Dec. 17, 1929. M. FARMER 1,739,958

ELECTRICAL ANNEALING

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Fig. 1.

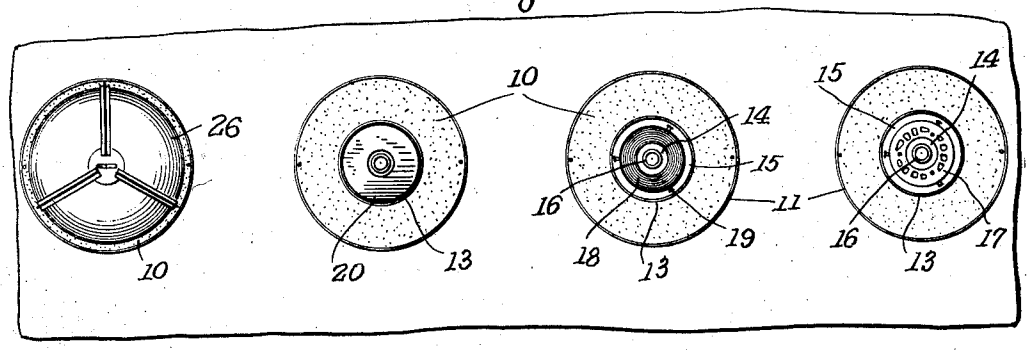
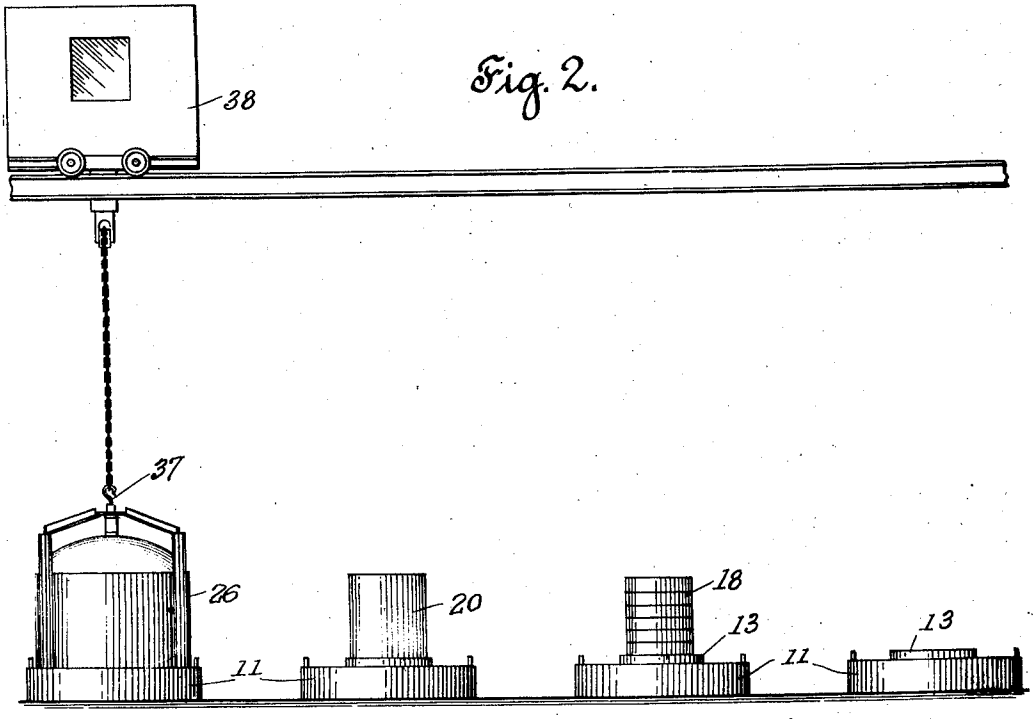


Fig. 2.



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Malcolm Farmer

BY

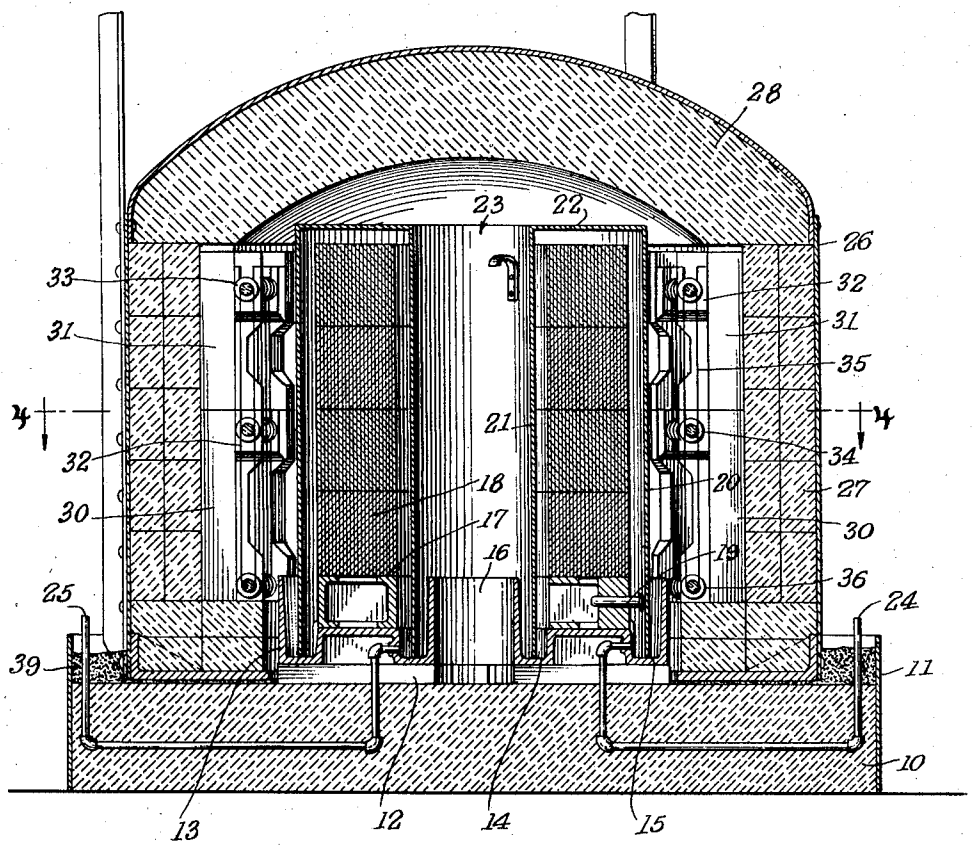
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Fig. 3.



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Fig. 4.

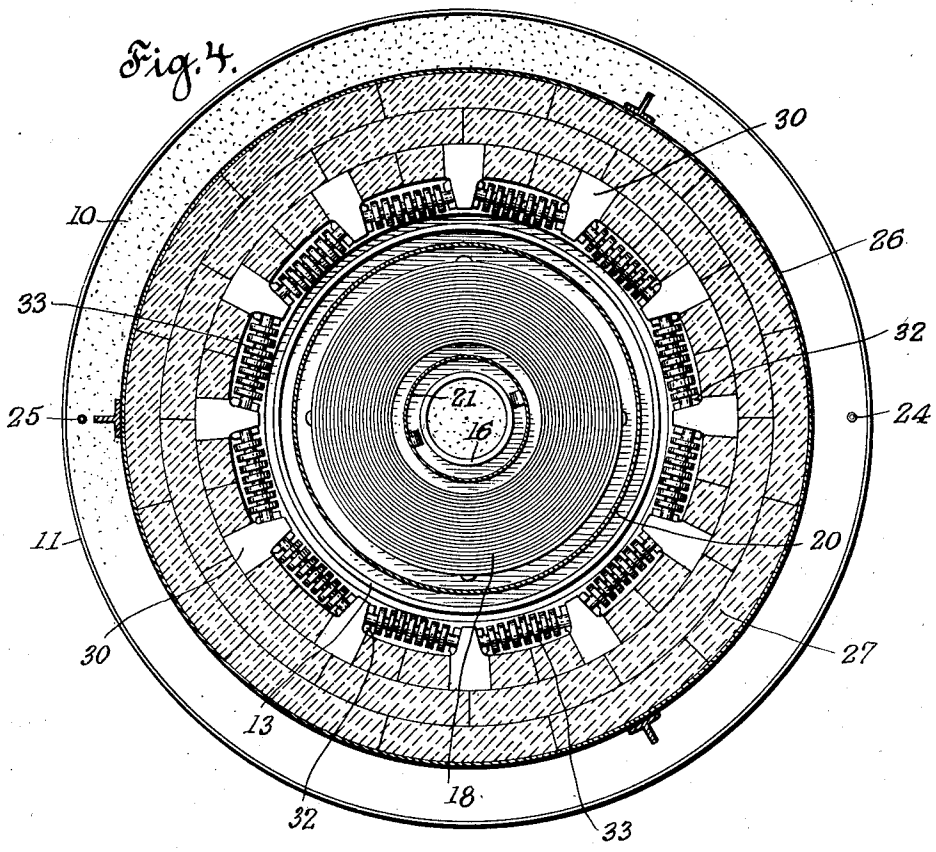
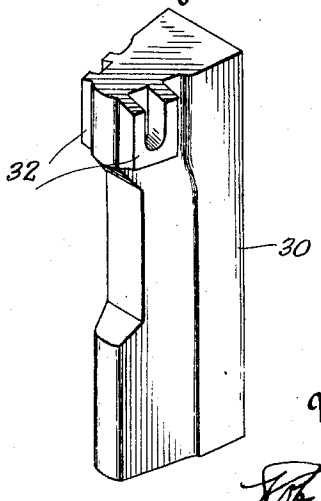


Fig. 5.



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Fig.6.

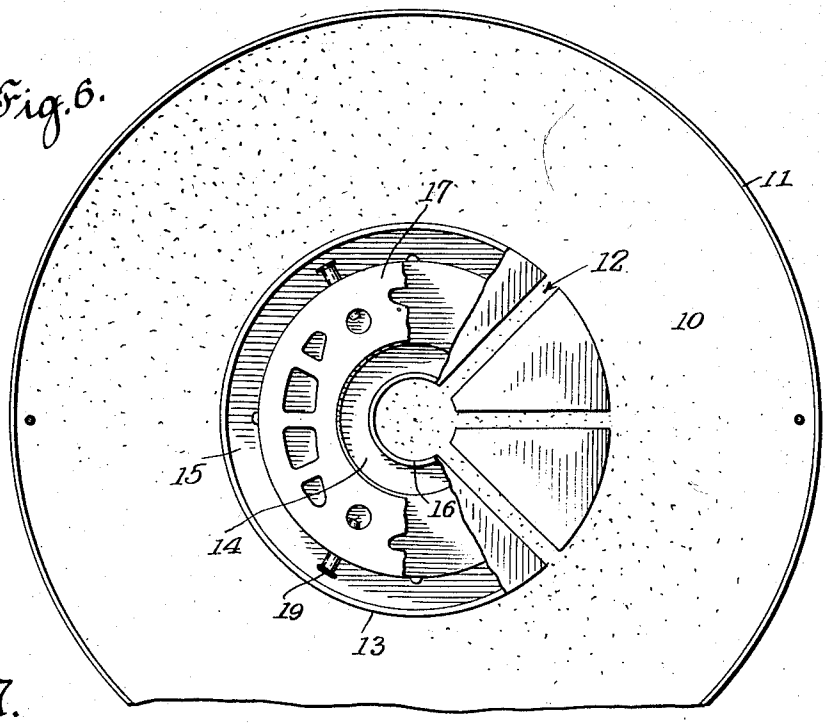


Fig.7.

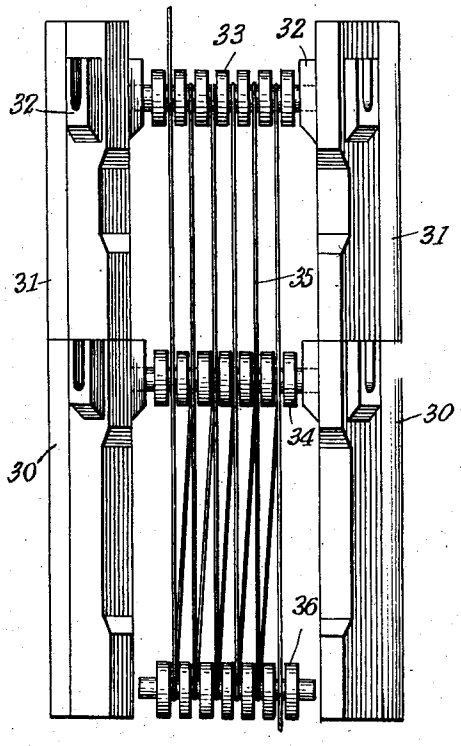
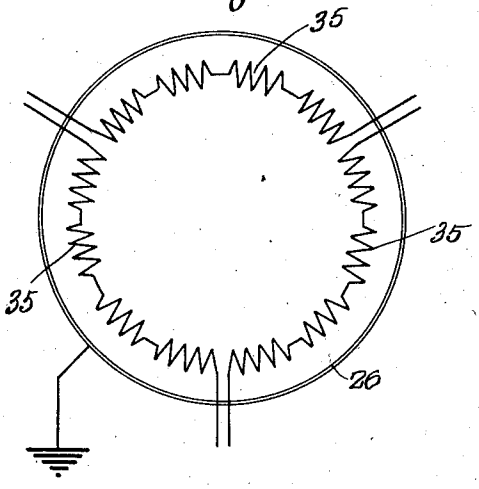


Fig.8.



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Patented Dec. 17, 1929 1,739,958

UNITED STATES PATENT OFFICE

MALCOLM FARMER, OF HARTFORD, CONNECTICUT

ELECTRICAL ANNEALING

Application filed August 2, 1926. Serial No. 126,361.

The present practice of annealing cold rolled steel involves certain factors which have as their aim, the desire to anneal the steel and at the same time to maintain the unoxidized finish on the surface and also to maintain the polish which is given to the steel by cold rolling. After long study and experimentation I have been able to arrive at a most satisfactory method employing electricity as a heating means. It has been found, however, that the weight of the usual container is so great in relation to the weight of the steel that the amount of electricity used for the purpose of effecting this annealing, makes the cost of heating very expensive.

This objection I have overcome by placing electrical resistance wires on the inside of a hood or cover surrounding the steel with the idea that the heating of the steel may be effected more directly and with less cost.

Practically all steel which is annealed has been rolled and in the rolling operation, it is necessary to lubricate this steel with a certain amount of mineral oil. During the course of the annealing operation, the lubricating oil which remains on the steel volatilizes, the hydro-carbon compounds composing it distilling off slowly as the heat arises. It is a well known fact that when the products of distillation of hydro-carbons are brought into contact with extremely hot surfaces, there is a tendency for these hydro-carbons to break down to lighter hydro-carbons and carbon. It has been found that where the electrical resistors have been placed in the same chamber with the steel, there is a precipitation of carbon by the "cracking" of the hydro-carbon gases which result in short circuits and which in turn results in burning out the electrical parts of the equipment.

The advantage of placing the electrical resistance in close proximity to the steel to be heated is obvious and further, it is obvious that these electrical resistors can be put on the inside of a container which is lined inside and outside with insulating materials and thus conserving the heat, but as above stated, the effect of the mineral oil vapors in cracking when they came in contact with the highly heated electrical resistance wires, has made it necessary to make provision for overcoming this objection.

This difficulty has been overcome by utilizing a thin shell of metal within a heating hood, which is impervious to the distilled vapor generated within the shell thus protecting the electrical resistors and providing a chamber in which the steel may be cooled in a non-oxidizing atmosphere.

In the accompanying four sheets of drawings I have shown one form of apparatus for treating rolls or coils of metal. According to the preferred form of my invention the material is loaded or stacked in the treating room and the heater is brought to it. The heater consists of a bell-like hood with electrical resistors within it and with a thermally insulating shell. A single heater is sufficient to treat several charges. Each charge is first covered with a metal shield and then the heater is lowered over the shielded charges successively, remaining on each a sufficient time to heat the material through its shield. The shield serves to prevent any oil or other substance from being transferred from the steel to the heater wires. The parts should be designed so as to bring the heater wires as close as possible to the material to be treated.

After a charge is heated the heater is removed and the stock is allowed to cool in its shield in an atmosphere of non-oxidizing gas. The shields are then raised and the annealed material taken away.

Fig. 1 is a plan view showing on a small scale four treating stations, the one at the right showing merely the base or support, the next showing a charge of metal on the base, the next showing a shield in place and the one at the left showing a heater in use.

Fig. 2 is a side view of the same with an overhead conveyor or trolley for moving the heater from one station to the other.

Fig. 3 is a vertical sectional view on a larger scale, of one complete heating and cooling unit with material in place.

Fig. 4 is a horizontal section on the plane of the line 4—4 of Fig. 3.

Fig 5 is a perspective view of one of the pedestals for supporting the resistor wires.

Fig. 6 is a plan view, parts being broken away to show the base and platform of a station.

Fig. 7 is a detail side view showing how the resistors may be supported.

Fig. 8 is a diagrammatic plan view of the circuit employed in a heater.

The base 10 may be formed of concrete and has a flange 11. Portions of the base are elevated somewhat above the remainder so as as to provide air passages 12 leading to the center beneath the charge support 13. This support 13 has annular channels or grooves 14 and 15, and a central air passage 16.

A hollow base ring 17 serves as a platform for the material such as coils 18 of strip steel to be treated. This ring has trunnion pins 18 to facilitate handling the stock. Preferably the apparatus is designed to accommodate several coils at once at each station. Fig. 3 shows four coils of stock and Fig. 2 shows six layers.

The shield is of thin sheet metal shaped to conform as nearly as practical to the shape of the charge of metal to be treated. It has an outer wall 20 to set in the groove 15 and an inner wall 21 to set in groove 14. The top is closed at 22 and there is a central air passage 23. A gas pipe 24 leads into the interior of the shield and a pipe 25 leads out of it so that a suitable gas may be continuously passed through the shield and around the stock while it is being treated, particularly during the cooling.

The heater hood consists of a shell 26 lined with thermally insulating or non-conductive material such as fire brick 27, and high temperature resisting cement 28. A number of pedestals 30, 31 of insulating material are built into the side wall of the hood and provided with sockets 32 at the upper ends to receive the spools 33 and 34 which carry the resistor wires 35 which are looped up and down in a suitable manner. The lower spool 36 keeps the wire taut. These wires are preferably arranged in separate circuits, for instance three, as shown in Fig. 8, so that in case one should burn out while in operation the process can be continued without disturbance with the others. The shell 26 is preferably grounded for safety's sake.

The hood is preferably provided with a hook or eye 37 to facilitate handling. An overhead crane or trolley 38 serves to lift the hood and move it from station to station.

In carrying out the process or method the stock to be treated is placed on a ring 17 within a support 13. A shield is then lowered over the stock and its lower edges may be sealed in the grooves 14 and 15. The heater hood is then lowered over the shield and the edge sealed at 39. Current is then turned on for the desired time which may be several hours during which the stock is gradually and uniformly heated to the desired temperature. The shield prevents the products of distillation of oil on the stock from damaging the heater wires. The heater is then removed and may be immediately, while it is still hot, lowered over another charge. When the heater is removed, air can circulate beneath the ring 13 through the passages 12, 16 and 21 and around the shield so as to gradually cool it. The shield protects the stock and controls the rate of cooling. While the stock is cooling, gas is supplied through the pipes 24 so as to prevent the stock from oxidizing. This arrangement makes it possible to bring the resistance wires close to the stock to be heated so as to use the current as efficiently as possible and at the same time ensures uniformity of action without damage to the resistors.

It should be understood that I consider that the invention is susceptible of embodiment in other forms of apparatus and that the method may be applied to the treatment of material other than steel and in forms other than coils.

I claim:

1. Electrical annealing apparatus comprising a base for supporting the material to be treated and having air passages, a movable shield adapted to be placed over the material and rest on the base and having an air passage communicating with the air passages on the base, a heating hood adapted to be lowered over the shield, said hood containing electrical resistors adjacent said shield and means for sealing said air passages when the resistors are being heated.

2. The method of annealing which comprises stacking the material to be treated, covering the material with a gas-tight shield, enclosing the shield with a heater having an external thermally insulating wall and internal electrical resistors, passing an electric current through the resistors for a sufficient time to heat the material to the desired temperature, removing the heater, leaving the material to cool in the shield and enveloping the material in a non-oxidizing gas while it cools.

3. The method of annealing which comprises placing a coil of material to be treated on a base, lowering over the material, a gas tight shield, lowering over the shield, a heater having internal electrical resistors, passing an electric current through the resistors for a sufficient time to heat the material to the desired temperature, raising and removing the heater and leaving the material to cool in the shield.

4. The method of annealing which comprises arranging coils of the material to be treated on a plurality of bases, placing a shield over each base, lowering an electrically heated hood over the various shields suc-

cessively and leaving each shield and its contents to cool after the hood has been removed from it.

5. The method of annealing strip steel which comprises arranging the steel in coils, stacking the coils, electrically heating said stack of coils and at the same time preventing the products of volatilization from the stack from reaching the heating means and removing the heating means and allowing the stack to cool in a non-oxidizing atmosphere.

6. Electrical annealing apparatus comprising a base for supporting the material to be treated, said base having a sealing channel, a shield adapted to be placed over the material and to extend into said sealing channel for sealing the lower edge of the shield, and a heating hood open at the bottom and adapted to be lowered over the shield, said hood containing electrical resistors on the inside for surrounding the material to be treated.

7. Electrical annealing apparatus comprising a base for supporting the material to be treated, an annular shield adapted to be placed over the material and rest on the base, means for sealing the lower edge of the shield, a heating hood open at the bottom and adapted to be lowered over the shield, said hood containing electrical resistance and means for sealing the lower edge of said hood.

8. Electric annealing apparatus comprising a base having a central tubular projection, an outer flange and an intervening supporting ring for coils of metal, a shield member open at the bottom and adapted to be lowered over coils of metal supported on said ring and a heater adapted to be lowered over the shield, said heater having an insulating base ring, insulating side walls and an insulating top and electric resistance wires supported within said heater and exposed toward said shield when the parts are in heating position.

MALCOLM FARMER.