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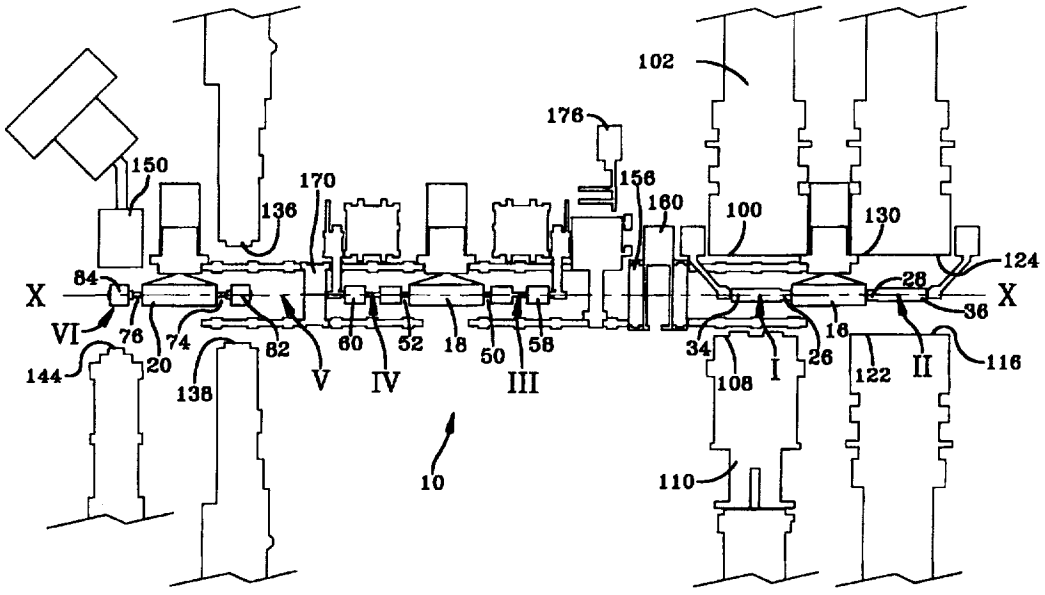

(57) Abstract

A tire assembly method and apparatus are diclosed which utilize at least two rotatable turrets (16, 18) that each have two drums (26, 28, 58, 60) and at least one transfer unit (156) for transferring tire components from one turret to another. The preferred embodiment of the invention features three turrets (16, 18, 20) and two transfer units (156, 170), wherein a carcass band is assembled on the drums of a first turret (16) the tread package is assembled on a third turret (20), and the complete tire carcass is assembled on a second turret (18), in between the first and third turrets. Simultaneous, continuous and sequential building and assembly of tire carcass bands and tread packages for a plurality of tires is provided by the method and apparatus of this invention.

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METHOD AND APPARATUS FOR SIMULTANEOUSLY ASSEMBLING A PLURALITY OF TYRES

Technical Field

This invention pertains to the art of methods and apparatuses for assembling tires, and more specifically to methods and apparatuses for simultaneously and sequentially assembling a plurality of tires.

Background Art

In the past, machines to build tires have included combinations of drums for forming tire carcasses and transfer units for transferring partially built tire carcasses from drum to drum. One such tire building apparatus is disclosed in U.S. Patent No. 5,141,587 to Sumiuchi et al. Sumiuchi utilizes three drums for forming green partially built carcasses and transfer units that slide along guide rails for transferring the partially built carcasses from one drum to another. At any given time, tire components can be applied to the partially built carcasses of three tires. Applicants recognized the need to increase the efficiency and production of tire building apparatuses. Applicants utilize a number of rotating turrets to successionally move tire forming drums from component applicator to component applicator without having to transfer a partially formed tire carcass from a drum more than once, thereby reducing the time to produce tires while providing tire uniformity and production efficiency.

The present invention contemplates a new and improved tire building apparatus and method which is simple in design, effective in use, and overcomes the foregoing difficulties and others while providing better and more advantageous overall results.

Disclosure of Invention

In accordance with the present invention, a new and improved tire building apparatus and method is provided which increases tire building efficiency and uniformity while reducing production time.

According to one aspect of the present invention a tire building apparatus is disclosed, the tire having a plurality of associated tire components. The tire building apparatus for assembling the plurality of tire components is characterized by at least two turrets, each of the turrets being rotatable about a generally vertical axis, drum shafts extending from each of the turrets in generally opposite directions, drums mounted on the drum shafts, the turrets and the drum shafts being in general alignment with one another along an axis extending between the turrets, tire component application means positioned adjacent the drums for applying the associated tire components to the drums to form a tire carcass band, at least one transfer unit located between the turrets for transferring the tire carcass band from one of the

drums of one of the turrets to one of the drums of the other of the turrets, and tire removal means for removing the tire carcass from the tire building apparatus.

According to another aspect of the present invention, there is provided a tire building apparatus for assembling a plurality of associated tire components to form a tire carcass characterized by a first turret having a first drum shaft and a second drum shaft extending from the first turret in opposite directions, the first drum shaft having a first drum mounted thereon, the second drum shaft having a second drum mounted thereon and the first turret being rotatable to move the first drum and the second drum between a first station and a second station; the second turret having a third drum shaft and a fourth drum shaft extending from the second turret in opposite directions, the third drum having a third drum mounted thereon, the fourth drum shaft having a fourth drum mounted thereon and the second turret being rotatable to move the third drum and the fourth drum between a third station and a fourth station; the third turret having a fifth drum shaft and a sixth drum shaft extending from the third turret in opposite directions, the fifth drum shaft having a fifth drum mounted thereon, the sixth drum shaft having a sixth drum mounted thereon; and the third turret being rotatable to move the fifth drum and the sixth drum between a fifth station and a sixth station; means for applying tire components to the first drum and the second drum at the first station; means for applying tire components to the first drum and the second drum at the second station; means for applying tire components to the fifth drum and the sixth drum at the fifth station; means for applying tire components to the fifth drum and the sixth drum at the sixth station; a first transfer unit located between the first turret and the second turret for transferring applied tire components from the first station of the first turret to the third station of the second turret; means for applying beads to the applied tire components during transfer between the first station and the third station; a second transfer unit located between the second turret and the third turret for transferring applied tire components from the fifth station of the third turret to the fourth station of the second turret to assemble a tire carcass; and tire carcass removal means for unloading the tire carcass.

According to another aspect of the present invention, there is provided a method of building a tire using a tire building apparatus having a first turret spaced from a second turret, a transfer unit positioned between the first turret and the second turret, the first turret having a first drum and a second drum, the second turret having a third drum and a fourth drum, a first station and a second station located at the first turret for positioning the first drum and the second drum adjacent tire component applicators, a third and a fourth station

located at the second turret for positioning the third drum and the fourth drum to receive a carcass band from the transfer unit and other tire components characterized by positioning the first drum in the first position; applying a first position tire component to the first drum; rotating the first turret to move the first drum to the second position; applying a second position tire component to the first drum to form a tire band; rotating the first turret to move the first drum and the tire band to the first position; transferring the tire band from the first drum to the third drum at the third station by the transfer unit and applying beads to the tire band; rotating the second turret to move the third drum to the fourth position; applying additional tire components at the fourth position to form a tire carcass; rotating the second turret to move the third drum from the fourth position to the third position, and removing the tire carcass from the third drum for transfer to storage or vulcanization facilities.

One advantage of the present invention is that five tires may be assembled simultaneously.

Another advantage of the present invention is that a partially built carcass is transferred from one drum to another drum only once.

Another advantage of the present invention is that the tire building apparatus can produce a tire ready for vulcanization approximately every 35-40 seconds.

Another advantage is that the layout of the tire component applicators provides ready access for changing the applicators for building tires with different specifications and for servicing.

Still other benefits and advantages of the invention will become apparent to those skilled in the art to which it pertains upon a reading and understanding of the following detailed specification.

Brief Description of Drawings

The invention may take physical form in certain parts and arrangement of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and herein:

Figure 1 is a schematic plan view of a tire building apparatus;

Figure 2 is a front view of a transfer unit;

Figure 3 is a side view of the tire building apparatus showing the first step in tire building procedure;

Figure 4 is a side view of the tire building apparatus showing the second step in tire building procedure;

Figure 5 is a side view of the tire building apparatus showing the third step in tire building procedure;

Figure 6 is a side view of the tire building apparatus showing the fourth step in tire building procedure;

Figure 7 is a side view of the tire building apparatus showing the fifth step in tire building procedure;

Figure 8 is a side view of the tire building apparatus showing the sixth step in tire building procedure;

Figure 9 is a side view of the tire building apparatus showing the seventh step in the tire building procedure; and,

Figure 10 is a plan view of a modification including an injection molded tread pick-up apparatus for applying an injection molded tread to be used in conjunction with the present invention.

Detailed Description of the Invention

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 the same, Figure 1 shows a plan view of a tire building apparatus 10. The tire building apparatus 10 is designed to build a number of tires simultaneously in a step-by-step process. Preferably, the tire building apparatus 10 partially builds five tire carcasses simultaneously at peak performance.

The tire building apparatus 10 has at least two turrets 16,18 and may include a third turret 20. The first turret 16 has two drum shafts 26,28 that extend from the turret in generally opposite directions. Drums 34,36 are mounted on the ends of the drum shafts 26,28 of the first turret 16. The first turret 16 is rotatable in a manner such that drums 34,36 rotate between a first station I and a second station II. At an initial point of time, drum 34 is located at the first station I, while drum 36 is located at the second station II. When the first turret 16 rotates, drum 34 moves to the second station II and drum 36 moves to the first station I.

The second turret 18 has two drum shafts 50,52 that extend from the turret in generally opposite directions. Drums 58,60 are mounted on the ends of the drum shafts 50,52 of the second turret 18. The second turret 18 is rotatable in a manner such that drums 58,60 are moved between a third station III and a fourth station IV. At an initial point of time, drum 58 is located at the third station III, while drum 60 is located at the fourth station

IV. When the second turret 18 rotates, drum 58 is moved to the fourth station IV and drum 60 is moved to the third station III. The first turret 16, the drum shafts 26,28 of the first turret, the second turret 18, and the drum shafts 50,52 of the second turret are preferably in general alignment with one another.

The third turret 20 has two drum shafts 74,76 that extend from the turret in generally opposite directions. Drums 82,84 are mounted on the ends of the drum shafts 74,76 of the third turret 20. The third turret 20 rotates in a manner such that drums 82,84 are moved between a fifth station V and a sixth station VI. At an initial point in time, drum 82 is located at the fifth station V, while drum 84 is located at the sixth station VI. When the third turret 20 rotates, drum 82 is moved to the sixth station VI and drum 84 is moved to the fifth station V. The third turret 20 and the drum shafts 74,76 of the third turret are preferably in a generally axial alignment with the first turret 16 and second turret 18.

At the first station I, there are means for applying a tire component to drums 34,36, such as a liner by an applicator 100 that is fed by a liner conveyor 102. The first station I also has a means for applying a tire component to drums 34,36, such as a sidewall by an applicator 108 that may be fed by a sidewall conveyor 110. In the preferred embodiment of the invention, the liner applicator 100 and the sidewall applicator 108 are positioned on opposite sides of the axis x-x. The liner applicator 100 first applies the liner to one of the drums 34,36, and then the sidewall applicator 108 applies the sidewalls.

At the second station II there is located toeguard applying means such as toeguard applicator 116 for applying a toeguard to the drums 34,36. Also, means for applying other tire components such as plies and a wedge to the drums, by a first ply applicator 122, a second ply applicator 124, and a wedge applicator 130 located at the second station II. In the preferred embodiment of the invention, the toeguard applicator 116 and the first ply applicator 122 are on one side of the axis x-x, and the second ply applicator 124 and the wedge applicator 130 are on the opposite side of the axis. The toeguard is preferably applied first at the second station II, and then the first ply is applied. Thereafter, the second ply and the wedge are applied.

At the fifth station V there are located means for applying another tire component such as a breaker to the drums 82,84, by a first breaker applicator 136 and a second breaker applicator 138. In the preferred embodiment of the present invention, the first breaker applicator 136 is on one side of the axis x-x, and the second breaker applicator 138 is on the opposite side of the axis x-x. Preferably, the first breaker is applied to either of the drums

82,84 by the first breaker applicator 136, and then the second breaker is applied by the second breaker applicator 138.

At the sixth station VI there are located means for applying additional tire components such as a tread, by a tread applicator 144. At the sixth station VI there may also be located means for applying other tire components such as a spiral overlay, with a spiral overlay applicator 150 if high-performance tires are being produced by the tire building apparatus 10.

With reference to Figures 1 and 2, a first transfer unit 156 is located between the first turret 16 and the second turret 18. The first transfer unit 156 picks up the tire components after they are assembled in the form of a band 158 on one of the drums 34,36 at the first station I and second station II and transfers the band from the first station I to one of the drums 58,60 at the third station III. The first transfer unit 156 also contains a bead loading apparatus 160 for applying beads to the band 158 as the band is transferred from the first station I to the third station III. The first transfer unit 156 preferably has a cylindrical or substantially cylindrical support structure 164 fitted with radially movable shoes 166 that grip the band 158. The support structure 164 is moved axially of the apparatus 10 over one of the drums 34,36 and the movable shoes 166 are moved radially inward to grip the band 158. The first transfer unit 156 then transports the band 158 from one of the drums 34,36 to one of the waiting drums 58,60 at the third station III, where the support structure 164 surrounds the waiting drum and places the band over the drum. The band 158 is then released by the movable shoes 166, and the first transfer unit 156 moves away from the drum.

At the third station III, the band 158 is shaped on one of the drums 58,60 of the second turret 18 as the turret rotates the band to the fourth station IV.

A second transfer unit 170 is located between the second turret 18 and the third turret 20. The second transfer unit 170 is axially movable to transfer a complete breaker and tread package from the fifth station V and to place it around the band 158 waiting at the fourth station IV. The second transfer unit 170 preferably operates in the same manner as the first transfer unit 156 as shown in Figure 2.

Although five tires may be built simultaneously on the tire building apparatus 10, Figures 3-9 follow the production of one tire on the tire building apparatus to illustrate the timing and steps involved in the process. Figure 3 shows the beginning step of tire construction on the tire building apparatus 10. First, the inner liner is applied at the first station I to the drum 34 by liner applicator 100. Then the sidewall is applied by sidewall applicator 108. Next, the sidewall is automatically spliced, or in some cases manually spliced

by a worker. After the sidewall is spliced, the first turret 16 is rotated moving the drum 34 from the first station I to the second station II. At approximately the same time, the first breaker is applied to drum 82 at the fifth station V of the third turret 20 by the first breaker applicator 136. Next, the second breaker is applied on top of the first breaker on drum 82 by the second breaker applicator 138. After the second breaker is applied, the third turret 20 is rotated, moving drum 82 from the fifth station V to the sixth station VI.

Figure 4 shows the tire building apparatus 10 with drum 34 rotated to the second station II and drum 82 rotated to the sixth station VI. At the second station II, the liner is stitched. After the stitching of the liner, the toeguard is then applied by the toeguard applicator 116. The first ply is then applied by the first ply applicator 122. The second ply is applied by the second ply applicator 124. Finally the wedge is applied by the wedge applicator 133. After the wedge is applied, the first turret 16 is rotated, moving the drum 34 with the band 158 comprised of liner, sidewall, toeguard, plies, and wedge back to the first station I to await transfer to the third station III. The drum 34 may be expanded before or after application of any component to the place the component in tension and remove trapped air. At the sixth station VI, the spiral overlay may be applied by the spiral overlay applicator 150 on top of the breakers if required, or the drum 82 may sit idle for a period of time until a tread is applied on top of the breakers. The tread is then applied by the tread applicator 144, and then the tread is manually spliced if required. The third turret 20 is then rotated, moving drum 82 back to the fifth station V to await transfer to the fourth station IV.

Figure 5 shows the first transfer unit 156 moved into position to remove the band 158 from the drum 34 and move it to the drum 58 at the third station III. Beads may be applied to the band 158 at the first station I or at the third station III by a bead loading apparatus 160 connected to the first transfer unit 156.

Figure 6 shows the next step of the production of a tire carcass as the second transfer unit 170 is moved into position to pick up the breaker and tread package from drum 82 at the fifth station V.

Figure 7 shows the first transfer unit 156 in position to place the band 158 on the drum 58 at the third station III. After the band 158 is transferred to the drum 58 at the third station III, the second turret 18 is rotated, moving the drum 58 to the fourth station IV. As the second turret 18 is rotated, the drum 58 inflates to shape the band 158 and turns up part of the band around the beads. Further turn-up may be required as the drum 58 remains at the fourth station IV awaiting the breaker and tread package to complete the shaping and

turn-up. A stitching device of the type commonly used in the art then may be used to stitch the sidewall.

Figure 8 shows the second transfer unit 170 in position for placing the breaker and tread package onto the band 158 at the fourth station IV. The second turret 18 is then rotated, moving the drum 58 back to the third station III after the second transfer unit 170 moves back to a neutral position as shown in Figure 9. At the third station III, the breaker and tread package is stitched. The tire carcass, now ready to be vulcanized, is removed from the tire building apparatus 10 by a tire remover 180 at the third station III. A tire carcass is removed from the tire building apparatus 10 approximately once every 35-40 seconds.

Figure 10 shows an alternate embodiment of the present invention where an injection molded tread 180 is placed directly over the breaker at the sixth station VI. The injection molded tread 180 either is removed from the injector body 184 directly by a pick-up apparatus 188 or is stored and then loaded onto the pick-up apparatus. The pick-up apparatus 188 may use a pick-up shoe to grasp the injection molded tread 180, or, as shown in Figure 109, the pick-up apparatus may have a vacuum ring 190 that grasps and holds the injection molded tread in place. The pick-up apparatus 188 then transfers the injection molded tread 180 to the sixth station VI and places the tread onto the drum 82 holding the breakers. If the pick-up shoe is used in the pick-up apparatus 188, then the shoe simply releases the injection molded tread 180. If the vacuum ring 190 is used in the pick-up apparatus 188, then air in the vacuum ring is removed to create a vacuum that holds the injection molded tread 180 in place, and the tread is removed by allowing air into the vacuum ring, thereby eliminating the vacuum and releasing the tread.

The preferred embodiments have been described, hereinabove. It will be apparent to those skilled in the art that the above methods may incorporate changes and modifications without departing from the general scope of this invention. It is intended to include all such modifications and alterations in so far as they come within the scope of the appended claims or the equivalents thereof.

Having thus described the invention, it is now claimed:

CLAIMS

1. A method of building a tire using a tire building apparatus having a first turret spaced from a second turret, a transfer unit positioned between said first turret and said second turret, said first turret having a first drum and a second drum, said second turret having a third drum and a fourth drum, a first station and a second station located at said first turret for positioning said first drum and said second drum adjacent tire component applicators, a third station and a fourth station located at said second turret for positioning said third drum and said fourth drum to receive a carcass band from said transfer unit and other tire components characterized by:

(a) positioning said first drum in said first position,

(b) applying a first position tire component to said first drum,

(c) rotating said first turret to move said first drum to said second position,

(d) applying a second position tire component to said first drum to form a tire band,

(e) rotating said first turret to move said first drum and said tire band to said first position,

(f) transferring said tire band from said first drum to said third drum at said third station by said transfer unit and applying beads to said tire band,

(g) rotating said turret to move said third drum to said fourth position,

(h) applying additional tire components at said fourth position to form a tire carcass,

(i) rotating said second turret to move said third drum from said fourth position to said third position, and

(j) removing said tire carcass from said third drum for transfer to storage or vulcanization facilities.

2. The method of claim 1 further characterized by said tire components being applied from both sides of said drum at said first position and at said second position.

3. The method of claim 1 further characterized by said third rum being expanded to shape said tire band.

4. The method of claim 1 wherein said tire building apparatus has a third turret spaced from said second turret with a fifth drum and a sixth drum, a fifth station and a sixth station located at said third turret, a second transfer unit positioned between said third turret and said

second turret wherein applying additional tire components at said fourth position is characterized by:

(a) applying a tire component to said fifth drum at said fifth station;

(b) rotating said third turret to move said fifth drum to said sixth station;

(c) applying another tire component to said fifth drum to provide a tread breaker package;

(d) rotating said third turret to move said fifth drum to said fifth position; and

(e) transferring said tread breaker package from said fifth position to said fourth position of said second turret by said second transfer unit.

5. The method of claim 1 further characterized by applying a second first position tire component to said first drum in said first position.

6. The method of claim 5 further characterized by applying a second second position tire component to said first drum in said second position.

7. The method of claim 6 further characterized by applying said first position tire component and said second first position tire component from opposite sides of said first drum in said first position.

8. The method of claim 6 further characterized by applying said first second position tire component and said second second position tire component from opposite sides of said first drum in said second position.

9. The method of claim 4 further characterized by said tire component applied to said fifth drum at said sixth station being a tire tread.

10. The method of claim 9 wherein said tire tread is an injection molded tread characterized by loading said tread in a pick up apparatus and transferring said tread to said sixth station for application to said fifth drum.

11. The method of claim 9 wherein said tire tread is an injection molded tread characterized by removing said tread directly from an injector body by a pick up apparatus and transferring said tread to a said sixth station for application to said fifth drum.

12. A tire building apparatus for assembling a plurality of associated tire components to form a tire carcass characterized by:

(a) at least two turrets, each of said turrets being rotatable about a generally vertical axis, drum shafts extending from each of said turrets in generally opposite

directions, drums mounted on said drum shafts, said turrets and said drum shafts being in general alignment with one another along an axis extending between said turrets;

(b) tire component application means positioned adjacent said drums for applying said associated tire components to said drums to form a tire carcass band;

(c) at least one transfer unit located between said turrets for transferring said tire carcass band from one of said drums of one of said turrets to one of said drums of the other of said turrets; and

(d) tire removal means for removing said tire carcass from said tire building apparatus.

13. The tire building apparatus of claim 12 further characterized by said tire component application means comprising means for applying a sidewall and an inner liner to one of said drums of one of said turrets and means for applying a toeguard, a first ply, a second ply, and a wedge to one of said drums of one of said turrets, said inner liner, said sidewall, said toeguard, said first ply, said second ply, and said wedge forming a tire band.

14. The tire building apparatus of claim 13 further characterized by said tire component application means for applying a breaker to one of said drums of one of said turrets and means for applying a tread to one of said drums of one of said turrets.

15. The tire building apparatus of claim 14 further characterized by said tire component application means comprising means for applying beads to said tire band.

16. The tire building apparatus of claim 12 further characterized by said at least two turrets comprising a first turret, a second turret, and a third turret, said first turret rotating between a first station and a second station, said second turret rotating between a third station and a fourth station, and said third turret rotating between a fifth station and a sixth station.

17. The tire building apparatus of claim 16 further characterized by said tire component application means comprising means for applying an inner liner and a sidewall to one of said drums at said first station of said first turret and means for applying a toeguard, a first ply, a second ply, and a wedge to one of said drums at second station of said first turret, said inner liner, said sidewall, said toeguard, said first ply, said second ply, and said wedge forming a carcass.

18. The tire building apparatus of claim 17 further characterized by means for applying beads to said carcass.

19. The tire building apparatus of claim 18 further characterized by said tire component application means comprising means for applying a breaker to one of said drums at said fifth

station of said third turret and means for applying a tread to one of said drums at said sixth station of said third turret.

20. The tire building apparatus of claim 19 further characterized by at least one transfer unit comprising a first transfer unit for transferring said tire components from said first station of said first turret to said third station of said second turret and a second transfer unit for transferring said tire carcass from said fifth station of said third turret to said fourth station of said second turret.

21. The tire building apparatus of claim 20 further characterized by said tire component application means further comprising means for applying a spiral overlay to one of said drums at said sixth station of said third turret.

22. A tire building apparatus for assembling a tire, said tire having a plurality of associated tire components, said system for assembling said tire characterized by:

(a) a first turret rotatable between a first station and a second station, said first turret having a first drum shaft and a second drum shaft extending from said first turret in opposite directions, said first drum shaft having a first drum mounted thereon, said second drum shaft having a second drum mounted thereon;

(b) a second turret rotatable between a third station and a fourth station, said second turret having a third drum shaft and a fourth drum shaft extending from said second turret in opposite direction, said third drum shaft having a third drum mounted thereon, said fourth drum shaft having a fourth drum mounted thereon;

(c) a third turret rotatable between a fifth station and a sixth station, said third turret having a fifth drum shaft and a sixth drum shaft extending from said third turret in opposite directions, said fifth drum shaft having a fifth drum mounted thereon, said sixth drum shaft having a sixth drum shaft having a sixth drum mounted thereon;

(d) means for applying an inner liner to said first drum and said second drum at said first station;

(e) means for applying a sidewall to said first drum and said second drum at said first station;

(f) means for applying a toeguard to said first drum and said second drum at said second station;

(g) means for applying a first ply and a second ply to said first drum and said second drum at said second station;

(h) means for applying a wedge to said first drum and said second drum at said second station to form a tire band;

(i) means for applying a first breaker and a second breaker to said fifth drum and said sixth drum at said fifth station;

(j) means for applying a tread to said breaker on said fifth drum and said sixth drum at said sixth station to form a tread package;

(k) a first transfer unit located between said first turret and said second turret for transferring said tire band from said first station of said first turret to said third station of second turret;

(l) a second transfer unit located between said second turret and said third turret for transferring said tread package from said fifth station of said third turret to said fourth station of said second turret; and,

(m) tire carcass removal means for removing said tire carcass from said system.

23. The tire building apparatus of claim 19 further characterized by a pick up apparatus located adjacent said sixth station for transferring an injection molded tread to one of said drums at said sixth station of said third turret.

24. The tire building apparatus of claim 23 further characterized by said pick up apparatus being positioned adjacent an injector body for removing said tread directly from said injector body.

25. A tire building apparatus for assembling a plurality of associated tire components to form a tire carcass characterized by:

(a) a first turret having a first drum shaft and a second drum shaft extending from said turret in opposite directions, said first drum shaft having a first drum mounted thereon, said second drum shaft having a second drum mounted thereon and said first turret being rotatable to move said first drum and said second drum between a first station and a second station;

(b) said second turret having a third drum shaft and a fourth drum shaft extending from said second turret in opposite directions, said third drum shaft having a third drum mounted thereon, said fourth drum shaft having a fourth drum mounted thereon and said second turret being rotatable to move said third drum and said fourth drum between a third station and a fourth station;

(c) said third turret having a fifth drum shaft and a sixth drum shaft extending from said third turret in opposite directions, said fifth drum shaft having a fifth drum mounted thereon, said sixth drum shaft having a sixth drum mounted thereon, and said third turret being rotatable to move said fifth drum and said sixth drum between a fifth station and a sixth station;

(d) means for applying tire components to said first drum and said second drum at said first station;

(e) means for applying tire components to said first drum and said second drum at said second station;

(f)means for applying tire components to said fifth drum and said sixth drum at said fifth station;

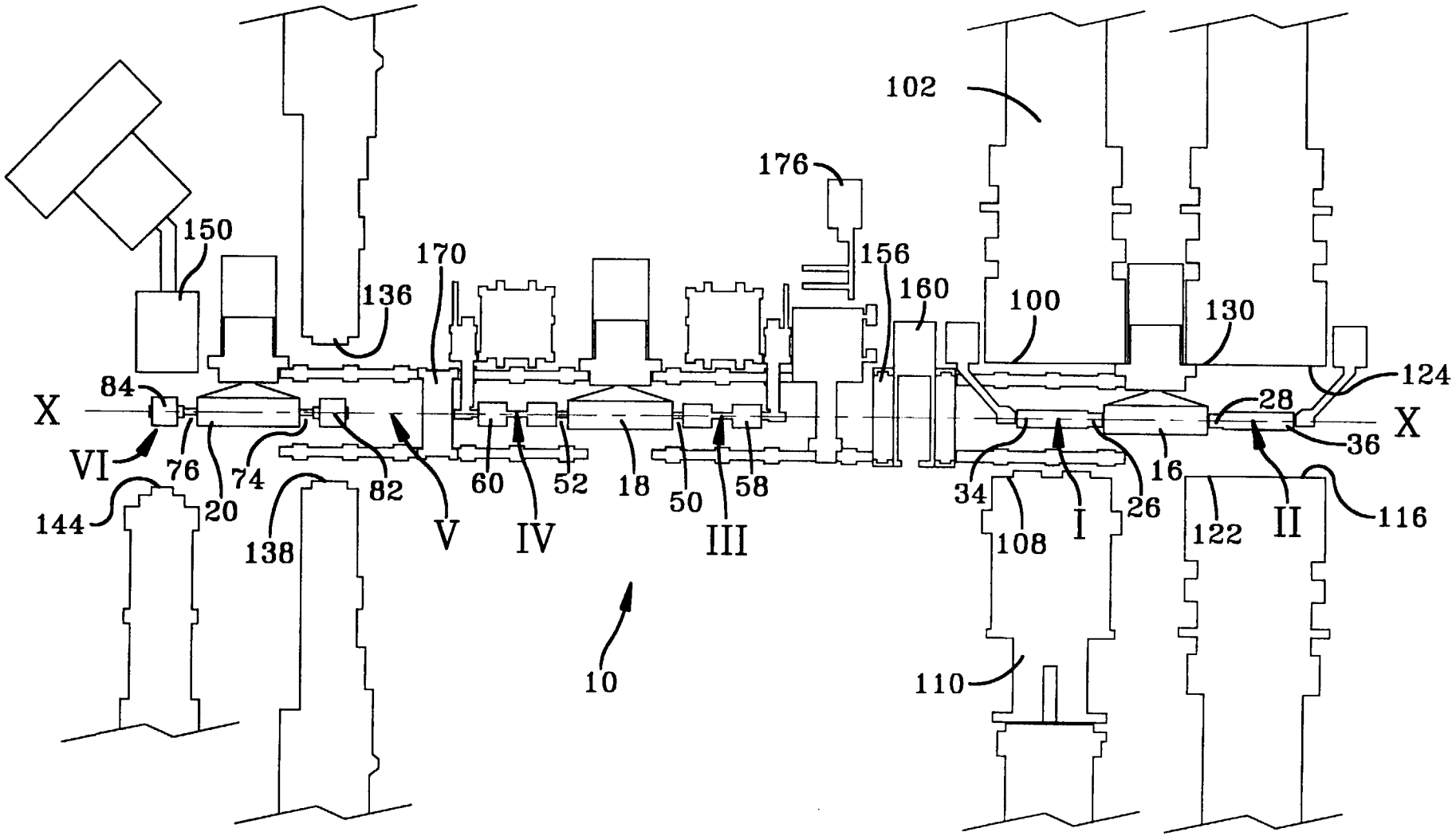
(g) means for applying tire components to said fifth drum and said sixth drum at said sixth station;

(h) a first transfer unit located between said first turret and said second turret for transferring applied tire components from said first station of said first turret to said third station of said second turret;

(i) means for applying beads to said applied tire components during transfer between said first station and said third station;

(j) a second transfer unit located between said second turret and said third turret for transferring applied tire components from said fifth station of said third turret to said fourth station of said second turret to assemble a tire carcass, and tire carcass removal means for unloading said tire carcass.

26. An apparatus and method as shown and described in the accompanying description and drawings.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FIG–1

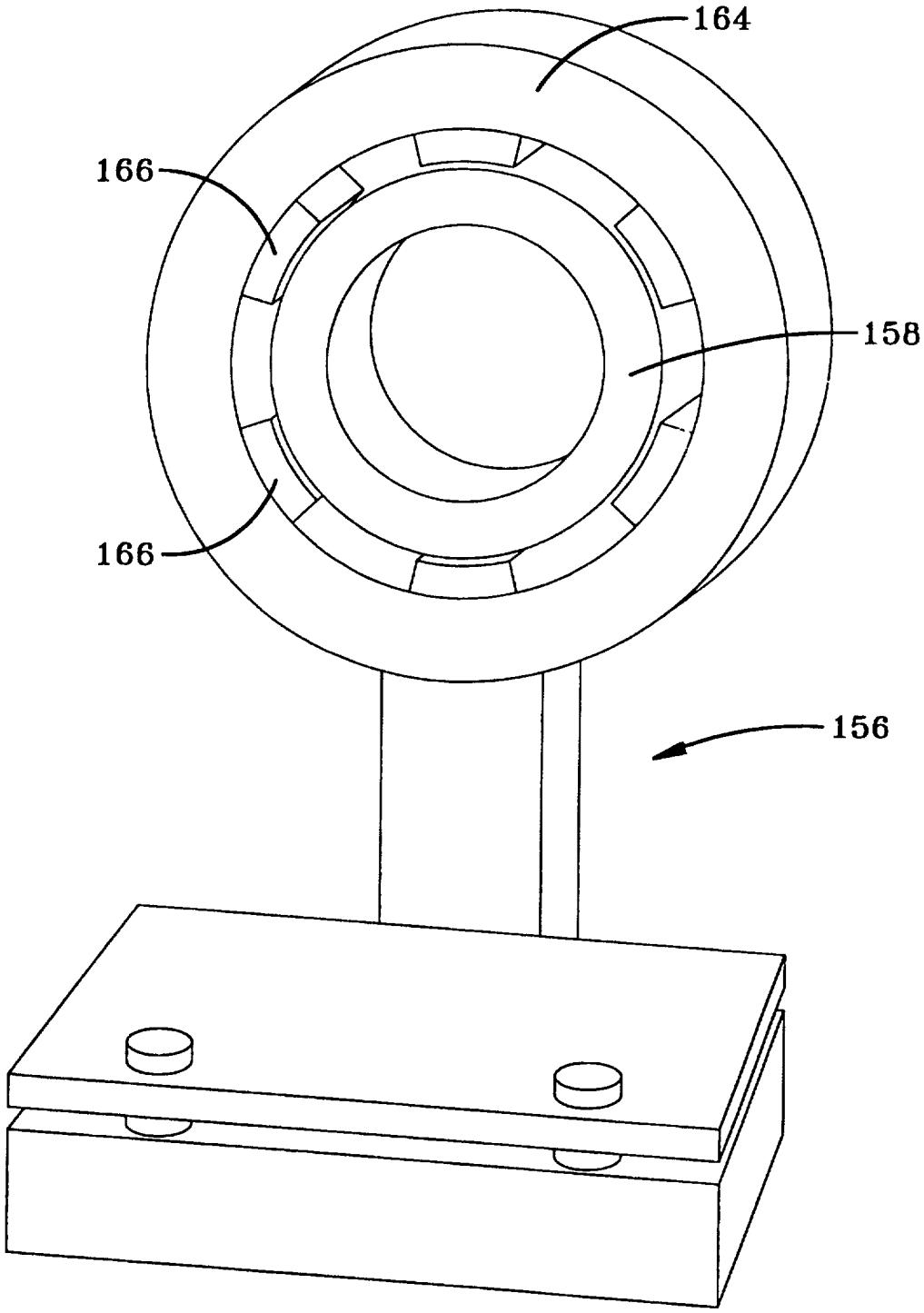


FIG-2

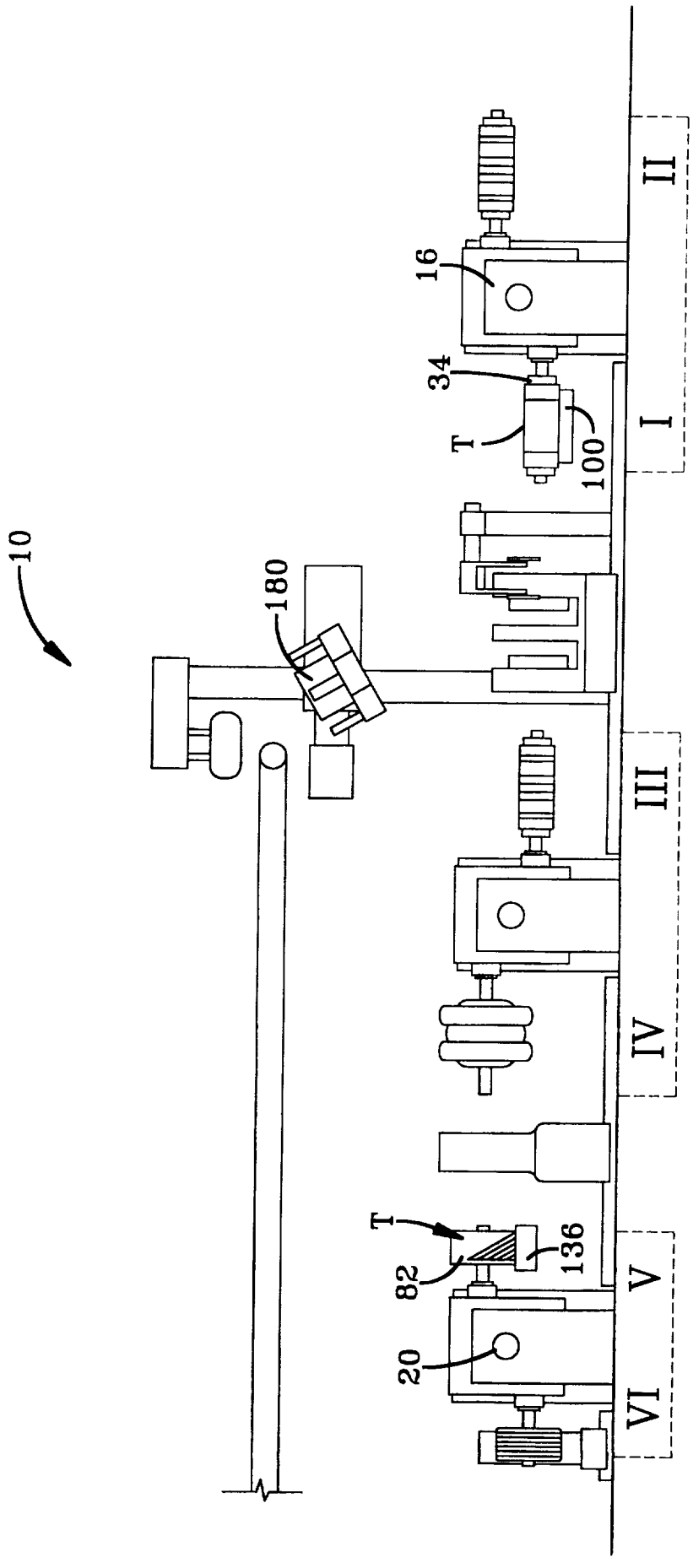


FIG-3

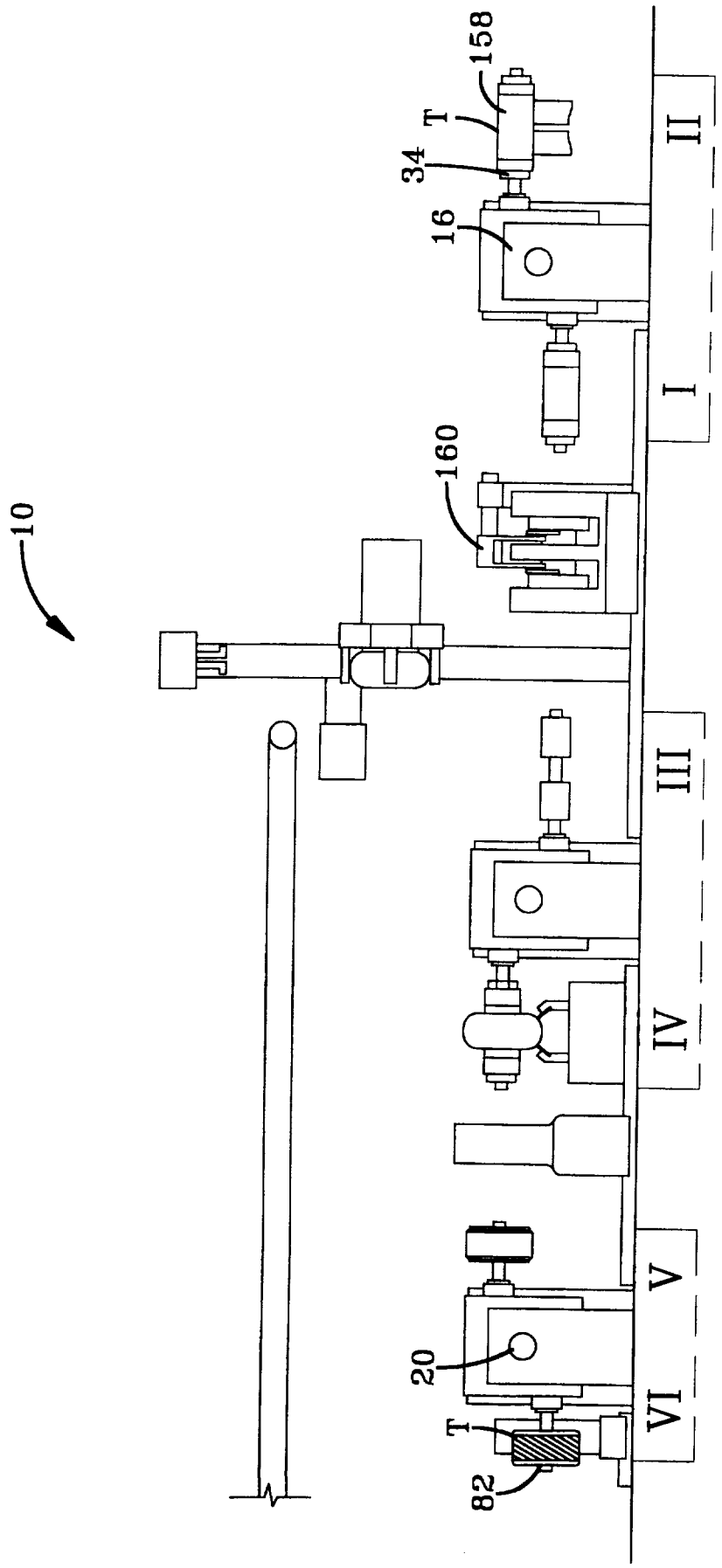


FIG-4

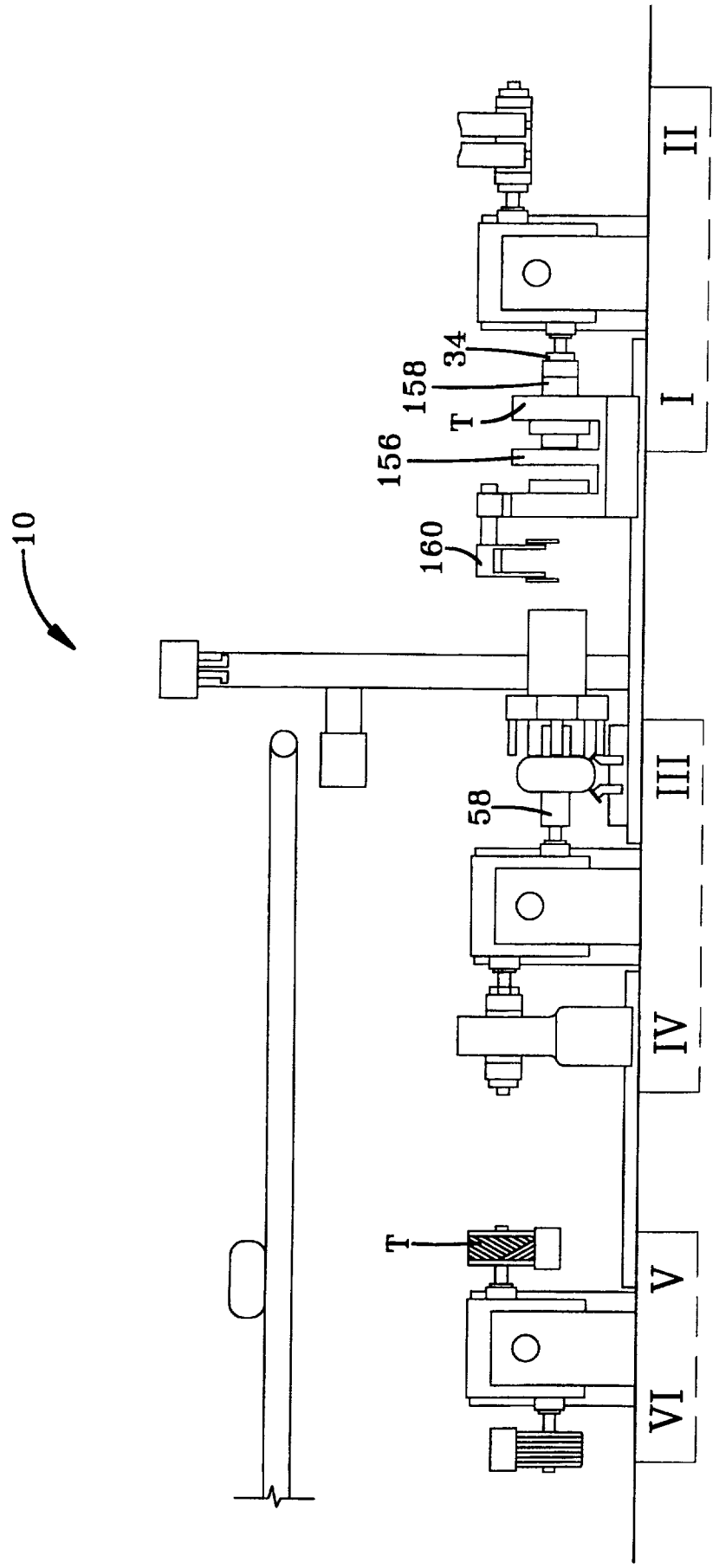
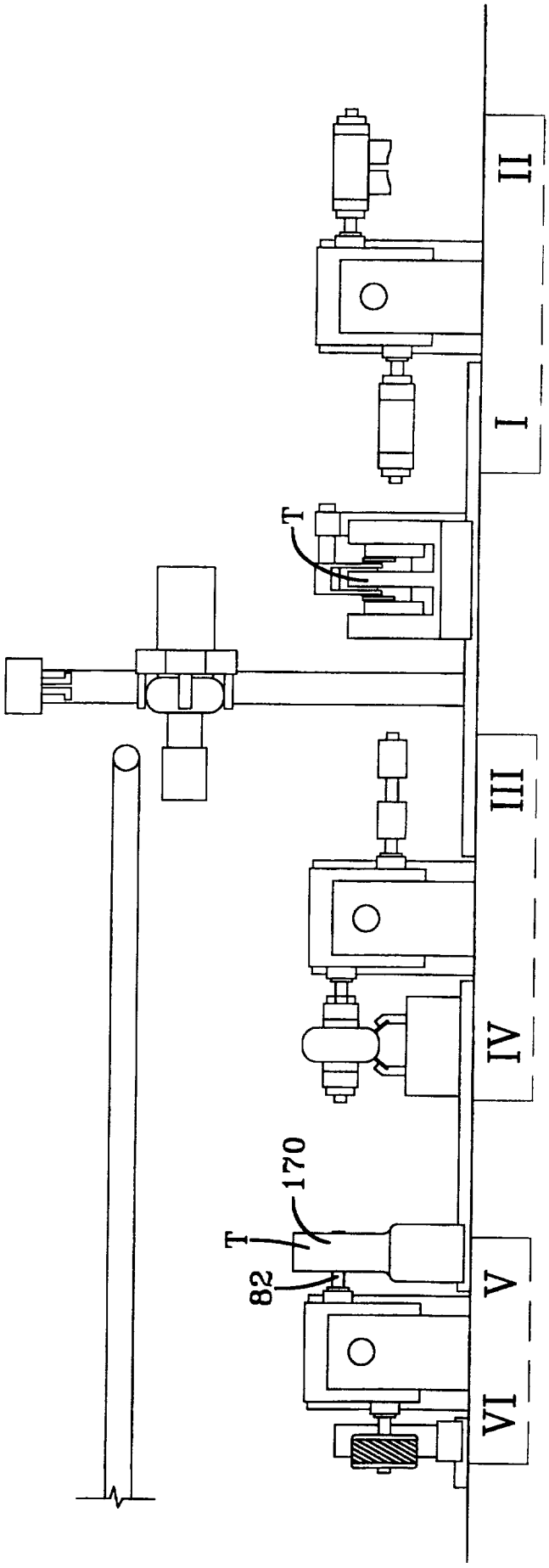


FIG-5



FIG—6

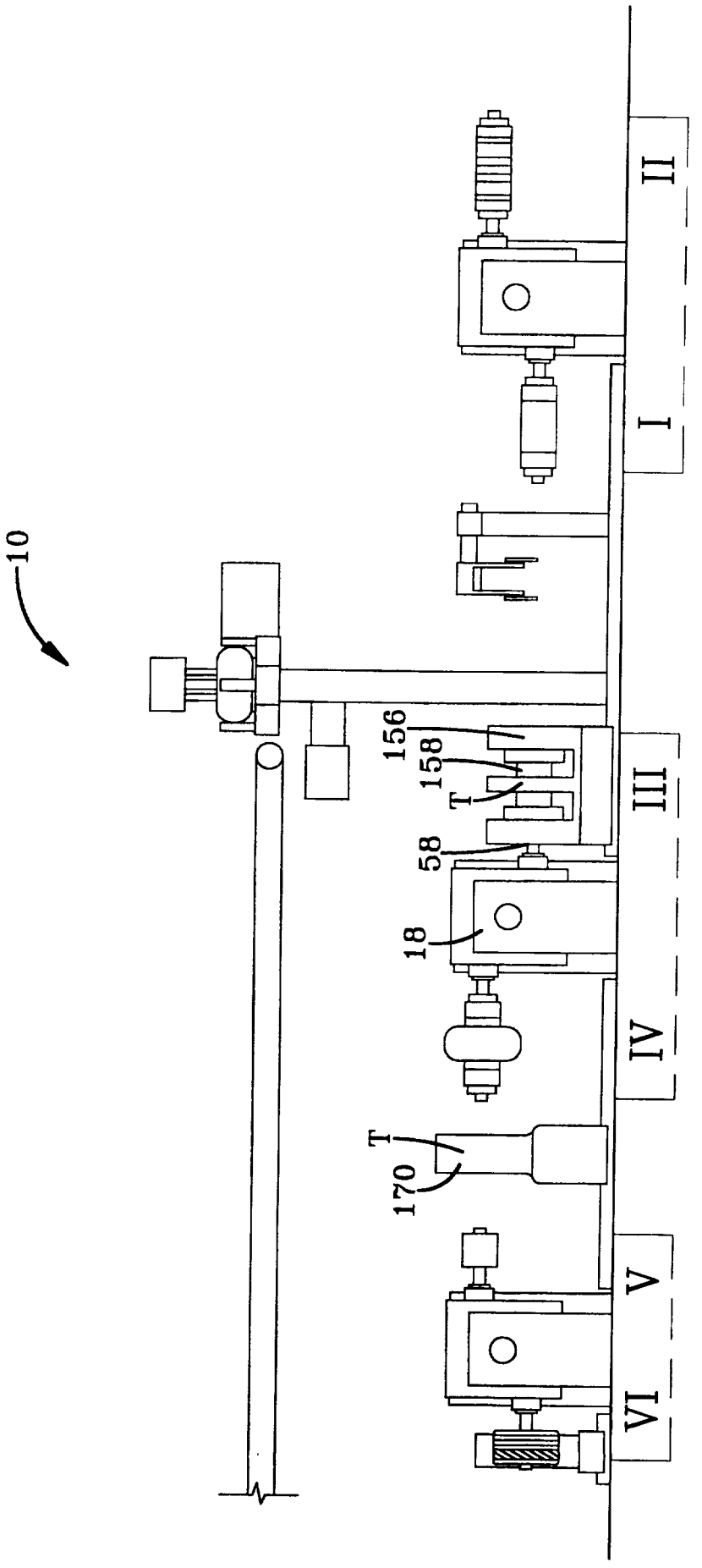


FIG-7

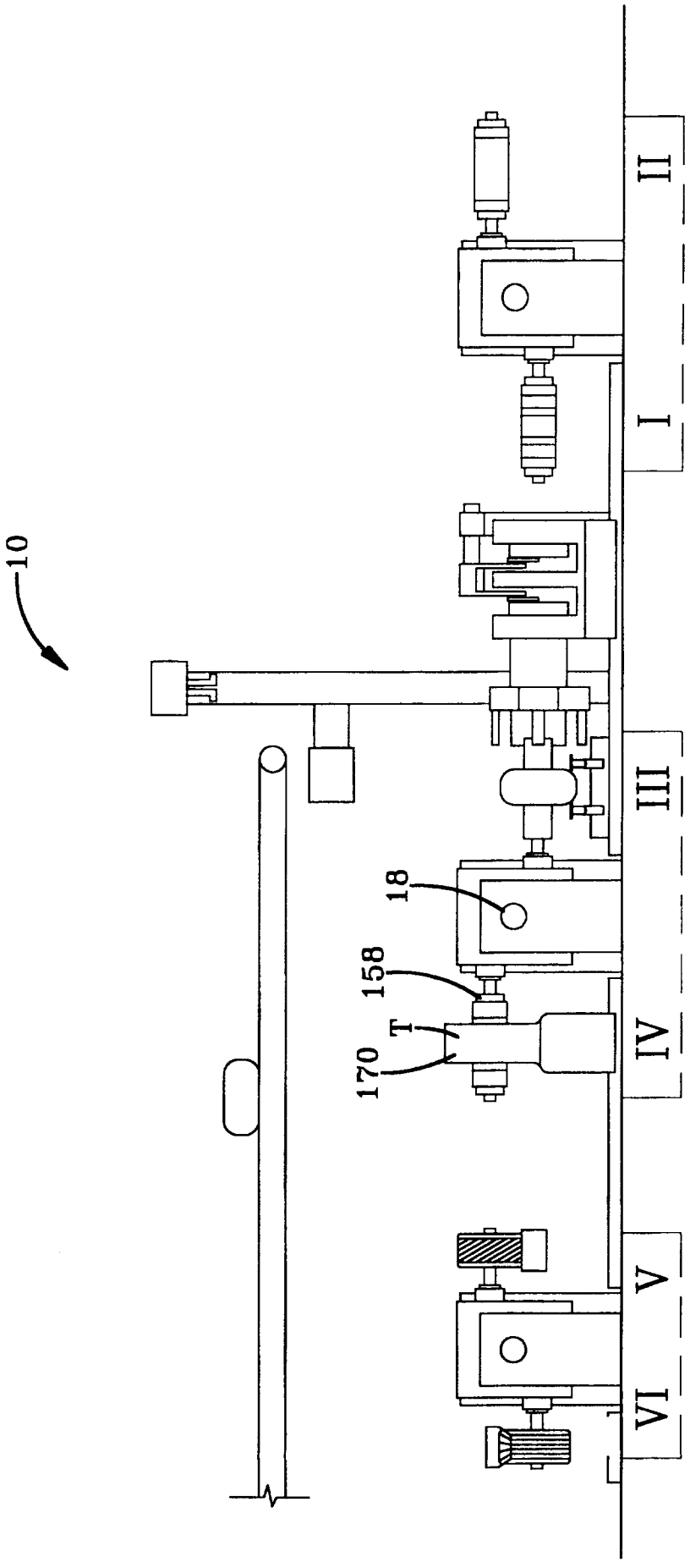


FIG-8

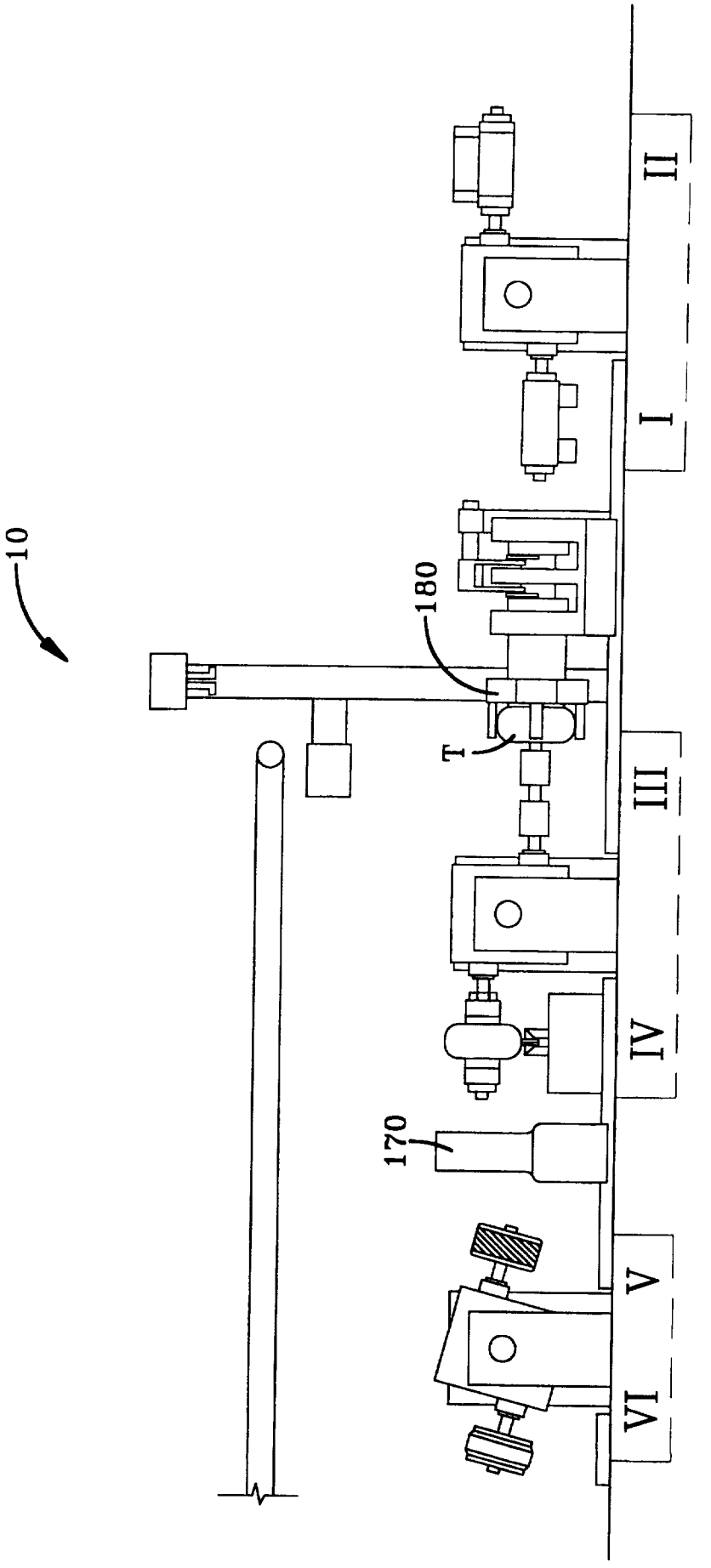


FIG-9

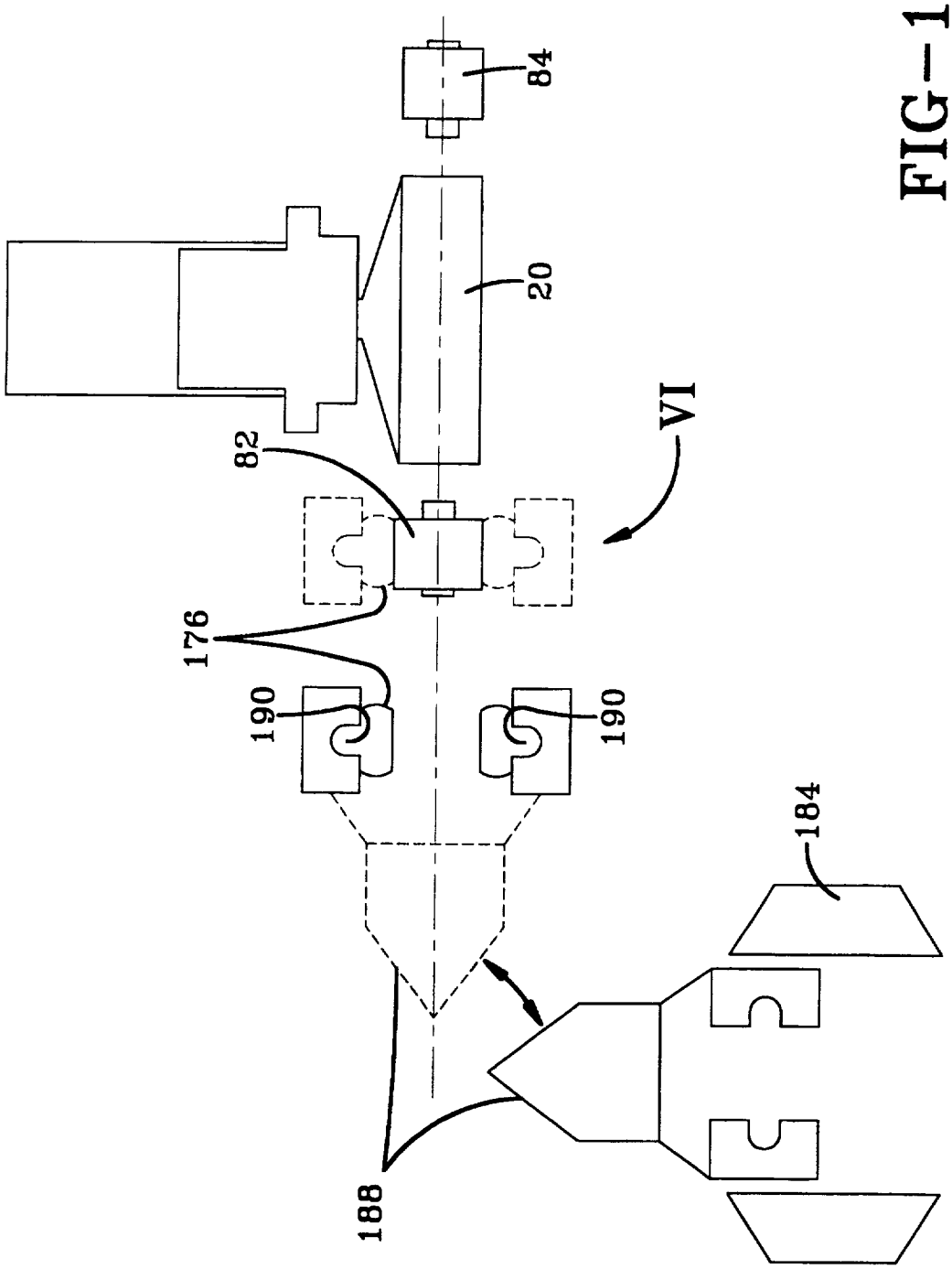


FIG-10

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 96/14942

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B29D30/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 407 152 A (J. I. HAASE) 3 September 1946 see the whole document	1,4-9, 12-20, 22,25,26
X	EP 0 026 315 A (BAYER AG) 8 April 1981 see page 8, line 23 - page 10, line 12; figures 5,6	1,2,5-8, 12-15
X	EP 0 167 224 A (BATES W & A LTD) 8 January 1986	12,13
A	see the whole document	1,15
A	EP 0 246 497 A (FIRESTONE TIRE & RUBBER CO) 25 November 1987 see the whole document	1,12-15

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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Date of the actual completion of the international search	Date of mailing of the international search report
13 May 1997	02.06.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Fregosi, A

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 96/14942

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 105 487 A (SUZUKI MASAYOSHI ET AL) 8 August 1978 see column 4, line 43 - column 5, line 36; figures 1-4,6	1,3,12
A	GB 1 141 620 A (THE DUNLOP COMP. LTD.) 29 January 1969 see page 2, line 14 - line 29	9-11,23, 24

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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