

Nov. 1, 1966

N. J. RANNEY ET AL

3,281,957

APPARATUS FOR PROCESSING STRIP MATERIAL

Filed April 22, 1963

4 Sheets-Sheet 1

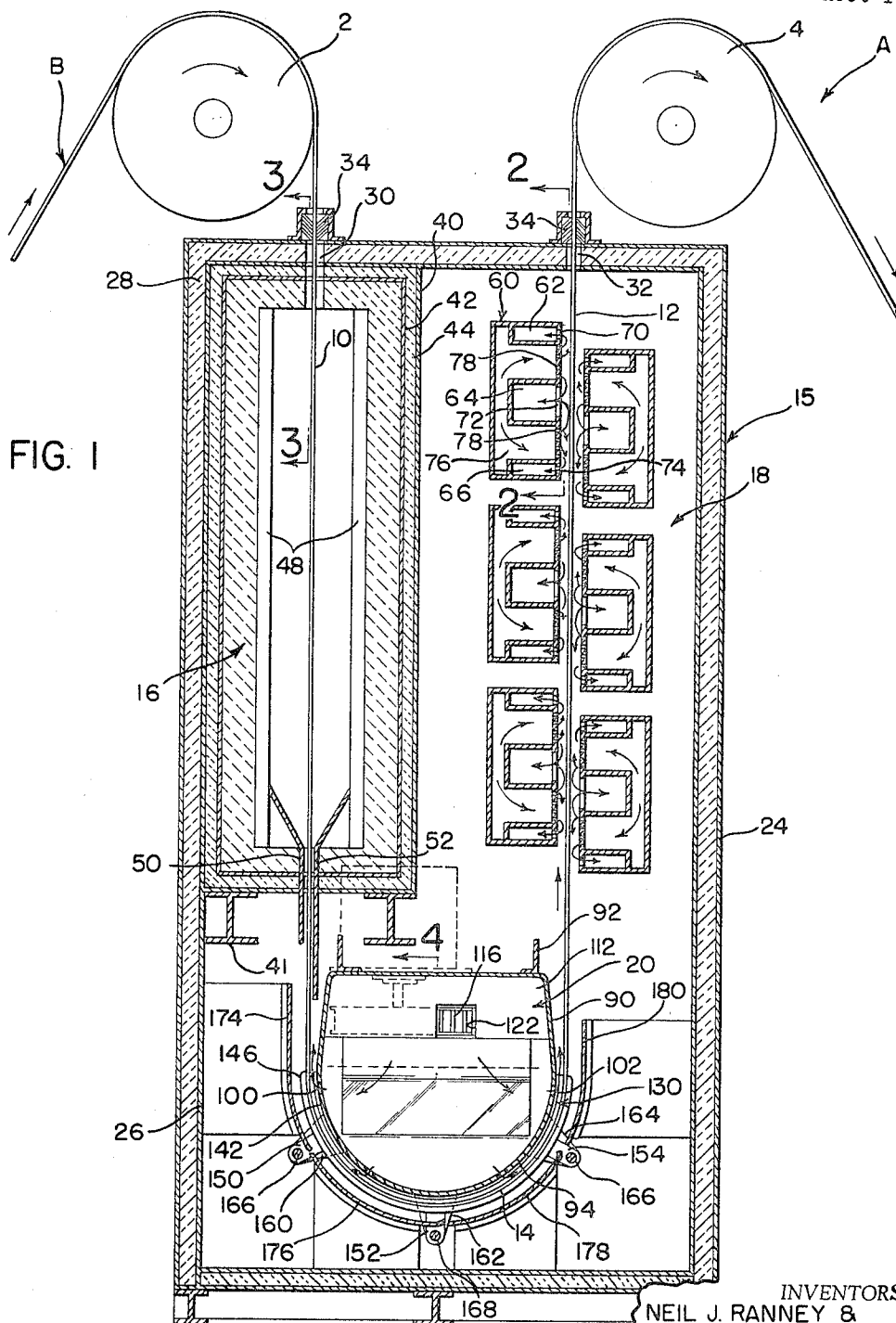


FIG. 1

INVENTORS.
NEIL J. RANNEY &
WILLIAM I. CALLAGHAN

BY

Tilbury & Body
ATTORNEYS

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N. J. RANNEY ET AL

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4 Sheets-Sheet 2

FIG. 2

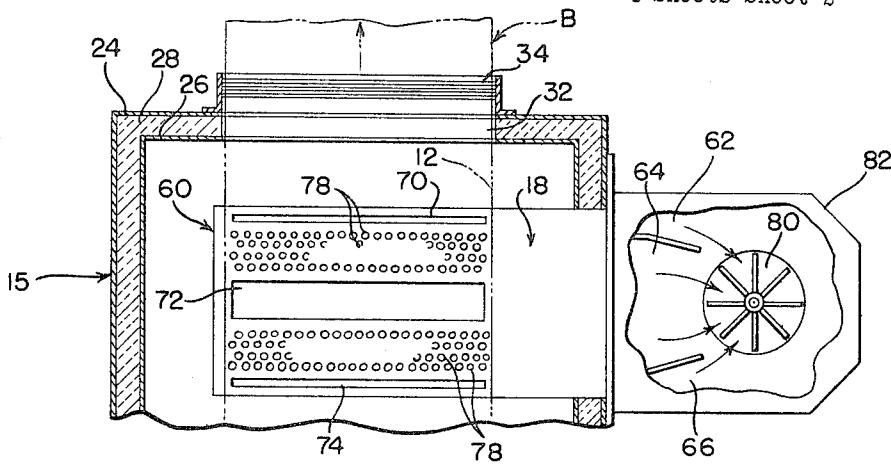
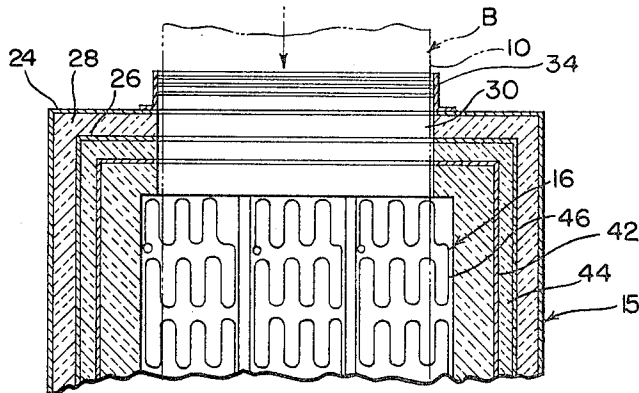
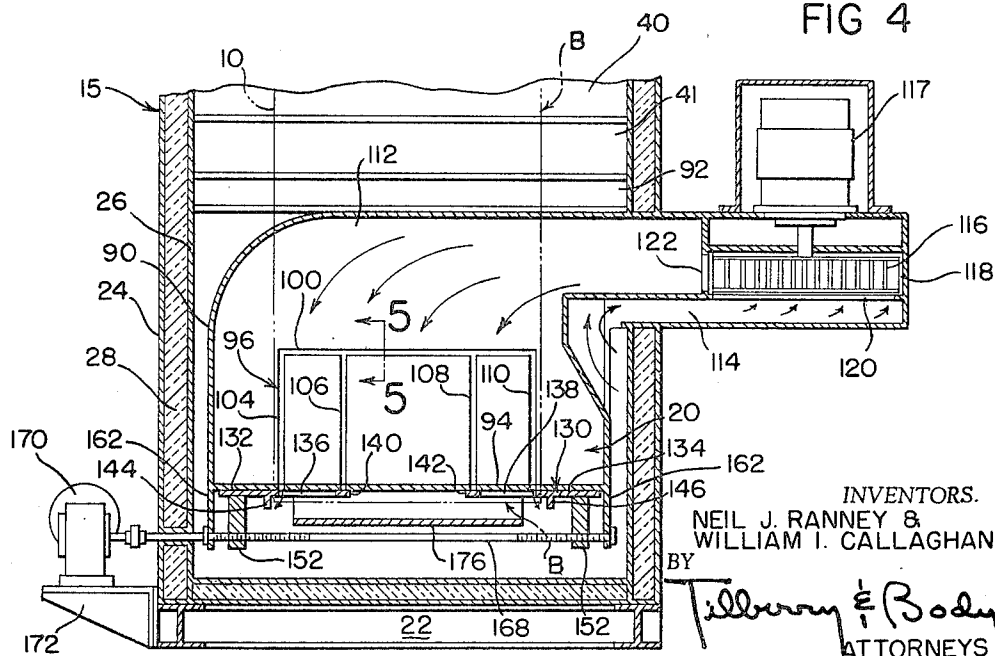


FIG. 3

FIG. 4



INVENTORS.
NEIL J. RANNEY &
WILLIAM I. CALLAGHAN

BY

Tilbury & Boddy
ATTORNEYS

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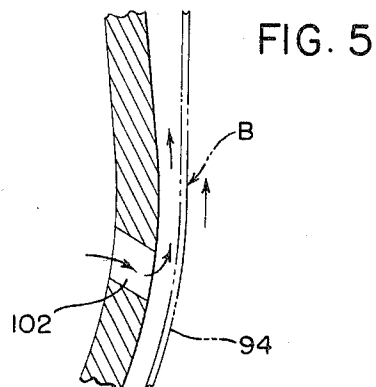
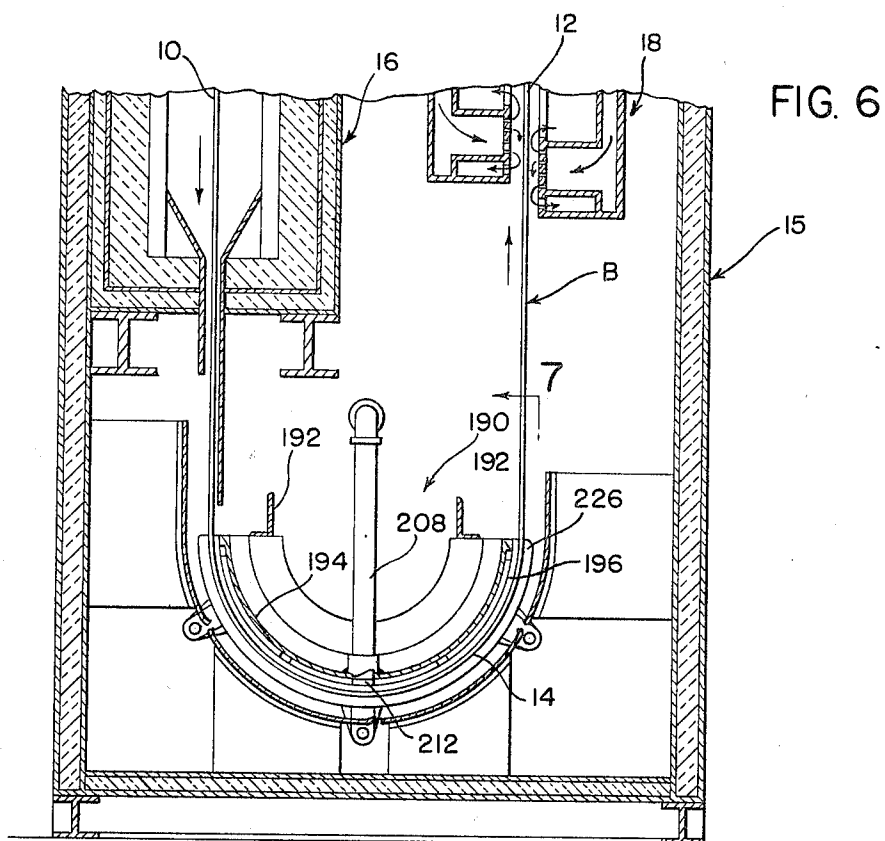
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4 Sheets-Sheet 3



INVENTORS.
NEIL J. RANNEY &
WILLIAM I. CALLAGHAN
BY
Tilbury & Body
ATTORNEYS

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N. J. RANNEY ET AL

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4 Sheets-Sheet 4

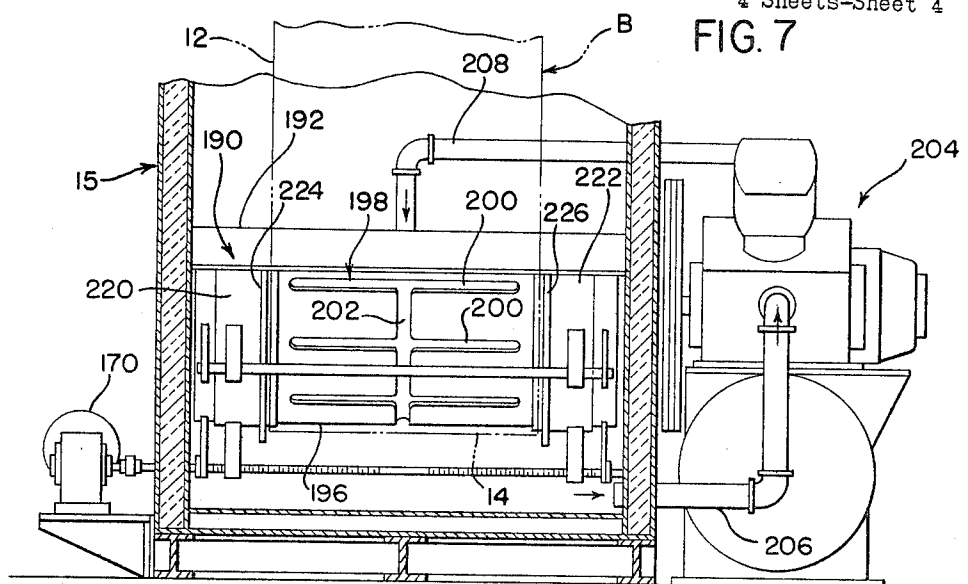
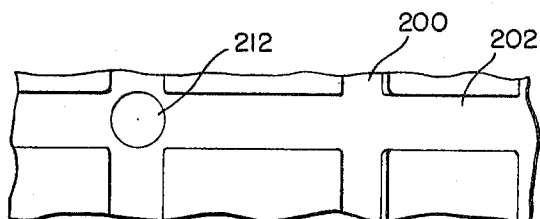


FIG. 9

INVENTORS.
NEIL J. RANNEY &
WILLIAM I. CALLAGHAN

BY

Tilbury & Body
ATTORNEYS

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3,281,957

APPARATUS FOR PROCESSING STRIP MATERIAL
Neil J. Ranney, Mentor, and William I. Callaghan, Paines-
ville, Ohio, assignors to Production Machinery Cor-
poration, Mentor, Ohio, a corporation of Ohio
Filed Apr. 22, 1963, Ser. No. 274,734
15 Claims. (Cl. 34-156)

The present invention pertains to the art of processing strip material and more particularly to an apparatus for processing a continuously moving strip.

The present invention is particularly applicable for annealing a thin metal strip as it is moving along a strip processing line and it will be discussed with particular reference thereto; however, it must be appreciated that the invention has much broader applications and may be used for performing other processing operations on continuously moving strip of various non-metallic materials.

In processing strip metal, it is common practice to continuously feed the strip through a long processing line including an annealing apparatus wherein the moving strip is first heated and then cooled at a controlled rate. Since the strip is traveling rapidly through the processing line, the apparatus for both heating and cooling the strip must extend over a substantial length of the moving strip so that the strip may be heated to the desired temperature and cooled at a controlled rate. If the annealing apparatus were mounted in the horizontal position, a substantial floor space would be required and supports would have to be provided within the apparatus to prevent sagging of the strip. Accordingly, it has become common practice in annealing a continuously moving metal strip to use a tower furnace extending substantially in a vertical direction with the strip first passing either upwardly or downwardly the complete vertical length of the furnace and, then, reversing in direction and again traveling the complete length of the furnace.

As the strip travel upwardly through the furnace, it is said to be moving on an "up pass" and, as a corollary, as the strip is moving downwardly through the furnace it is said to be moving on a "down pass." These terms will be hereinafter used to refer to these lines of movement of the strip through the furnace. Furthermore, the invention will be discussed in relation to a furnace wherein the initial heating is on the down pass and the cooling is on the up pass. It should be appreciated that the reverse arrangement could be utilized without departing from the intent or scope of the present invention.

Since the length of travel necessary for heating and cooling the strip cannot be changed, it is desirable to heat the strip as it is passing through the furnace on the down pass and then cooling the strip as it is traveling through the furnace on the up pass, to thereby limit the height of the furnace. Often, the surface of the heated strip was very easily damaged. Consequently, as the heated strip passed over a roll which directed the strip from the down pass to the up pass, the surface of the strip was often damaged so that it was unacceptable for its intended use. In order to overcome this disadvantage, the roll between the down and up passes was covered with various materials to prevent damage of the strip surface. None of these materials proved satisfactory to eliminate the surface damage to the strip.

Since it has heretofore been impossible to provide a means for directing the strip from one pass to the other without marring the surface of the strip, it has become accepted practice to take the up pass of the strip on the outside of the furnace and accomplish both heating and cooling of the strip on the down pass. This presented the benefits of a vertical furnace; however, in order to provide the proper length for heating and cooling, the furnace was exceedingly tall. This made the furnace quite

2

expensive and presented numerous difficulties in the construction thereof. Further, if the necessary length for accomplishing heating and cooling of the strip was beyond a certain length, the weight of the strip on the down pass would stretch the strip, especially adjacent the heated portions of the strip.

These disadvantages and others are completely overcome by the present invention which is directed toward an apparatus for processing a continuously moving strip having two substantially parallel vertical passes which apparatus includes a means for guiding the strip from one pass to the other without causing surface damage to the strip.

In accordance with the present invention there is provided an improvement in an apparatus for processing a continuously moving strip which apparatus comprises a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on the strip and a second pass for performing a finishing operation on the strip with at least one of the passes being in the chamber. The improvement in the above type of apparatus comprising arranging the two passes so that they are vertical and substantially parallel and further providing a means for guiding the strip between these passes including a support having a generally cylindrical surface, an orifice network coextensive with the surface and defining a generally rectangular strip supporting portion on the surface, and power means for forcing the gaseous material from the chamber through the orifice network and toward the strip under sufficient pressure and volume to maintain the strip spaced from the support surface.

In accordance with a further aspect of the present invention there is provided a fluid support for a continuously moving strip having a given width, comprising a cylindrical support surface extending along the line of movement of the strip, a means for forcing pressurized fluid between the strip and the support surface, and baffle rails on the support surface and extending along the line of movement of the strip. This aspect of the present invention is characterized in that the baffle rails extend radially outward from the support surface a distance greater than the radial extended distance of the support strip and the rails are spaced transversely from each other a distance slightly greater than the width of the strip.

A fluid support as defined above provides improved fluid support characteristics at a higher efficiency and, thus, lower cost.

The primary object of the present invention is the provision of a processing apparatus for vertically processing a continuously moving strip, which apparatus has a high efficiency and does not require the tremendous vertical travel of the strip in one direction as was heretofore necessary.

Another object of the present invention is the provision of an apparatus as defined above which does not cause surface damage to the strip even when the strip is heated to a very high temperature or is otherwise made more susceptible to such damage.

Yet another object of the present invention is the provision of a fluid support for a continuously moving strip which support has a high efficiency, is not complex to produce, is durable in operation and is low in cost.

Still another object of the present invention is the provision of a support for a continuously moving strip which support includes baffle rails extending along the side of the moving strip and closely spaced therefrom so that a pressurized fluid under the strip is more efficiently used.

Yet another object of the present invention is the provision of a fluid support as defined above which support is used in combination with a network of orifices so arranged and constructed to provide the fluid cushion under

the strip and between baffle rails which fluid cushion is characterized as being formed from a high volume of low pressure fluid.

Still another object of the present invention is the provision of a fluid support as defined above which support is used in combination with a network of orifices so arranged and constructed to provide the fluid cushion under the strip and between baffle rails which fluid cushion is characterized as being formed from a low volume of high pressure fluid.

These and other objects and advantages will become apparent from the following description used to illustrate the preferred embodiment of the present invention as read in connection with the accompanying drawings in which:

FIGURE 1 is a cross-sectioned, side elevational view of the preferred embodiment of the present invention;

FIGURE 2 is a partial cross-sectional view taken generally along line 2—2 of FIGURE 1;

FIGURE 3 is a partial cross-sectional view taken generally along line 3—3 of FIGURE 1;

FIGURE 4 is a partial cross-sectional view taken generally along line 4—4 of FIGURE 1;

FIGURE 5 is a partial cross-sectional view taken generally along line 5—5 of FIGURE 4;

FIGURE 6 is a partial cross-sectional, side elevational view similar to FIGURE 1 and illustrating a modification of the preferred embodiment;

FIGURE 7 is a partial cross-sectional view taken generally along line 7—7 of FIGURE 6; and

FIGURES 8 and 9 are enlarged, partial views illustrating the orifice network of the modification shown in FIGURES 6 and 7.

Referring now to the drawings, wherein the showings are for the purpose of illustrating preferred embodiments of the invention only and not for the purpose of limiting same, FIGURE 1 shows an apparatus A for processing a continuously moving strip B, which, in accordance with the illustrated embodiment of the present invention, comprises a thin sheet metal strip. Although it is appreciated that various processing operations may be accomplished in apparatus A, in accordance with the preferred embodiment of the present invention, the apparatus is adapted to anneal the moving strip B by first heating the strip to the annealing temperature and, thereafter, cooling the strip at a controlled rate for proper annealing.

To better explain the operation of apparatus A, the sections of the strip passing through the apparatus and between guide rolls 2, 4 are designated as down pass 10, up pass 12 and transfer pass 14. It is appreciated that the transfer pass 14 could be located above the guide rolls 2, 4 so that the initial pass of the apparatus would be an up pass followed by a down pass. The present invention will operate satisfactorily in both directions; however, in accordance with the preferred embodiment of the present invention the moving strip B hangs downwardly between the guide rolls.

Referring now more specifically to the components of apparatus A, there is included a casing 15, a heating unit 16 adjacent down pass 10, a plurality of separate cooling units 18 adjacent up pass 12 and a guide means 20 adjacent transfer pass 14.

In operation of the apparatus A as so far described, the moving strip B passes downwardly from guide roll 2 through heating unit 16 wherein the temperature of the strip is raised to the annealing temperature. Thereafter, the strip passes around the guide means 20 and upwardly through the separate cooling units 18 which are so controlled to cool the moving strip at the desired rate for annealing. After the strip is cooled it passes from the casing 15 and around guide roll 4 so that it is adapted for subsequent processing.

Referring now more particularly to the details of casing 15, there is provided a support frame 22, an outer shell 24 and an inner shell 26. To insulate the interior of casing 15 there is provided, between the shells, an appropriate

insulation 28. In many instances, it is desirable to provide a controlled atmosphere within casing 15; therefore, in accordance with the preferred embodiment of the present invention, the casing forms a cavity isolated from the ambient atmosphere and the strip B enters the cavity through entrance slot 30 and leaves the cavity through exit slot 32 which slots are provided with seals 34 to prevent rapid egress of gases from the cavity. Hereinafter, the inner cavity will be referred to generally as casing 15 for purposes of simplicity.

A variety of heating units could be provided within casing 15; however, in accordance with the preferred embodiment of the present invention the heating unit 16 comprises an outer shell 40 secured to support beams 41, an inner shell 42 and a heat insulation 44. The heating unit 16 is powered by electrical energy and includes electrical heating elements 46 carried within compartments 48 extending on opposite sides of strip B. At the exit end of the heating unit there is provided threading plates 50, 52 so that the strip B can be conveniently started through the heating unit without damage to the unit.

Cooling of the strip B during the up pass 12 is accomplished by a plurality of separate cooling units 18 only one of which will be described in detail and it is appreciated that the description of this one cooling unit will apply equally to the other units.

The cooling units include a distributor housing 60 extending across the strip B and provided with intake manifolds 62, 64 and 66 which manifolds are opened toward the strip by intake slots 70, 72 and 74. Within the same housing 60 there is provided an exhaust manifold 76 having outlet jet orifices 78 pointed toward the strip B. To circulate the atmosphere within casing 15 from the exhaust manifold to the intake manifolds there is provided, in accordance with the preferred embodiment of the present invention, a circulating fan 80 located within housing 82.

In operation, the fluid forming the atmosphere within casing 15 is drawn by fan 80 into intake manifolds 62, 64, 66 by way of the slots 70, 72, 74. This fluid is then directed through jet orifices 78 onto the surface of the moving strip B. The orifices 78 create jets of high velocity fluid that impinge upon the strip and cool the strip at the desired rate. It is noted that the fluid forming the atmosphere within casing 15 is recirculated by fan 80 so that external air is not drawn into the casing 15. This is important in annealing certain easily tarnished strips.

Referring more specifically to the guide means 20 adjacent transfer pass 14, as shown in FIGURES 1 and 4, there is provided a casing 90 supported within casing 15 by support beams 92. On the outer periphery of casing 90 there is provided a cylindrical support surface 94 extending generally along the line of movement of strip B around transfer pass 14 and having orifice network 96 defining a strip support portion which is generally rectangular in configuration. The orifice network includes transversely extending orifices 100, 102 which define the length of the support portion and are generally spaced from each other 180°. Extending between the transverse orifices there are provided in the longitudinal or, line of movement, direction orifices 104, 106, 108 and 110 which orifices are used in pairs to support the moving strip B in a manner to be hereinafter described in detail.

To force support fluid outwardly from the orifices the casing 90 is provided with a low pressure, high volume plenum chamber 112 and an intake manifold 114 which intake manifold is communicated with the atmosphere around the casing 90. Spaced transversely from moving strip B there is provided an impeller 116 adapted to be rotated by a motor 117 so that fluid in manifold 114 may be drawn into the impeller through an axial inlet 120 and expelled from the impeller into the plenum chamber 112 through radial outlet 122.

As so far described, the fluid within casing 15 which

5

forms the atmosphere for the annealing of the strip B is drawn into the manifold 114 and then forced into the plenum chamber 112. The impeller is of the type which causes a high volume of fluid flow at relatively low pressures so that the plenum chamber is filled with a high volume of low pressure fluid. This fluid is forced from the plenum chamber through the orifices and toward the strip B to support the strip spaced slightly from the cylindrical support surface 94, more specifically the support portion of that surface as defined by the orifice network 96. Hereinafter, further structure will be defined for greatly improving the support characteristics of the fluid issuing from the orifices.

On support surface 94 there is provided a baffle rail and shutter assembly 130 having transversely spaced cylindrical plates 132, 134 matching surface 94 and slidable transversely thereon. Each plate 132, 134 is provided with a generally rectangular opening 136, 138 respectively which openings extend in the line of movement direction, i.e. cylindrically around surface 94, a distance greater than the spacing between slots 100, 102 so that when the opening is above these slots the fluid issuing from the slots will not be blocked. The openings define cylindrically shaped longitudinally extending shutters 140, 142 in the plates 132, 134, respectively, which shutters are shown as being positioned over slots 106, 108, respectively, to block the issuance of pressurized fluid from these slots or orifices. The openings 136, 138 are so dimensioned that when the plates are shifted from the position shown in FIGURE 4 a slight distance transversely inward, the shutters 140, 142 open slots 106, 108 and close slots 104, 110. In this manner, movement of plates 132, 134 can conveniently determine which pair of slots are opened and which pair are closed. This shutter operation is used for changing the effective width of orifice network 96 when a strip having a substantially different width is being passed through apparatus A.

Spaced transversely outward only a slight amount from openings 136, 138 there are provided on plates 132, 134, respectively, circumferentially extending baffle rails 144, 146 which have a radial height greater than the spacing of strip B from cylindrical surface 94. When the plates 132, 134 are positioned as shown in FIGURE 4, the rails 144, 146 are spaced only slightly from the slots 104, 110. When the plates are moved transversely inward to open slots 106, 108 and close slots 104, 110, the rails 144, 146 are positioned transversely inward a sufficient distance to be spaced only slightly from the edges of the moving strip B. Preferably, the slots 106, 108 are near the edges of the moving strip also.

To support and shift the plates 132, 134 there are provided circumferentially spaced apertured support blocks 150, 152 and 154 spaced transversely from and aligned with support lugs 160, 162 and 164, respectively. These blocks and lugs are arranged in pairs and the respective blocks and lugs of each pair are numbered identically. Rods 166 extend transversely between lugs 160 and between lugs 164, and each rod is journaled in their respective blocks 150, 154 so that the blocks can slide freely along the rods.

To impart movement to the plates 132, 134 there is provided a screw shaft 168 having reversed threads on either end thereof which threads coast with the threaded apertures of blocks 152. The shaft 168 is journaled within lugs 162 and is rotated by appropriate control motor 170 supported on frame 22 by bracket 172.

In operation, the motor 170 adjusts the position of plates 132, 134 so that the proper circumferentially extending orifice or slot is opened and so that the rails 144, 146 are spaced only slightly from the edge of the moving strip B.

To assist in threading the strip B around the surface 94, there are provided threading plates 174, 176, 178 and 180 constructed in a manner to provide a substantially

6

continuous surface spaced slightly from the intended path of the strip B.

Referring now to FIGURE 5, a particular construction of the orifices on support surface 94 is disclosed. The orifices extend through the casing 90 at a slight angle, preferably 30°, which directs the air toward the air pocket between the surface 94 and strip B. This allows convenient formation of a low pressure, high volume air pocket between the strip and the support surface. The baffle rails which are spaced only slightly from the edges of the strip B assist also in the confinement of the low pressure fluid between surface 94 and strip B so that the efficiency of the fluid support is greatly improved.

In FIGURES 6-9 there is disclosed a modification of the preferred embodiment of the invention as shown in FIGURES 1-5, which modification utilizes a high pressure, low volume fluid cushion for supporting strip B adjacent the transfer pass 14. This modification of the present invention includes guide means 190 supported within casing 15 by support beams 192. Around the transfer pass 14 there is provided a cylindrically extending distributor head 194 with an outer support surface 196. The support surface receives an orifice network 198 comprising, basically, transversely extending rather shallow grooves 200 and a cylindrically extending groove 202. These grooves substantially cover the support surface 196.

To circulate fluid from adjacent the distributor head 194 there is provided a compressor 204 having an intake 206 adjacent the outer surface 196 and an outlet pipe 208. The outlet pipe is provided with a coupling 210 having an orifice 212 which orifice is in direct communication with the grooves 200, 202 so that pressurized fluid from the pipe 208 is conveniently directed into the shallow grooves on surface 196. Fluid from the atmosphere filling casing 15 issues from orifice 212 under high pressure but with only a low volume which low volume, high pressure fluid fills the grooves 200, 202 and provides a cushion for supporting the moving strip B.

The guide means 190 is provided with cylindrically extending plates 220, 222 similar to plates 132, 134 of guide means 20 with the exception that the openings 136, 138 are not provided. Adjacent the inwardmost edge of plates 220, 222 there are provided cylindrically extending baffle rails 224, 226. To compensate for variation in the width of strip B, the plates 220, 222 may be moved in a transverse direction by motor 170, as was described in detail above, until the rails 224, 226 are spaced only slightly from the edges of the strip. In this manner, the grooves 200 are closed by the plates so that the effective width of the orifice network 198 is substantially the same as the width of the strip passing over the distributor head 194.

The fluid cushion between the strip B and the support surface of the two modifications described above is formed from the fluid within casing 15 by a re-circulating system as is evident from the discussion above of the preferred embodiments of the present invention. It is appreciated that, especially in FIGURES 1-5, one fan may be utilized for creating the fluid cushion for supporting the strip at transfer pass 14 and for cooling the strip during the up pass 12. This would allow one fan and intake system for providing two separate functions, i.e., fluid support and cooling. It is appreciated that this same type of dual use of the compressor 204 could be accomplished in the modification of the present invention shown in FIGURES 6-9.

The present invention has been discussed in connection with two preferred embodiments; however, it is appreciated that various structural changes may be made without departing from the intended spirit and scope of the present invention as defined in the appended claims. For instance, although only one up pass and one down pass is illustrated it is within the contemplation of the present invention to have multiple up and down passes with proc-

essing of the strip taking place along various combinations of these passes.

Having thus described our invention, we claim:

1. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, said support including a plenum chamber coextensive therewith, said network including elongated orifices communicating said plenum chamber with said surface, and said power means comprising a means for supplying said fluid under low pressure and in high volume to said plenum chamber, a first and second shutter plate spaced transversely from each other, said plates being positioned adjacent said surface and adapted to close said orifices, and means for moving said plates transversely on said surface for limiting the transverse width of said orifice network.

2. The improvement as defined in claim 1 wherein each of said plates carries a baffle rail coextensive in a cylindrical direction with said plates and said baffle rails having a radial height greater than the spacing of said strip from said surface, and said rails being movable with said plates to a position closely spaced from the edges of said strip.

3. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, a first and second shutter plate spaced transversely from each other, said plates being positioned adjacent said surface and adapted to close said orifice network and means for moving said plates transversely on said surface for limiting the transverse width of said orifice network.

4. The improvement as defined in claim 3 wherein each of said plates carries a baffle rail coextensive in a cylindrical direction with said plates, said baffle rails having a radial height greater than the spacing of said strip from said surface and said rails being movable with said plates to a position closely spaced from the edges of said strip.

5. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a general-

ly rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, a first and second baffle rail coextensive in a cylindrical direction with said surface and spaced transversely from each other, said rails having a radial height greater than the spacing of said strip from said surface, means for limiting the transverse width of said network and means for moving said rails transversely into close spaced relationship with the edges of said strip.

6. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, said orifice network includes a first pair of cylindrically extending orifices spaced a first transverse direction and a second pair of cylindrically extending orifices spaced a second transverse direction, a first and second shutter plate spaced transversely from each other, said plates being positioned adjacent said surface and movable from a first position wherein said first pair of orifices is opened and said second pair of orifices is closed to a second position wherein said second pair of orifices is opened and said first pair of orifices is closed, and means for moving said plates alternately between said first and second positions.

7. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, said support including a plenum chamber coextensive therewith, said network including elongated orifices communicating said plenum chamber with said surface, and said power means comprising a means for supplying said fluid under low pressure and in high volume to said plenum chamber, a first and second baffle rail coextensive in a cylindrical direction with said surface and spaced transversely from each other, said rails having a radial height greater than the spacing of said strip from said surface, means for limiting the transverse width of said network and means for moving said rails transversely in close spaced relationship with the edges of said strip.

8. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means includ-

9

ing a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, said network including a plurality of shallow slots on said surface and opened only toward said strip, said power means comprising means for supplying said fluid under high pressure and in low volume to said slots, a first and second shutter plate spaced transversely from each other, said plates being positioned adjacent said surface and adapted to close said slots, and means for moving said plates transversely on said surface for limiting the transverse width of said orifice network to substantially the width of said strip.

9. The improvement as defined in claim 8 wherein each of said plates carries a baffle rail coextensive in a cylindrical direction with said plates, said baffle rails having a radial height greater than the spacing of said strip from said surface and said rails being movable with said plates to a position closely spaced from the edges of said strip.

10. In an apparatus for processing a continuously moving strip comprising, a chamber filled with an atmosphere of gaseous material, a first pass for performing a preliminary operation on said strip, a second pass for performing a finishing operation on said strip, at least one of said passes being in said chamber, said passes being substantially vertical and substantially parallel to each other, and means for guiding said strip between said passes, the improvement comprising: said means including a support having a generally cylindrical surface, an orifice network coextensive with said surface and defining a generally rectangular strip support portion on said surface, and power means for forcing said gaseous material from said network toward said strip in sufficient volume and under sufficient pressure to maintain the strip spaced from said surface, said network including a plurality of shallow slots on each surface and opened only toward said strip, and said power means comprising means for supplying said fluid under high pressure and in low volume to said slots, a first and second baffle rail coextensive in a cylindrical direction with said surface and spaced transversely from each other, said rails having a radial height greater than the spacing of said strip from said surface, means for limiting the transverse width of said network and means for moving said rails transversely in close spaced relationship with the edges of said strip.

11. A fluid support for a continuously moving strip comprising a cylindrical support surface extending in the

10

line of movement direction of said strip, first and second slots in said surface and extending transversely across said surface, third and fourth slots extending longitudinally of said surface and defining with said transverse slots a generally rectangular support portion on said surface, baffle rails coextensive with and spaced transversely outwardly from each of said longitudinal slots, said rails having a radial height greater than the spacing of said strip from said surface, said rails being spaced transversely from each other a distance slightly greater than the width of said strip, and means for forcing a high volume of low pressure fluid through said slots toward said moving strip.

12. A fluid support as defined in claim 11 including means for adjusting the transverse spacing of said rails.

13. A fluid support as defined in claim 12 wherein said adjusting means includes a rotatable rod having a first and second cam means connected respectively to one of said rails to move said rails in opposite transverse directions as said rod is rotated, and means for rotating said rod.

14. A fluid support as defined in claim 11 including fifth and sixth slots extending in a longitudinal direction and transversely spaced from each other a distance different from the transverse spacing of said third and fourth slots, a first and second shutter plate spaced transversely from each other, said plates being positioned adjacent said surface and movable from a first position wherein said third and fourth slots are opened and said fifth and sixth slots are closed to a second position wherein said fifth and sixth slots are opened and said third and fourth slots are closed, and means for moving said plates alternately between said first and second positions.

15. A fluid support as defined in claim 14 wherein said rails are secured respectively to said first and second plates.

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FREDERICK L. MATTESON, Jr., *Primary Examiner.*

NORMAN YUDKOFF, JOHN J. CAMBY, *Examiners.*

50 F. E. DRUMMOND, C. R. REMKE,

Assistant Examiners.