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[54] **HEAT TREATING FURNACE**

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[52] **U.S. Cl.** ..... **214/21,** 198/208, 214/152, 263/8 R

[51] **Int. Cl.** **B65g 23/44**

[58] **Field of Search** ..... 214/21; 263/8 R, 263/8 A; 198/127 R, 208

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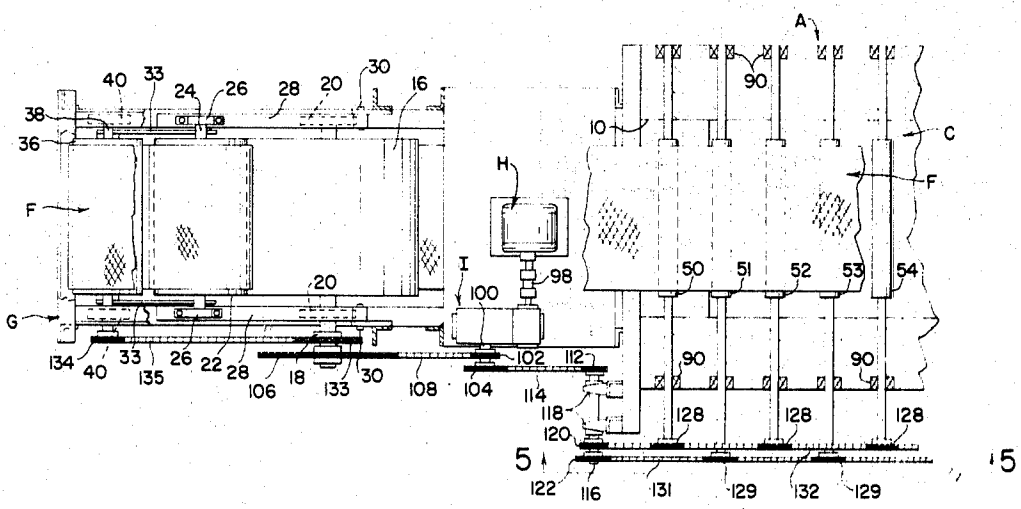
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[57] **ABSTRACT**

A conveyor belt or flat elongated material is pulled in a predetermined direction at a predetermined speed across spaced-apart supporting rolls in a heat treating furnace. Alternate ones of the supporting rolls are rotatably driven to move the peripheral surfaces thereof at a speed greater than the predetermined speed and in a direction for imparting frictional forces to the belt or flat elongated material acting in the predetermined direction. The remainder of the rolls are rotatably driven so that the peripheral surfaces thereof move in a manner for imparting frictional forces to the belt or flat elongated material acting opposite to the predetermined direction. Alternate addition and subtraction of forces act on the belt or flat elongated material to provide essentially uniform tension in the belt or flat elongated material to obtain an essentially uniform catenary between rolls. The alternate addition and subtraction of forces maintains at a minimum the tension required to pull the belt or flat elongated material through the furnace.

24 Claims, 7 Drawing Figures



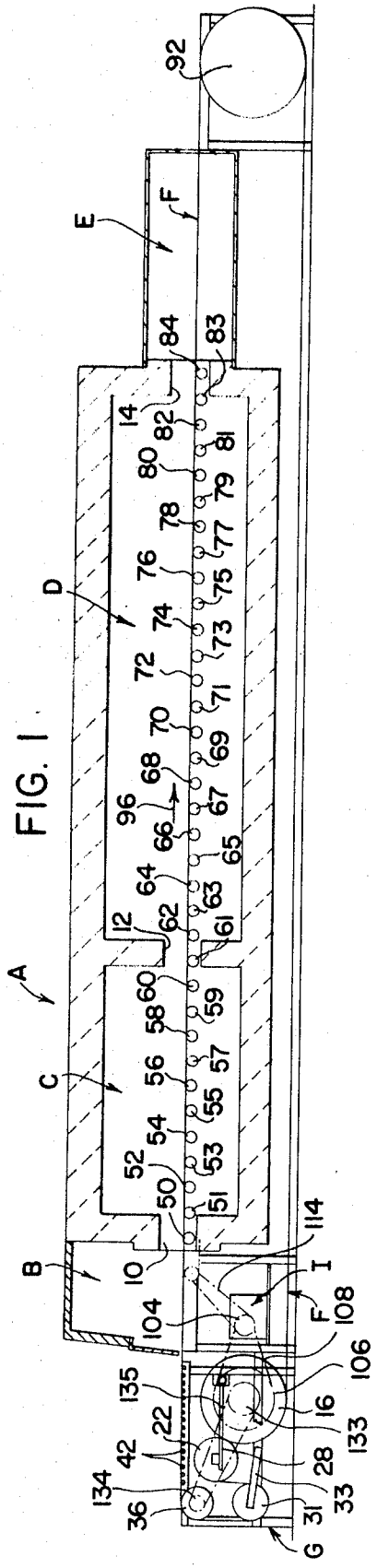


FIG. 1

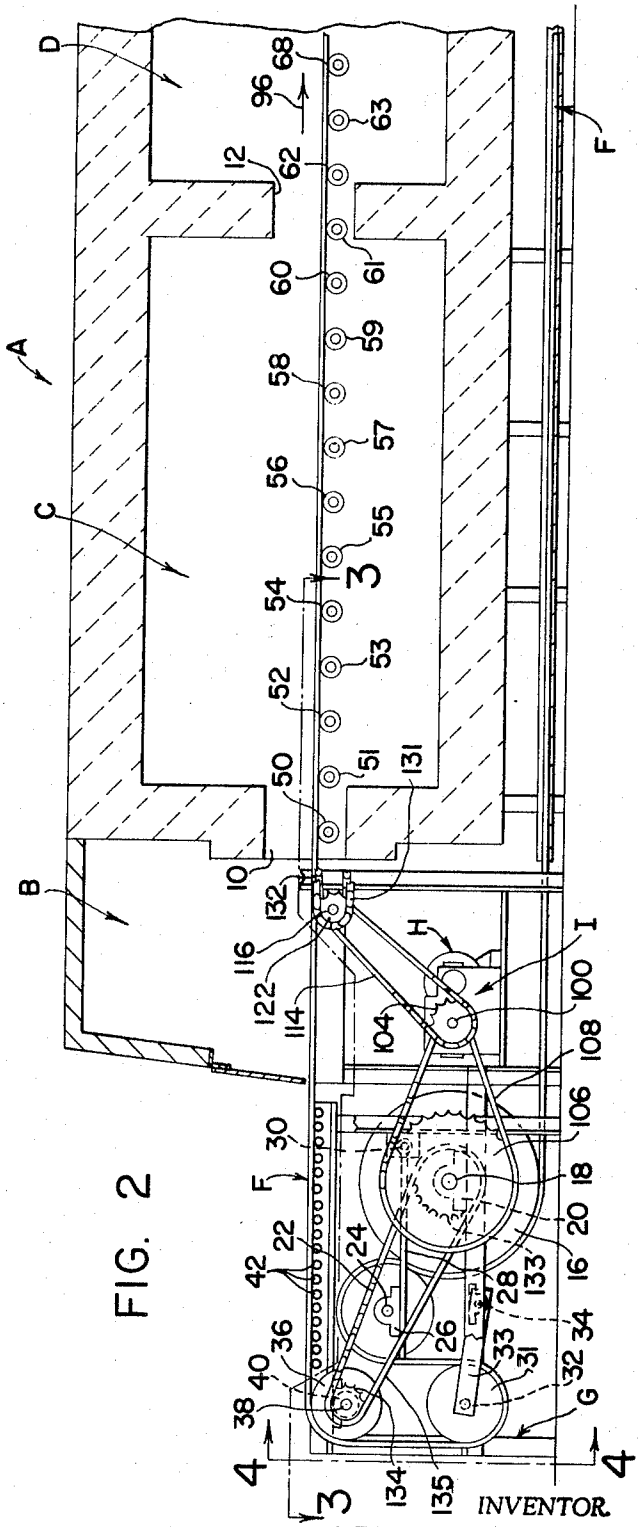


FIG. 2

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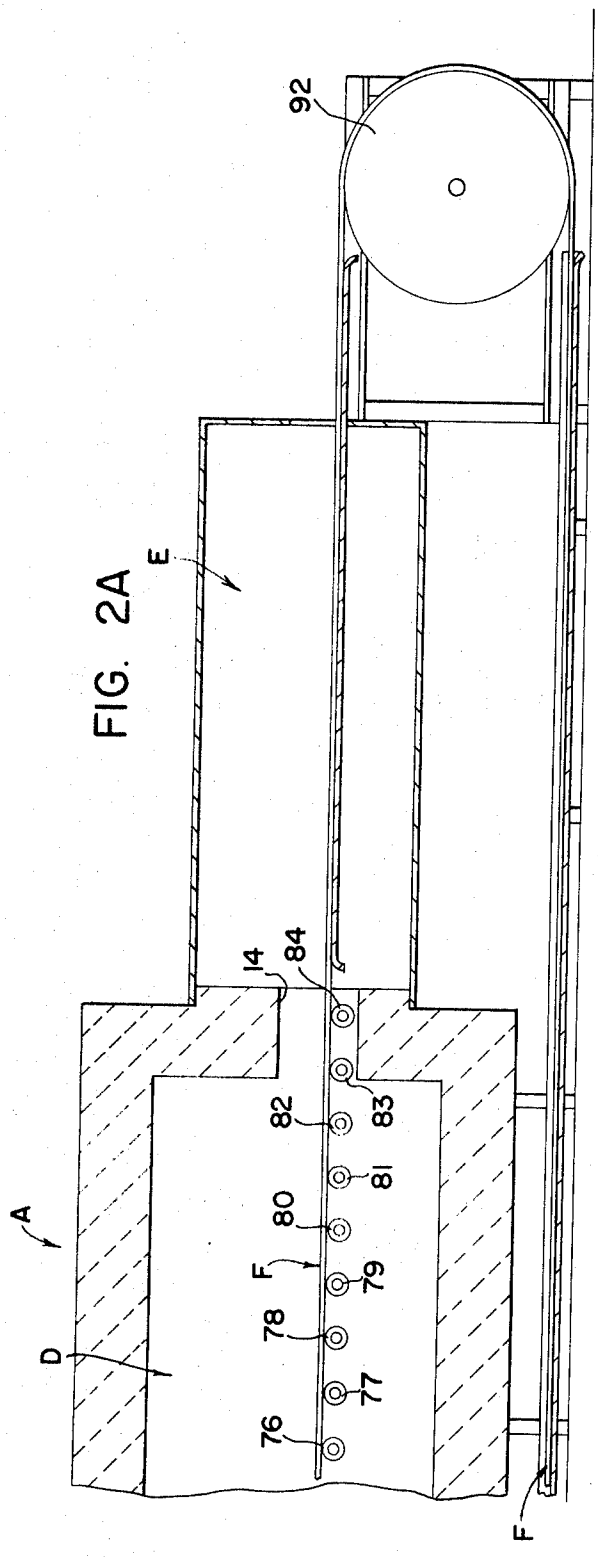


FIG. 2A

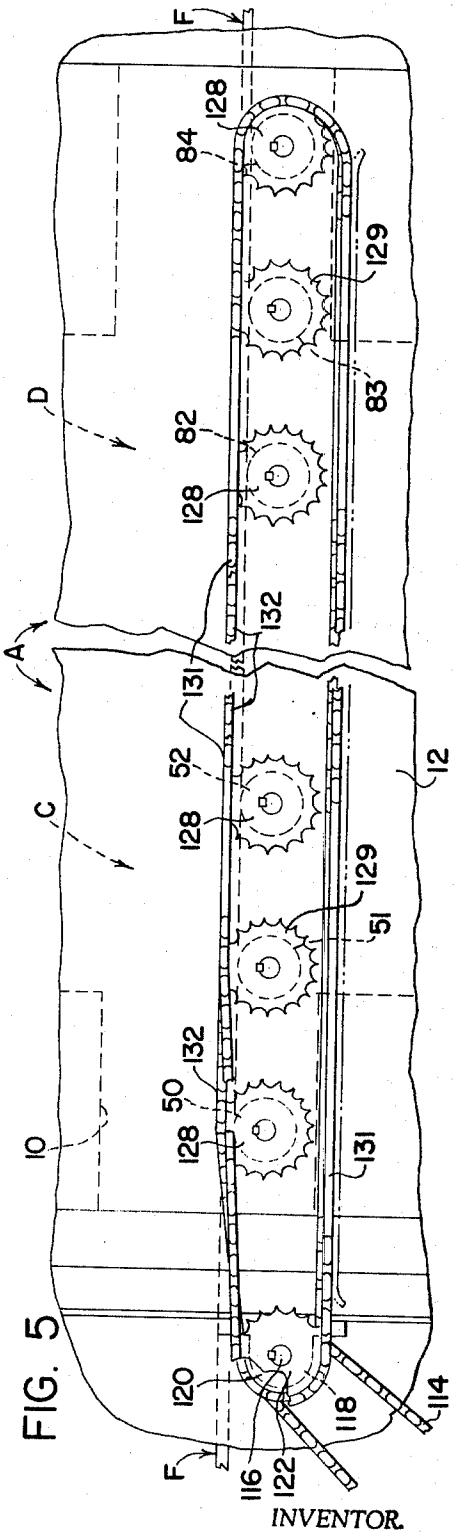


FIG. 5

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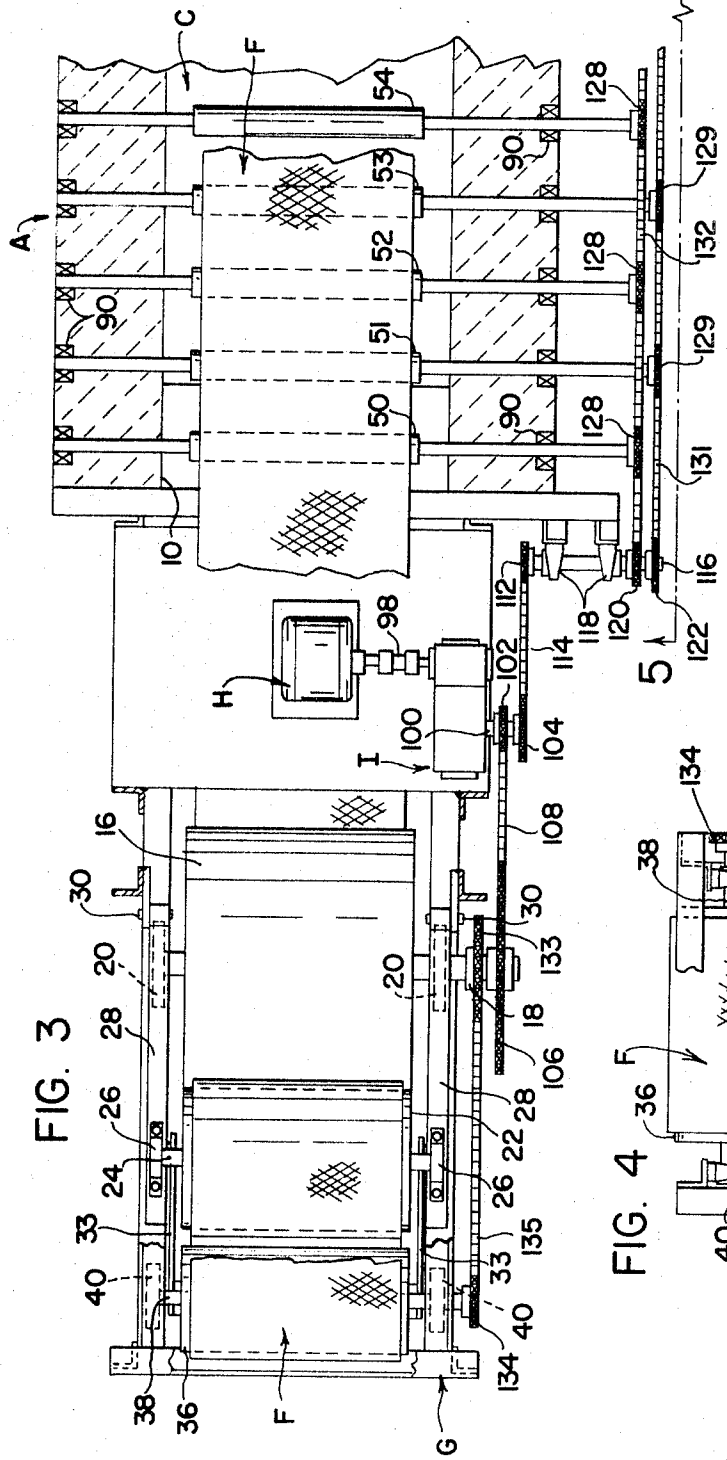


FIG. 3

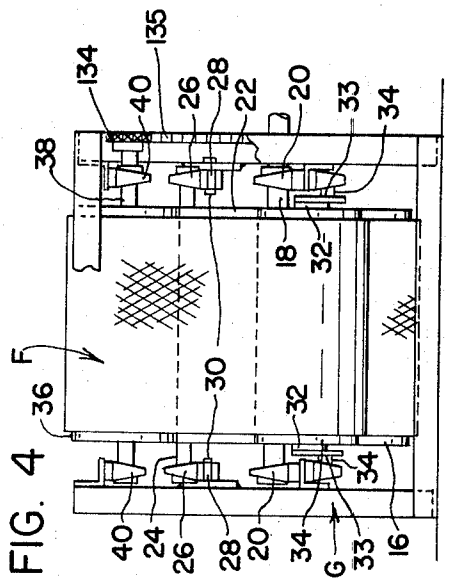


FIG. 4

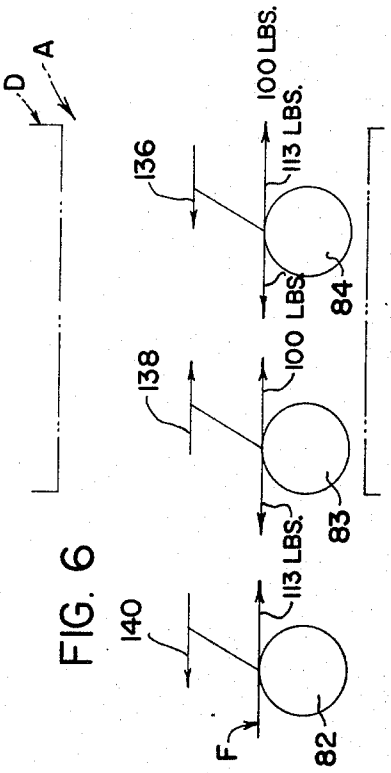


FIG. 6

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HEAT TREATING FURNACE

BACKGROUND OF THE INVENTION

This application pertains to the art of conveyor belt transport systems and more particularly to a supporting and driving arrangement for a flexible continuous conveyor belt. The invention is particularly applicable to use in a high temperature heat treating furnace and will be described with particular reference thereto although it will be appreciated that the invention has broader applications and may be used for supporting and driving other elongated flat articles and in particular ferrous and non-ferrous flat strip metal.

Heat treating furnaces of a known type include a continuous flexible metal mesh conveyor belt for conveying articles to be heat treated through the furnace. The open mesh belt allows uniform heating of parts. The belt is pulled across supporting means within the furnace. One type of supporting means includes a skid on which the conveyor belt simply slides. The frictional retarding force acting between the skid and belt necessitates a very high pulling force which results in significant tension in the belt. When operating with a furnace at extremely high temperatures, the tension in the belt must be kept low to avoid rupture. It is possible to use a very small furnace having a supporting means with a very small area. With such an arrangement, the normal force acting on the skid due to the weight of the belt and parts thereon is kept to a minimum and the frictional retarding force is also minimized. However, the conveyor belt must then travel at an extremely slow speed through the furnace in order to maintain the parts at a desired temperature for a desired period of time. This greatly reduces the capacity of the furnace. Increasing the size of the furnace and the area of the supporting means in order to speed up the belt and increase production results in a frictional retarding force which is too great.

Other supporting means for such furnaces have included rotatably driven rolls positioned in spaced-apart relationship and rotatable on axes transverse to the direction of belt movement. As a practical matter, it is impossible to exactly synchronize the speed of such supporting rolls with the speed of the belt. In addition, slight variations in diameter of adjacent rolls causes a variation in the peripheral surface speed of each roll. If all of the supporting rolls are rotating with a surface speed slightly less than the speed of the belt, movement of the belt across the rolls is retarded and an extremely high friction force is produced so that permissable belt tension will be exceeded. If the surface speed of the rolls is slightly greater than the speed of the belt, an extremely large catenary will be formed in the belt between a pair of rolls. Parts carried on the belt may pile up in such a catenary or be deformed due to the curvature of the belt at the catenary. Further, excessive tension may, depending upon equipment length, be produced in the belt at the entering end of the heating zones.

SUMMARY OF THE INVENTION

A heat treating furnace has a continuous flexible metal mesh conveyor belt on which parts to be heat treated are carried through the furnace. The belt is pulled in a predetermined direction through the furnace across supporting means. The supporting means comprises a plurality of spaced-apart rolls extending

transversely to the direction of movement of the belt. Alternate ones of the supporting rolls are rotatably driven so that the peripheral surfaces thereof move at a speed greater than the predetermined speed of the belt in a direction to impart frictional forces to the belt in its predetermined direction of movement. The other rolls are rotatably driven so that the peripheral surfaces thereof move in a manner to impart frictional forces to the belt in a direction opposite to its predetermined direction of movement.

Rotatably driving the rolls in the manner described provides an arrangement wherein the tension in the belt is alternately increased and decreased as it travels through the furnace. This prevents formation of excessive catenaries in the belt and also minimizes the frictional force imparted to the belt as it travels across the supporting means.

It is a principal object of the present invention to provide an improved transport system for a substantially flat elongated article.

It is also an object of the present invention to provide such a transport system wherein resultant frictional forces imparted to the article moving across a supporting means are minimized and do not accumulate.

It is an additional object of the present invention to provide a heat treating furnace with a transport system for a movable conveyor belt.

It is another object of the present invention to provide a heat treating furnace with such a transport system whereby resultant frictional retarding forces imparted to the conveyor belt are minimized.

It is another object of the present invention to provide an improved method for maintaining low tension and minimizing formation of catenaries in a flexible conveyor belt for a heat treating furnace.

It is also an object of the present invention to provide an improved method for transporting a substantially flat elongated article across support means.

BRIEF DESCRIPTION OF THE DRAWING

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawing which forms a part hereof.

FIG. 1 is a side elevational cross-sectional view of a furnace having the improvements of the present invention incorporated therein;

FIG. 2 is an enlarged, partial, side elevational cross-sectional view of a portion of the furnace of FIG. 1;

FIG. 2A is an enlarged, partial, side elevational cross-sectional view of a portion of the furnace of FIG. 1;

FIG. 3 is a cross-sectional plan view looking in the direction of arrows 3—3 of FIG. 2;

FIG. 4 is an end elevational view looking in the direction of arrows 4—4 of FIG. 2;

FIG. 5 is a side elevational view looking in the direction of arrows 5—5 of FIG. 3; and

FIG. 6 is a diagrammatic view showing forces applied to a conveyor belt with the improvements of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein the showings are for purposes of illustrating a preferred embodiment

of the invention only and not for purposes of limiting same, FIG. 1 shows a heat treating furnace A having a charging vestibule section B, a preheat section C, a main heat and soak section D, and a cooling section E.

Furnace A is of a known type and the various sections may be lined with refractor material in a known manner. The heated sections of furnace A may be heated by gas burners or by electric heaters in a known manner. In addition, a protective gas atmosphere may be circulated through furnace A. Narrow passageways **10, 12** and **14** may separate the various sections of furnace A. Coolant fluid may be circulated through cooling section E or through pipes located therein in a known manner.

A continuous flexible metal mesh conveyor belt F extends through furnace A for conveying parts to be heat treated therethrough. Sintered metal parts may be carried by conveyor belt F, although it will be recognized that the principles of the present invention may be used for conveying any type of parts, or transfer of ferrous or non-ferrous flat strip metal. The principles of the present invention are especially well suited for a furnace operating at an extremely high temperature. In one arrangement, main heat and soak section D operates at 2,100° F and preheat section C operates at 1,600° F. At such temperatures, the amount of tension which can be applied to belt F is very limited.

In one arrangement, a rotatably driven conveyor belt drive drum **16** has its shaft **18** rotatably mounted in bearings **20** secured to framework G. The width of drum **16** is at least as great as the width of conveyor belt F. Belt F contacts the lower left periphery of drive drum **16** over an arc somewhat greater than 90°. Belt F then loops over a force applying idler drum **22** having its shaft **24** rotatably mounted in bearings **26.** Bearings **26** are carried on rods **28** pivotally connected with framework G as by pivot pins **30.** Force applying drum **22** is then free to fall downward into engagement with belt drive drum **16.** This provides a normal force between belt F and drum **16** so that the frictional force will be sufficient to move belt F when drum **16** is rotated. Drum **22** may be biased toward drive drum **16** by suitable springs if so desired.

Belt F loops downward from force applying drum **22** around a slack takeup tensioning dancer drum **31.** Tensioning drum **31** has a shaft **32** rotatably mounted on arms **33** which are pivotally connected to frame G by pins **34** so that drum **31** simply hangs in the loop of belt F. Tensioning drum **31** simply rolls within the loop as the conveyor belt is driven. Tensioning drum **31** may have a predetermined weight for taking up slack in belt F and providing a desirable tension force in belt F. Drum **31** may be hollow and filled with water to provide variable weight. Tensioning drum F is free to float upward or downward for enlarging or decreasing the size of the loop in belt F. Belt F then goes upward around a driven drum **36** having its shaft **38** rotatably mounted in bearings **40** secured to framework G. Belt F then extends horizontally through furnace A. Drums **16, 22, 34** and **36** all have a longitudinal length which is at least as great as the width of belt F.

Belt F extends from driven drum **36** over a plurality of rotatable idler rollers **42.** Belt F then extends through charging vestibule B. Parts to be heat treated are deposited on belt F at the location of idler rollers **42** for passage through furnace A. Belt F may be supported in passing through charging vestibule B on rolls or on a skid.

Belt F is supported for movement through furnace sections C and D on a plurality of spaced-apart rolls **50–84.** Each roll **50–84** is rotatably mounted in bearings **90** mounted on the sidewalls of furnace A. Each roll has a longitudinal length at least equal to the width of belt F. The rolls are mounted for rotation on axes extending transversely to the direction of movement of belt F. Belt F then extends through cooling section E and may be supported for movement therethrough on a conventional skid. Belt F emerges from cooling section E and extends around idler drum **92.** Belt F then extends back beneath furnace A to drive drum **16.** Belt F may be supported on a skid or on rollers between drive drum **16** and idler drum **94.** Rotation of drive drum **16** in a clockwise direction as viewed in FIG. 1 causes belt F to be pulled in the direction of arrow **96** through furnace A.

It is desirable that belt F be maintained under a predetermined minimum tension in order to prevent belt F from sagging into pronounced catenaries between adjacent rolls. Pronounced sagging of belt F between adjacent rolls may cause parts being heat treated in furnace A to have the belt curvature imparted thereto. The frictional resistance retarding movement of belt F across drums **22, 34** and **36,** idler rollers **42** and the support in vestibule B, may be designed so that a pulling force necessary to move belt F will produce a predetermined desired tension at the exit point from heating section D. A desirable minimum tension is easily produced simply by adjusting the weight of tensioning drum **31.**

As previously explained, it is a practical impossibility to drive rolls **50–84** so that the peripheral surfaces thereof move at the same speed as belt F. Rotation of rolls **50–84** so that the peripheral surfaces thereof move slower than belt F results in an extremely large friction force as the belt must be dragged across the rolls. Movement of rolls **50–84** so that the peripheral surfaces thereof move at a speed greater than the speed of belt F will result in a large catenary forming between a pair of adjacent rolls. Parts being carried on the belt will then bunch up in this catenary or will be severely warped. Further, excessive tension may be produced in the belt at the entering end of heating chambers C or D.

In accordance with the present application, a motor H has its output shaft **98** drivingly connected with transmission I. Output shaft **100** from trasnmission I has two sprockets **102** and **104** thereon. Sprocket **102** is drivingly connected with a sprocket **106** by chain **108.** Sprocket **106** is secured on shaft **18** of conveyor belt drive drum **16.** Sprocket **104** from transmission I is connected with srpocket **112** by chain **114.** Sprocket **112** is secured to one end portion of jack shaft **116** which is rotatably mounted in bearings **118.** The other end of jack shaft **116** has a pair of sprockets **120** and **122** thereon. Sprocket **120** is of slightly smaller diameter than sprocket **112.** Each even numbered roll **50–84** has a sprocket **128** thereon, while each odd numbered roll **51–83** has a sprocket **129** thereon. All of sprockets **128** are drivingly connected with sprocket **120** by chain **132.** Each sprocket **129** is drivingly connected with sprocket **122** by chain **131.** Rolls **50–84** are rotatably driven so that the peripheral surfaces thereof move in the same direction as the predetermined direction of

movement of belt F through furnace A. Sprocket **133**, mounted on shaft **18** of drive drum **16**, is drivingly connected with sprocket **134**, mounted on shaft **38** of drum **36**, by chain **135** so that drum **36** is driven in a clockwise direction as viewed in FIGS. **1** and **2**.

Many metal mesh belts are not capable of use at temperatures as high as 2,100° F. At such temperatures, it is necessary to use an extremely expensive belt having a high nickel chromium content. Even with such a belt, the maximum allowable tension therein must be reduced by dividing the allowable room temperature tension by a factor as high as **25**. This severely limits the amount of pull which can be placed on the belt. If rolls **50–84** are not rotatably driven, the frictional force of the belt dragging thereacross may be insufficient to rotate the rolls. This is particularly true if the bearings become dirty or are poorly lubricated. If the rolls do not rotate, they will sag into a banana-like shape at the high temperatures involved. In addition, if the rollers do not rotate, the frictional force of the belt dragging across the non-rotating rolls will cause the maximum permissible tension in the belt to be exceeded.

In accordance with the present invention, frictional retarding forces acting upon belt F as it is pulled through furnace A are minimized in heated sections C and D by rotating alternate ones of rolls **50–84** at different speeds. In accordance with one arrangement, even number rolls **50–84** are rotated in such a manner that the peripheral surfaces thereof move at speed slower than the speed of belt F. Thus, belt F is dragged across slower moving even numbered rolls **50–84** and frictional forces are imparted to belt F acting opposite to its direction of movement. Odd numbered rolls **51–83** are driven in such a manner that the peripheral surfaces thereof move at a speed greater than the speed of belt F so that odd numbered rolls **51–83** slip relative to belt F and impart frictional forces thereto acting in its direction of movement. The peripheral surfaces of all of rolls **50–84** move in the same direction as the predetermined direction of movement of belt F. One example of the improved results achieved by this arrangement may be given. Assuming that belt F weighs 4 pounds per square foot and the load of parts carried on belt F amounts to 10 pounds per square foot, the total load on belt F will be 14 pounds per square foot. If belt F is two feet wide, to total load will be 28 pounds per linear foot. With rolls **50–84** spaced 9 inches apart, the total load per roll will be 21 pounds. With tensioning drum **34** and the frictional resistance to movement of belt F calculated so that the tension in belt F will be at a minimum of around 100 pounds at the point where it exits from main heating and soaking section D. Final even numbered roll **84** is rotating in such a manner that the peripheral surface therof is moving at a slower speed than the predetermined speed of belt F. Therefore, as shown in FIG. **6**, belt F is dragging across roll **84** and a frictional retarding force **136** is acting on belt F opposite to its direction of movement. If the coefficient of friction between belt F and each roll is 0.6, frictional force **136** is equal to the load per roll of 21 pounds times 0.6, or 13 pounds. Therefore, the total tension in belt F immediately upon exiting from main heating section D and passing over last roll **84** is 113 pounds. Next adjacent odd numbered roll **83** is rotating in such a manner that the peripheral surface thereof is moving at a greater speed than the speed of belt F. Therefore roll **83** imparts a frictional force **138** to belt F acting in the same direction as the predetermined direction of movement of belt F. Force **138** will also be 13 pounds as previously calculated. This reduces the tension in belt F between rolls **83** and **84** to 100 pounds. Next adjacent even number roll **82** is rotating in such a manner that the peripheral surface thereof is moving at a slower speed than the predetermined speed of belt F. This imparts a frictional force **140** acting upon belt F in a direction opposite to its predetermined direction of movement. Therefore, the tension in belt F between rolls **82** and **83** is 113 pounds. It will be evident that the calculations may go on throughout the entire length of heating sections C and D, and the tension in belt F alternates between 100 and 113 pounds when proceeding between each adjacent pair of rolls. Therefore, the tension in belt F is made substantially constant throughout heating sections C and D and is not substantially greater at the entrance end to heating section C than it is at the exit end of heating section D. In the preferred arrangement, the predetermined tension at the entrance end is always less than the predetermined tension at the exit end. The described arrangement also maintains a desired minimum tension in belt F to prevent formation of extreme catenaries in belt F.

It will be recognized that it is possible to drive even numbered rolls **50–84** in such a manner that the peripheral surfaces thereof move in a direction opposite to the direction of movement of belt F. It is also possible to replace even numbered rolls **50–84** with skids so that belt F is dragged thereacross. In any event, even numbered rolls **50–84** define means for applying spaced-apart frictional forces to belt F in a direction opposite to the direction of movement of belt F. Odd numbered rolls **51–83** define means for applying spaced-apart friction forces to belt F acting in a direction which is the same as the direction of movement of belt F. All of rolls **50–84** act on belt F to alternately increase and decrease the predetermined tension therein so that belt F is under a predetermined entrance tension adjacent the entrance end of heating section C which is not substantially greater than predetermined tension in belt F adjacent the exit end of heating section D. In the most preferred arrangement, the tension in belt F adjacent the entrance end of section D is always less than the tension therein adjacent the exit end of section D.

While the invention has been described with reference to a preferred embodiment, it is obvious that equivalent alterations and modifications will occur to those skilled in the art upon the reading and understanding of this specification. The present application includes all such equivalent alterations and modifications and is limited only by the scope of the claims.

Having thus described my invention, I claim:

1. A transport system for a substantially flat elongated article comprising support means for supporting said article and including an entrance support end and an exit support end, tensioning means for tensioning said article to a predetermined tension force between said entrance and exit support ends, article moving means for pulling said article under said predetermined tension force across said support means in a predetermined direction from said entrance support end toward said exit support end at a predetermined speed, said support means including a plurality of spaced-apart friction applying means engaging said article at spaced-apart intervals in said predetermined direction for applying spaced-apart friction forces to said article acting

in said predetermined direction, each of said spaced-apart friction forces being substantially less than said predetermined tension force, and a plurality of spaced-apart friction drag applying means engaging said article at spaced-apart intervals in said predetermined direction intermediate said friction applying means for applying spaced-apart friction drag forces to said article acting opposite to said predetermined direction, each of said friction drag forces being substantially less than said predetermined tension force and substantially equal to each of said friction forces, said article being under an exit tension force adjacent said exit support end and under an entrance tension force adjacent said entrance support end, said friction applying means and said friction drag applying means being positioned so that said entrance tension force and said exit tension force do not differ by an amount greater than substantially one of said friction forces or friction drag forces.

2. The device of claim **1** wherein said article comprises a continuous conveyor belt.

3. The device of claim **1** wherein said friction applying means and said friction drag applying means act on said article to alternately increase and decrease said predetermined tension therein from said exit end to said entrance end whereby said entrance tension force is less than said exit tension force.

4. The device of claim **1** wherein said friction applying means comprises a plurality of spaced-apart rotatable rollers, said rollers being rotatable on axes extending transverse to said predetermined direction.

5. The device of claim **4** wherein each of said rollers has a peripheral surface engaging said article, and roller drive means for rotating said rollers to move said peripheral surfaces thereof at a speed greater than said predetermined speed in a direction to impart frictional forces to said article acting in said predetermined direction.

6. The device of claim **5** wherein said article comprises a continuous conveyor belt, said article moving means comprising a rotatably driven drum engaging said belt, and a common power source for rotatably driving said drum and said roller drive means.

7. The device of claim **5** wherein said friction drag applying means comprises a plurality of spaced-apart rotatable extending rollers, said drag rollers being rotatable on axes depending transverse to said predetermined direction intermediate said friction force applying rollers.

8. The device of claim **7** wherein each of said drag rollers has a peripheral surface engaging said article, and drag roller drive means for rotating said drag rollers to move said peripheral surfaces thereof in a manner for imparting friction forces to said article acting opposite to said predetermined direction.

9. The device of claim **8** wherein said drag roller drive means is for driving said drag rollers to move said peripheral surfaces thereof at a speed less than said predetermined speed and in the same direction as said predetermined direction.

10. The device of claim **8** wherein said article comprises a continuous conveyor belt, said article moving means comprising a rotatably driven drum engaging said belt, and a common power source for rotatably driving said drum and said roller drive means.

11. The device of claim **1** wherein said article comprises a flexible continuous conveyor belt and said article moving means comprises a rotatably driven drum engaging said belt, said belt having a loop therein, and a slack takeup tensioning drum engaging said belt at said loop, said tensioning drum being movable for enlarging or decreasing the size of said loop.

12. The device of claim **1** wherein said friction drag applying means comprises a plurality of spaced-apart rotatable drag rollers, said drag rollers being rotatable on axes extending transverse to said predetermined direction, each of said drag rollers having a peripheral surface engaging said article, and drag roller drive means for rotating said drag rollers to move said peripheral surfaces thereof in a manner for imparting friction forces to said article acting opposite to said predetermined direction.

13. The device of claim **12** wherein said drag roller drive means is for driving said drag rollers to move said peripheral surfaces thereof at a speed less than said predetermined speed and in the same direction as said predetermined direction.

14. The device of claim **1** and further including a heat treating furnace for heat treating parts, said support means being positioned in said furnace and said article comprising a flexible continuous conveyor belt for conveying parts through said furnace, said article moving means comprising a conveyor belt drive means.

15. The device of claim **14** wherein said conveyor belt drive means comprises said tensioning means for applying said predetermined tension force to said belt adjacent said exit end while pulling said belt across said support means, said friction applying means and said friction drag applying means alternately increasing and decreasing said predetermined tension force in said belt from said exit end to said entrance end whereby said entrance tension force in said belt adjacent said entrance end is not substantially greater than said exit tension force therein adjacent said exit end.

16. The device of claim **15** wherein said support means includes a pluraltiy of spaced-apart friction applying rollers and said rollers define said friction applying means, said rollers being spaced-apart in said predetermined direction and being rotatable on axes extending transverse to said predetermined direction, each of said rollers having a peripheral surface, friction applying roller drive means for rotating said rollers to move said peripheral surfaces thereof at a speed greater than said predetermined speed in a direction to impart friction forces to said belt acting in said predetermined direction, and said friction drag applying means being positioned intermediate said friction applying rollers.

17. The device of claim **16** wherein said support means further includes a plurality of spaced-apart friction applying drag rollers and said drag rollers define said friction drag applying means, said drag rollers being spaced-apart in said predetermined direction and being rotatable on axes extending transverse to said predetermined direction, each of said drag rollers having a peripheral surface engaging said belt intermediate said friction applying rollers, and drag roller drive means for rotating said drag rollers to move said peripheral surfaces thereof in a manner for imparting frictional forces to said belt acting opposite to said predetermined direction.

18. The device of claim **17** wherein said drag roller drive means is for driving said drag rollers to move said peripheral surfaces thereof at a speed less than said

predetermined speed and in the same direction as said predetermined direction.

19. The device of claim **17** and including a common power means for moving said belt and rotatably driving said rollers.

20. A method of transporting a substantially flat elongated article across support means for supporting said article and having an entrance end and an exit end comprising the steps of; placing predetermined tension force in said article between said entarnce and exit ends, pulling said article under said predetermined tension force across said support means in a predetermined direction from said entrance end toward said exit end at a predetermined speed, applying a plurality of first friction forces to said article at spaced-apart intervals acting in said predetermined direction, each of said first friction forces having a magnitude substantially less than said predetermined tension force, and applying a plurality of friction drag forces to said article at spaced-apart intervals intermediate said first friction forces acting opposite to said predetermined direction, each of said friction drag forces having a magnitude substantially less than said predetermined tension force and substantially equal to each of said first friction forces, whereby said article is under exit tension force adjacent said exit end and under entrance tension forces adjacent said entrance end, and said exit and entrance tesnion forces do not differ by an amount greater than substantially one of said friction forces.

21. The method of claim **20** wherein said support means includes a plurality of spaced-apart first rollers having peripheral surfaces engaging said article and said step of applying said first friction forces to said article is carried out by rotating said rollers to move said peripheral surfaces thereof at a speed greater than said predetermined speed in a direction to impart said first friction forces to said article in said predetermined direction.

22. The method of claim **21** wherein said support means includes a plurality of spaced-apart drag rollers having peripheral surfaces engaging said article intermediate said first rollers and said step of applying said friction drag forces to said article is carried out by rotating said drag rollers in a manner to apply said friction drag forces to said article acting opposite to said predetermined direction.

23. The method of claim **22** wherein said drag rollers are driven to move said peripheral surfaces thereof at a speed less than said predetermined speed and in a common direction with said predetermined direction.

24. A method for maintaining low tension and minimizing the magitude of catenaries in a flexible conveyor belt for a heat treating furnace having entrance and exit ends wherein said belt travels in a predetermined direction from said entrance end toward said exit end at a predetermined speed over a plurality of spaced-apart supporting rolls comprising the steps of; placing predetermined tension force in said belt between said entrance and exit ends, pulling said belt under said predetermined tension force through said furnace at said predetermined speed, rotating alternate ones of said rolls to move the peripheral surfaces thereof at a speed greater than said predetermined speed in a direction to impart friction forces to said belt acting in said predetermined direction, and driving the remainder of said rolls in a manner to impart drag frictional forces to said belt acting opposite to said predetermined direction, each of said friction forces having a magnitude substantially less than said predetermined tension force, whereby said belt is under entrance tension force adjacent said entrance end and under exit tension force adjacent said exit end, and said exit and entrance tension forces do not differ by an amount greater than one of said friction forces.

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