W. B. PEIRCE.

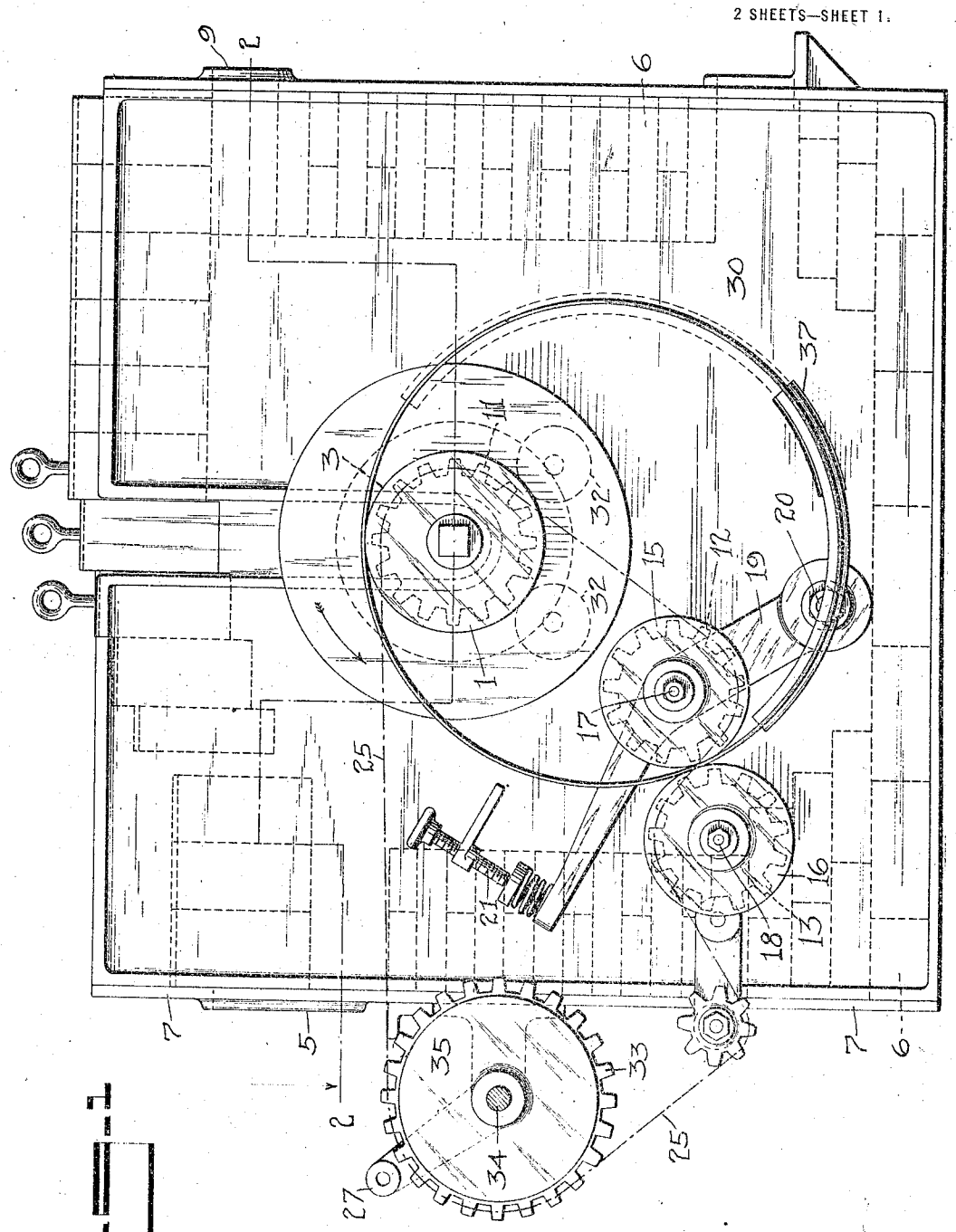
COIL HEATING FURNACE.

APPLICATION FILED NOV. 10, 1911.

1,243,442.

Patented Oct. 16, 1917.

2 SHEETS—SHEET 1.



Witnesses:
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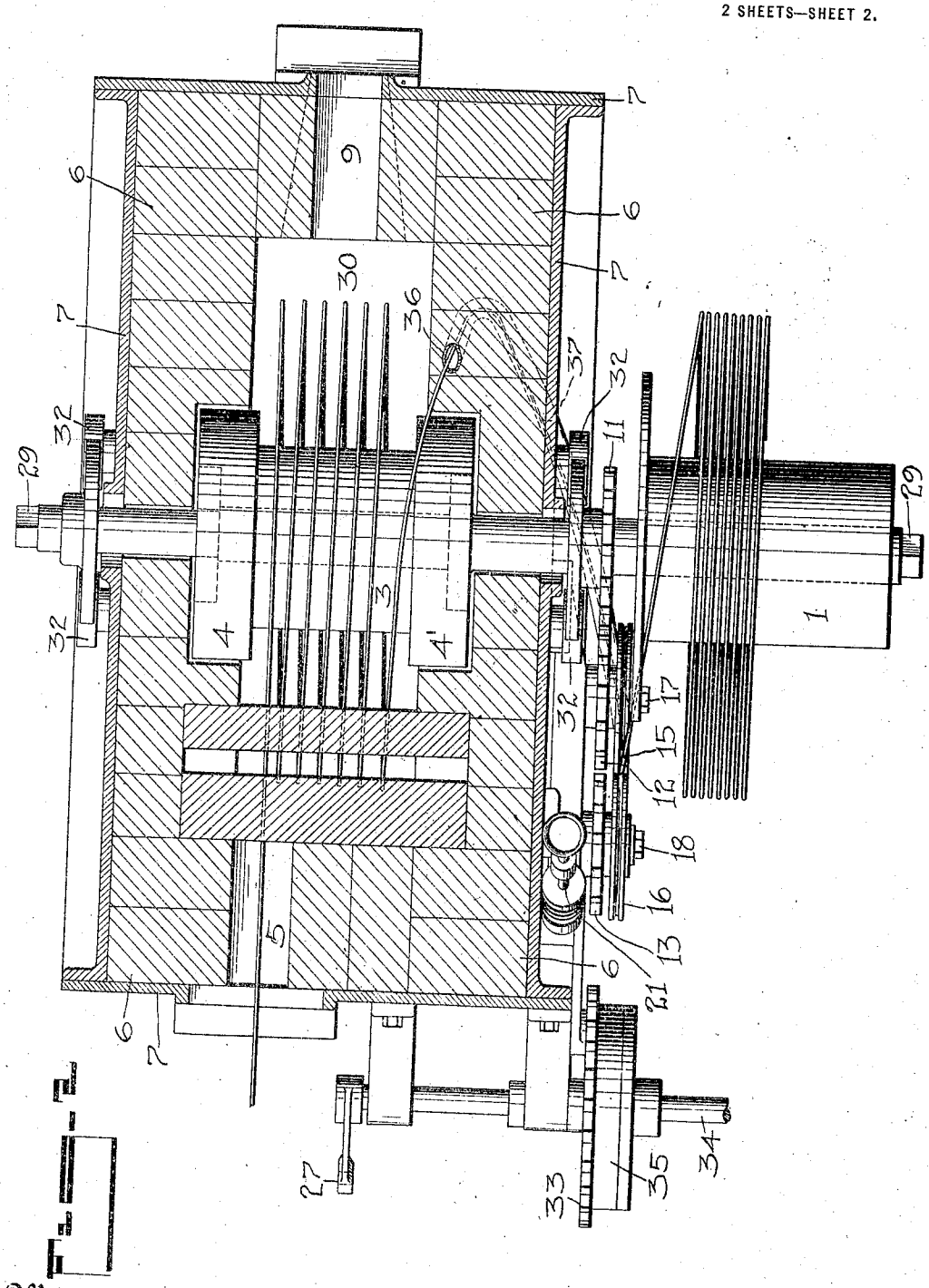
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UNITED STATES PATENT OFFICE.

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COIL-HEATING FURNACE.

1,243,442. Specification of Letters Patent. **Patented Oct. 16, 1917.**

Application filed November 10, 1911. Serial No. 659,467

To all whom it may concern:

Be it known that I, WILLIAM B. PEIRCE, a citizen of the United States, residing at 145 Bryant street, in North Tonawanda, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Coil-Heating Furnaces, of which the following is a specification.

This invention concerns progressively heating a continuous length of material while feeding it into, through and out of a furnace. It involves a method of handling the material, which, though useful for other purposes, is particularly adapted for furnaces and operations where the metal is heated to a very high temperature, particularly where heated up to the softening point. Effective heating to such temperatures requires that the metal passing through the furnace be kept freely exposed on all sides to a very high heat for a considerable time. To do this with the metal passing straight through the furnace would require either a very slow feed or a very long furnace, whereas it is desirable to use a relatively small, compact furnace and to give the metal a desired high rate of feed into and out of the furnace combined with a relatively slow rate of progress through the furnace.

For some purposes, it has been proposed to accomplish this by giving the metal a straight feed into and out of the furnace, the intermediate portions being wound tightly around a revolving drum within the furnace. Such method involves extensive contact of the metal with the drum and prevents its free exposure and uniform heating on all sides. On the other hand, winding the metal in large, open, freely suspended coils in accordance with my present method has not heretofore been attempted because of the difficulties resulting from the initial stiffness of the metal and the effect of the heat in softening it.

My method, while capable of useful employment for operations permitting tight winding of the material on the drum, is of much greater importance and usefulness for operations requiring free suspension and exposure of the metal for effective, uniform, high temperature heating. It involves giving to the material fed into the furnace a predetermined initial shape and set in the curvature of a coil or helix of desired diameter and length suitable to the stiffness of the material and the size of the furnace. This material is wound into the furnace so that it hangs loosely from a suitable support and, though the material is more or less flexible, the construction of the support is such as to permit the successive turn to assume and maintain a curvature and spacing roughly approximating the coil or helix shape originally given it.

By suitably predetermining the length of the interior support and the number of turns of the helix hanging thereon, the length of time required for travel of each turn through the furnace may be as long as necessary. Hence, it is possible to maintain the required rate of output of heated material while using a relatively small, compact furnace.

Because of the effect of the heat upon the coiled material in softening it, it is necessary to carefully control the rates of movement of the metal at the supply end and the exit end, so that it will be unwound from the exit end of the helix by the time it has become softened to the proper degree and before it becomes too soft to maintain proper separation of the turns of the helix.

The material is uniformly heated because the amount of it which actually touches the support is small and the point of contact is more or less shifting.

The material to be heated may be supplied in ready formed coils containing any desired length of the material, preferably the ordinary commercial coils obtainable from the rod mills. Such material already has an initial shape or set of approximately the curvature of the coil in which it is marketed and such curved shape or set may be utilized in the formation of the desired helix within the furnace, the method of transfer into the furnace operating to progressively open out the coils to the desired helical form.

The transfer of the material from the exterior coil to the interior helix may be effected, with or without change in the diameter of the turns, through an oblique opening into the furnace, and this opening need not be of much greater diameter than the thickness of the material.

My above described method for progressively heating coiled material may be used for any desired purpose but it is particularly applicable to the heating of iron until it is soft enough for forging operations. In such case, it saves the necessity of straightening and cutting the coiled material into lengths, heating it in long furnaces and transferring it by hand to the automatic forging machine or other apparatus in which it is to be used.

The specific means for transferring the exterior coiled material into the furnace and for giving the successive turns the helical bend or offset, is shown herein as consisting of feed mechanism operating to drive the material endwise through a helical or corkscrew passage in the walls of the furnace. The longitudinal support within the furnace from which hang the helical coils and along which they move while being heated, is shown as a rotating cylinder. The fully heated material is shown as being withdrawn and fed out, in a radial plane from the remote end of the helix. Other specifically different arrangements for accomplishing the formation, support, axial travel and unwinding of the helix are shown in my copending application Serial No. 846,744, filed June 23rd, 1914.

My present apparatus and its method of operation will be more fully understood from the following detailed description in connection with the accompaanying drawings in which—

Figure 1 is a side elevation of a furnace with my invention applied thereto, and

Fig. 2 is a plan view partly in section on the line 2—2 of Fig. 1.

In the drawings 6, 6, 6, 6, represent the walls of a furnace made of fire resisting material and secured by an exterior frame 7, 7, 7, 7.

The heating chamber within the furnace, is indicated at 30. A source of heat is supplied for said furnace chamber as indicated at 9.

It will be understood that this furnace may be heated by any of the means usually employed for this purpose, and by any fuel usually employed in such furnaces.

This invention aside from the method and considering only the mechanical devices which may be employed in carrying out the same consists in the employment with such a furnace of coil controlling devices by which the coiled material is moved through it at suitable speed.

One form of devices which will accomplish this purpose is shown in the drawings and consists of a suitable coil supporting member, 1, which is here shown as a cylinder mounted upon a shaft, 29, by which it is turned.

The coil to be heated is hung upon this supporting member, 1, which is placed near the outside of the furnace and is shown as supported upon the roller bearings 32 32.

This shaft, 29, is turned by a sprocket, 11, driven by a chain, 25, from a driving sprocket, 33, to which power is applied from a prime mover through the shaft, 34. 35 is a clutch. A feed controlling device is provided consisting of the feed rollers 15 and 16 which are mounted to revolve upon their studs 17 and 18 respectively, being actuated by sprockets 12 and 13 through the driving chain 25.

One of these feed rolls, as 15, is mounted upon a lever 19 which is rotatable upon its supporting stud 20 and whose free end is capable of adjustment by a set screw 21, so as to press more or less closely against its companion roller 16 to adapt it to feed various sizes of coiled material.

The rolls 15—16 feed the coiled material through the adjacent furnace wall, and into the heating chamber, 30, of the furnace.

A passage through said adjacent furnace wall, is supplied for this purpose, and this passage is curved as is indicated at 36, 37, so that the coiled material may pass through it while still retaining its coiled form.

For ease of construction, I prefer to place in the furnace wall, an iron pipe as is illustrated at 36, 37, which pipe is bent to approximately the same curvature as the coiled material, and this pipe is so placed in the wall as to afford a lead to the coiled material in a direction toward the furnace chamber, 30.

The amount of lead in the inlet passage depends upon the thickness of the furnace wall, and upon the gage and stiffness of the coiled material, since thin materials should be given a greater lead than thick ones in order to separate the turns more widely and so decrease the number of them, and hence the length of time they remain in the furnace.

After passing through the inlet opening 36, 37, the coiled material passes over a supporting member, 3, which is mounted within said furnace chamber upon the shaft, 29, and which is made of a heat resisting material, and is also preferably supplied with a pair of collars as indicated at 4 and 4', placed adjacent to the interior faces of the furnace walls, to prevent the coiled material from falling into the spaces between said furnace walls and the ends of said supporting member 3.

Suitable driving means are supplied for rotating this interior coil supporting member, and the drawings illustrate one form of such driving mechanism as consisting of the sprocket, 11, and drive chain, 25.

The material to be heated passes around and hangs from this interior supporting member 3 in large depending coils freely

exposed to the heat on all sides except at the top point where they rest upon the cylinder, the number of turns of the coil being such as will enable it to remain in the heating chamber of the furnace long enough to be brought up to the desired temperature, after which it passes out from the furnace chamber, 30, through an orifice, 5, in the end wall of the furnace, in the direction of the rotation of the sustaining member, 3.

Upon its emergence from the chamber, 30, the heated material is ready for any subsequent operation to which its heated condition adapts it.

I have preferred to make the supporting members 1 and 3, of equal diameter, and to rotate them at the same speed, and for simplicity, I have shown them as mounted upon the same shaft, 29, and driven by a single driving member, sprocket, 11, actuated by the drive chain, 25.

It will be understood, though, that separate driving members may be used for the exterior and interior coil supports.

The preferred method of operation of my above apparatus is claimed in my copending application Serial No. 74,330, filed January 26th, 1916, as a division of this application.

The apparatus disclosed herein is covered by certain of the generic claims contained in my copending application Serial No. 846,744 and the claims of this application are directed to features not shown in said application, serial No. 846,744.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A furnace having exterior and interior coil supporting members in axial alinement with means for driving them by power and with a wall between them perforated for passage of the coiled material.

2. A furnace having exterior and interior coil supporting rotatable members with means for rotating them by power and with a wall between them perforated for passage of the coiled material without distortion.

3. A furnace having exterior and interior coil supporting members with means for driving them by power and a wall between them with a curved passage through it to permit the passage of the coiled material from one coil supporting member to the other without distortion.

4. A furnace having exterior and interior coil supporting members and a feeding device so placed as to operate upon the coiled material at a point between said supporting members, and in a direction tangential to the curve of the coiled material.

5. A furnace having exterior and interior rotatable coil supports of substantially equal diameter, and a feeding device with means for actuating said supports and feeding device at a uniform circumferential speed.

6. A furnace, a coil supporting member situated interiorly thereof, a second coil supporting member situated exteriorly thereof, means whereby said two coil supporting members are movably supported, and means independent of the material of the coil for moving said two coil supporting members in unison.

7. A furnace, a rotatable coil supporting member situated interiorly thereof, a second rotatable coil supporting member situated exteriorly thereof, said two rotatable coil supporting members being arranged in axial alinement, and means independent of the material of the coil for rotating said two coil supporting members.

8. A furnace, a rotatable coil supporting member situated interiorly thereof, a second rotatable coil supporting member situated exteriorly thereof, said two rotatable coil supporting members being arranged in axial alinement, and means independent of the material of the coil for rotating said two coil supporting members in the same direction.

9. A furnace, a rotatable coil supporting member situated interiorly thereof, a second rotatable coil supporting member situated exteriorly thereof, a common supporting shaft to which said two rotatable coil supporting members are fixed in spaced relation, and means for driving said shaft to cause the coil supporting members to rotate in the same direction.

10. A furnace having an interior coil supporting member, and the wall of the furnace having a feed aperture therethrough through which the material may be fed to said coil supporting member, and said aperture extending through the wall of the furnace in a curved direction, the radius of the curve being approximately that of the coil to be supported by said coil supporting member.

11. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil into the furnace.

12. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil into the furnace, said means including a drive element engaging the coil material to drive the same in a direction tangential to the curve of the coiled material.

13. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil into the furnace, said means including a drive element engaging the coil material to drive the same in a direction tangential to the curve of the coiled

material and a passage way formed through the wall of the furnace adjacent said drive element through which the coiled material may pass into the furnace without material distortion from its coiled condition.

14. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil into the furnace, said means including a drive element engaging the coil material to drive the same in a direction tangential to the curve of the coiled material and a passage way formed through the wall of the furnace adjacent said drive element through which the coiled material may pass into the furnace without material distortion from its coiled condition, a coil supporting member interiorly of the furnace, both of said coil supporting members being rotatable, and means for rotating said two coil supporting members.

15. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil into the furnace, said means including a drive element engaging the coil material to drive the same in a direction tangential to the curve of the coiled material and a passage way formed through the wall of the furnace adjacent said drive element through which the coiled material may pass into the furnace without material distortion from its coiled condition, a coil supporting member interiorly of the furnace, both of said coil supporting members being rotatable, and means for rotating said two coil supporting members at uniform speeds comprising a common shaft to which both of said coil supporting members are attached and means for rotating said shaft.

16. A furnace, a cylindrical coil supporting member within said furnace disposed with its axis in a horizontal plane, and said coil supporting member being of a diameter smaller than the interior diameter of the coil to be supported thereby so that the coil will hang loosely therefrom and expose substantially all portions of the coil uniformly to the heat of the furnace and means for rotating said coil supporting member so as to cause the coil supported thereby to rotate.

17. A furnace having a compartment therein to receive a coil of material to be treated and a rotatable member for frictionally engaging the coil of material at one point in the circumference thereof to rotate said coil of material, and means independent of said coil of material for rotating said rotatable member.

18. A furnace, means exteriorly of the furnace for holding a coil of material adjacent the furnace, and means for projecting the material of the coil in a direction axially of the coil and in a curved path into the furnace, the curve of said path being approximately co-axial with said coil.

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