

June 7, 1932.

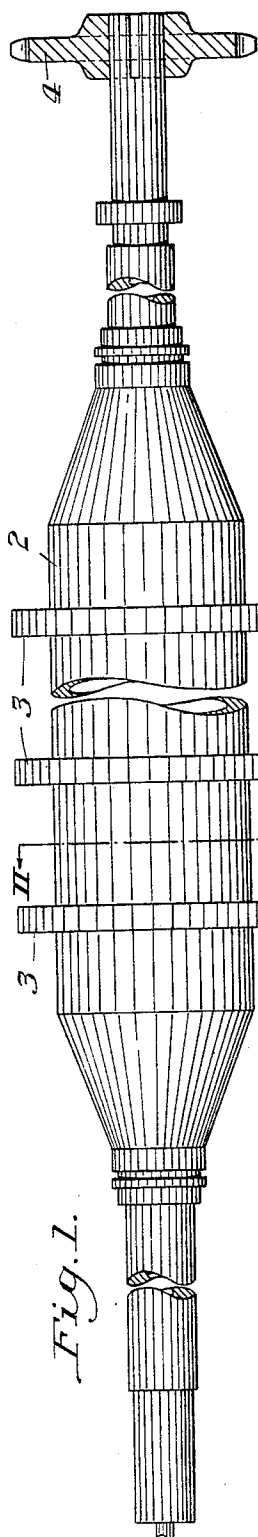
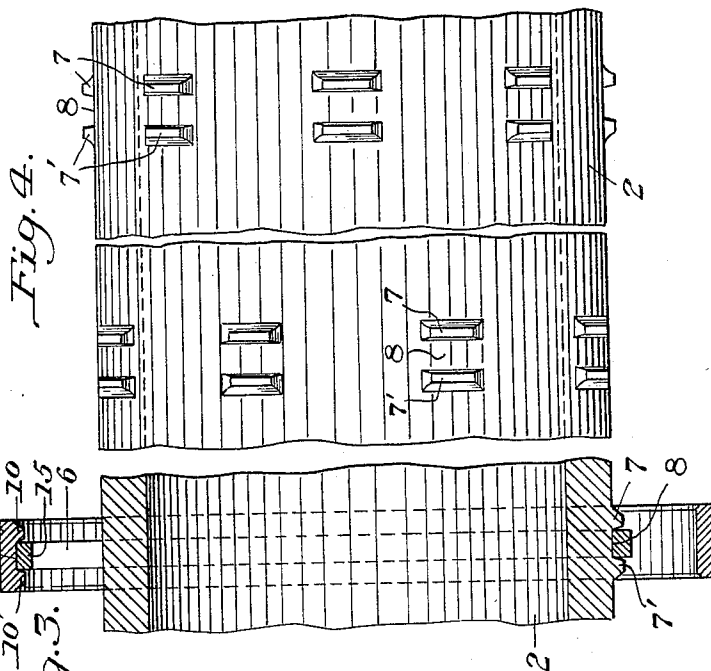
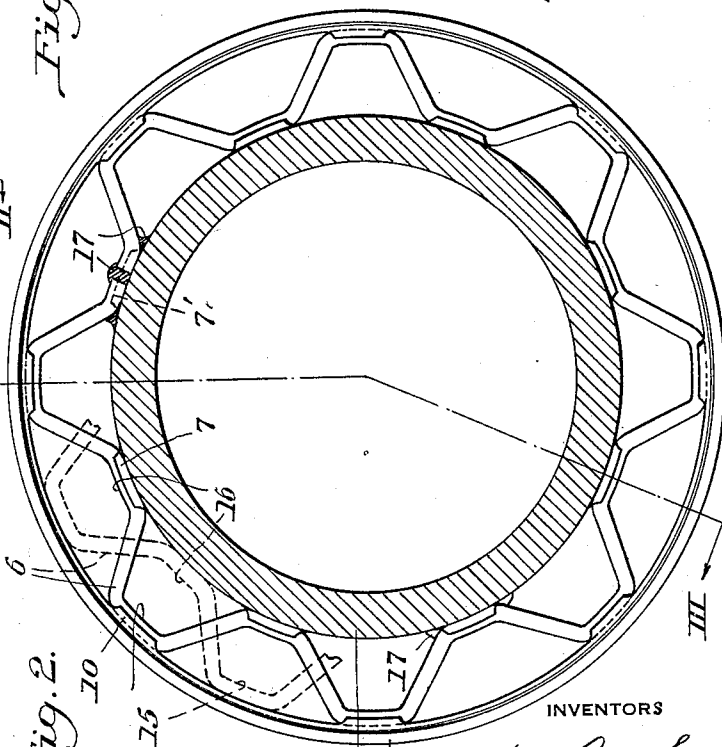
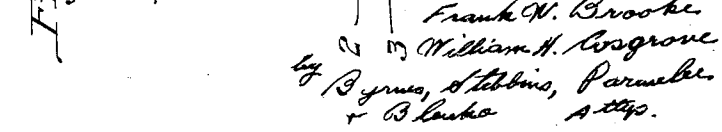
F. W. BROOKE ET AL

1,861,489

CONVEYING APPARATUS

Filed Feb. 17, 1930

3 Sheets-Sheet 1



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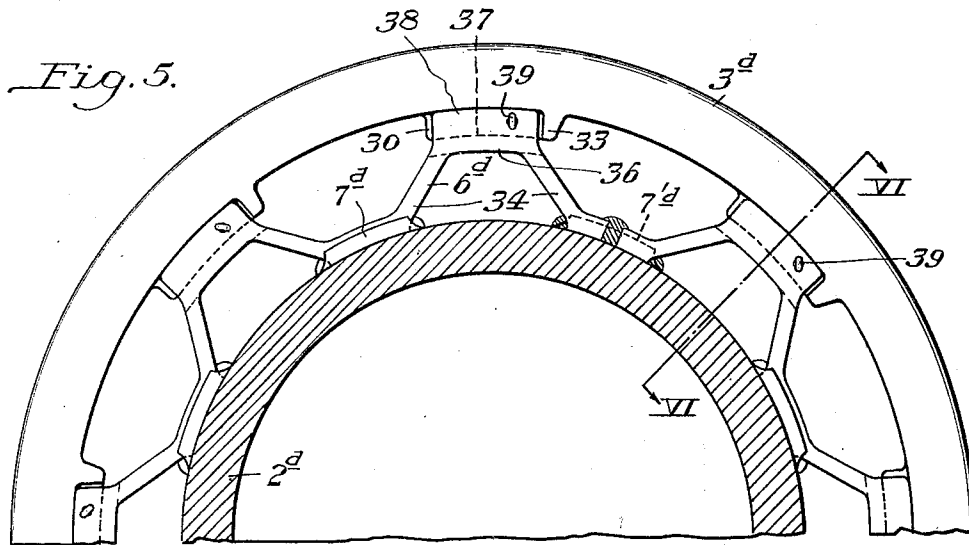
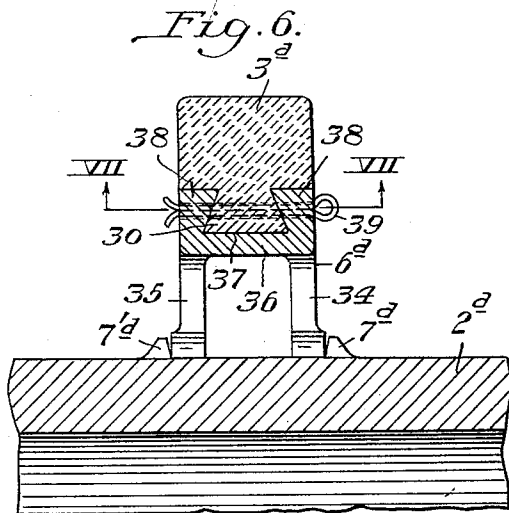
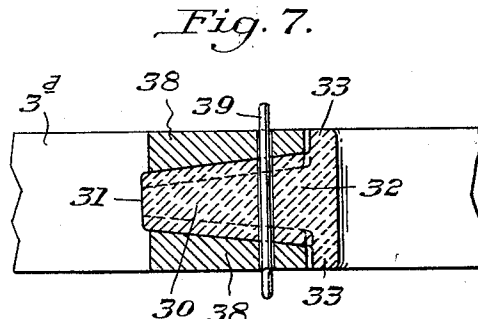
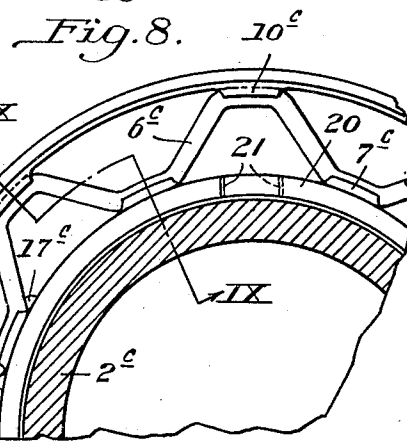
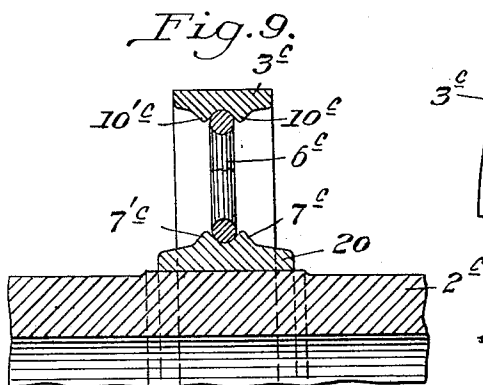
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1,861,489

CONVEYING APPARATUS

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3 Sheets-Sheet 2



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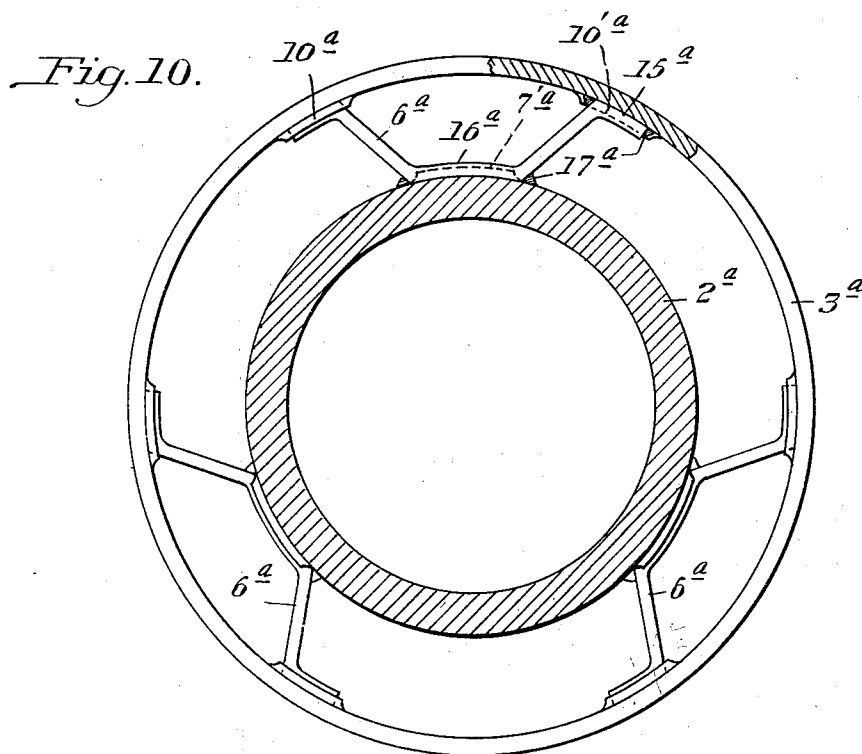
F. W. BROOKE ET AL

1,861,489

CONVEYING APPARATUS

Filed Feb. 17, 1930

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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CONVEYING APPARATUS

Application filed February 17, 1930. Serial No. 429,042.

This invention relates generally to convey-
ing apparatus and more particularly to ap-
paratus for conveying sheets through a heat
treating furnace.

At the present time, sheets are generally
conveyed through heat treating or normaliz-
ing furnaces while supported on discs carried
by rolls. The discs on the different rolls
are arranged in staggered relation so as to
provide sufficient supporting surface for the
sheets to prevent warping or bending there-
of. The discs carried by the rolls consist es-
sentially of a relatively heavy boss or hub,
from which extends a continuous web which
connects the hub to the outer flange or rim
which supports the material being conveyed
through the furnace. Sometimes the webs
of the discs are provided with holes, in order
to decrease the weight. These discs are con-
nected to the rolls in various ways, usually by
keys.

In sheet normalizing furnaces, it is general
practice to provide each roll with from eight
to ten discs spaced axially thereof. Each
of these discs weighs approximately thirty
pounds, so that the total weight of the discs
on each roll is from two hundred and forty
pounds to three hundred pounds. When nor-
malizing sheets seventy-two inches wide and
twenty W. G. thick, the weight of the sheet
per roll equals about twelve pounds, and when
sheets seventy-two inches wide and sixteen
W. G. thick are being carried by the rolls, the
weight of the sheet per roll is about twenty
pounds. It will thus be seen that the weight
of the discs is many times greater than the
weight of the sheet being carried thereby, and
that any arrangement which will reduce the
weight of the discs will result not only in de-
creased cost, due to the fact that less mate-
rial is used in the discs, but it also reduces the
cost of the rolls themselves which can be made
lighter if they have less weight to carry. Our
invention provides an arrangement in which
the weight of the elements which carry the
sheet material is only about one-third of the
weight of the discs ordinarily employed.

Sheet normalizing furnaces ordinarily are
operated at temperatures of about 1900° F.,
and it is accordingly necessary to make the

conveying apparatus out of expensive re-
fractory material. A nickel chromium alloy
is generally used for this purpose.

One of the disadvantages of these nickel
chromium alloys is their tendency toward
permanent growth. When this occurs it sets
up severe strains between the roll and the
discs, which may be sufficient to rupture one
or the other and cause a serious break-down
in the furnace. According to our invention,
we provide a resilient connection between the
surface which supports the sheet material
and the rolls, and in this manner prevent set-
ting up undue strains which might otherwise
result from the permanent growth of the
roll. These elements which connect the rim
and roll generally take the form of spiders
which can either be rolled or cast. They are
made separate and independently of the ma-
terial supporting surface or rim, so that
there is no difficulty in rolling or casting
them. A good deal of difficulty has been ex-
perienced in casting discs of the type now
generally used for conveying material
through furnaces. These discs have a heavy
hub, and a heavy rim or flange which sup-
ports the material being conveyed through
the furnace, and the rim and hub are con-
nected by a relatively thin web. The differ-
ence in section of the rim and hub and web
make it very difficult to produce a casting
which is free from shrinks. This difficulty
is enhanced when it is attempted to cast the
discs out of refractory alloy, such as a nickel
chromium alloy. This is due to the fact that
it is very difficult to get two streams of this
metal to knit together. This property of
nickel chromium alloys has a tendency to
produce seams and other defects in the discs.
All these disadvantages are overcome in our
invention, because of the fact that the rim
which supports the material being conveyed
through the furnace, and the spider, which
connects the rim to the roll, are made sepa-
rately and each has a substantially uniform
cross section.

In the accompanying drawings which il-
lustrate several preferred embodiments of
our invention,

Figure 1 is a plan view of a roll having

several material conveying elements carried thereby,

Figure 2 is a section on the line II—II of Figure 1,

Figure 3 is a section on the line III—III of Figure 2,

Figure 4 is a plan view of a portion of a conveying roll with the material supporting elements removed,

Figure 5 is a view similar to Figure 2 but showing a modified form of the invention, in which a non-metallic refractory rim is employed for supporting the material conveyed through the furnace,

Figure 6 is a section on the line VI—VI of Figure 5,

Figure 7 is a section on the line VII—VII of Figure 6,

Figure 8 is a sectional view similar to Figure 2 but illustrating a modification in which the roll carries a split ring,

Figure 9 is a section on the line IX—IX of Figure 8, and

Figure 10 is a view similar to Figure 2, but illustrating another embodiment in which three separate spiders are employed for connecting the rim and roll.

Referring more particularly to Figures 1 to 4 of the accompanying drawings, there is shown a roll 2 having a plurality of rims 3 connected thereto, which convey the material through the heat-treating furnace. The roll 2 and rims 3 carried thereby are rotated through a sprocket wheel 4 by any desired means, not shown. The rims 3 are spaced axially of the roll and radially thereof. They are spaced radially of the roll by spiders 6, as shown in detail in Figure 2. The roll 2 is provided with a plurality of lugs 7 spaced circumferentially thereof. It is also provided with a plurality of lugs 7' spaced circumferentially of the roll, and also axially of the roll in alinement with the lugs 7, in order to provide a groove 8 between each of the lugs 7 and 7'.

The rim 3 has a plurality of lugs 10 spaced circumferentially of the rim and extending radially inward toward the axis of the roll. It also has a plurality of lugs 10' (see Figure 3) spaced circumferentially of the rim and axially of the roll in alinement with the lugs 10, in order to provide grooves 11 between each pair of lugs 10 and 10'.

The spider 6 is formed, as shown in Figure 2. It may be rolled, cast or otherwise shaped. The roll 2, the rim 3 and the spider 6 are made of a refractory alloy such as a nickel chromium alloy adapted to withstand high temperatures. The sheet supporting rims 3 and the spiders 6 are connected to the roll by first placing the spider in the position indicated by the dotted lines in Figure 2. The spider is then rotated clockwise, as indicated by the arrows in this figure, to bring the upper horizontal portion 15 of the spider

between the lugs 10 and 10', and the lower horizontal portion 16 of the spider between the lugs 7 and 7' on the roll 2. The spider is then welded to the rim 3 and roll 2, as indicated by the numeral 17. This arrangement provides a resilient connection between the rim and roll which prevents undue strains being set up on contraction and expansion or permanent growth of the roll or rim.

In some cases it is not necessary to provide lugs on either the rim 3 or the roll 2. The spider may be connected to the roll and rim simply by welding or other desired method. If lugs are employed they may be used only on the rim or on the roll, rather than on both the rim and roll as shown in Figure 2.

Referring to Figure 10, in which corresponding parts have been indicated by the same reference numerals with the letter "a" suffixed thereto, the construction is generally similar to that shown in Figure 2, except that a plurality of separate spiders 6a are employed in place of the single spider 6, shown in Figure 2. As illustrated in Figure 10, three of these spiders are employed. A greater or lesser number may be used if desired.

In Figures 8 and 9, there is illustrated an embodiment in which a split ring 20 is shown as carried by the roll 2c. The ring is split, as indicated by the reference numeral 21. The split ring 20 is provided with lugs 7c and 7'c, corresponding to the lugs 7 and 7' shown in Figure 4. The rim 3c has lugs 10c and 10'c corresponding to the lugs 10 and 10' shown in Figure 4. The rim 3c is connected to the lugs on the rim and split ring 20 by welding, as indicated at 17c. The provision of the split ring 20 additionally insures that undue stresses which might tend to rupture the connection between the spider and rim or roll, will not be set up. The spider 6c is illustrated in Figure 9 as being round in cross section and as having been produced by a rolling operation. The spiders may either be cast or rolled as desired, either in this embodiment or in any of the other embodiments according to the particular conditions to which they will be subjected when in use. When the gases have a high sulphur contents, it is preferred to use a spider which has been cast, rather than rolled, as it has been found that cast spiders will withstand the action of these gases to a greater extent than rolled sections without corroding.

Where sheets are conveyed through a normalizing furnace while supported on metallic discs or rims, the discs sometimes accumulate a scale from the oxide which may form on the sheets under certain conditions. This oxide adheres sufficiently strongly to the discs to make small scratches on the sheets which may cause these sheets to be rejected.

In order to prevent the adherence of scale on the elements which support the sheet, we may make the supporting rims out of a non-

metallic refractory inert material, such as high-grade fire clay, mullite, or high temperature porcelains. Figures 5, 6 and 7 illustrate one embodiment in which such a non-metallic refractory rim is provided for supporting the sheets while being conveyed through the furnace. The rim 3*d* is made out of non-metallic refractory material of the character referred to. The spider 6*d* and the roll 2*d* are made out of a refractory metal or alloy such as a nickel chromium alloy. The rim 3*d* is provided with radially extending circumferentially spaced projections 30, which are dove-tailed in cross section, as shown in Figures 6 and 7. In addition to being dove-tailed in shape, these projections vary in cross section from one end to the other to form a wedge. As shown in Figure 7, the left hand end 31 of the projection 30 is smaller in diameter than the right hand end 32. The right hand end of the projection 30 has flanges 33 extending axially of the roll for a purpose hereinafter described. The spider 6*d* has two legs 34 and 35 which are seated between lugs 7*d* and 7'*d* on the roll. The legs 34 and 35 are joined together by a horizontally extending web 36. The two outer ends 38 of the legs are flanged so that with the web 36 they form a recess 37, which corresponds in shape to the dove-tailed projection 30 on the rim 3*d*. The parts are assembled by placing the spider 6*d* in a position corresponding to the dotted line position of the spider 6, as shown in Figure 2. The spider is then rotated until the parts assume the position indicated in Figure 5, and the right hand end of the portions 38 contact with the flanges 33. A cotter pin 39 is then passed through corresponding openings in the spider 6*d* and projection 30 to hold the parts in place. Since the rim is made of a non-metallic refractory material, welding is not employed to hold the parts in place.

The employment of resilient metallic spiders for connecting non-metallic refractory rims to metallic rolls results in a structure in which the unequal expansion and contraction of the roll and the rim is compensated by the resilient character of the spider. This enables us to utilize a supporting surface for the sheets which will not accumulate scale and accordingly will not mar the sheet, and in which the unequal expansion and contraction of the roll and rim are compensated by the resilient spider 6*d*.

The spiders or the arms which connect the material supporting rims to the roll may be cast, rolled or otherwise shaped, as desired, whether a metallic or non-metallic material supporting rim is employed. The split ring 20 shown in Figure 8 may be employed with any of the other forms of the invention, if it is desired to increase the resiliency of the connection between the roll and rim.

We have illustrated and described several preferred embodiments of our invention. It is to be understood, however, that the invention may be otherwise embodied within the scope of the following claims.

We claim:

1. Conveying apparatus comprising a roll, a plurality of material supporting rims spaced axially of the roll and radially thereof, lugs spaced circumferentially of the roll, other lugs spaced circumferentially of the rim, and out of radial alinement with the first-mentioned lugs, and a resilient spider connected to said first-mentioned lugs and said other lugs.

2. Apparatus for conveying sheets through a heat-treating furnace, which comprises a roll, at least three narrow sheet-supporting refractory rims spaced axially of the roll, and radially thereof, a plurality of pairs of lugs spaced circumferentially of the roll, the lugs of each pair being spaced axially of the roll to provide a groove therebetween, and a resilient spider in the grooves and connected to the lugs and supporting the rim.

3. Conveying apparatus comprising a roll, a plurality of material supporting rims spaced axially of the roll, and radially thereof, a plurality of pairs of lugs spaced circumferentially of the rim, the lugs of each pair being spaced axially of the roll to provide a groove therebetween, and a resilient spider in the grooves and connected to the lugs, the spider being supported by the roll.

4. Conveying apparatus comprising a roll, a plurality of material supporting rims spaced axially of the roll and radially thereof, a plurality of pairs of lugs spaced circumferentially of the roll, the lugs of each pair being spaced axially of the roll to provide a groove therebetween, a plurality of pairs of lugs spaced circumferentially of the rim, said last-mentioned lugs of each pair being spaced axially of the roll to provide a groove therebetween, the pairs of lugs on the roll being out of radial alinement with the pairs of lugs of the rim, and a resilient spider in the grooves between the pairs of lugs.

5. Conveying apparatus comprising a roll, a plurality of narrow non-metallic refractory rims spaced axially of the roll and radially thereof, and a resilient refractory metallic spider connecting each rim to the roll.

6. Conveying apparatus comprising a metallic roll, a plurality of non-metallic refractory rims spaced axially of the roll and radially thereof, and resilient spiders between the roll and rims, the spiders and rim having projection and recess engagement.

7. Conveying apparatus comprising a metallic roll, a plurality of non-metallic refractory rims spaced axially of the roll and radially thereof, the rims having radially extending projections spaced circumferentially thereof, and resilient spiders connect-

ing the rims and roll, the spiders being provided with recesses corresponding to the projections on the rim.

8. Conveying apparatus comprising a metallic roll, a plurality of non-metallic refractory rims spaced axially of the roll and radially thereof, the rims having radially extending dove-tailed projections spaced circumferentially thereof, and resilient spiders connecting the rims and roll, the spiders being provided with recesses corresponding to the projections on the rim.

9. Conveying apparatus comprising a metallic roll, a plurality of non-metallic refractory rims spaced axially of the roll and radially thereof, the rims having radially extending dove-tailed projections spaced circumferentially thereof, each projection varying in cross section from one end to the other, and resilient spiders connecting the rims and roll, the spiders being provided with recesses corresponding to the projections on the rim.

10. Conveying apparatus comprising a roll, a plurality of material supporting rims spaced axially of the roll and radially thereof, split rings carried by the roll and spaced axially thereof in substantially radial alignment with the rims, and resilient spiders connecting the rims and split rings.

In testimony whereof we have hereunto set our hands.

FRANK W. BROOKE.
W. H. COSGROVE.

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