May 19, 1936. F. J. WINDER ET AL 2,041,312

ANNEALING APPARATUS

Original Filed March 26, 1934 2 Sheets-Sheet 1

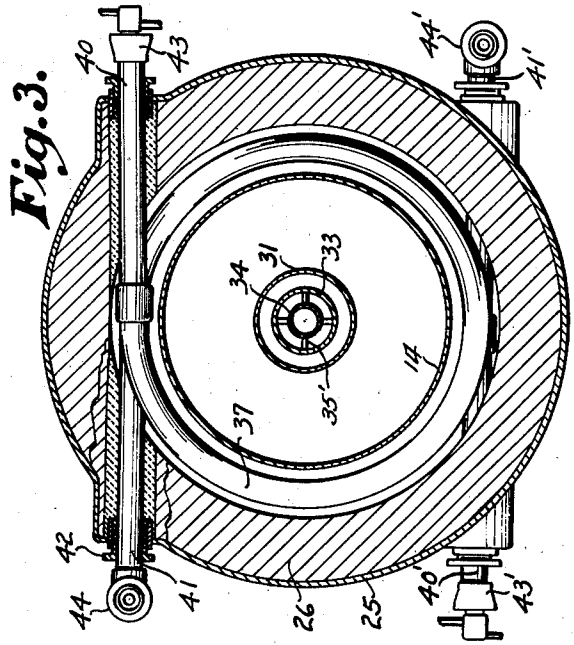


Fig. 3.

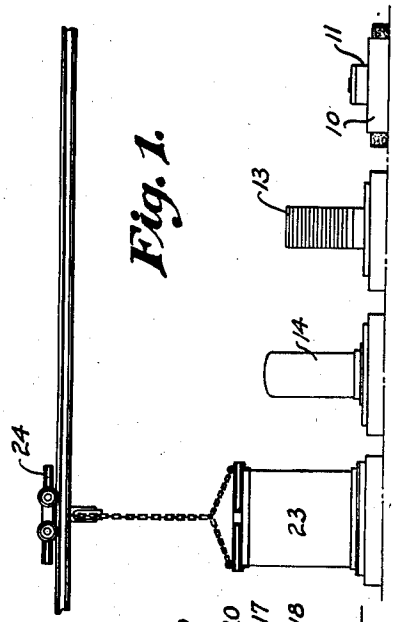


Fig. 1.

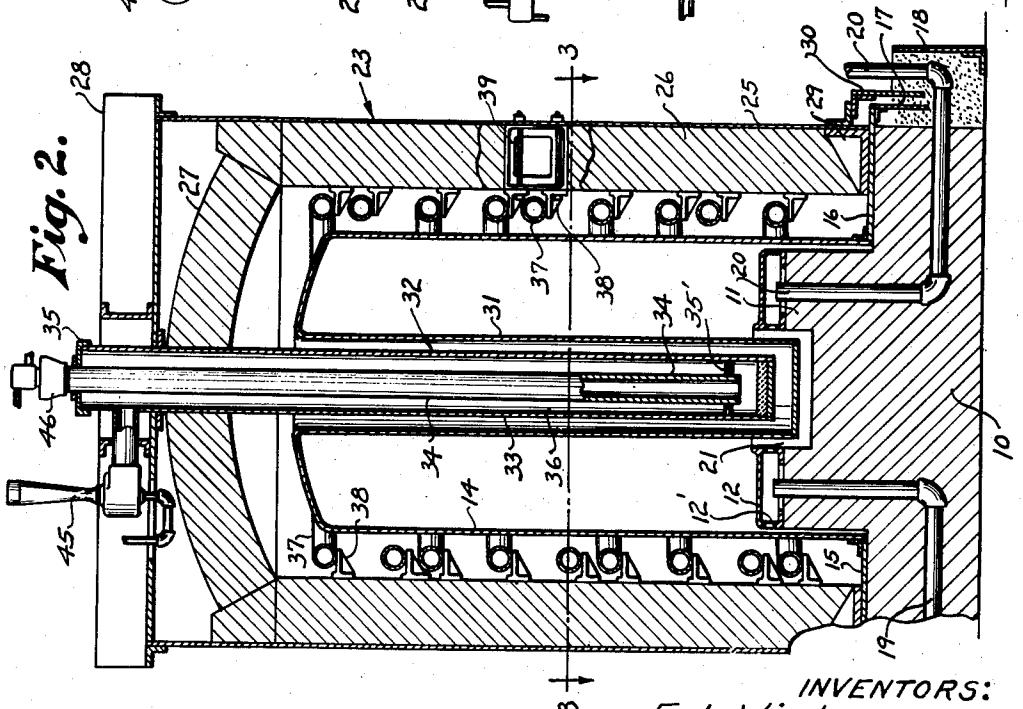


Fig. 2.

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Fig. 4.

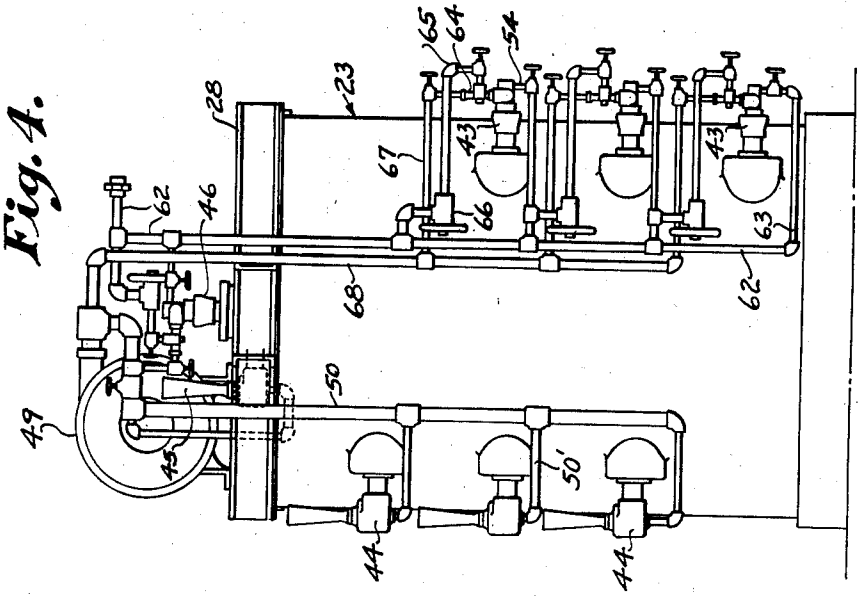


Fig. 6

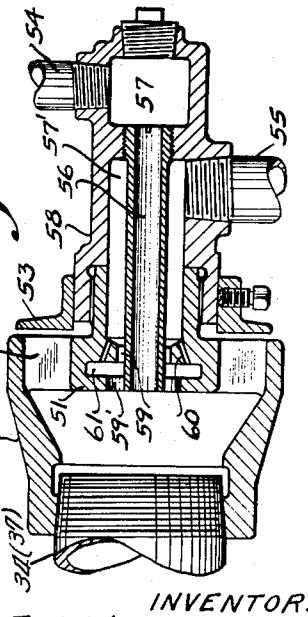
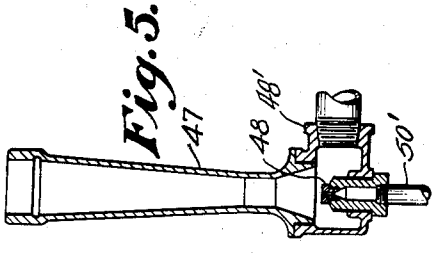


Fig. 5.



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UNITED STATES PATENT OFFICE

2,041,312

ANNEALING APPARATUS

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Application March 26, 1934, Serial No. 717,356
Renewed January 20, 1936

10 Claims. (Cl. 266—5)

This invention relates to heat-treating furnaces of the type embodying a furnace base on which the material is supported during heat-treatment and a heating hood which is removably seated on the base to form a heating chamber for the material.

The object of the invention is to provide a circular furnace of the type indicated with combustion radiator tubes so arranged as to effect uniform heating of annular material such as coiled strip steel.

Referring to the drawings wherein the preferred form of the invention is shown;—

Fig. 1 is a side elevation showing, on a small scale, four treating stations, the one at the right showing merely a furnace base, the next showing a furnace base with a charge of material supported thereon, the next showing a furnace base with a protective bell for the material in place on the base and the one at the extreme left showing a heating hood in place on a furnace base, the view also showing an overhead conveyor for moving the heating hood from one furnace base to another;

Fig. 2 is a vertical sectional view of the improved furnace;

Fig. 3 is a horizontal section on line 3—3 of Fig. 2;

Fig. 4 is a side elevation of the furnace shown in Fig. 2;

Fig. 5 is an enlarged sectional view of an exhauster associated with the outlet end of the several combustion radiator tubes, and

Fig. 6 is an enlarged sectional view of a burner associated with the intake end of the several combustion radiator tubes.

The base of the furnace is indicated at 10 and is shown as provided with an upstanding circular portion 11 on the top of which is an annular stool 12 on which the material 13 (see Fig. 1) is supported during heating and cooling. The material will ordinarily be covered over by a gas tight metal cover 14 during heating and cooling and a protective gas will ordinarily be flowed through the cover. The supply pipe for the protective gas is indicated at 19 and the exhaust pipe at 20. The stool 12 has side openings 12' through which the gas enters and leaves the cover.

The cover 14 is shown as having a radial foot 15 for seating on a shelf 16 around the base portion 11 and said foot is provided with a depending circumferential flange 17 for dipping into a sand trough 18 around the base 10. The cover is annular in horizontal section. The walls of its central tunnel are indicated at 31 and the tunnel is sufficiently long to permit its lower end, which is closed to extend into a central recess 21 in the top of the upstanding portion 11 of the furnace base.

The heating hood is generally indicated at 23. It is open at the bottom and has side walls 26 and a roof 27. The walls are contained within a metal shell 25 having an annular foot 29 on which the side walls 26 are supported. Secured to and surrounding the shell 25 is a depending flange 30 for dipping into the sand trough 18. The shell extends above the roof 27 a sufficient distance to support a framework 28 which permits the hood as a whole to be lifted.

Extending downwardly centrally axially from the top of the hood is a fuel-fired heater generally indicated at 32. This heater comprises two concentric radiator tubes 33 and 34 arranged in radially spaced relation as indicated at 36. The outer tube 33 is closed at its lower end whereas the lower end of the inner tube 34 is open. Radial spacer fingers 35' between the tubes maintain them in radially spaced relation. The outer tube 33 is supported by the framework 28 and the inner tube 34 is supported by a cap 35 on top of the outer tube.

Extending radially from the upper end of the outer tube 33 is a branch pipe which connects with an exhauster 45 which, as shown in Fig. 5, comprises a discharge nozzle 48 set to discharge into a Venturi tube 47 which extends from a chambered fitting 48 wherein the nozzle is mounted. Air or other fluid under pressure is delivered to the nozzle by a supply pipe 50'. Since the tubes 33 and 34 are in open communication at their lower ends it will be readily appreciated that the suction effect produced by the exhauster will cause a down draft in the inner tube 34.

At the upper end of the inner tube 34 is a burner 46, the details of which are shown in Fig. 6 and which will now be described. Secured to the upper end of the tube 34 is a tubular extension 52 having a flaring mouth which is open to the atmosphere. Positioned centrally axially in the extension as by ribs 51' is a hub 51 having an axial extension for supporting a tubular extension 58 having a chamber 57 at its outer end. Fuel gas is delivered to the chamber 57 by a gas supply pipe 54 and extending from the chamber is a gas discharge tube 56. The air for supporting combustion of the fuel discharged from the tube 56 is the air which is drawn into the upper end of the combustion tube 34 by the draft

produced by the exhauster 45. A shutter 53 in front of the extension 52 controls the effective inlet area thereof. The fuel discharge tube 56 passes through a chamber 57' to which a preformed combustible mixture of air and fuel gas is delivered by a supply pipe 55. The mixture thus delivered to the chamber 57' flows therefrom through a relatively restricted passage 59 around the tube 56 adjacent its discharge end and serves, when ignited, as a tubular pilot flame for insuring ignition of the fuel issuing from the tube 56. To insure ignition of the mixture issuing from the passage 59, some of the mixture flows from the chamber 57' by way of a ring of outwardly diverging ports 60 which discharge into a shielded combustion groove 61 having an outlet 59' around the discharge end of fuel tube 56. The mixture issuing from the chamber 57' is initially ignited by inserting a flare into the extension 52.

By introducing the fuel and its combustion supporting air into the combustion tube 34 in the manner described, combustion proceeds relatively slowly as compared with a preformed mixture of air and fuel gas and consequently localized or spot heating of the tube 34 is prevented.

The means for producing radiant heat along the side walls of the heating hood comprises a plurality of horizontally extending vertically spaced combustion radiator tubes generally indicated at 37. Each tube enters the hood tangentially, makes a complete loop therein and then leaves the hood tangentially as clearly shown in Fig. 3. Where the tubes enter and leave the hood, stuffing boxes 42 may be provided. Each tube is individually supported on a number of shelves or ledges 38 projecting from bodies 39 embedded in the walls of the hood as shown in Fig. 2. At the intake end of each tube is a burner similar to that shown in Fig. 6, and at the outlet end is an exhauster similar to that shown in Fig. 5.

It is a feature of the invention that adjacent tubes 37 enter and leave the hood at diametrically opposite points with the result that in one set of tubes the flow of heating gases is in a clockwise direction whereas in the other set the flow is counterclockwise thereby insuring more uniform heating in the hood. Referring to Fig. 3 wherein the arrangement is illustrated, the entering end of the top tube is indicated at 40 and its leaving end at 41. In the next lower tube the entering end is indicated at 40' and its leaving end at 41'. The burner and exhauster for the top tube are indicated at 43 and 44 respectively whereas in the next lower tubes the corresponding parts are indicated at 43' and 44' respectively.

By entering the tubes 37 tangentially, a substantial portion of each tube inwardly from its burner is straight. Intermixing of the fuel and its combustion supporting air in this particular portion of the tubes, therefore, proceeds relatively slowly with the result that the entering portion of the tubes is not overheated. The curvature of the tubes accelerates intermixing but not to such degree as to cause objectional spot heating.

An air blower 49 mounted on the framework 28 at the top of the hood 23 supplies pressure air to the several exhausters previously described, as through supply pipe 50 of which the pipes 50' constitute branches. Air from the blower is also utilized for making up the combustible mixture supplied to the several burner chambers 57', the air being delivered by pipe 68 and lateral branches 67 to a plurality of inspirator-type mixing devices 64, one for each burner. The gas to be mixed with the air is delivered to said devices by supply pipe 62 and lateral branches 65 in each of which latter is a governor or pressure regulator 66 for reducing the gas to atmospheric pressure. Mixing apparatus of this type is well known in the art. The pipes 54 which deliver gas to the several burner chambers 57' are lateral branches from the main gas supply pipe 62.

What is claimed is:

1. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a ring-type cover adapted to be placed over the material and to rest on the base, a heating hood open at the bottom and adapted to be lowered over the cover and to rest on the base, a fuel fired heater arranged in the middle portion of said cover and comprising: a heat-radiating conduit having its intake and exhaust ends outside of said hood, means for delivering fuel to the intake end of the conduit and means at the exhaust end of the conduit tending to draw the fuel through the conduit.

2. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a ring-type cover adapted to be placed over the material and to rest on the base, a heating hood open at the bottom and adapted to be lowered over the cover and to rest on the base, a heater arranged in the middle portion of said cover and comprising: a pair of upright, parallelly extending tubes which extend into said portion from outside of said hood and which are in communication within said portion, means for delivering fuel to the outer end of one of said tubes, and means at the outer end of the other tube tending to draw the fuel through said tubes.

3. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a movable cover adapted to be placed over the material and to rest on the base, a heating hood open at the bottom and adapted to be lowered over the cover and to rest on the base, heating tubes arranged circumferentially along the inside wall of the hood, the ends of each tube extending tangentially out of the hood in opposite directions, and means for applying heat internally to said tubes.

4. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a movable cover adapted to be placed over the material and to rest on the base, a heating hood open at the bottom and adapted to be lowered over the cover and to rest on the base, two sets of heating tubes within the hood, one set leading around the cover in a clockwise direction, and the other set leading around the cover in a counterclockwise direction, the tubes of one set alternating with the tubes of the other set in vertical series.

5. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a heating hood open at the bottom and adapted to be placed over the material and to rest on the base, vertically spaced, horizontally arranged heating tubes, each entering the hood tangentially and making a loop therein and leaving the hood tangentially, and means for applying heat internally to said tubes.

6. Heat-treating apparatus comprising, in combination, a base for the material to be treated, a heating hood open at the bottom and adapted to be placed over the material and to rest on the

base, vertically spaced, horizontally arranged heating tubes, each entering the hood tangentially and making a loop therein and leaving the hood tangentially, means associated with one end of each tube for supplying fuel thereto, and means associated with the other end of each tube for withdrawing products of combustion from the tube.

7. The combination specified in claim 5, characterized by means projecting from the inner wall of the hood for movably supporting the tubes.

8. Heat-treating apparatus comprising, in combination a base for the material to be treated, a heating hood open at the bottom and adapted to be placed over the material and to rest on the base, vertically spaced, horizontally extending heating tubes, each entering the hood tangentially and making a loop therein and leaving the hood tangentially, and each open at the intake end to the atmosphere, a gas-supply pipe leading to each tube at the intake end thereof, and an aspirator arranged at the exit end of each tube for inducing gaseous flow through the tube.

9. Heat treating apparatus comprising, in combination, walls forming a chamber for the material to be treated, means for producing heat in said chamber, said means comprising an upright combustion tube in said chamber and which has its upper end extending through the roof of said chamber, a conduit extending upwardly from the lower end of said tube and through the roof of said chamber to form a continuous flow path from the upper end of said tube to the upper end of said conduit, a suction producing device at the upper end of said conduit for drawing air into said tube at the upper end of the latter, and means for discharging fuel downwardly into the upper end of said tube.

10. Heat-treating apparatus comprising, in combination, a base for supporting the material to be treated, a heating hood open at the bottom and adapted to be placed over the material and to cooperate with said base to form a closed heating chamber, heating means in the hood, said means including an outer tube having a closed end inside of the hood and having its other end outside of the hood, an inner tube of smaller diameter arranged within the outer tube and extending adjacent to but spaced from the closed end of the outer tube, the intake end of the inner tube being outside of said hood, means for flowing fuel into the intake end of the inner tube, means for producing draft through the tubes, and said tubes extending between the top and bottom of the chamber.

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