

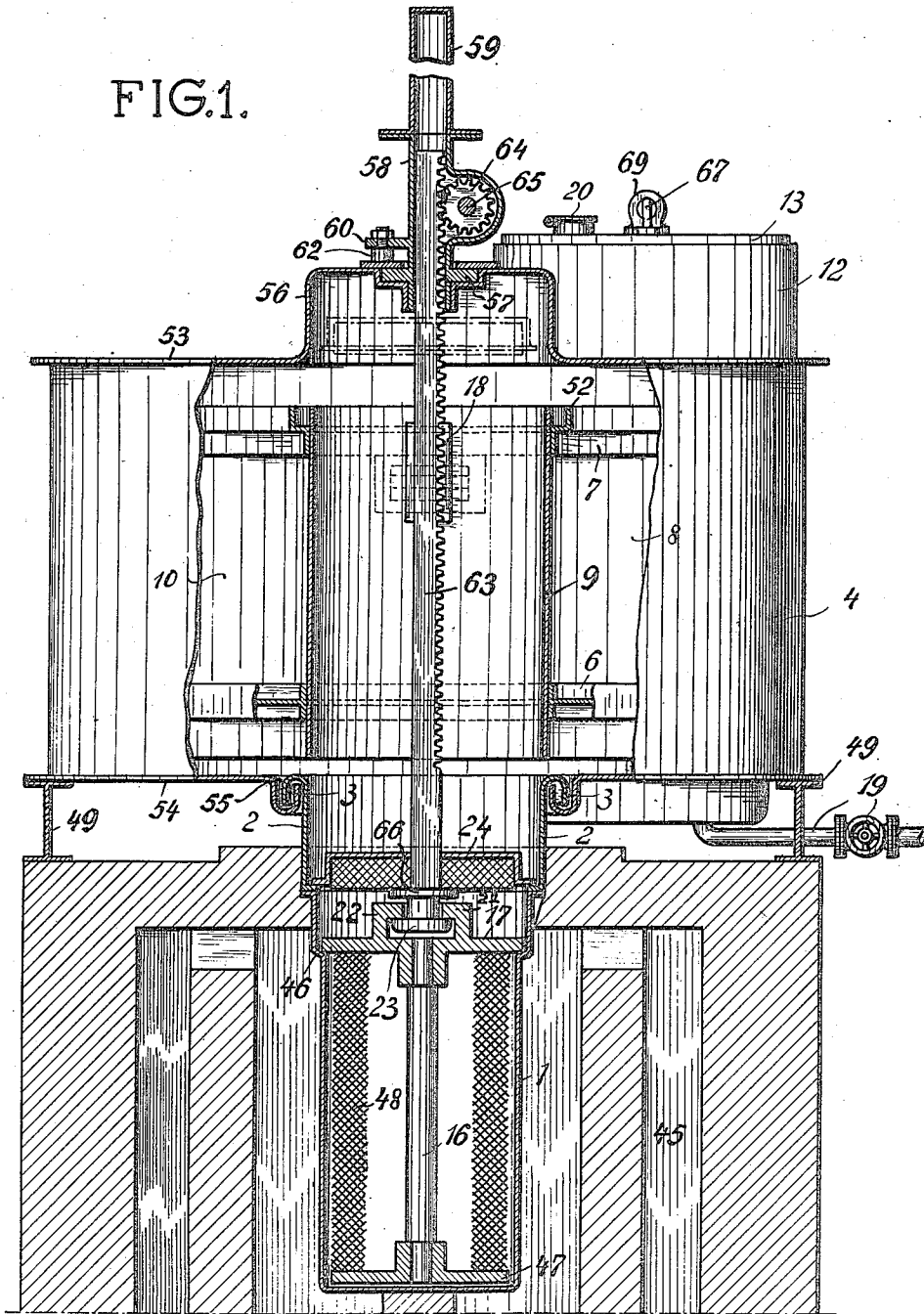
H. HILLEBRAND, JR.
ANNEALING APPARATUS.
APPLICATION FILED JUNE 19, 1912.

1,064,481.

Patented June 10, 1913.

4 SHEETS—SHEET 1.

FIG. 1.



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4 SHEETS—SHEET 2.

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FIG. 2.

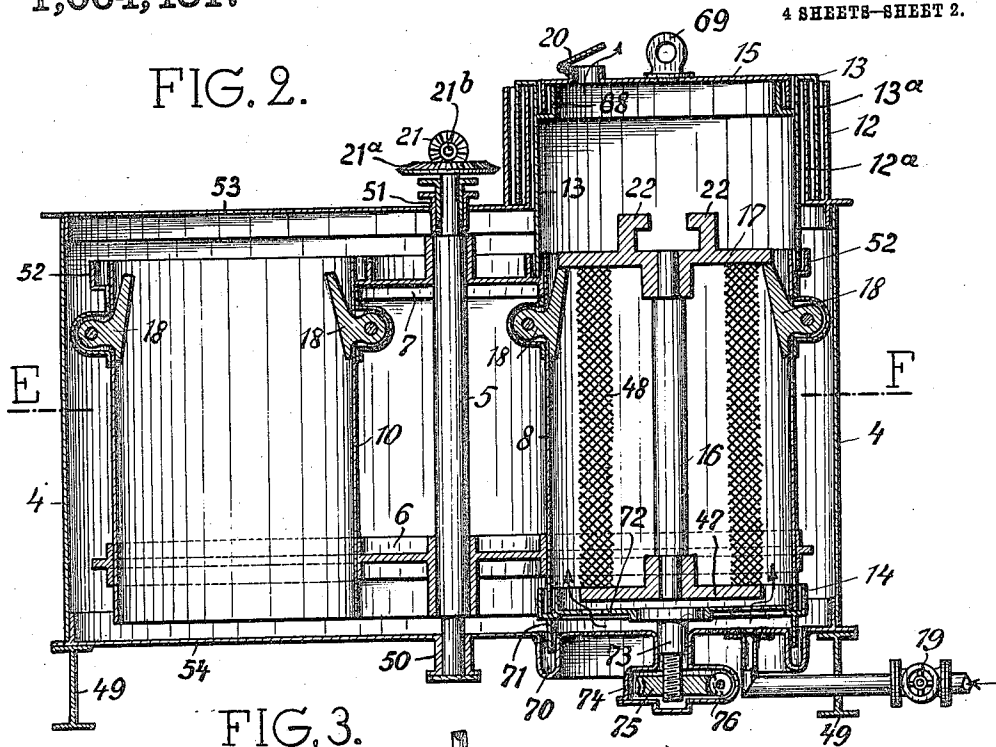
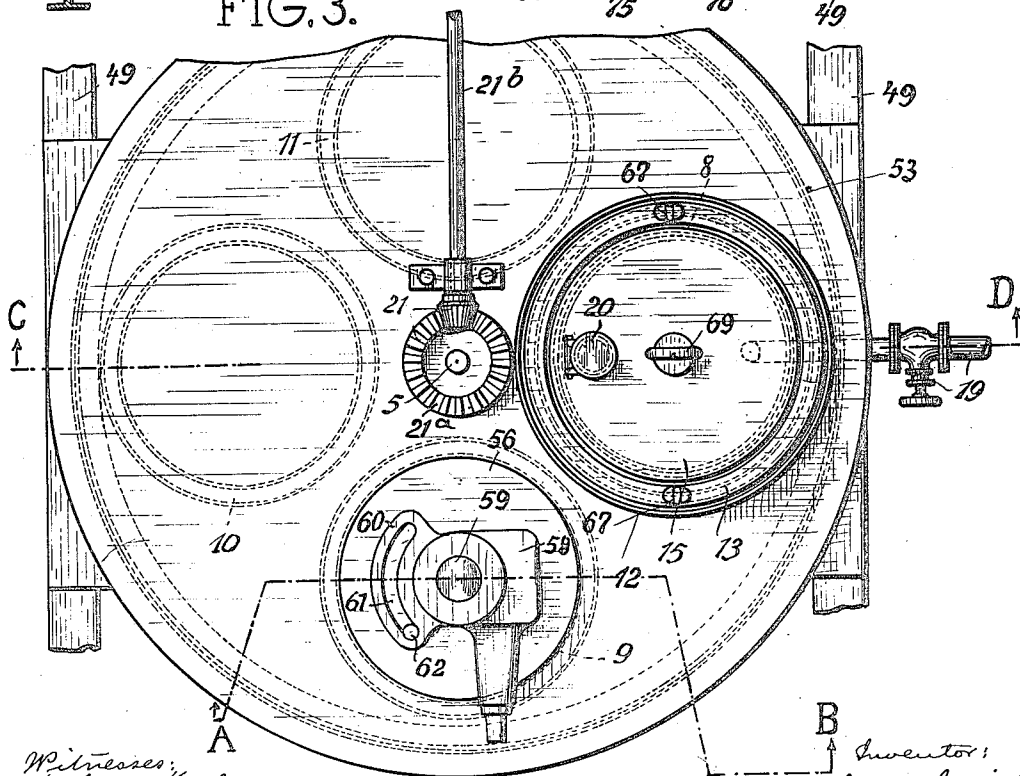


FIG. 3.



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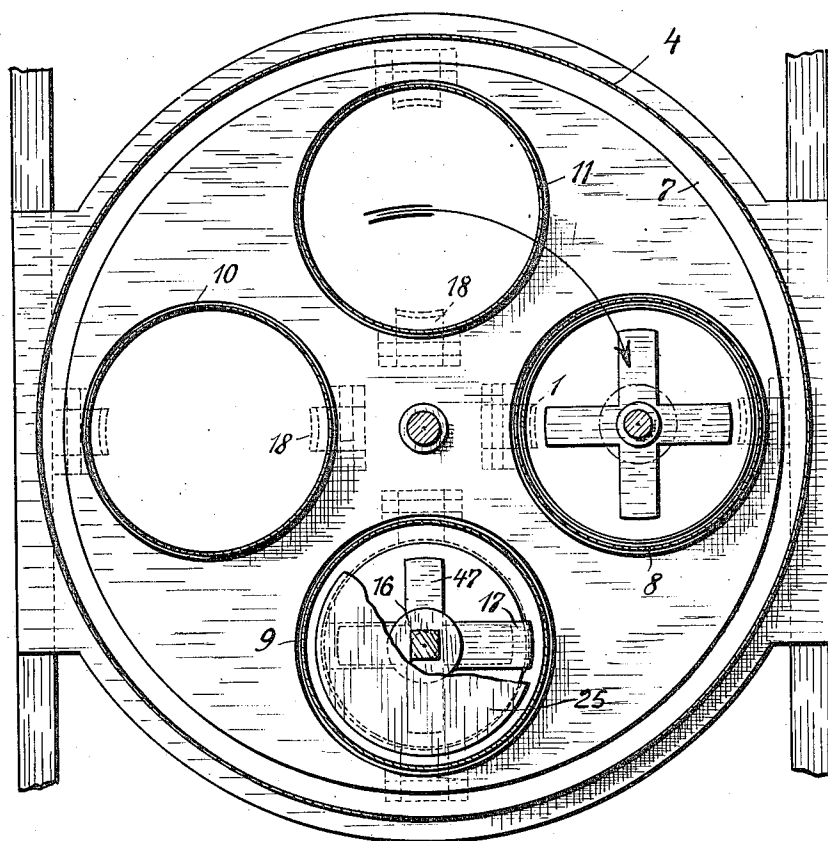
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4 SHEETS—SHEET 3.

FIG. 4.



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4 SHEETS—SHEET 4.

FIG. 5.

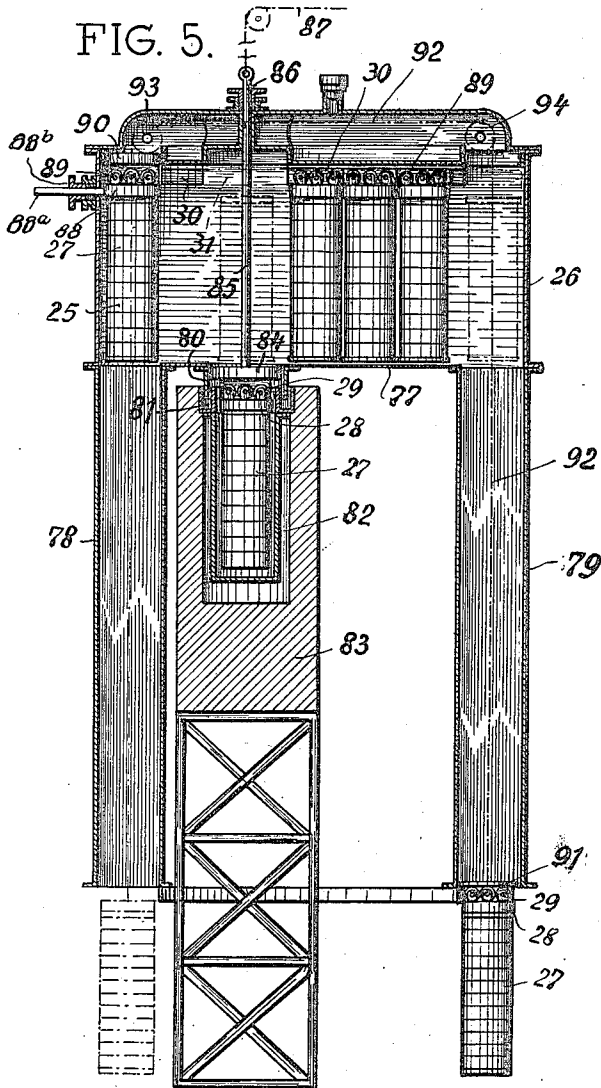


FIG. 8.

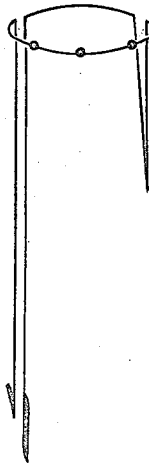


FIG. 7.

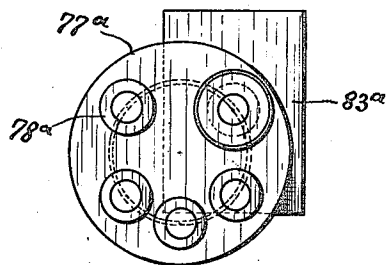
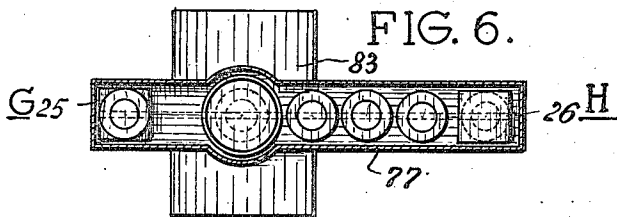


FIG. 6.



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UNITED STATES PATENT OFFICE.

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ANNEALING APPARATUS.

1,064,481.

Specification of Letters Patent.

Patented June 10, 1913.

Application filed June 19, 1912. Serial No. 704,495.

To all whom it may concern:

Be it known that I, HERMANN HILLEBRAND, Jr., a citizen of the Empire of Germany, residing at Werdohl, in Westphalia, Empire of Germany, have invented a new and useful Annealing Apparatus, of which the following is a specification.

My invention relates to a novel apparatus for annealing, particularly wire in coils, hoops and small iron wares, which apparatus comprises a furnace with an annealing pot, a cooling chamber, means for supplying wares to be annealed to the chamber while excluding the air, means for moving the wares in the chamber into the axis of the annealing pot, means for inserting the wares into the pot while closing the latter and for afterward withdrawing therefrom the annealed wares, means for moving the annealed goods in the cooling chamber step by step so as to allow them to cool off, and means for withdrawing the cooled wares from the chamber while excluding the air.

The annealing apparatus is so designed, that the wares to be annealed or cooled are moved in a direction or plane at right angles to the axis of the annealing pot, so as to reduce as much as possible the length of the apparatus.

The apparatus is further so designed as to withdraw the wares to be cooled in the chamber from the heating influence of the annealing pot.

The cooling chamber and the annealing pot are to be filled with a neutral gas such as illuminating gas, so as to protect the wares from oxidation. In case the wares to be annealed and cooled are moved in a direction at right angles to the axis of the annealing pot *i. e.* in a straight line, the wares are supplied on one side and discharged on the other side. In lieu of moving the goods to be annealed in a straight direction, they may be fed in a circle, in which case, a turntable may be employed for receiving in consecutive cylinders open at both ends the wares, for moving them severally into the axis of the annealing pot, for permitting the wares to be there inserted, afterward for receiving back the annealed wares, for moving them farther step by step and at last for permitting the wares to be discharged. In such an apparatus the goods are introduced and again discharged

on one and the same place, so that only a limited space is required for the apparatus. When the annealing pot is placed vertically, simple means may be employed for moving the goods horizontally in the cooling chamber. When a turntable with open cylinders is employed, special devices may be employed for air-tightly shutting any of the cylinders from the cooling chamber, before the apparatus is opened, then the annealed wares are withdrawn from the shut-off cylinder and are replaced by fresh wares, after which the apparatus is again closed, the air in the cylinder is replaced by the neutral gas and the cylinder is put into open communication with the cooling chamber. When a rectangular cooling chamber is placed vertically and the annealing pot is placed beneath it, two high tubes may be attached to the bottom of the chamber on both sides of the pot and the wares may be passed from below through one tube into the chamber and the annealed goods may be removed from the chamber downward through the other tube. In this case no special means for air-tightly closing the apparatus are necessary with the exception of stuffing-boxes for rods for horizontally pushing the wares in the chamber.

In the accompanying drawings: Figure 1 is a vertical section through the broken line A—B in Fig. 3, seen in the direction of the arrows, and shows an annealing apparatus comprising a cylindrical cooling chamber with a turntable therein and an annealing pot with furnace below, Fig. 2 is a vertical section through the cooling chamber alone on the line C—D in Fig. 3, Fig. 3 is a top view of the same, Fig. 4 is a horizontal section through the same on the line E—F in Fig. 2, Fig. 5 is a vertical longitudinal section through a modified annealing apparatus on the line G—H in Fig. 6, this apparatus comprising a rectangular cooling chamber, two high tubes and a furnace with annealing pot beneath the chamber, Fig. 6 is a horizontal section through the same near the top of the cooling chamber, Fig. 7 is a plan view of a modification of this apparatus, in which the cooling chamber is made cylindrical, and Fig. 8 diagrammatically illustrates the path of the wares through this modified apparatus.

The annealing apparatus illustrated at

Figs. 1 to 4 comprises a furnace 45 with an annealing pot 1 therein and a circular closed casing 4 with a turntable therein. I do not further describe the construction of the furnace 45, as it is immaterial to my invention, the essential point being that the furnace be capable of properly heating the annealing pot 1.

The annealing pot 1 shown is of a known construction and is preferably provided with a shoulder 46 for supporting some holder for the wares to be annealed. In the present case this holder is shown as adapted to hold wire 48 in coils. It consists of a crosshead 17 adapted to be supported by the shoulder 46 and to be connected in any known manner by means of a central rod 16 with a cross 47 below. On the top of the furnace 45 two beams 49, 49 are shown to be placed for supporting the casing 4. The bottom 54 of this casing is in its center provided with a step-bearing 50 of any known construction and the cover 53 is provided in its center with a stuffing-box 51. A vertical shaft 5 is mounted to turn in the bearing 50 and the stuffing-box 51 and carries two superposed disks 6 and 7 with four vertical cylinders 8, 9, 10, 11 secured in these disks. The four cylinders are disposed at the same distance from the shaft 5 and are set at a right angle to one another. They are open above and below, pass through the two disks 6, 7 and their upper edges are surrounded with concentric walls 52 on the disk 7, so as to form an annular furrow to be filled with a sealing liquid. The central shaft 5 forms with the two disks 6, 7 and the four cylinders 8, 9, 10, 11 a turntable, which can be turned by means of two bevel wheels 21^a, 21, a shaft 21^b and a hand-crank or some mechanism (not shown) at the outer end of the shaft. Preferably the periphery of the large bevel wheel 21^a is provided with four pendent indicators (not shown) and the upper surface of the cover 53 is provided with four marks, whereby it is rendered possible to move all the four cylinders 8, 9, 10, 11 exactly through a right angle, so that they can all be consecutively brought into the vertical axis of the annealing pot 1. Two opposite rocking supports 18, 18 are provided on the inside of each cylinder 8, 9, 10, 11 and are adapted to support the crosshead 17 of any holder, as is clearly shown in Fig. 2 on the right. Preferably the inner faces of the supports 18, 18 facing one another are inclined, so as to enable them to turn outward, should the crosshead 17 during its upward motion from the annealing pot 1 through the cylinder happen to strike the supports 18, 18, so that the motion of the holder is not prevented.

The upper end of the annealing pot 1 is gas-tightly connected with a cylindrical extension 2, which passes through a corre-

sponding aperture in the bottom 54 and has at the upper end a roll-shaped border 3 adapted to plunge in some sealing liquid contained in an annular recess 55 in the bottom 54, whereby the annealing pot 1 is gas-tightly connected with the casing 4, while the border 3 of the extension 2 is at liberty to expand under the influence of the heat transmitted by the walls of the pot 1 and the extension 2. The extension 2 has the same inside diameter as any cylinder 8, 9, 10, 11 and on its lower flange a cover 24 lined with refractory material can rest for preventing the heat of the pot 1 from passing upward. The cover 53 is provided on its upper side with a cylindrical dome 56 coaxial with the annealing pot 1. The top of the dome 56 is provided with a stuffing-box 57 of any known construction, in which the lower tubular end of a casing 58 can be turned. The casing 58 has a segment 60 with a concentric slot 61 in which latter a stud 62 on the cover 53 engages. On the casing 58 is put a long tube 59 closed at the upper end and a vertical rack 63 is guided in the casing 58 and the tube 59. A pinion 64 in the casing 58 meshes with the rack 63 and can be turned from without by means of a handcrank (not shown) on the outer end of its shaft 65. The rack 63 passes through the cover 24 and has a collar 66 for lifting the cover off the lower flange of the extension 2. The lower end of the rack 63 is provided with another collar 23, which is adapted to engage beneath two opposite hooks 22, 22 provided on the cross-head 17.

The cover 53 is provided on the upper side at a right angle to the dome 56 with two high concentric cylinders 12, 12^a (Fig. 2) forming a deep groove which is filled with a suitable sealing liquid. Into this liquid the long pendent outer border 13^a of a sealing tube 13 permanently plunges and the lower edge of this tube can plunge into the sealing liquid in the groove formed by the wall 52 and any tube 8, 9, 10, 11. The sealing tube 13 is provided on its upper rim with two opposite rings 67, 67 (Figs. 1 and 3), by means of which it can be suspended from two chains or ropes (not shown) passing over two guiding pulleys on some ceiling and connected at their other ends with counterweights. It will be seen, that in this manner the sealing tube 13 can be raised and lowered by hand. On the inside the tube 13 is provided at its upper end with a concentric bent projection 68, whereby another groove is formed, which is filled with a sealing liquid. Into this liquid the pendent border of a cover 15 can plunge, which is in its center provided with a ring 69 that is to be suspended from some chain or rope (not shown) passing over a pulley on the ceiling and carrying at its other end a counterweight, whereby the cover 15 is balanced.

The cover 15 is provided with an air-discharging valve 20 of any approved construction.

The bottom 54 is provided on its upper side with a deep groove 70 concentric with the sealing tube 13 and filled with a sealing liquid. Into this liquid another sealing tube 71 permanently plunges, which is supported by an open disk 72 and a screw-spindle 73. This spindle is longitudinally guided in a casing 74 connected with the bottom 54 and can be raised and lowered by means of a worm wheel 75 and a worm 76, which latter can be turned from without by means of a hand-crank (not shown) put on the outer end of its shaft. On some point within the furrow 70 the bottom 54 is connected with a bent tube 19, through which a neutral gas can be supplied from some source to the casing 4. The upper edge 14 of the sealing tube 71 is also furrowed and this furrow is filled with a sealing liquid into which the lower edge of any cylinder 8, 9, 10, 11 can plunge. The above mentioned rocking supports 18, 18 engage with their naves in suitable recesses of the cylinder 8, 9, 10, 11, so that when the upper sealing tube 13 plunges with its lower edge into the seal 52 and the lower sealing tube 71 is raised for permitting the lower edge of the cylinder 8 or 9 or 10 or 11 to plunge into its seal 14, the space within the cylinder and the two sealing tubes 13 and 71 is gas-tightly separated from the interior of the casing 4, which serves as a cooling chamber.

The annealing apparatus operates as follows: After having shut off the supply of neutral gas through the tube 19 and raised the lower sealing tube 71 and lowered the upper sealing tube 13 together with the cover 15 for gas-tightly separating the interior of the cylinder 8 (which is assumed to occupy the position shown), the cover 15 is taken off, the holder 17, 16, 47 with the annealed wire 48 is in any known manner removed upwardly, after which another holder with a fresh charge of wire 48 is introduced from above, care being taken that the ends of the crosshead 17 are put on the upper faces of the two rocking supports 18, 18, and then the cover 15 is again put on. Now the neutral gas is turned on through the tube 19, so that it passes upward through the cylinder 8 and the wire coils 48 and expels the air, which escapes through the valve 20. Then the lower sealing tube 71 is lowered and the upper sealing tube 13 is so much raised as to permit the hooks 22, 22 of the crosshead 17 to pass under it. In this manner the interior of the cylinder 8 is put into open communication with the cooling chamber filled with neutral gas, while all air is excluded. The shaft 21^b is then operated by means of its hand-crank or otherwise for turning the cylinder 8 through a right angle

into the axis of the annealing pot 1. At this moment the rack 63 occupies nearly its highest position, so that its lower collar 23 freely passes under the two hooks 22, 22 of the crosshead 17. Next the hand-crank on the shaft 65 is turned a little for raising a bit the rack 63, so that its collar 23 engages the two hooks 22, 22 and thereby lifts the crosshead 17 just off the two supports 18, 18, whereupon the shaft 65 is turned to the left in Fig. 3 through a convenient angle around the axis of the rack 63, so as to move the ends of the crosshead 17 out of the reach of the two supports 18, 18. Afterward the rack 63 with the holder and the charge 48 is lowered into the annealing pot 1 by means of the hand-crank on the shaft 65. The cover 24 engaging the lower flange of the extension 2 shuts the annealing pot 1 off from the cooling chamber and the fire gases of the furnace 45 sweeping the outer surface of the pot 1 will anneal the wire 48. Meanwhile the following cylinder 11 has replaced the cylinder 8 in the position shown and is being shut off from the cooling chamber in the manner described above and its annealed charge is replaced by a fresh one, after which the cover 15 is put on and the air contained in the cylinder is replaced by neutral gas. About at the moment that this task has been finished, the charge 48 in the annealing pot 1 will have been annealed, so that it can be withdrawn from the pot 1 by means of the rack 63, after which the shaft 65 in Fig. 3 is turned to the left, that is to the initial position shown in full lines, so as to move the ends of the crosshead 17 over the two supports 18, 18. Then the rack 63 is slightly lowered, so as to release the two hooks 22, 22, whereupon the turntable is turned through another right angle, so as to move the cylinder 8 with the annealed charge 48 into the position of the cylinder 10 shown in Fig. 4 and to move the cylinder 11 with the fresh charge into the position of the cylinder 9, that is into the axis of the annealing pot. Then the fresh charge can be lowered into the annealing pot and the annealed charge in the cylinder 8 is allowed to cool off in the cooling chamber, while the cylinder 10 having been moved into the position of the cylinder 8 is separated from the cooling chamber and its annealed charge is replaced by a fresh one. Obviously, when the charge 48 lowered from the cylinder 11 into the pot 1 has been annealed, again raised and put on the supports 18, 18 in the cylinder 11 and the turntable is again turned through a further right angle, the annealed charge in the cylinder 8 will further cool off in the position shown of the tube 11. After the following turn of the turntable this annealed charge is replaced by a fresh one, as described above,

In Figs. 5 and 6 a modified annealing ap-

paratus is illustrated, which presents the advantage, that no special means are required for shutting off the neutral gas in the cooling chamber from the atmosphere.

5 A perfectly closed prismatic casing 77 of a rectangular cross section forms the cooling chamber and is connected at the bottom with two high tubes 78, 79 on the ends 25, 26 and with a sealing tube 80 between them. The

10 two tubes 78 and 79 freely communicate with the cooling chamber, and the sealing tube 80 plunges in the liquid contained in an annular groove 81 on the upper end of the annealing pot 82. A furnace 83 of any

15 known construction is adapted to heat the pot 82. The holder for containing the goods to be annealed may be of any known construction. For example it may consist of several superposed baskets or broken vessels

20 27 suitably connected together and suspended from a head plate 88 (similar to 28 in Fig. 12) by means of a cross pin similar to 38. The head plate 88 may be provided with two parallel series of rollers 89 mounted

25 on pins secured in projections of the plate. At the top of the casing 77 a rail 30 is fastened, which rail is broken so as to leave space for a piston 84 adapted to close the sealing tube 80. The piston 84 is connected

30 with a vertical rod 85, which passes through a stuffing-box 86 in the top and is shown to be connected with a chain or rope 87 by means of which the piston 84 can be moved up and down in any known manner.

35 Two pistons 90 and 91 similar in construction to 84 are connected together by means of two parallel chains or ropes 92 passing over two pairs of guiding pulleys 93 and 94 mounted in the top of the casing.

40 The piston 90 is adapted to move through the left tube 78 and the cooling chamber in Fig. 5 and the piston 91 through the right tube 79 and the cooling chamber. A charged holder, that is a head plate 88 with the pendent column of vessels 27 filled with

45 wares, can be attached to the piston 90 by moving the two series of rollers 89 over the rail made in one with the piston. Then the holder with the fresh charge can be raised through the left tube 78 in any known manner,

50 until the rail of the piston 90 registers with the rail 30, while the other piston 91 with the attached holder and annealed wares is lowered through the right tube, as is

55 shown, so that the holder with the annealed wares can be taken off. The holder with the fresh charge, that is the head plate 88 can be horizontally pushed to the right by means of suitable rods 88^a passing through

60 stuffing-boxes 88^b on the left side of the casing 77, so as to shift the rollers 89 from the piston 90 to the rail 30, after which the piston 90 alone is lowered for receiving a fresh charge, as is indicated by dotted lines.

65 When the piston 84 occupies its highest po-

sition in which it registers with the broken rail 30, the fresh charge can be wheeled over its rail, while the annealed charge is shifted to the other part of the rail 30. Then the piston 84 with its charge can be lowered for inserting the charge into the annealing pot 82. The cooling chamber, that is the casing 77, and the greater part of the two high tubes 78, 79 is kept full of the neutral gas, which owing to its smaller specific weight cannot escape from the apparatus.

The apparatus just described may be modified in that the casing 77 is made cylindrical and the rail 30 is made circular, as is indicated at Fig. 7, which requires no further explanation. Of course the casing 77^a requires to be connected with one high tube 78^a only, through which the fresh charge is raised and the annealed charge lowered, any known device being provided for effecting this motion. Fig. 8 diagrammatically illustrates the path of the wares through this apparatus.

I claim:

1. In an annealing apparatus of the class described, the combination with a closed casing adapted to be filled with neutral gas and to serve as a cooling chamber, of an annealing pot communicating with said casing, a furnace for heating said annealing pot, means for introducing wares to be annealed into said closed casing in a direction parallel to said annealing pot while excluding the air, means for shifting the introduced wares into the axis of said annealing pot, means for inserting the wares in said annealing pot while shutting off the latter from the cooling chamber and for again withdrawing the wares when annealed, means for moving the annealed wares step by step in a direction at right angles to said pot so as to allow them to cool off, and means for withdrawing the cooled wares from said casing while excluding the air.
2. In an annealing apparatus of the class described, the combination with a closed casing adapted to serve as a cooling chamber, of two vertical tubes beneath said casing and communicating therewith and at the lower end with the atmosphere, an annealing pot parallel to said two tubes and communicating with said casing, said casing and said annealing pot and the greater part of said two tubes being adapted to be filled with a light neutral gas, a furnace for heating said annealing pot, means for introducing wares to be annealed from below through one of said two tubes into said casing, means for horizontally shifting the introduced wares into the axis of said annealing pot, means for inserting the wares in said annealing pot while shutting off the latter from the cooling chamber and for again withdrawing the wares when an-

nealed, means for horizontally shifting the annealed wares step by step so as to allow them to cool off, and means for withdrawing the cooled wares from said casing downward through the other of said two tubes.

3. In an annealing apparatus of the class described, the combination with a cylindrical closed casing adapted to serve as a cooling chamber, of a vertical tube beneath said casing and communicating therewith and at the lower end with the atmosphere, an annealing pot parallel to said tube and communicating with said casing, said casing and said annealing pot and the greater part of said tube being adapted to be filled with a light neutral gas, a furnace for heating said annealing pot, means for introducing wares to be annealed from below through said tube into said casing, means for horizontally shifting the introduced wares into the axis of said annealing pot, means for inserting the wares in said annealing pot while shutting off the latter from the cooling chamber and for again withdrawing the wares when annealed, means for horizontally shifting the annealed wares along the periphery of a circle step by step so as to allow them to cool off, and means for withdrawing the cooled wares from said casing downward through said tube.

4. In an annealing apparatus of the class described, the combination with a closed casing adapted to serve as a cooling chamber, of two vertical tubes beneath said casing and communicating therewith and at the lower end with the atmosphere, an annealing pot beneath said casing and communicating therewith, said casing and said annealing pot and the greater part of said two tubes being adapted to be filled with a light neutral gas, a furnace for heating said annealing pot, two pistons each provided with a rail, means for moving up and down said two pistons through said two tubes and the cooling chamber, a third piston adapted to shut off said annealing pot from the cooling chamber and provided with a rail, means for moving said third piston up and down through the cooling chamber, two rail parts at the top of the cooling chamber adapted to periodically register with the rails of said

three pistons, wheeled holders for wares adapted to be laterally moved one after the other over the rail of one piston when at the lower end of one tube and off the rail of the second piston when at the lower end of the second tube, also to be shifted from the rail of the first piston when raised to one of said two rail parts, then therefrom to the rail of the third piston when raised, afterward therefrom to the second rail part and subsequently therefrom to the rail of the second piston, and means for horizontally shifting said holders in the cooling chamber.

5. In an annealing apparatus of the class described, the combination with a cylindrical closed casing adapted to serve as a cooling chamber, of a vertical tube beneath said casing and communicating therewith and at the lower end with the atmosphere, an annealing pot beneath said casing and communicating therewith, said casing and said annealing pot and the greater part of said tube being adapted to be filled with a light neutral gas, a furnace for heating said annealing pot, a first piston provided with a rail, means for moving said first piston up and down through said tube and the cooling chamber, a second piston adapted to shut off said annealing pot from the cooling chamber and provided with a rail, means for moving said second piston up and down through the cooling chamber, two rail parts at the top of the cooling chamber adapted to register with the rails of said two pistons in their highest position and forming therewith a circle, wheeled holders for wares adapted to be laterally moved over the rail of said first piston when at the lower end of said tube and off the same, also to be shifted from the rail of the first piston when raised to one of said two rail parts, then therefrom to the rail of said second piston when raised, afterward therefrom to the second rail part and subsequently therefrom to the rail of the first piston, and means for horizontally shifting said holders in the cooling chamber.

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