United States Patent

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[33] **Germany**
[31] **ST28,692**

[54] **DRIVEN ROLLER FOR ROLLER CONVEYORS**
17 Claims, 6 Drawing Figs.

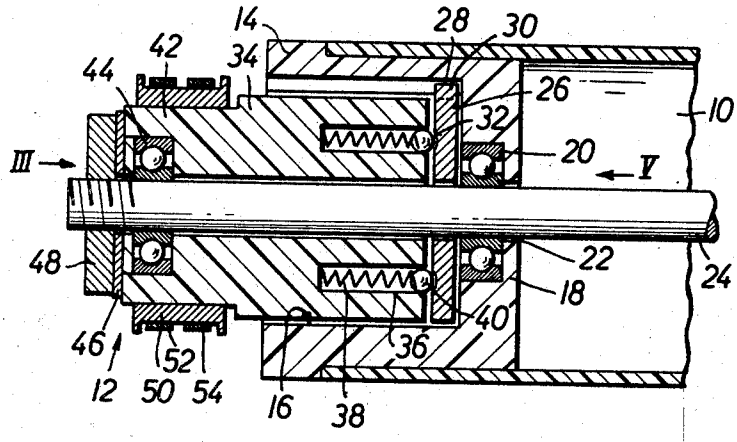
[52] **U.S. Cl.** **198/127,** 64/29
[51] **Int. Cl.** **B65g 13/02,** F16d 7/00
[50] **Field of Search** 198/127; 29/110, 115; 64/29, 5; 192/56

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ABSTRACT: A driven roller for use in roller conveyors comprises a cylindrical load-engaging shell provided with a cap in one of its axial ends. The cap has an axial bore which accommodates the sleeve of a driving portion rotatable by a pulley or gear. The sleeve carries one or more spring-biased balls which normally extend into sockets provided in the cap to thus rotate the shell by way of the cap. The balls are expelled from the sockets in response to application of a predetermined force which tends to rotate the sleeve with reference to the cap or vice versa.



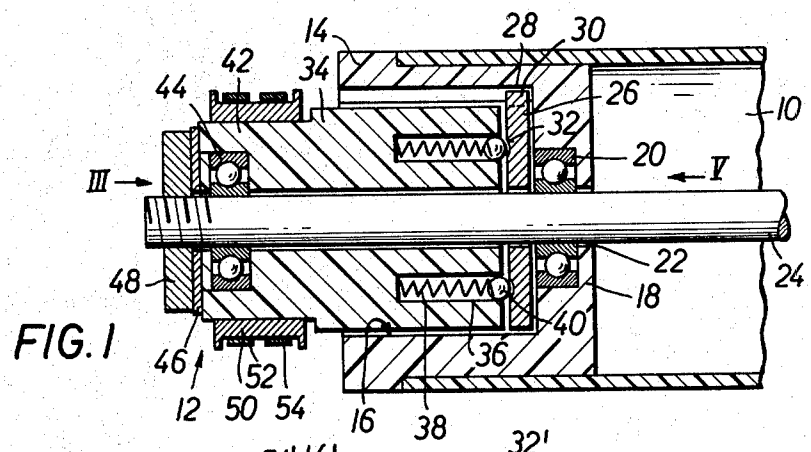


FIG. 1

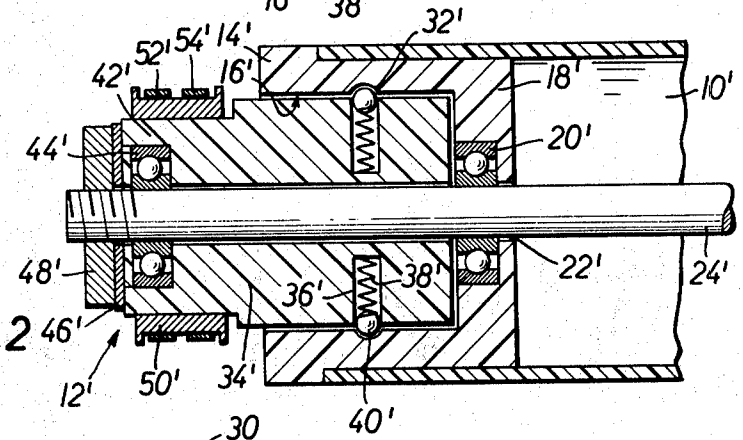


FIG. 2

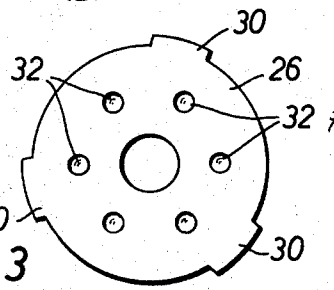


FIG. 3

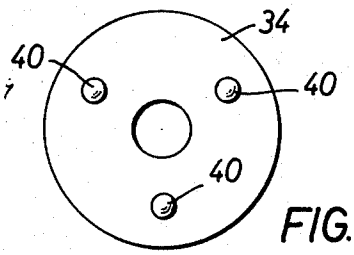


FIG. 5

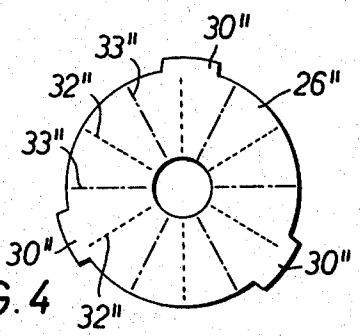


FIG. 4

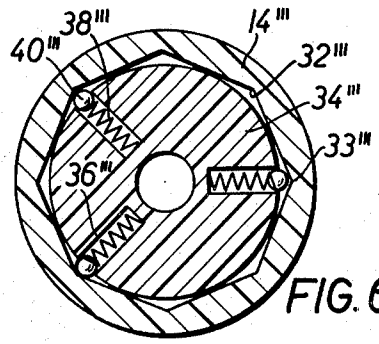


FIG. 6

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DRIVEN ROLLER FOR ROLLER CONVEYORS

BACKGROUND OF THE INVENTION

The present invention relates to roller conveyors in general, and more particularly to improvements in driven rollers for use in roller conveyors.

It is already known to employ in roller conveyors rollers which are driven in such a way that a load (e.g., a crate or a box) can be transported at a given speed, namely, at a speed which depends on the peripheral speed of driven rollers, and that the load can be accelerated by hand or by other means so that its speed exceeds such given speed. As a rule, the drive for the rollers comprises a ratchet wheel on the roller and a pawl which is rotated about the axis of the roller and drives the ratchet wheel in one direction. The positions of the ratchet wheel and pawl can be reversed. The pawl is yieldable so that the ratchet wheel can be accelerated in the one direction when an operator desires to push the load along the roller conveyor and to thereby accelerate that cylindrical load-engaging portion of the roller which is connected with the ratchet.

A drawback of the just described structure is that the cylindrical load-engaging portion of the driven roller cannot be arrested when the load comes to a halt, for example, at the collecting or transfer station which is normally located at the discharge end of the roller conveyor. Thus, the roller rotates with reference to a stationary load as long as the drive of the roller conveyor remains in operation. This can produce considerable wear on the load and/or on the driven rollers and can also result in deformation of transported good and/or overheating of rollers.

It is also known to employ in a roller conveyor driven rollers wherein a rotary load-engaging roller portion is in permanent frictional engagement with a driving portion. Such driven rollers permit shifting of loads forwardly or backwards, as well as stoppage of loads with reference to the driving portion by simultaneously holding the driven portion against rotation with the driving portion. However, the driven rollers are quite complicated and unreliable because, when the driving portion rotates with reference to the driven portion and/or vice versa, permanent frictional engagement between such portions causes overheating and considerable wear so that the magnitude of forces with which the driving portion transmits torque to the driven portion varies in dependency on circumstances and also in response to progressing wear on such portions. Furthermore, the parts which are in frictional engagement with each other must be inspected, repaired and/or replaced at frequent intervals so that the conveyor is out of commission for extended periods of time. Overheating can cause excessive frictional engagement between driving and driven portions so that the driven portion continues to rotate when the load is at a standstill or that the load travels with reference to the driven portion when it is desired to advance the load at a speed which is higher than the speed transmitted thereto by the driving portion when the latter rotates with the driving portion.

SUMMARY OF THE INVENTION

One of the objects of my invention is to provide a driven roller which is constructed and assembled in such a way that the driven portion which is engaged by the load can rotate with or relative to the driving portion, that the driven portion can be held against rotation while the driving portion continues to rotate, and that angular displacement of the driving portion with reference to the driven portion or vice versa necessitates the application of a predetermined force which is not dependent on changes in temperature or other uncontrollable factors.

Another object of the invention is to provide a driven roller which is constructed in such a way that the magnitude of force which is to effect movement between the driving and driven portions can be selected and altered at will, that the wear on the driving and driven portions during relative movement with reference to each other is negligible, and that all such parts which might undergo wear in response to extended use are readily accessible for inspection, repair and/or replacement.

A further object of the invention is to provide a driven roller which is particularly suited for use in that region or in those regions of a roller conveyor where the load normally comes to a halt while the driving portions of rollers continue to rotate.

An additional object of the invention is to provide a driven roller whose operation is not affected by extended idleness, by extended use, and/or by changes in temperature and/or the weight of conveyed goods.

Still another object of the invention is to provide a driven roller which is constructed in such a way that, once the driving and driven portions of the roller are properly assembled with each other, the magnitude of torque which the driving portion transmits to driven portion remains unchanged unless and until the person in charge desires to bring about a change in the magnitude of such torque.

A further object of the invention is to provide a roller which occupies little room, wherein the driving portion occupies less room than the driving portion of a conventional roller, wherein the driving portion does not interfere with travel of loads which are transported by the driven portion, and which can receive motion from one of the adjacent rollers and can transmit motion to another adjacent roller in a novel and space-saving way.

The invention is embodied in a driven roller for use in roller conveyors, particularly at the load-collecting and load-removing stations of such conveyors. The roller comprises a load-engaging cylindrical driven portion rotatable about a predetermined axis, for example, about the axis of a shaft which is fixedly mounted in the conveyor frame, and a driving portion rotatable about the same axis with the relative to the driven portion. One of these portions comprises at least one integral or separable female coupling member and the other portion comprises male coupling means including at least one preferably spherical or semispherical male coupling member which extend into and engages with the female coupling member when the driving portion rotates the driven portion. At least one of the coupling members is yieldable to permit disengagement of the coupling members in response to application of a predetermined force which tends to rotate the driving portion with reference to the driven portion or vice versa. The yieldability of the one or both coupling members may be due to elasticity or deformability of their material and/or to the provision of resilient biasing means which urges the female coupling member against the male coupling member and/or vice versa. The driven portion can be rotated by the load with reference to the driving portion in either direction, or such driven portion can be brought to a halt while the driving portion continues to rotate in response to torque transmitted thereto by a belt, a chain or an analogous endless flexible element, a gear train or another suitable transmission. When the driving portion rotates with reference to the driven portion, or vice versa, the only frictional engagement which takes place is that between the male coupling member or members and the female coupling member or members. If the male coupling member or members constitute balls or analogous rolling elements, such friction is negligible and the wear on the driving and driven portions is much less than in aforedescribed conventional rollers wherein the driving and driven portions are in permanent frictional engagement which must suffice to rotate the driven portion in response to rotation of the driving portion during normal operation of the roller.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved roller itself, however, both as to its construction and it mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary axial sectional view of a driven roller which embodies one form of the invention;

FIG. 2 is a similar fragmentary axial sectional view of a second roller;

FIG. 3 is a front elevational view of a female coupling member in the roller of FIG. 1, substantially as seen in the direction indicated by arrow III;

FIG. 4 is a front elevational view of a modified female coupling member which can be utilized in the roller of FIG. 1;

FIG. 5 is a front elevational view of a part in the driving portion which carries a set of male coupling members, substantially as seen in the direction of arrow V in FIG. 1; and

FIG. 6 is a transverse sectional view of a roller which constitutes a modification of the roller shown in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a portion of a driven roller which embodies one form of my invention. The roller comprises a driven portion which is rotatable about the axis of a fixed horizontal shaft 24 and includes a cylindrical load-engaging shell 10 and an annular end wall or cap 14 which is fitted into and is welded, glued, screwed, bolted, riveted or otherwise nonrotatably secured to the left-hand end portion of the shell 10. The driven portion of the roller further comprises a disc-shaped female coupling member 26 which is also shown in FIG. 3. The driving portion of the roller is denoted by the numeral 12. The ends of the fixed shaft 24 are mounted in a frame which is not shown in FIG. 1; it can be said that the shaft 24 forms part of the frame and that it defines a common axis for the driving and driven portions of the roller.

The cap 14 is provided with a larger-diameter bore 16 the inner end portion of which accommodates the female coupling member 26. The bore 16 communicates with a smaller-diameter bore 22 which is formed in the bottom wall 18 of the cap 14 and accommodates a portion of the shaft 24. An antifriction bearing 20 is installed in the cap 14 to the right of the bore 16 and the inner race of this bearing is mounted on the shaft 24. The coupling member 26 is provided with one or more (for example, three) radial projections 30 (see FIG. 3) which extend into axially parallel internal grooves 28 of the cap 14 so that the member 26 must share all angular movements of the parts 10 and 14. The projections 30 are preferably equidistant from each other. The left-hand face of the coupling member 26 is formed with six equidistant concave sockets 32 each of which is located at the same distance from the axis of the shaft 24.

The driving portion 12 of the roller comprises an elongated cylinder or sleeve 34 which extends with little clearance into the bore 16 of the cap 14 and is formed with an axial bore for the shaft 24. The right-hand end face of the sleeve 34 is formed with three equidistant axially parallel blind bores 36 each of which accommodates a biasing means here shown as a stressed helical spring 38 and a ball-shaped male coupling member 40 (see also FIG. 5). The distance between the axes of bores 36 and the axis of the shaft 24 is the same as that between the axis of the shaft 24 and the center of a socket 32. The springs 38 bias the corresponding male coupling members 40 (hereinafter called balls for short) against the left-hand face of the female coupling member 26 whereby the balls penetrate into the adjoining sockets 32 in certain angular positions of the sleeve 34 with reference to the cap 14. The driving portion 12 transmits torque to the shell 10 of the driven portion when the balls 40 extend into the adjoining sockets 32 so that the driving and driven portions then rotate as a unit. If the load resting on the peripheral surface of the shell 10 is accelerated by hand, by gravity or for another reasons, the female coupling member 26 rotates with reference to the sleeve 34 whereby the balls 40 are expelled from the adjoining sockets 32 and penetrate into next-following sockets in response to continued angular displacement of the member 26 with reference to the sleeve 34. If the shell 10 is brought to a halt or is caused to rotate at a speed which is less than the speed of the sleeve 34, the balls 40 are again expelled from adjoining sockets 32 and permit rotation of the sleeve 34 with reference to the female coupling member 26. The magnitude of torque which can be transmitted by the driving portion 12 to the driven portion can be regulated by changing the bias of the springs 38, by changing the depth of the sockets 32 and/or by replacing the balls 40 with male coupling members of greater or lesser diameter.

The sleeve 34 comprises a smaller-diameter cylindrical extension 42 which projects from the bore 16 of the cap 14 and accommodates an antifriction bearing 44 mounted on the shaft 24. Suitable sealing elements (not shown) are provided to prevent penetration of foreign matter into the bore 16 and into the bearing 44. The left-hand end face of the extension 44 abuts against a washer 46 which is held against axial movement by a nut 48 meshing with the externally threaded left-hand end portion of the shaft 24.

The structure which drives the portion 12 comprises a pulley or sheave 50 which is fixed to and surrounds the exposed part of the extension 43, and one of two endless belts 52, 54 which are trained over the sheave 50. It will be noted that the sheave 50 and the belts 52, 54 do not extend upwardly beyond the external surfaces of the parts 10 and 14; this is desirable to avoid unnecessary engagement between the system which rotates the roller and the load which travels on the conveyor. It is clear that the sheave 50 can form an integral part of the extension 42 and it is equally possible to replace the illustrated belt drive with a system of gears or with another transmission of any known design. One of the belts 52, 54 serves to drive the roller of FIG. 1 and receives motion from the sheave of the preceding roller (not shown). The other belt is driven by the sheave 50 and rotates the sheave of the next-following driven roller (not shown). The foremost roller is driven by an electric motor or by another suitable prime mover, and the remaining driven rollers are driven one by the other. The motor is preferably of the variable-speed type or it rotates the foremost roller by way of variable-speed transmission, not shown. When the roller conveyor is in operation, all of the sheaves 50 rotate irrespective of whether the corresponding shells 10 rotate with or move relative to their sheaves or are at a standstill.

The operation of the roller will be readily understood upon perusal of the preceding description. As stated before, the magnitude of torque between the driving and driven portions of the roller can be selected and varied in a number of ways, either by changing the bias of the springs 38 or by replacing such springs with stronger or weaker springs, by replacing the balls 40 with balls of greater or lesser diameter, and/or by replacing the female coupling member 26 with one having deeper or shallower sockets 32. If the shell 10 supports a load which is to advance faster than warranted by the rotational speed of the sleeve 34, the load is pushed forwardly and causes rotation of the sleeve 10 and parts 14, 26 at a speed which exceeds the speed of the sleeve 34. The balls 40 are then expelled from adjoining sockets 32 and snap into next-following sockets until the speed of the driven portion is reduced to match that of the sleeve 34 or until the drive for the sleeve is arrested and the load is permitted to come to a standstill. If the load (e.g., a crate) reaches the collecting and/or removing station and is brought to a halt, for example, in response to engagement with a stationary stop or in response to engagement with the preceding crate, the shell 10 is arrested and the balls 40 are again expelled from their sockets 32 to penetrate into and to be expelled from the next-following sockets, as long as the sleeve 34 continues to rotate. Thus, the load can either accelerate or arrest the shell 10 while the sleeve 34 receives torque from the pulley 50.

The female coupling member 26 is replaced or exchanged when the operator wishes to change the magnitude of torque which is transitted to the shell 10 or when the female coupling member 27 undergoes excessive wear. However, the wear is minimal because the male coupling members 40 are normally received in the adjoining sockets 32 and also because the male

coupling members merely roll along the left-hand face of the female coupling member **26** when the shell **10** rotates with reference to the sleeve **34** or vice versa. It is preferred to produce at least some parts of the roller of synthetic plastic material, particularly some or all of the parts which constitute the driving portion **12**.

FIG. **4** illustrates a modified disc-shaped female coupling member **26''** which can be utilized in the driven roller of FIG. **1**. This member **26''** again comprises three radial projections **30''** which can be received in the grooves **28** of the cap **14**, but the concave sockets **32** are replaced by radially extending sockets in the form of channels or troughs or valleys **32''** (denoted by broken lines) separated from each other by radially extending ridges or elevations **33''** (indicated by phantom lines). The operation of a roller which embodies the female coupling member **26''** of FIG. **4** is clearly analogous to that of the roller shown in FIG. **1**. The difference is that the balls **40** transmit torque when they enter the adjoining troughs **32''** each of which is preferably flanked by two mutually inclined surfaces meeting along a pronounced edge. It is clear that the female coupling member **26** or **26''** can form an integral part of the cap **14**, i.e., this cap may constitute the female coupling member of the driven portion. Also, the female coupling member **26** or **26''** can be integrally secured to the cap **14**. Furthermore, the position of the male and female coupling members can be reversed, i.e., the balls **40** and springs **38** can be installed in the cap **14** and the female coupling member **16** or **26''** can be mounted on or made integral with the sleeve **34**. This would merely amount to a simple reversal of functions.

The right-hand end of the shell **10** shown in fig. **1** preferably accommodates a second annular cap **14**. If desired or necessary, such second cap can accommodate a second female coupling member **26** or **26''** and the roller may comprise a second driving portion which is rotated in synchronism with the driving portion **12** and transmits torque to the second cap in the same way as described in connection with the cap **14** and driving portion **12**.

FIG. **2** illustrates a driven roller which is quite similar to the roller of FIG. **1** and wherein parts analogous to previously described parts are denoted by similar numerals each followed by a prime. The main difference is that the cap **14'** constitutes the female coupling member and that the sockets **32'** are formed in or machines into the cylindrical internal surface of the cap **14'**. The sleeve **34'** is provided with one, two or more radial bores **36'** for prestressed springs **38'** which bias balls **40'** so that each such ball tends to enter a socket **32'** in one of several angular positions of the driven portion with reference to the driving portion **12'** or vice versa. It will be noted that the sockets **32'** are coplanar with the balls **40'** and that such parts are located in a plane which is normal to the axis of the shaft **24'**.

FIG. **6** illustrates a modification of the roller shown in FIG. **2**. This modification employs the principle which was explained in connection with FIG. **4**; however, the sockets or troughs **32'''** and ridges or elevations **33'''** extend in parallelism with the axis of the shaft and are provided in the internal surface of the female coupling member or cap **14'''**. The sleeve of the driving portion is shown at **34'''**, the male coupling members at **40'''**, the radial bores of the sleeve **34'''** at **36'''**, and the biasing means for the balls at **38'''**. The driving portion rotates the driven portion including the cap **14'''** when the balls **40'''** extend into the adjoining troughs **32'''**.

It is clear that the position of male and female coupling members shown in FIGS. **2** and **6** can be reversed. Referring again to FIG. **2**, the balls **40'** can be installed in the internal surface of the cap **14'** can the sockets **32'** can be provided in the peripheral surface of the sleeve **34'**. The same applies for the balls **40'''** and sockets or troughs **32'''** shown in FIG. **6**.

Since at least some parts of the improved roller can be mass-produced of synthetic plastic material, the initial cost of the roller is but a fraction of the cost of many presently known driven rollers. Furthermore, the operator can maintain a supply of spare parts so that worn springs and male and/or female coupling members can be replaced to prolong the useful life of rollers. It was found that a roller conveyor employing the improved driven roller requires very little maintenance.

My driven roller is susceptible of many additional modifications without departing from the spirit of the present invention. Referring again to FIG. **1**, the springs **38** and bores **36** can be omitted, and the balls **40** can be replaced by integral semispherical or like projection on the right-hand end face of the sleeve **34** if the female coupling member **26** is biased in a direction to the left by one or more helical springs, leaf springs, elastic cushions or analogous biasing means. Of course, such biasing means for the female coupling member **26** can be provided in addition to or as a substitute for the biasing means **38**.

It is further possible to replace the parts **26**, **38** and **40** shown in FIG. **1**, with one or more elastically deformable projections on the bottom wall **18** of the cap **14** whereby such projections normally extend into the adjoining bores **36** or into sockets corresponding to sockets **32** but can be expelled from such bores or sockets in response to rotation of the shell **10** with reference to the sleeve **34** or vice versa. Alternatively, the entire female coupling number **26** may consist of elastically deformable material and may comprise one or more projections which can penetrate into or be expelled from the bores **36** or other types of sockets provided in the right-hand end face of the sleeve **34**. Of course, the elastic projections can be provided on the periphery of the sleeve **34** to penetrate into sockets provided in the internal surface of the cap **14**, or vice versa.

Finally, the features of the roller shown in FIG. **2** could be incorporated in the roller of FIG. **1**. Thus, the cap **14** could be provided with one or more sockets **32'** and the sleeve **34** could carry one or more spring biased balls **40'**. The same holds true for the rollers which embody the features shown in FIGS. **4** and **6**, i.e., the cap **14'''** of FIG. **6** could accommodate the female coupling member **26'** and the sleeve **34'''** could carry one or more axially movable balls **40** cooperating with the sockets **32''** of the female coupling member **26''**.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of may contribution to the art.

I claim:

1. In a roller conveyor, a driven roller of uniform outer diameter rotatable about a predetermined axis and comprising a load-engaging cylindrical driven portion formed with an axially extending bore; a driving portion rotatable about said axis with and relative to said driven portion, one of said portions comprising at least one female coupling member and the other portion comprising male coupling means including at least one male coupling member received in and engaging with said female coupling member when said driving portion rotates said driven portion, at least one of said coupling members being yieldable to permit disengagement of said coupling members in response to application of a predetermined force which tends to rotate said driving portion with reference to said driven portion or vice versa, said coupling members being located in said bore, and said driving portion comprising a part projecting outwardly from said bore; and drive means for rotating said driving portion and comprising a driving element fixed to said part and having a diameter which is less than said outer diameter of said roller.

2. A structure as defined in claim **1**, wherein said female coupling member comprises a socket and said male coupling member extends into said socket when said driving portion rotates said driven portion.

3. A structure as defined in claim **1**, wherein said female coupling member comprises a plurality of sockets which are equidistant from each other, as considered in the direction of rotation of said driving portion, and are located at the same distance from said axis, said male coupling means comprising

a plurality of male coupling members each received in one of said sockets when said driving portion rotates said driven portion.

4. A structure as defined in claim 1, wherein said one portion is said driven portion and wherein said female coupling member is located at the inner end of said bore, said driving portion comprising a sleeve extending into said bore and having an end face adjacent to said female coupling member, said male coupling member normally extending beyond said end face.

5. A structure as defined in claim 1, wherein said female coupling member has an internal surface provided with at least one socket and said other portion comprises a sleeve extending into said female coupling member and having a peripheral surface adjacent to said internal surface, said male coupling member normally extending beyond said peripheral surface.

6. A structure as defined in claim 1, wherein said male coupling member is a sphere and further comprising resilient means urging said sphere into said female coupling member.

7. A structure as defined in claim 1, wherein said female coupling member is provided with at least one concave socket for said male coupling member.

8. A structure as defined in claim 1, wherein said female coupling member is provided with at least one trough-shaped socket for said male coupling member.

9. A structure as defined in claim 8, wherein said socket extends in parallelism with said axis.

10 A structure as defined in claim 8, wherein said socket extends radially of said axis.

11. A structure as defined in claim 1, wherein at least one of said coupling members is seperable from the respective portion.

12. A structure as defined in claim 11, wherein said one coupling member is said female coupling member and wherein said female coupling member is provided with at least one socket for said male coupling member.

13. A structure as defined in claim 1, wherein said female coupling member is a disc which is accommodated in said bore and shares angular movements of said driven portion about said axis.

14. A structure as defined in claim 1, wherein said female coupling member is an annulus arranged to share all angular movements of said driven portion about said axis.

15. A structure as defined in claim 1, wherein said driving element is a sheave and further comprising a first endless flexible element trained over and arranged to rotate said sheave and a second endless flexible element trained over and driven by said sheave.

16. A structure as defined in claim 1, wherein said driven portion comprises a hollow cylindrical load-engaging shell and a cap provided in one axial end of said shell said cap being formed with said axial bore.

17. A structure as defined in claim 1, wherein said female coupling member is provided with a plurality of sockets and said male coupling means comprises a plurality of male coupling members each received in one of said sockets when said driving portion rotates said driven portion, the number of said sockets exceeding the number of said male coupling members.