March 26, 1963 C. W. ELRICK ETAL 3,082,996

COIL SUPPORT FOR ANNEALING FURNACES

Original Filed Sept. 24, 1958 2 Sheets-Sheet 1

FIG. 1

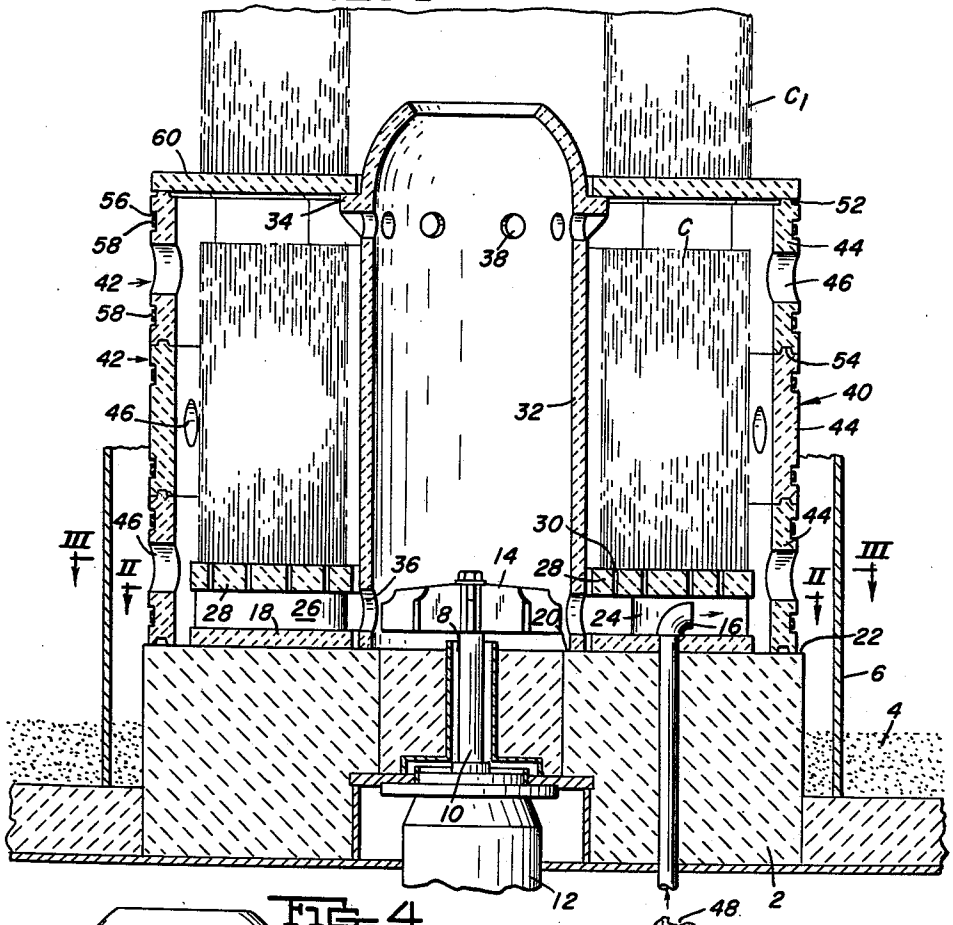


FIG. 4

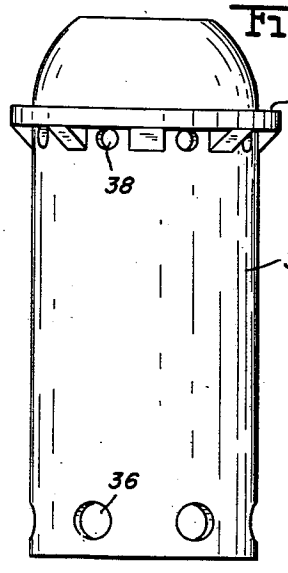


FIG. 5

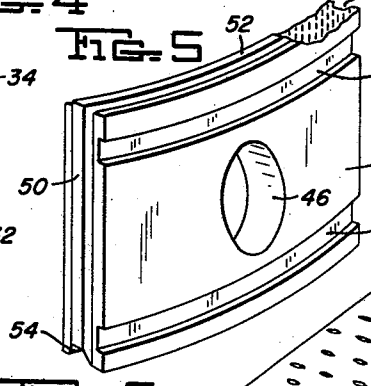


FIG. 7

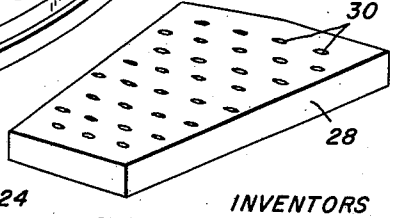
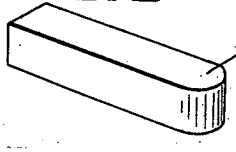


FIG. 6



INVENTORS
CHARLES W. ELRICK and
STEPHEN J. RYBARCZYK
By Donald G. Dalton
Attorney

March 26, 1963 C. W. ELRICK ETAL 3,082,996

COIL SUPPORT FOR ANNEALING FURNACES

Original Filed Sept. 24, 1958 2 Sheets-Sheet 2

FIG. 2

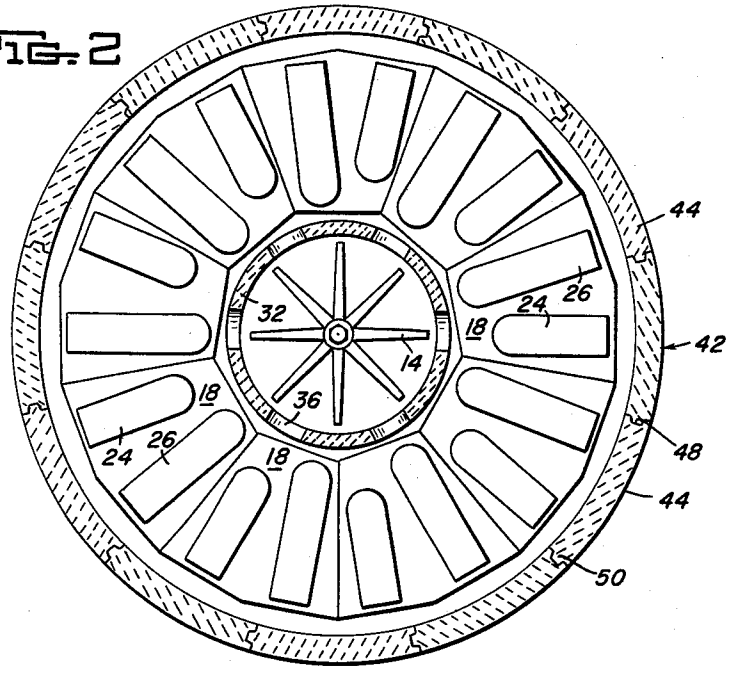
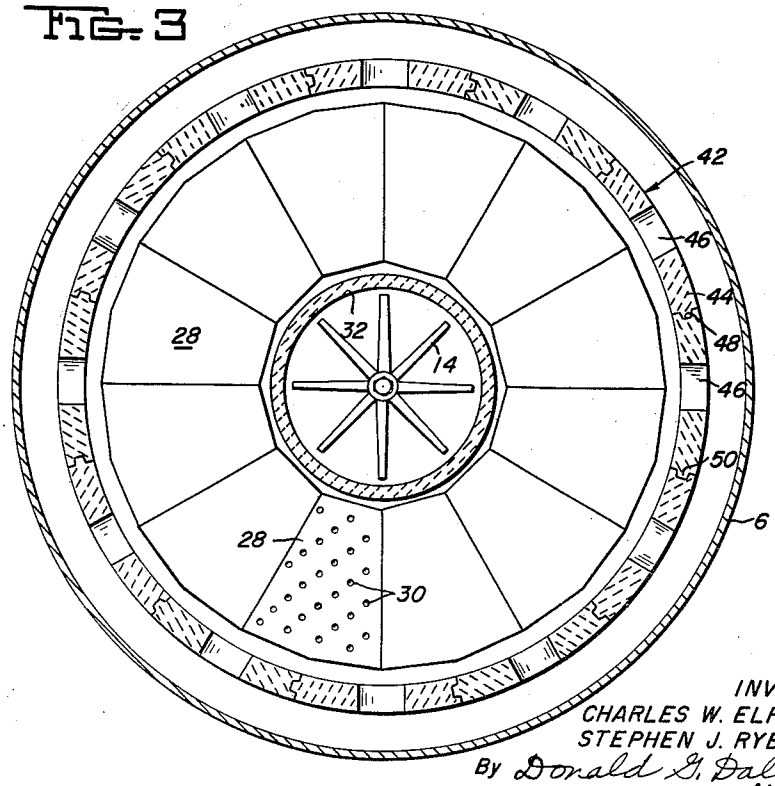


FIG. 3



INVENTORS
CHARLES W. ELRICK and
STEPHEN J. RYBARCZYK
By Donald G. Dalton
Attorney

United States Patent Office 3,082,996 Patented Mar. 26, 1963

3,082,996

COIL SUPPORT FOR ANNEALING FURNACES

Charles W. Elrick and Stephen J. Rybarczyk, Vandergrift, Pa., assignors to United States Steel Corporation, a corporation of New Jersey

Continuation of application Ser. No. 763,060, Sept. 24, 1958. This application June 19, 1961, Ser. No. 118,152

8 Claims. (Cl. 263—49)

This application, which is a continuation of our copending application Serial No. 763,060, filed September 24, 1958, now abandoned, relates to a coil support for strip metal coils in a two-high box annealing furnace and more particularly to supports for handling silicon steels. Such steels must be annealed at temperatures exceeding 2000° F. for an extended period of time. This high temperature causes the steel strip to become soft so that each coil must be annealed without any weight being imposed thereon. Egge Patent No. 2,878,005, dated March 17, 1959, discloses a coil support suitable for this purpose. However, the coil support shown therein and other coil supports of which we have knowledge are made of cast steel which was thought necessary for strength requirements. However, it has been found that such supports warp and bend due to the high annealing temperatures so that they have a short life. Since the support plate and pedestal assemblies shown in the Egge patent cost approximately $1700 per stand at the time of our invention and are only useful for several annealing cycles, the cost of annealing is excessively high. A separating insulating layer of a refractory is applied in solution to the surfaces of the strip prior to coiling. During the annealing cycle excess moisture in this insulating material has a tendency to become entrapped between convolutions at the bottom of the coil since the coil edges rest on a steel plate. Boiling of this moisture leads to dilution and a washing away of the separating mixture in that area so that there is danger of the convolutions sticking together. Also, slight variations in expansion and contraction rates together with temperature variations within the furnace cause the strip edges of the coil on the steel support plate to bend and become deformed during the heating and cooling cycles. This requires slow and difficult uncoiling of the strip, thus damaging the coil ends and side edges which must be removed. The removed material may be as great as 6% of the total weight of the coil. The cast steel also has a high heat absorbing capacity so that the heat input required during an annealing cycle is excessively high. The rate of cooling of the charge is also high since the heat must be removed from the coil supporting structures as well as from the charge.

It is therefore an object of our invention to provide an improved coil support having an increase life without deformation.

Another object is to provide a coil support which has minimum heat absorption whereby the heat input and cooling rate for a given annealing cycle is reduced.

Still another object is to provide such a support which minimizes the danger of damaging the edges of the strip.

A further object is to provide such a support which is less expensive than a metal support and wherein parts of the structure can be readily replaced.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a vertical sectional view of a box annealing furnace equipped with the support of our invention;

FIGURE 2 is a view taken on the line II—II of FIGURE 1;

FIGURE 3 is a view taken on the line III—III of FIGURE 1;

FIGURE 4 is an elevation of the center support;

FIGURE 5 is a perspective view of an element of the support;

FIGURE 6 is a perspective view of another element of the support; and

FIGURE 7 is a perspective view of still another element of the support.

Referring more particularly to the drawings, the reference numeral 2 indicates a refractory base including the usual sand seal 4 and inner cover 6. A central opening 8 is provided in the base 2 through which a fan shaft 10 extends from motor 12. Fan blade 14 attached to shaft 10 is preferably made of a ceramic material. A gas inlet 16 extends through the base 2. Except for the material of the fan blade 14 the parts so far described are conventional. A ceramic plate-like member 18 made up of a plurality of tiles rests on the top of base 2 and extends from a point outwardly of said central opening 8 to a point spaced inwardly of the outer periphery of the base so as to provide shelves 20 and 22. Ceramic support blocks 24 and 26 rest on the member 18 and extend radially thereof as best shown in FIGURE 2. The blocks 24 are located between the blocks 26 and are shorter than the blocks 26. The blocks 24 and 26 preferably extend outwardly to the outer part of plate-like member 18 and the inner end of the blocks 24 terminate short of the inner periphery of the member 18. Ceramic segments 28 shown in FIGURE 7 are supported on top of the blocks 24 and 26 and are preferably provided with holes 30 therethrough. The segments 28 form an annular member having generally the same inner and outer diameter as the plate-like member 18. A hollow ceramic inner column 32 having a circumferential supporting ledge 34 intermediate its ends is removably disposed on shelf 20. The supporting ledge is spaced above the segments 28 a distance greater than the height of coil C which is supported on the segments 28. The column 32 has bottom openings 36 and top openings 38 through the walls thereof and both ends of the column are open. An outer column 40 rests on the shelf 22 and has an inside diameter greater than the outside diameter of the segments 28. The top of the column 40 is in the same horizontal plane as the top of the supporting ledge 34. The outer column includes a plurality of superimposed rings 42 each being formed of a plurality of ceramic tiles 44 having openings 46 therethrough. Preferably one end of each tile 44 has a groove 48 therein and the other end a tongue 50 thereon with the tongue 50 of one tile being received in the groove 48 of the adjacent tile. Similarly, the top of the tile is provided with a tongue 52 and the bottom of the tile with a groove 54, the tongue being received in the groove of the tile thereabove. A pair of recesses 56 are also provided on the outer periphery of the tiles for receiving metal bands 58. An upper ceramic support plate 60 rests on the ledge 34 and outer column 40 and is adapted to support a coil C1. It will be seen from the drawings that the tiles 44 are relatively thin compared to the height and diameter of column 40. The ceramic material used in the support is preferably a high alumina refractory or a super duty fireclay. The material may have the following analysis: 38.9% silica, 53.2% alumina, 1.2% ferric iron oxide, 1.9% titania, 3.7% magnesia, .2% lime and .9% potash and soda.

In charging the furnace, coil C is placed on segments 28 and the inner column 32 placed on shelf 20. The rings 42 are then placed one on top of the other on shelf 22 and ceramic plate 60 placed on shelf 34 and the top of the outer column 40. The coil C1 is placed on plate 60 and the inner cover 6 placed around the assembly into

sand seal 4. The annealing gas introduced through pipe 16 is circulated by means of fan blade 14 through the openings between blocks 24 and 26 and upwardly around the outside of coil C and also outwardly through openings 46 and upwardly around the outside of coil C1. The gas passes downwardly through the eye of coil C1 and inwardly between the top of coil C and the bottom of plate 60 through openings 38 and then downwardly through the column 32.

While one embodiment of our invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. Apparatus for supporting heavy coils of steel strip in an annealing furnace comprising a base with a center opening therethrough, a first shelf adjacent said opening and a second shelf adjacent the outer periphery of said base, a ceramic support mounted on said base between said shelves and having openings therethrough, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said ceramic support a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its wall between the top of the ceramic support and said first shelf and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said ceramic support, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column being formed of a pluraltiy of ceramic tiles, said ceramic tiles being relatively thin compared to the diameter and height of said outer column.

2. Apparatus for supporting heavy coils of steel strip in an annealing furnace comprising a base with a center opening therethrough, a first shelf adjacent said opening and a second shelf adjacent the outer periphery of said base, a ceramic support mounted on said base between said shelves and having openings therethrough, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said ceramic support a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its wall between the top of the ceramic support and said first shelf and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said ceramic support, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column being formed of a plurality of ceramic tiles, said ceramic tiles being relatively thin compared to the diameter and height of said outer column, and an upper ceramic support plate resting on said supporting ledge and said outer column and adapted to support a coil thereon.

3. Apparatus for supporting heavy coils of steel strip in an annealing furnace comprising a base with a center opening therethrough, a first shelf adjacent said opening and a second shelf adjacent the outer periphery of said base, a ceramic support mounted on said base between said shelves and having openings therethrough, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said ceramic support a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its wall between the top of the ceramic support and said first shelf and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said ceramic support, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column including a plurality of superimposed rings each formed of a plurality of ceramic tiles and a metal band around the outside thereof, said ceramic tiles being relatively thin compared to the diameter and height of said outer column, said inner and outer columns having a plurality of openings through the walls thereof.

4. Apparatus for supporting heavy coils of steel strip in an annealing furnace according to claim 3 in which said ceramic material is a high alumina refractory.

5. Apparatus for supporting heavy coils of steel strip in an annealing furnace comprising a base with a center opening therethrough, a ceramic plate-like member resting on said base and extending from a point adjacent said center opening to a point spaced inwardly from the outer periphery of said base so as to provide a first shelf adjacent said opening and a second shelf adjacent said periphery, a plurality of ceramic support blocks extending radially on said plate-like member with a space between adjacent blocks and the inner ends of at least part of said blocks terminating short of the inner periphery of said plate-like member, ceramic segments resting on and extending between said blocks, said segments having openings therethrough and being adapted to support a coil thereon, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said segments a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its walls between said base and said ceramic segments and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said segments, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column being formed of a plurality of ceramic tiles, said ceramic tiles being relatively thin compared to the diameter and height of said outer column.

6. Apparatus for supporting heavy coils of steel strip in an annealing furnace comprising a base with a center opening therethrough, a ceramic plate-like member resting on said base and extending from a point adjacent said center opening to a point spaced inwardly from the outer periphery of said base so as to provide a first shelf adjacent said opening and a second shelf adjacent said periphery, a plurality of ceramic support blocks extending radially on said plate-like member with a space between adjacent blocks and the inner ends of at least part of said blocks terminating short of the inner periphery of said plate-like member, ceramic segments resting on and extending between said blocks, said segments having openings therethrough and being adapted to support a coil thereon, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said segments a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its wall between said base and said ceramic segments and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said segments, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column including a plurality of superimposed rings each formed of a plurality of ceramic tiles and a metal band around the outside thereof, said ceramic tiles being relatively thin compared to the diameter and height of said outer column, said inner and outer columns having a plurality of openings through the walls thereof.

7. Apparatus for supporting heavy coils in steel strip in an annealing furnace comprising a base with a center opening therethrough, a ceramic plate-like member resting on said base and extending from a point adjacent said

center opening to a point spaced inwardly from the outer periphery of said base so as to provide a first shelf adjacent said opening and a second shelf adjacent said periphery, a plurality of ceramic support blocks extending radially on said plate-like member with a space between adjacent blocks and the inner ends of at least part of said blocks terminating short of the inner periphery of said plate-like member, ceramic segments resting on and extending between said blocks, said segments having openings therethrough and being adapted to support a coil thereon, a hollow ceramic inner column having a circumferential supporting ledge intermediate its ends removably disposed on said first shelf, said supporting ledge being spaced above said segments a distance adapted to freely permit positioning a coil between said ceramic support and said supporting ledge, said inner column having openings through its walls between said base and said ceramic segments and an outer column resting on said second shelf and having an inside diameter greater than the outside diameter of said segments, the top of said outer column being in the same horizontal plane as the top of said supporting ledge, said outer column including a plurality of superimposed rings each formed of a plurality of ceramic tiles and a metal band around the outside thereof, said ceramic tiles being relatively thin compared to the diameter and height of said outer column, said inner and outer columns having a plurality of

openings through the walls thereof, and an upper ceramic support plate resting on said supporting ledge and said outer column and adapted to support a coil thereon.

8. Apparatus for supporting heavy coils in steel strip in an annealing furnace comprising a base with a center opening therethrough, a ceramic plate-like member resting on said base and extending from a point adjacent said center opening to a point spaced inwardly from the outer periphery of said base, a plurality of ceramic support blocks extending radially on said plate-like member with a space between adjacent blocks and the inner ends of at least part of said blocks terminating short of the inner periphery of said plate-like member, ceramic segments resting on and extending between said blocks, said segments having openings therethrough and being adapted to support a coil thereon.

References Cited in the file of this patent

UNITED STATES PATENTS

260,890	Norton	July 11, 1882
1,289,890	Owens	Dec. 31, 1918
1,622,431	Feigenbaum	Mar. 29, 1927
2,450,836	Levy et al.	Oct. 5, 1948
2,731,254	Campbell et al.	Jan. 17, 1956
2,878,005	Egge	Mar. 17, 1959