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(54) A BELT POWER TRANSMISSION DEVICE

(71) We, MITSUBISHI ELECTRIC CORPORATION, a Japanese Company of 2-3, 2-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan; and SHINWA SANGYO COMPANY LIMITED, a Japanese Company of 2-2, 4-chome, Hatchobori, Chuo-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved belt power transmission device.

According to the invention there is provided a belt power transmission device comprising a drive shaft having a pulley rotatable therewith, a driven shaft having a pulley rotatable therewith, a pair of intermediate pulleys rotatable with a common intermediate shaft and respectively engaged through respective belts with the drive shaft and driven shaft pulleys, said intermediate pulley shaft being displaceable toward or away from the drive and driven shafts and spring means being provided biasing the intermediate shaft so as to give a tension to both said belts and means for adjusting the loading of said spring.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side sectional view of a belt power transmission device constructed in accordance with the present invention;

Figure 2 is a longitudinal sectional view taken along the line II—II in Figure 1;

Figure 3 is a side sectional view of a second embodiment of this invention;

Figure 4 is a longitudinal sectional view taken along the line IV—IV in Figure 3;

Figure 5 is an enlarged sectional view of an automatic adjusting mechanism of this invention; and

Figure 6 is a longitudinal sectional view of a further embodiment of this invention.

Referring to Figures 1 and 2, which show one embodiment of the belt power trans-

mission device of this invention, the device comprises a bracket 1, a casing 2, a fitting flange 3, an input shaft 4, an output shaft 5, pulleys 6, 7 and 8 and 9, belts 10 and 11, a pulley shaft 12 on the opposite ends of which said pulleys 7 and 8 are mounted, a cylindrical supporting frame 13 and bearings 14 and 15 fixed inside the opposite ends of said frame 13 for supporting said pulley shaft 12. A recess 16 is formed in the casing 2 opposite to the supporting frame 13, a hole 17 formed through the bottom of the recess 16, a projection 18 formed on an outer wall of the recess 16, and a pair of stepped recesses 19 formed in opposite inside walls of the recess 16. A collar supporting bar 20 is slidably inserted through the hole 17 and is threaded at one end so as to be engaged into a screw hole of a projecting portion 21 of the supporting frame 13. Accordingly, the supporting frame 13 is supported by the supporting bar 20. The width between the pulley 7 and the supporting bar 20 is designated by a reference character a , and the width between the supporting bar 20 and the pulley 8 is denoted by a reference character b , the tension of the belt 10 by T_1 , the tension of the belt 11 by T_2 . The supporting bar 20 is set at the point with respect to the supporting frame 13 in the relationship of an equation $T_1/T_2 = b/a$. This device also comprises a cover 22 mounted on the opening of the recess 16, an adjusting bar 23 fixedly engaged with a central hole of the cover 22 and to which at one end is fixed a handle 24 and at the other end is threaded a spring locating bracket 25 engaged with the screw portion of the adjusting bar 23 and having lugs 26 projecting at both sides and engaged with the slots 19, respectively. If the handle 24 is rotated to turn the adjusting bar 23, the spring locating bracket 25 is moved axially of the adjusting bar 23. This device also comprises a spring locating bracket 27 fixed to the other end of the supporting bar 20, a

compressed spring 28 and a cover 29.

If the handle 24 is rotated, the spring bracket 25 is axially moved so that the force of the spring 28, due to its compression, which acts on the supporting bar 20 and pulley shaft 12 is adjusted so that the tension of the belts 10 and 11 may be varied both at the same time.

Reference is now made to Figures 3 to 5, which show another embodiment of this invention wherein similar parts and components to those shown in Figures 1 and 2 are designated by the same reference numerals and as parts denoted by 1 to 15 are the same as those shown in Figures 1 and 2 their description is accordingly omitted.

In Figures 3 and 4, the device comprises supporting arms 30 and 31 integrally attached to the supporting frame 13, the supporting arm 30 being rotatably mounted on a support 33 provided in the casing 2 by means of a pivot shaft 32; a rod 34 being inserted into a hole 35 at the end of the other supporting arm 31 so as to pass through a bore in the wall 2a of the casing 2; and an automatic tension adjusting mechanism 37 which will be hereinafter described in detail with reference to Figure 5. In recesses 39 in the wall 2a of the casing 2 on opposite sides of the bore 36 are rotatable elements 38 biased by respective leaf springs (not shown) to engage the rod 34. The assembly 48 thus functions as a one-way clutch. Similar elements 45 are rotatably located in recesses 44 on opposite sides of the bore in the element 42 and are similarly urged by respective leaf springs (not shown) to engage the rod 34 whereby the assembly 49 functions as another one-way clutch, the two sets of elements 38 and 45 being positioned to permit axial movement of the rod 34 through the bores in the members 48 and 42 in the direction of the arrow A of Figure 5 but to resist relative movement of the rod 34 in the direction of the arrow B. Also provided are a cover 55, a spring retaining sleeve 41, a nut 47, a spring 50, an adjuster 51 rockably supported at a central portion thereof, one end of which is in contact via a roller 52 with a flange of the element 42 and a reciprocally moving bar 53 pivotally connected to the other end of the adjuster 51 at one end thereof and passing at its other end through a hole 54 of the casing 2 to be pivotally connected eccentrically to the pulley 9 so that during rotation of the pulley 9 the bar 53 is continuously reciprocated and the adjuster 51 continuously oscillated between its full line and phantom line positions illustrated.

The tension of the belts 10 and 11 is initially set by rotating the nut 47 to draw the rod 34 through the bore 36 in the direction of the arrow A while the adjuster 51

is in its full line position until a chosen loading is imposed on the spring 50. Thereafter, if the belts 10 and 11 expand the spring 50 will move the element 42 in the direction of the arrow A, thereby drawing the rod through the bore 36 in the same direction to maintain tension on the belts. However during the next movement of the adjuster 51 from its phantom line to its full line position the element 42 is moved along the rod 34 toward the element 41 and is held in the new position due to the orientation of the element 45. The orientation of the elements 38 causes them to prevent movement of the rod 34 through the bore 36 in the direction of the arrow B. The distance between the elements 41 and 42 is thus shortened to give the spring 50 increased loading which compensates for the expansion of the belts 10 and 11.

Referring to Figure 6, which shows a further embodiment of this invention, the tension of the belts 10 and 11 may be manually adjusted by means of the combination of a spring bracket 56, an adjusting nut 57 and a lock nut 58, the other construction being similar to that of the second embodiment of this invention and accordingly will not be further described.

WHAT WE CLAIM IS:—

1. A belt power transmission device comprising a drive shaft having a pulley rotatable therewith, a driven shaft having a pulley rotatable therewith, a pair of intermediate pulleys rotatable with a common intermediate shaft and respectively engaged through respective belts with the drive shaft and driven shaft pulleys, said intermediate pulley shaft being displaceable toward or away from the drive and driven shafts and spring means being provided biasing the intermediate shaft so as to give a tension to both said belts and means for adjusting the loading of said spring.

2. A belt power transmission device as claimed in claim 1, wherein the means for adjusting the loading of the spring comprises a shaft connected to mounting means for the intermediate shaft and longitudinally movable relative to a casing for the device, an adjusting screw rod spaced from and coaxial with said shaft and a movable element threadedly engaged with said rod, means for preventing said movable element from rotating but allowing it to move axially of the rod in response to rotation of the latter, the spring acting between said shaft and movable element for providing tension to said belts, and means for rotating the rod to adjust the loading of the spring.

3. A belt power transmission device as claimed in claim 1, including a shaft movable in response to the displacement of said intermediate shaft, an element movable

compressed spring 28 and a cover 29.

If the handle 24 is rotated, the spring bracket 25 is axially moved so that the force of the spring 28, due to its compression, which acts on the supporting bar 20 and pulley shaft 12 is adjusted so that the tension of the belts 10 and 11 may be varied both at the same time.

Reference is now made to Figures 3 to 5, which show another embodiment of this invention wherein similar parts and components to those shown in Figures 1 and 2 are designated by the same reference numerals and as parts denoted by 1 to 15 are the same as those shown in Figures 1 and 2 their description is accordingly omitted.

In Figures 3 and 4, the device comprises supporting arms 30 and 31 integrally attached to the supporting frame 13, the supporting arm 30 being rotatably mounted on a support 33 provided in the casing 2 by means of a pivot shaft 32; a rod 34 being inserted into a hole 35 at the end of the other supporting arm 31 so as to pass through a bore in the wall 2a of the casing 2; and an automatic tension adjusting mechanism 37 which will be hereinafter described in detail with reference to Figure 5. In recesses 39 in the wall 2a of the casing 2 on opposite sides of the bore 36 are rotatable elements 38 biased by respective leaf springs (not shown) to engage the rod 34. The assembly 48 thus functions as a one-way clutch. Similar elements 45 are rotatably located in recesses 44 on opposite sides of the bore in the element 42 and are similarly urged by respective leaf springs (not shown) to engage the rod 34 whereby the assembly 49 functions as another one-way clutch, the two sets of elements 38 and 45 being positioned to permit axial movement of the rod 34 through the bores in the members 48 and 42 in the direction of the arrow A of Figure 5 but to resist relative movement of the rod 34 in the direction of the arrow B. Also provided are a cover 55, a spring retaining sleeve 41, a nut 47, a spring 50, an adjuster 51 rockably supported at a central portion thereof, one end of which is in contact via a roller 52 with a flange of the element 42 and a reciprocally moving bar 53 pivotally connected to the other end of the adjuster 51 at one end thereof and passing at its other end through a hole 54 of the casing 2 to be pivotally connected eccentrically to the pulley 9 so that during rotation of the pulley 9 the bar 53 is continuously reciprocated and the adjuster 51 continuously oscillated between its full line and phantom line positions illustrated.

The tension of the belts 10 and 11 is initially set by rotating the nut 47 to draw the rod 34 through the bore 36 in the direction of the arrow A while the adjuster 51

is in its full line position until a chosen loading is imposed on the spring 50. Thereafter, if the belts 10 and 11 expand the spring 50 will move the element 42 in the direction of the arrow A, thereby drawing the rod through the bore 36 in the same direction to maintain tension on the belts. However during the next movement of the adjuster 51 from its phantom line to its full line position the element 42 is moved along the rod 34 toward the element 41 and is held in the new position due to the orientation of the element 45. The orientation of the elements 38 causes them to prevent movement of the rod 34 through the bore 36 in the direction of the arrow B. The distance between the elements 41 and 42 is thus shortened to give the spring 50 increased loading which compensates for the expansion of the belts 10 and 11.

Referring to Figure 6, which shows a further embodiment of this invention, the tension of the belts 10 and 11 may be manually adjusted by means of the combination of a spring bracket 56, an adjusting nut 57 and a lock nut 58, the other construction being similar to that of the second embodiment of this invention and accordingly will not be further described.

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1. A belt power transmission device comprising a drive shaft having a pulley rotatable therewith, a driven shaft having a pulley rotatable therewith, a pair of intermediate pulleys rotatable with a common intermediate shaft and respectively engaged through respective belts with the drive shaft and driven shaft pulleys, said intermediate pulley shaft being displaceable toward or away from the drive and driven shafts and spring means being provided biasing the intermediate shaft so as to give a tension to both said belts and means for adjusting the loading of said spring.

2. A belt power transmission device as claimed in claim 1, wherein the means for adjusting the loading of the spring comprises a shaft connected to mounting means for the intermediate shaft and longitudinally movable relative to a casing for the device, an adjusting screw rod spaced from and coaxial with said shaft and a movable element threadedly engaged with said rod, means for preventing said movable element from rotating but allowing it to move axially of the rod in response to rotation of the latter, the spring acting between said shaft and movable element for providing tension to said belts, and means for rotating the rod to adjust the loading of the spring.

3. A belt power transmission device as claimed in claim 1, including a shaft movable in response to the displacement of said intermediate shaft, an element movable



- axially of said shaft, said spring acting between a member fixed relative to a casing of the device and said axially movable element for tensioning said belts, a one-way clutch adapted to prevent movement of the shaft in a direction to relieve tension on the belts and means adjustable longitudinally of the shaft for adjusting the positions of said axially movable element thereby to adjust the loading of the spring.
4. A belt power transmission device as claimed in claim 3, and further comprising an element rockable in response to rotation of one of said pulleys and engageable with said axially movable element to displace the same relative to the shaft in the spring-loading direction, there being provided a second one-way clutch acting between the shaft and axially movable element to prevent relative movement of the latter in the direction to relieve the loading on the spring.
5. A belt power transmission device substantially as hereinbefore described with reference to Figures 1 and 2, Figures 3, 4 and 5 or Figure 6 of the accompanying drawings.
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