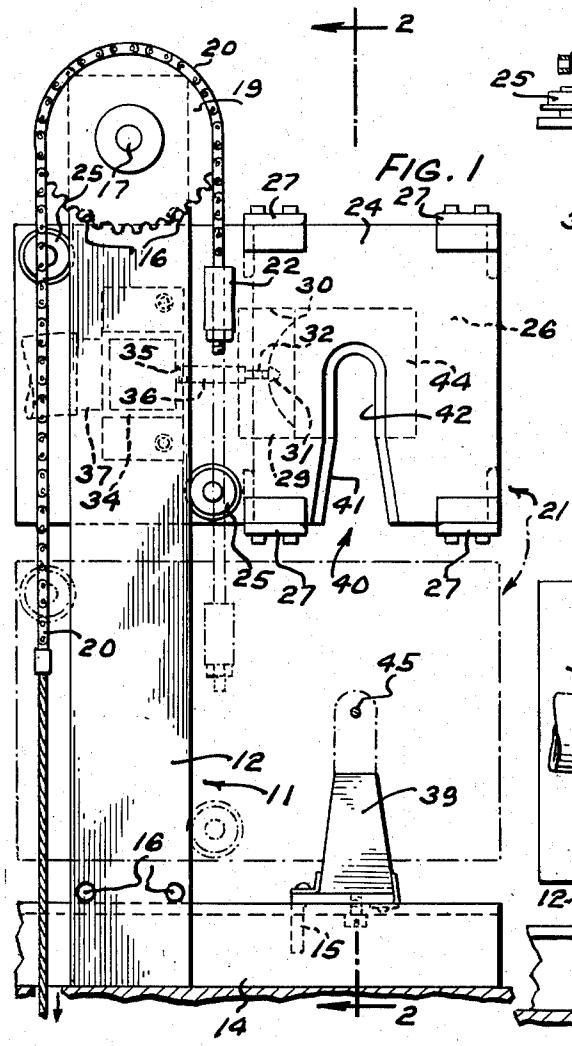


FIG. 4

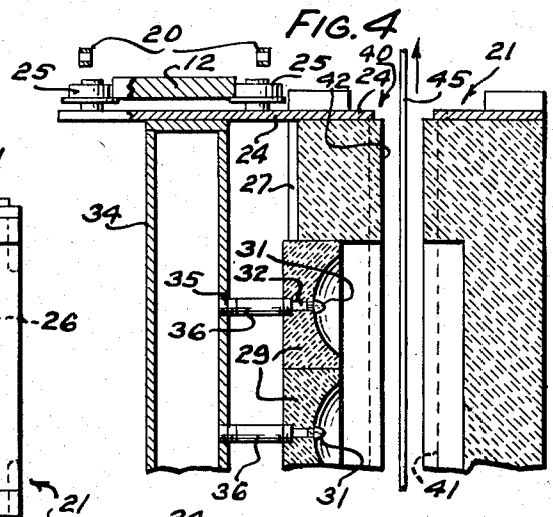


FIG. 3

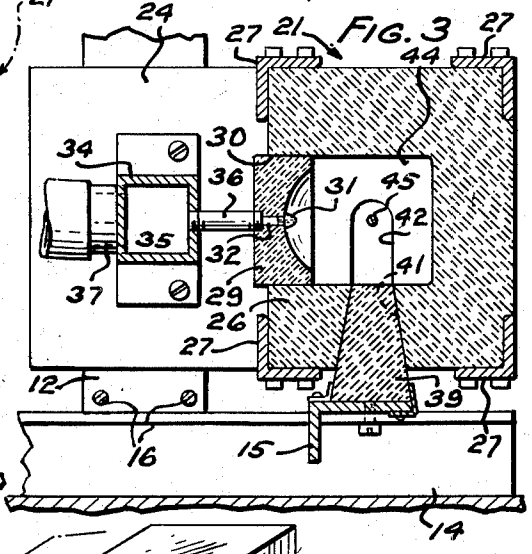
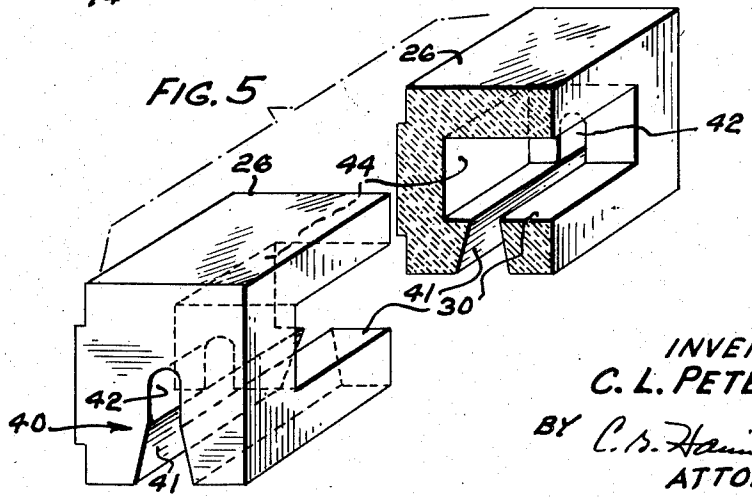


FIG. 5



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United States Patent Office 2,890,874
Patented June 16, 1959

2,890,874

HEAT TREATING FURNACE FOR FILAMENTARY PRODUCTS

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Application October 17, 1956, Serial No. 616,550

5 Claims. (Cl. 263—3)

This invention relates to apparatus for heat treating filamentary products and more particularly to an apparatus for heat treating continuously moving filamentary products.

In the present invention, the disclosed apparatus is designed to anneal continuously moving wire, but it will be manifest from the following description that the invention is equally applicable to other types of heat treatments of various filamentary materials.

In the manufacture of electrical conductors, it is customary to start with a metal rod of substantial diameter and reduce the diameter of this rod to the desired size by means of a wire drawing process wherein the metal rod is pulled through a series of reducing dies of gradually diminishing diameters until the desired wire size has been achieved. As a result of these drawing or metal working operations, the metal of which the wire is composed is in a state known as "work hardened." When this occurs, the wire is usually annealed to render it less brittle and hence of greater utility as an electrical conductor.

It has been customary in the past to effect such annealing of drawn wire as a separate operation. The wire was wound on reels as it left the drawing apparatus and then transported on the reels to a furnace to be annealed. In addition to the objectionable handling operations required to accomplish this annealing, there is the additional inconvenience of the relatively long heating periods due to the slow rate at which wire wound on reels is heated by a conventional hot air annealing furnace. Manifestly then, an annealing furnace which can be utilized in combination with a wire drawing machine to form an apparatus which will both draw and anneal wire in one continuous operation will effect a saving in both time and expense.

It is therefore a principal object of this invention to provide a novel apparatus for heat treating continuously moving filamentary products.

It is another object of this invention to provide a heat treating apparatus capable of operation in combination with an apparatus for producing filamentary products.

It is a further object of this invention to provide a movably mounted open-sided heating chamber and a fixed closure member in register with the open side of the heating chamber for substantially closing the opening in the heating chamber side.

It is still another object of this invention to provide a heat treating apparatus for filamentary material into which the filament can be inserted with a minimum of difficulty.

With these and other objects in view, the present invention contemplates a movably mounted heating chamber provided with a filament admitting opening therein and a fixed closure member. Upon placement of the filament in its running position, the heating chamber is moved into engagement with the closure member thereby substantially closing the opening and leaving only a small

longitudinal passage in the heating chamber through which the filament passes.

Other objects, advantages, and novel features of the invention will become apparent upon consideration of the following detailed description in conjunction with the accompanying drawings wherein:

Fig. 1 is an end elevation view illustrating an annealing furnace embodying the principal features of the invention wherein a movable heating chamber is shown both in its rest position (solid lines) and in its annealing position (phantom lines);

Fig. 2 is a side elevation view, in full section, taken along the line 2—2 of Fig. 1;

Fig. 3 is an end elevation view, in full section, taken along the line 3—3 of Fig. 2 after the heating chamber has been moved into the annealing position;

Fig. 4 is a fragmentary plan view, in full section, taken along the line 4—4 of Fig. 2; and

Fig. 5 is a perspective view of the hollow refractory block forming the interior of the heating chamber, broken away and exploded for reasons of clarity.

Attention now is directed to the drawings wherein like numerals of reference designate like parts throughout the several views and wherein is disclosed a supporting frame, designated generally by the reference numeral 11, comprising upright standards 12, angle members 14 and 15, and longitudinal rods 16 all secured together as shown in any suitable manner. A shaft 17 is rotatably supported by the standards 12 and has roller chain sprockets 19 (Fig. 1) keyed to the extremities thereof. Depending from the sprockets 19 are roller chains 20. First extremities of the roller chains 20 extend into a pit in the floor on which the supporting frame 11 rests and have suitable counterweights (not shown) secured thereto. A movable heating chamber, designated generally by the reference numeral 21, is suspended from the second extremities of the roller chains 20 by means of projections 22 on the end plates 24 of the heating chamber 21. The end plates 24 are further provided with rollers 25 in rolling contact with the sides of the upright standards 12 to prevent any tendency of the heating chamber 21 to pivot about the extremities of the roller chains to which it is attached. This counterweight arrangement permits the heating chamber 21 to be held motionless at any selected position between the upper and lower limits of its range of movement.

The interior of the heating chamber 21 is formed of a hollow block 26 of refractory material which is held between end plates 24 by means of clamping bars 27. A plurality of parabolic heat reflectors 29 of refractory material are positioned within a longitudinal opening 30 in the side of the hollow refractory block 26. Each heat reflector 29 is provided with a burner 31 embedded therein and connecting with an aperture 32 in the reflector 29. A fuel manifold 34 is fixed between the end plates 24 adjacent the longitudinal opening 30 and is provided with a plurality of apertures 35 corresponding in positions to the apertures 32 in the heat reflectors 29. A series of pipe nipples 36 are fixed within the apertures 32 and the apertures 35 for the purpose of interconnecting the burners 31 with the fuel manifold 34. The manifold 34 is further provided with an inlet pipe 37 through which a combustible mixture of gas and air is fed to the burners 31 from a suitable source of supply.

A tapered closure block 39 of refractory material is rigidly attached to the supporting frame 11 on the top of the angle member 15. The hollow refractory block 26 is provided with a filament admitting passage 40 comprising a portion 41 running the entire length of the block 26 and having a taper corresponding to that of the closure block 29, and two sections 42 having parallel sides and com-

municating with the hollow interior 44 of the block 26.

Operation

In order that a better understanding of the invention may be had, its operation during a typical annealing process will now be described. With the movable heating chamber 21 in its upper position, the burners 31 are manually lit off and the combustible mixture flow regulated to provide the proper temperature within the hollow interior 44 of the refractory block 26. The aforementioned temperature to accomplish annealing is, of course, a function of the diameter of the wire, the composition of the wire, and the speed with which the wire passes through the heating chamber and is determined by giving proper consideration to these various factors. When the desired temperature within the block 26 has been achieved, the wire 45 is set in motion along the path best illustrated in Fig. 2 and the heating chamber 21 is simultaneously lowered to the annealing position (phantom lines—Fig. 1). The heating chamber is maintained in alignment with the closure block 39 by means of the rollers 25 bearing on the standards 12. When the heating chamber reaches the annealing position, tapered closure block 39 is tightly fitted into the tapered portion 41 of the filament passage 40 thereby completely closing off the interior 44 of the block 26 except for the openings at either end created by the sections 42 within which the wire is positioned. This substantially confines the hot gases and causes the wire to be heated to its annealing temperature by the time it reaches the exit end of the block 26. The heating chamber 21 is maintained in this position until the supply reel empties or the take-up reel is full. When the wire motion ceases, the heating chamber is raised to its rest position to prevent burning of that section of the wire remaining within the interior of the block 26. A new supply of wire 45 is then furnished and the above operations repeated.

Among the manifold advantages afforded by the aforementioned annealing apparatus is its suitability for use in conjunction with wire drawing machines to anneal wire as the wire is being drawn down, in addition to its utility in processes wherein it is desired to heat treat various filamentary materials in varying manners.

It is to be understood that although the apparatus described is utilized to anneal wire, its use is not limited thereto. It is manifest that numerous modifications of the hereinbefore described apparatus may be made to achieve a similar apparatus which will still be within the spirit and scope of the present invention.

What is claimed is:

1. An apparatus for annealing continuously moving wire comprising a base, upright standards secured to said base, heating means movably mounted on said standard, said heating means having an open-sided wire receiving slot extending longitudinally thereof, closure means secured to said base adjacent the path of travel of the wire and of a cross-section complementary to the outward portion of the wire receiving slot, guide means for maintaining said heating means in alignment with said closure means, and means for moving said heating means toward the path of travel of the wire to cause said closure means to enter and substantially close the wire receiving slot thereby forming an annealing chamber surrounding the moving wire.

2. An apparatus for annealing continuously moving wire comprising a base, upright standards secured to said base, an open-sided heating chamber movably mounted on said standards for heating a moving wire to its annealing temperature, a plurality of burners fixed within a side of said chamber and facing the interior thereof for heating said chamber, means for supplying a fluid combustible mixture to said burners, closure means secured to said base adjacent the line of travel of the moving wire and of a configuration complementary to the open side of said heating chamber, guide means on said heating chamber for maintaining said heating chamber in alignment with said closure means and counterweight means on said standards for moving said heating chamber toward the line of travel of the moving wire to cause said closure means to enter and substantially close the open side of said heating chamber whereby a substantially closed heating chamber surrounding said wire is formed.

3. In an annealing furnace, a base, upright standards secured to the base, a heating means, a counterweight mechanism mounted on the extremities of said standards for supporting the heating means in predetermined positions relative to said base, rollers mounted on said heating means and engaging said standards to prevent said heating means from moving out of alignment with said base, a first refractory block having a heating space extending through a flared mouth section, means for supporting said first block in said heating means, and a second refractory block mounted on said base in register with said flared mouth, said second block being of the same configuration as the flared mouth.

4. An apparatus for annealing continuously moving wire comprising a base, upright standards secured to said base, heating means, said heating means having an open-sided wire receiving slot extending longitudinally thereof, closure means secured to said base adjacent the path of travel of the wire and of a cross-section complementary to the outward portion of the wire receiving slot, a pair of guide rollers mounted on each end of said heating means and in rolling engagement with opposite sides of said standards for maintaining said heating means in alignment with said closure means, and a mechanism mounted on the extremities of said standards for supporting said heating means in predetermined positions relative to said base, said mechanism being connected to said heating means at points eccentric with respect to a longitudinal axis through the center of gravity of said heating means whereby the turning moment induced by gravitational forces tends to maintain said guide rollers in contact with the sides of said standards.

5. In a heating apparatus, a heating chamber, a pair of horizontal plates secured to and extending from the ends of the heating chamber, a pair of rollers mounted in a vertically and horizontally offset relation on the extending portion of each plate, the lower roller of each pair being mounted closer to the heating chamber than the upper roller of each pair, a pair of upright standards projecting between each pair of rollers so that the weight of the heating chamber forces said rollers into engagement with said standards, and means for moving said chamber to move said rollers along said upright standards.

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