Nov. 17, 1970 L. O. HEWKO Re. 26,978

ACCESSORY DRIVE MECHANISM

Original Filed Nov. 27, 1964 2 Sheets-Sheet 1

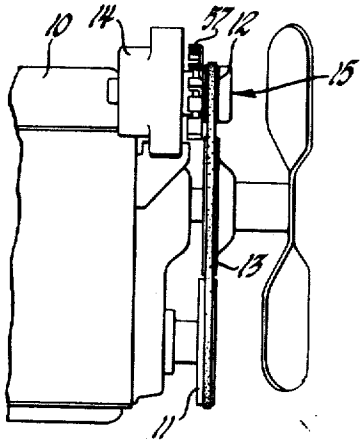


Fig. 1

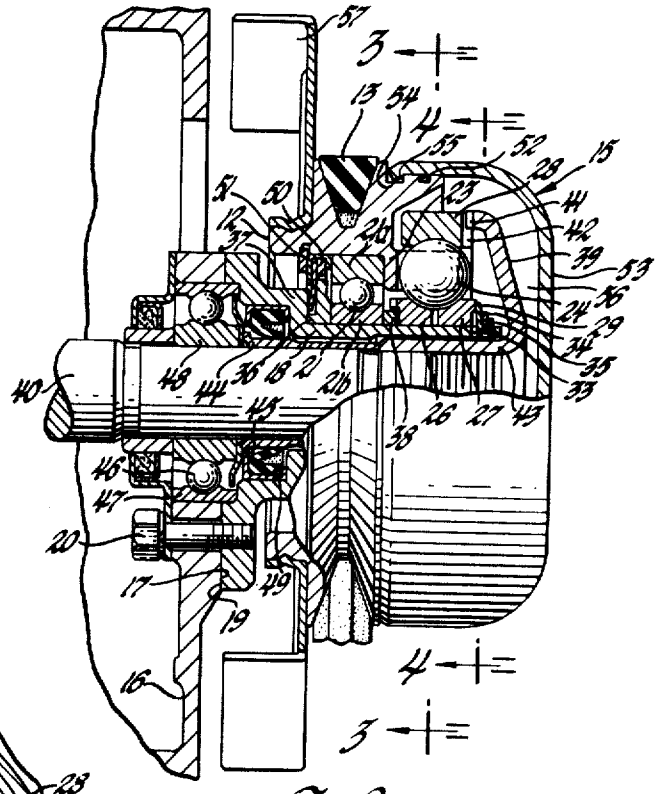


Fig. 2

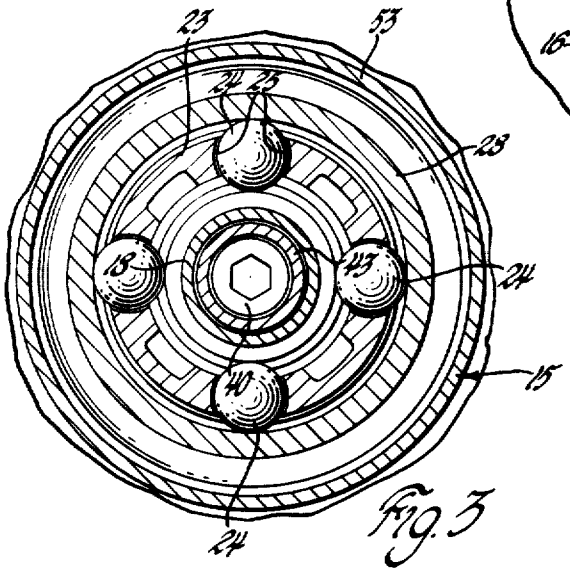


Fig. 3

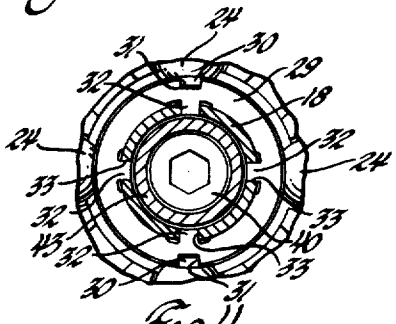


Fig. 4

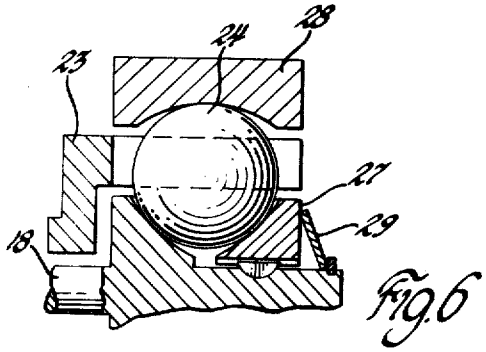


Fig. 6

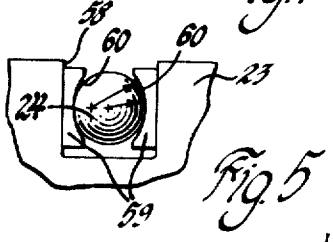


Fig. 5

INVENTOR.
Lubomyr O. Hewko

BY

John P. Moran

ATTORNEY

Nov. 17, 1970 L. O. HEWKO Re. 26,978

ACCESSORY DRIVE MECHANISM

Original Filed Nov. 27, 1964 2 Sheets-Sheet 2

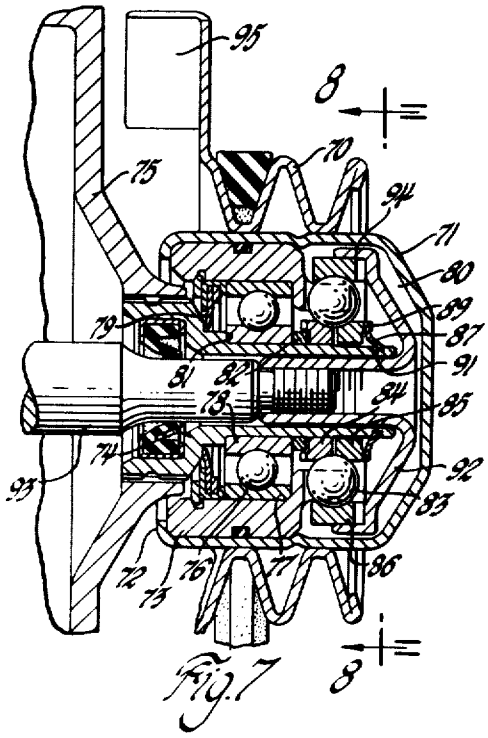


Fig. 7

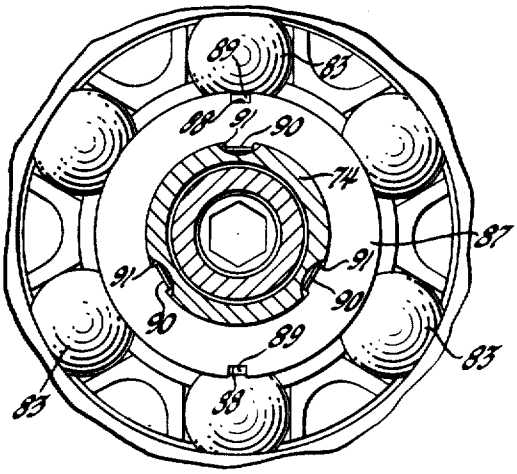


Fig. 8

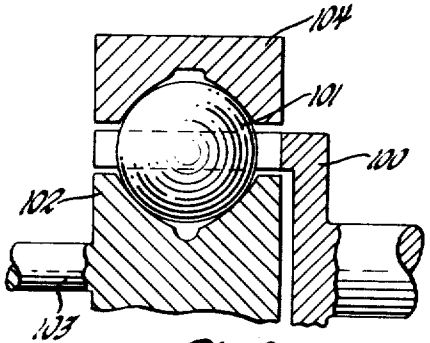


Fig. 9

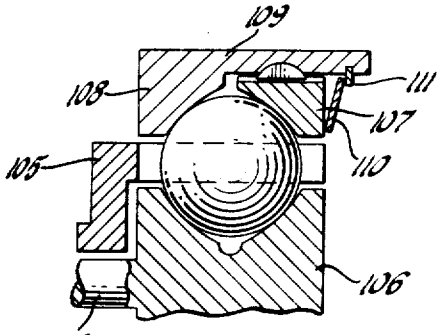


Fig. 10

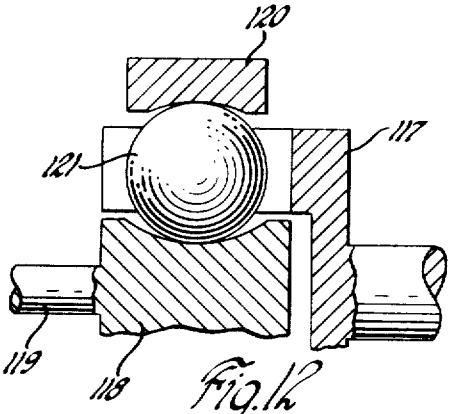


Fig. 12

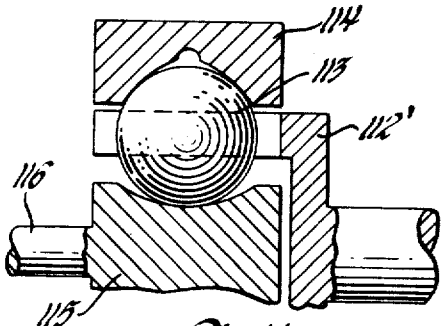


Fig. 11

INVENTOR.
Lubomyr O. Hewko
BY
John P. Moran
ATTORNEY

United States Patent Office

Re. 26,978
Reissued Nov. 17, 1970

26,978

ACCESSORY DRIVE MECHANISM

Lubomyr O. Hewko, Port Clinton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Original No. 3,327,566, dated June 27, 1967, Ser. No. 414,064, Nov. 27, 1964. Application for reissue June 20, 1969, Ser. No. 835,915

Int. Cl. F16c *33/38*; F16h *13/08, 13/14*

U.S. Cl. 74—798 10 Claims

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

ABSTRACT OF THE DISCLOSURE

A power transmitting mechanism including a housing; a support sleeve secured therein; an engine-driven input member including an axially extending cylindrical carrier; bearing means rotatably supporting the input member on the support sleeve; spaced reaction suns mounted on the support sleeve, one of which is axially movable; either (1) a plurality of equally spaced oppositely disposed spherical bearing surfaces formed in the cylindrical carrier, or (2) a plurality of equally spaced axial slots formed in the cylindrical carrier with oppositely disposed bearing inserts inserted therein having oppositely disposed spherical surfaces formed thereon; ball planets mounted between the oppositely disposed spherical surfaces, the radius of the spherical surfaces may be the same or slightly greater than the radius of the ball planets; a rotatable ring in frictional contact with the ball planets; and an output member secured to the rotatable ring.

This invention relates to an accessory drive mechanism and more particularly to an overdrive structure particularly adapted for driving engine-driven accessories such as generators or alternators commonly used on automotive vehicles.

Engine-driven accessories such as generators, alternators and air conditioning compressors are normally driven from the vehicle engines by means of belts and pulleys. In such drive arrangements the pulley diameters may be selected to provide overdrive of engine-driven accessories with respect to engine speed. However, the practical overdrive ratio obtainable is limited due to the relationship between the pulley size and belt life. It is desired to provide an overall step-up ratio between the engine crankshaft and the alternator of 3.6 to 1. This ratio exceeds the practical capabilities of pulley-belt drives in present day automotive vehicles wherein the engines may be operated through a wide speed range, for example, 500 r.p.m. at idle to a maximum speed of 5000 r.p.m. With a simple belt-pulley arrangement selected to provide a 3.6 to 1 overdrive ratio, belt life is very short and inadequate. While step-up gearing might be employed, such gear type step-up units are not suitable due to objectionable noise at the relatively high speeds involved.

The proposed drive structure herein disclosed provides efficient, quiet and vibration-free overdrive of a generator at a step-up ratio of the order of 3.6 to 1 and in addition provides for improvement in normal belt life. In order to increase belt life a portion of the desired ratio step-up is accomplished by a planetary friction drive and a second portion of the step-up is provided by the belt and pulleys. In this manner, normal belt life is increased. For example, a total overdrive ratio of 3.6 to 1 is accomplished by utilizing a 1.6 to 1 step-up planetary traction drive and the remaining 2.25 to 1 step-up is provided by conventional

V-belt running on 7.18-inch diameter and 3.18-inch diameter pulleys. With this arrangement, at 500 r.p.m. engine idling speed, the alternator speed is raised from 1150 to 1800 r.p.m. and its output is increased from approximately 9 amps to 29 amps. At 5000 engine r.p.m. the alternator speed is 18,000 r.p.m. which is within its permissible speed limit. It will readily be apparent that with the speeds involved that noise is a very important consideration which eliminates the use of simple step-up gearing.

The proposed friction drive structures herein disclosed are of simple structure, are adapted for use in installations where space requirements are critical, are inexpensive to manufacture, are capable of long useful life, and are quiet in operation.

An object of this invention is to provide an accessory drive for driving the accessories of an engine-driven vehicle wherein the accessories are driven at overdrive with respect to engine speed by means including a belt driven friction drive mechanism arranged such that one portion of the final overdrive ratio is obtained by belt drive and driven pulleys and a second portion by means of a friction drive transmission to assure long normal belt life and to provide adequate overall step-up of the accessory speed relative to engine speed to render the accessories more efficient particularly at relatively low engine speeds.

Another object of the invention is to provide a belt driven accessory drive system wherein one of the belt pulleys rotates as a unit with a carrier of a friction drive transmission to drive the carrier and wherein a ball roller driven by the carrier drives a ring output member at overdrive ratio with respect to speed of rotation of the pulley and carrier.

A further object of this invention is to provide an accessory drive mechanism of the type described including a friction drive assembly including a fixed support housing provided with an axially including a nonrotatable support sleeve, an engine-driven input member including a carrier, bearing means supporting said input member and carrier for rotation on the external surface of the support sleeve, a rotatable ring, spaced reaction suns on the external surface of the sleeve and fixed against rotation by the sleeve, a ball driven by the carrier and contacting said suns and ring, a final power delivery shaft extending through the hollow ground sleeve and a connector connecting the ring to the final power delivery shaft extending into the fixed support sleeve between the final power delivery shaft and the internal surface of said support sleeve for driving said final power delivery shaft.

A still further object of the invention is to provide a power transmitting mechanism wherein the carrier member includes equally spaced axial notches for the insertion of bearing inserts having opposed spherical surfaces for receiving ball planets, the spherical surfaces of the inserts having a slightly larger radius than that of the balls, providing a wedged opening therebetween whereby lubricant in the wedged opening can lift the ball planets for full hydrodynamic spherical bearing lubrication.

An additional object of this invention is to provide an [acessory] *accessory* drive mechanism of the type described wherein the friction roller, ring and connector cooperate to support the power delivery shaft to eliminate the need for providing a power delivery shaft bearing in addition to the bearing for supporting the planet carrier.

These and other objects and advantages of this invention will be apparent from the following description and claims, taken in conjunction with the following drawings, in which:

FIG. 1 is a diagrammatic side view of a vehicle engine equipped with an accessory and belt drive mechanism constructed in accordance with the principles of this invention.

FIG. 2 is an axial section through the friction roller overdrive mechanism.

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2.

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2.

FIG. 5 is a *fragmentary* side view of an alternate carrier construction which may be substituted for the carrier of FIG. 3.

FIG. 6 is a partially sectional view illustrating the contact geometry of the basic drive between the roller and sun and roller and ring as each being of concave profile.

FIG. 7 is a sectional view of an alternate construction wherein the friction contact roller functions both to drive the ring and as a roller bearing to support the power delivery shaft.

FIG. 8 is a sectional view taken along the line 8–8 of FIG. 7.

FIG. 9 is a sectional view of an alternate friction drive arrangement wherein two contacts are provided between the planet and sun and between the planet and ring.

FIG. 10 is a partially sectional view of an arrangement similar to FIG. 9 in that it provides four rolling contacts per planet and in addition illustrates the ring split into two halves with the normal load applied by a suitable axial spring.

FIG. 11 is a partially sectional view of an arrangement wherein the ring has two contacts and the sun a single contact with the planet.

FIG. 12 is a partially sectional view wherein there is only a single contact between the planet and sun and planet and ring and the geometry very closely resembles a radial ball bearing.

In FIG. 1 there is shown an engine **10** and an alternator **14**. A crankshaft driven pulley **11** [dirves] *drives* an alternator pulley **12** by means of a belt **13**. As heretofore stated, the pulley diameters are selected to provide a step-up belt drive of 2.25 to 1 in order to maintain the pulley diameters within a range wherein long belt life is possible.

As best shown in FIG. 2, a ball friction roller drive indicated generally at **15** provides an overdrive ratio of 1.6 to 1 between pulley **12** and an alternator input shaft **40**. An alternator support housing **16** is provided with a machined surface **17** to which is attached a reaction shaft **18** provided with a machine surface **19** matching surface **17**. Bolts **20** maintain the shaft **18** and housing **16** in assembled relationship. Reaction shaft **18** supports the friction drive, carries the reaction force to housing **16** and supports the belt force. Pulley **12** serves both as the housing for the drive assembly and the carrier for the planetary friction drive and is the power input member for the planetary friction drive. A radial ball bearing **21** disposed between outer and inner races **21a** and **21b** supports pulley **12** for rotation or reaction shaft **18**. Pulley **12** has formed integrally therewith a planet carrier **23** extending axially therefrom to receive four balls or planets **24**. As best shown in FIG. 3, carrier **23** has formed therein hydrodynamic journal bearing surfaces **25** for receiving balls **24**. As shown in FIG. [2] 3 these surfaces **25** are [semicircular] *spherical* to conform to the spherical surfaces of the balls. The surfaces **25** may, however, be of other than spherical configuration as hereafter set forth. Rollers **24** contact a pair of spaced suns **26** and **27** and a ring **28**. Sun **26** is fixed to reaction shaft **18** so as to be incapable of rotation or axial motion and may be press-fitted upon shaft **18**. Sun **27** is capable of axial motion but is incapable of rotation with respect to shaft **18**. Sun **27** is grounded to reaction shaft **18** by means of a Belleville spring **29**.

As best shown in FIG. 4, a pair of axially extending tangs or ears **30** on sun **27** extend into spaced slots **31** formed in Belleville spring **29**. Belleville spring **29** is provided with four tangs or ears **32** which extend into spaced radial slots **33** formed in shaft **18**. In this manner, Belleville spring transmits reaction torque from sun **27** to reaction shaft **18**. Referring again to FIG. 2, a spacer **34** disposed between spring **29** and a snap ring **35** serves as a means for producing proper axial deflection of spring **29** when the spring is assembled to shaft **18**. The thickness of spacer **34** is chosen to produce adequate normal load and consequently adequate torque capacity of the drive to withstand the maximum expected torque to be transmitted. A spacer **36** disposed between an upstanding flange **37** on shaft **18** and race [22] *21b* and a spacer **38** disposed between race **21b** and sun **26** insure proper axial [alignment] *spacing* of the parts. Ring **28**, which is the power delivery member of *the* roller drive assembly is connected to an alternator drive shaft **40** by means of a drive flange **39**. Drive flange **39** includes an ear **41** adapted to contact a slot **42** on ring **28** and a threaded cylindrical portion **43** adapted to contact an unthreaded cylindrical sleeve spacer **44** having a radially [extended] *extending* flange **45** formed on the end thereof. A ball bearing **46** is disposed between alternator housing **16**, and shaft **40**, the race **47** supporting both the reaction shaft **18** and housing **16** and the race **48** contacting power input shaft **40**. A shaft seal **49** contacts the outer surface of cylindrical sleeve spacer **44**. A face seal **50** is retained *against race 21a of bearing 21* adjacent spacer [38] *36* by a snap ring **51** carried by pulley **12**. It will be apparent that drive flange **39** is simply and easily assembled to the unit by rotating the flange relative to shaft **40** until flange **45** contacts bearing race **48**. A seal **52** is disposed between a cover **53** and pulley **12**. Cover **53** is retained upon pulley **12** by means of a bent-in rim **54** which extends into an annular groove **55** in pulley **12**. When assembled, lubricating oil is disposed in chamber **56** enclosed by the pulley and cover. A fan **57** supported on pulley **12** provides cooling for the alternator.

[A] As stated, suns **26** and **27** are prevented from rotation. The reaction torque is split between suns **26** and **27** with one-half carried by each sun. Belleville spring **29** functions both to transmit the reaction torque from sun **27** to reaction shaft **18** and to axially load the two suns toward each other in order to generate normal loads at the sun-planet and ring-planet contacts. The normal load when multiplied by the coefficient of traction and the radius at which it is acting, produces usable torque forces whereby ring **28** is driven. [Semicircular] *The spherical* openings or surfaces **25** are machined in the carrier **23** and constitute journal surfaces for the ball planets **24**. The balls, while rotating about their own centerline, generate a hydrodynamic film of oil between their outside surfaces and the carrier surface **25** capable of supporting the tangential torque force with a minimum of wear and power losses.

As heretofore stated, the surfaces **25** of carrier **23** are [semicircular] *spherical* in shape and are machined on the carrier. The shape of these surfaces may be modified and may consist of inserts rather than being machined on the carrier itself. In FIG. 5, carrier **23** is shown as having notches **58** formed therein [and adapted to receive] *having facing flat or planar parallel side walls providing bearing surfaces for the flat back faces of the* bearing inserts **59**. Inserts **59** are provided with spherical surfaces **60** which [conform more closely to] *cooperate with* the outer spherical surface of the ball planets **24** and produce better hydrodynamic load capacity. Here a spherical partial hydrodynamic bearing is generated by machining a spherical seat **60** inside the insert **59**. As indicated by the arrows, the radius of the seat is larger than the radius of the ball planet. This geometry generates a wedge action between the ball planet and the seat **60**. When oil is trapped in the wedge portion it tends to lift the ball *slightly off the centers of the bearing inserts 59* with a relatively high force. The contact geometry of the basic drive is best shown in FIG. 6 wherein the sun rolling surface and ring rolling surface are both concave. However, it is possible to use straight or convex rolling surfaces, if ad-

vantageous. The ring rolling surface illustrated as of concave profile might be of straight cylindrical shape.

In operation, pulley **12** is driven by V-belt **13** from crankshaft pulley **11** of FIG. 1 and at a speed greater than crankshaft speed. In order to preserve belt life, the step-up provided by the pulleys is of the order of 2.25 to one. Carrier **23** driven at the speed of rotation of pulley **12** applies a torque force to the ball planets **24** through the partial journal bearing surfaces **25**. Suns **26**, **27** being fixed to reaction shaft **18** form the reaction surface for ball planets **24**, causing the balls to rotate about the suns. This, in turn, causes ring **28** to rotate at an increased speed and in the same direction as pulley **12**. Ring **39** drives the alternator input shaft **40** at a ratio of 1.6 times the speed of rotation of pulley **12**, such that the shaft **18** is driven at a speed 3.6 times that of pulley **11**.

In FIG. 7 there is shown a simplified roller friction drive assembly of more compact nature than those heretofore described. In this figure a double pulley **70** is welded to a cover **71**, the cover **71** having bent-over tabs **72** for gripping the planet carrier **73**. A reaction shaft **74** splined to alternator housing **75** carries a roller bearing **76** having an outer race **77** contacting carrier **73** and an inner race **78** contacting reaction shaft **74**. A seal **79** prevents leakage of oil from a chamber **80** enclosed by cover **71**. Race **78** contacts a shoulder **81** on shaft **74** and a spacer **82**. Six ball planet rollers **83** contact spaced suns **84** and **85** and a ring **86**. Sun **84** is press-fitted on reaction shaft **74** and sun **85** is connected to reaction shaft **74** by means of Belleville spring **87**.

As best seen in FIG. 8, Belleville spring **87** is provided with spaced notches **88** adapted to receive ears **89** on sun **85** (shown in FIG. 7) and has bent-over tangs **90** disposed in [semispherical] *spherical* seats **91** formed in reaction shaft **74**.

The operation is the same as that previously described, but the structure is more compact. Belleville spring **87** is of simplified construction and the design eliminates the spacer **34** and snap ring **35** of FIG. 2. Belleville spring **87** is simply snapped into place on shaft **74** and requires no additional means of axial or torsional fastening. Another improvement consists in the elimination of the principal alternator bearing **46** of FIG. 2. In the FIG. 7 embodiment[s] the friction drive is further modified so as to function as a radial support for the alternator power input shaft **93**. This is accomplished by providing a pilot diameter **94** between the output flange **92** and the outer diameter of friction drive ring **86**. When flange **92** is threaded upon power delivery shaft **93**, the annular axially extending boss portion or pilot diameter **94** on flange **92** mates with the outer surface of ring **86** such that the planetary rollers **83** support one end of shaft **93** through suns **84**, **85** and reaction shaft **74**. Deletion of the conventional alternator bearing **46** of FIG. 2 results in considerable cost saving and structural simplification. Belt forces are transmitted to housing **75** through reaction shaft **74**. In the embodiment of FIG. 7, six planet balls **83** may be employed if desired. Further, in FIG. 7, a fan **95** is driven by pulley **70**. Fan **95** may be disposed within housing **75** and driven by shaft **93** rather than by the pulley **70**. Such an arrangement is advantageous in that the fan would then rotate at the output speed of the friction drive unit rather than its input speed.

It has heretofore been explained that the contact profiles of the carrier may be modified to different shapes. In addition the contact arrangements may be varied as shown in FIGS. 9 through 12.

In FIG. 9 a power input carrier **100** causes ball planets **101** to travel around sun **102** fixed to reaction shaft **103** to drive ring **104**. In this arrangement there are provided two contacts between the ball planet **101** and sun **102** and two contacts between ball planet **101** and ring **104**. This arrangement increases the axial stiffness of the drive. The required normal load between the rolling bodies is generated by interference fit between the three rolling bodies. The flexibility of the various members is effectively utilized as a loading spring.

FIG. 10 shows an additional arrangement having four rolling contacts per planet. Herein the ring **109** is divided into two halves **107** and **108** with the ring portion **107** keyed to portion [**109**] *108* for axial movement with respect thereto. A Belleville spring **110** seated upon a snap ring **111** provides proper normal loading of the rolling members. Sun **106** is prevented from rotation by a reaction shaft **112**. Carrier **105** is the input and ring **109** the power delivery member. This design does not depend upon dimensional interference fit for loading, but uses the separate, preferably flat rate spring **110**.

FIG. 11 shows a further contact arrangement wherein the ball planet **113** has two contacts with ring **114** and a single contact with sun **115**. The normal loading of the rolling bodies is again accomplished by interference fit using the elasticity of the rolling elements as a spring. Sun **115** is held against rotation by a reaction shaft **116**, carrier [**112**] *112'* is input, and ring **114** the output of the assembly.

In FIG. 12 there is only one contact between the ball planet **121** and sun **118** and one contact between the ball **121** and ring **120**. The geometry closely resembles a radial ball bearing. Here, again, the normal load in the contact is generated by dimensional interference of the rolling members. Sun **118** is held against rotation by reaction shaft **119**, carrier **117** is the input, and ring **120** the output of the unit.

It will *readily* be understood that the carriers of FIGS. 9 through 12 will be belt-driven and the rings connected to an alternator input shaft (not shown) as described in FIGS. 2 and 7.

Depending upon applications, each of the suggested arrangements has its own advantages. The fixed preload or interference preload arrangements are best suited for drive applications where the drive is required to operate at predominantly constant load. The spring preload arrangement having split sun or split ring is best suited where dimensional accuracy cannot be maintained, thus providing the required contact normal loads with relatively liberal manufacturing tolerance.

There has thus been provided a simple compact and inexpensive overdrive assembly particularly designed for driving an alternator of the type commonly used in automotive vehicles. The axial load required to transmit the peak torque of 36 inch pounds is relatively low, resulting in small loss of efficiency and long useful life. The drive provides a normal step-up of alternator speed which is quiet and vibration-free at all speeds due to the uninterrupted action of the rolling contacts and the continuous balance of all radial and axial force vectors between rolling bodies. In addition to displaying an absence of exciting forces, the traction drives behave dynamically as a staff viscous damper. This characteristic is of great benefit in applications containing objectionable natural vibration frequencies within their operating speed range, since the need for vibration dampeners is eliminated. The application is ideal for engine-driven alternators where quiet operation is essential and belt life is preserved by reducing the step-up provided by the belt and by supplying a portion of the step-up through the friction drive assembly.

What is claimed is:

1. Power transmitting mechanism comprising a non-rotatable housing, a hollow sleeve shaft fixed to said housing, a power input carrier, a bearing supporting said carrier on said sleeve shaft for rotation with respect to said shaft, a first sun carried by said shaft and fixed against movement with respect to said shaft, a second sun carried by said shaft and axially movable with respect thereto, means connecting said second sun to said sleeve shaft comprising a Belleville washer, said washer preventing rotation of said second sun and effective to bias said second sun axially toward said first sun, a ring spaced from said suns, said carrier extending into the space be-

tween said suns and ring, spaced surfaces on said carrier for receiving ball rollers, a torque transmitting ball disposed in the space between each of said spaced surfaces of said carrier and in nonslipping friction engagement with said ring and suns, a power delivery shaft extending through said hollow sleeve shaft, a bearing between said housing and power delivery shaft, *and* means connecting said ring to said power delivery shaft. [, said torque transmitting balls also providing a bearing support for said power delivery shaft.]

2. Power transmitting mechanism comprising a housing fixed against rotation, a hollow sleeve support shaft extending outwardly from said housing and fixed thereto, a power input planet carrier, a bearing rotatably supporting said carrier on said sleeve shaft, a first sun supported upon said sleeve shaft in fixed relationship with respect thereto, a second sun supported on said sleeve shaft and movable with respect thereto, a ring spaced from said suns, an extension on said carrier extending into the space between said ring and suns, a plurality of ball receiving pockets on said extension, a ball in each of said pockets, means for biasing said second sun axially with respect to said sleeve shaft to maintain said balls in nonslipping friction contact with said ring and suns comprising a Belleville washer, said washer having one portion thereof fixed to said sleeve shaft and a second portion fixed to said second sun for preventing rotation of said sun with respect to said sleeve shaft, a power delivery shaft extending through said sleeve shaft, and means connecting said power delivery shaft to said ring, said balls providing a support for rotatably supporting said power delivery shaft in said sleeve shaft.

3. Power transmitting mechanism comprising a housing fixed against rotation, a hollow sleeve support shaft fixed to said housing, a power input planet carrier, bearing means between said carrier and support shaft supporting said carrier for rotation with respect to said support shaft, a first sun supported on said support shaft and fixed against rotation with respect to said shaft, a second sun supported upon said support shaft and axially movable with respect thereto, a ring spaced from said suns, an extension on said carrier disposed in the space between said ring and suns, a series of spaced pockets formed on said extension, a ball roller disposed in each of said pockets and contacting said ring and said suns, an axially extending ear on said second sun, a notch on said support shaft, means for biasing said second sun axially toward said first sun to maintain said balls in nonslipping friction contact with said ring and said suns comprising a Belleville spring washer, a notch in said Belleville washer for receiving said ear, a tang on said washer extending into said support shaft notch, *a power delivery shaft,* and means connecting said power delivery shaft to said ring for rotation therewith, said balls providing a support for rotatably supporting said power delivery shaft in said support shaft.

4. An accessory drive for driving the accessories of an engine driven vehicle comprising a support housing, a support sleeve fixed to said housing, an engine driven planet carrier, a planet roller driven by said carrier, a reaction sun supported on said support sleeve, a bearing between said carrier and support sleeve, a ring, said planet roller being in friction contact with said sun and ring, a final power delivery shaft connected to drive an engine accessory and having one end extending into said support sleeve, and means for supporting said one end of said final power delivery shaft and for driving said power delivery shaft comprising a connection between said ring and power delivery shaft, said planet roller being effective to drive said ring and to support said ring and connection to thereby support said one end of said power delivery shaft.

5. In a power transmitting mechanism, a housing reaction member, a power input member, a power output member, planet carrier means rotatably mounted in said

housing member and connected to one of said members for transmitting torque, a plurality of equally spaced axial notches formed in said carrier having spaced parallel planar bearing surfaces facing each other, a pair of oppositely disposed bearing inserts in each of said notches and each bearing insert having a flat bearing surface in bearing contact with one of said planar bearing surfaces relative movement and a concave substantially spherical surface formed on the side opposite said flat bearing surfaces to provide two facing spherical surfaces in each notch, a planet ball mounted between the facing concave spherical surfaces of each of said pairs of bearing inserts and extending beyond opposed sides of said carrier, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls providing a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication, first ring means connected to another of said members for transmitting torque and in friction-drive contact with said ball, second ring means connected to a third of said members for transmitting torque and in friction-drive contact with said ball, and said first and second ring means axially and radially positioning said ball and including means to load said first and second ring means into torque-transmitting friction contact with said ball.

6. In a power transmitting mechanism, a housing reaction member, a power input member, a power output member, planet carrier means rotatably mounted in said housing member and connected to said power input member for transmitting torque, a plurality of equally spaced axial notches formed in said carrier having spaced parallel planar bearing surfaces facing each other, a pair of oppositely disposed bearing inserts in each of said notches and each bearing insert having a flat bearing surface in bearing contact with one of said planar bearing surfaces and a concave substantially spherical surface formed on the side opposite said flat bearing surfaces to provide two facing spherical surfaces in each notch, a planet ball mounted between the facing concave spherical surfaces of each of said pairs of bearing inserts and extending beyond opposed sides of said carrier, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls providing a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication, a first ring means connected to said housing reaction member for transmitting torque and in friction-drive contact with said ball, a second ring means connected to said power output member for transmitting torque and in friction-drive contact with said ball, said first and second ring means axially and radially positioning said ball and including means to load said first and second ring means into torque-transmitting friction contact with said ball.

7. In a power transmitting mechanism, a housing reaction member, a power input member, a power output member, planet carrier means rotatably mounted in said housing member and connected to said power input member for transmitting torque, a plurality of equally spaced axial notches formed in said carrier having spaced parallel planar bearing surfaces facing each other, a pair of oppositely disposed bearing inserts in each of said notches and each bearing insert having a flat bearing surface in bearing contact with one of said planar bearing surfaces and a concave substantially spherical surface formed on the side opposite said flat bearing surfaces to provide two facing spherical surfaces in each notch, a plant ball mounted between the facing concave spherical surfaces of each of said pairs of bearing inserts and extending beyond opposed sides of said carrier, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls pro-

viding a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication, split sun means connected to said housing reaction member and in friction-drive contact with said ball, ring means connected to said power output member and in friction-drive contact with said ball, said sun and ring means axially and radially positioning said ball and means to load said split sun means into torque-transmitting friction contact with said ball and said ball into torque-transmitting friction contact with said ring means.

8. A power transmitting mechanism for driving the accessories of an engine-driven vehicle, said mechanism comprising a housing, a reaction member secured to said housing, a power input member, a power output member, a planet carrier rotatably mounted in said housing and connected to one of said members for transmitting torque, a plurality of equally spaced radial passages having parallel side walls formed in said carrier, a sun member connected to a second of said members, a ring member mounted radially outwardly of said parallel side walls and connected to a third of said members, a pair of oppositely disposed bearing inserts secured by confinement between said parallel side walls of each radial passage, a concave spherical surface formed on each of said bearing inserts, a planet ball mounted between the concave spherical surfaces of each of said pairs of bearing inserts and in frictional contact with said sun and ring members, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls providing a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication.

9. A power transmitting mechanism comprising a housing, a reaction member secured to said housing, sun means axially slidably mounted on said reaction member, a power input member, a planet carrier rotatably mounted on said reaction member and driven by said input member, a plurality of equally spaced axial notches formed in said carrier, an output ring mounted radially outwardly of said notches, a pair of oppositely disposed bearing inserts secured by confinement within each of said notches, a concave spherical surface formed on each of said bearing inserts, a planet ball mounted between the concave spherical surfaces of each of said pairs of bearing inserts and contacting said sun means and said output ring, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls providing a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication.

10. A power transmitting mechanism comprising a housing, a reaction member secured to said housing, a sun member mounted on said reaction member, a power input member, bearing means mounted on said reaction member, a planet carrier rotatably mounted on said bearing means and driven by said input member, a power output member, a plurality of equally spaced axial notches formed in said carrier, a ring member mounted radially outwardly of said notches, said power output member being operatively connected to said ring member, a pair of oppositely disposed bearing inserts secured by confinement within each of said notches, a concave spherical surface formed on each of said bearing inserts, a planet ball mounted between the concave spherical surfaces of each of said pairs of bearing inserts, the concave spherical surface of each of said inserts having a larger radius than the radius of each of said planet balls providing a wedged opening between the ball and each of said concave spherical surfaces whereby lubricant in said wedged openings tends to lift said planet balls for full hydrodynamic spherical bearing lubrication.

References Cited

The following references, cited by the Examiner, are of record in the patented file of this patent or the original patent.

UNITED STATES PATENTS

1,399,442	12/1921	Rennerfelt	74—798
1,574,803	3/1926	Erban	74—798
1,585,140	5/1926	Erban	74—208 X
1,691,625	11/1928	Chilton	74—796
1,859,502	5/1932	Erban	74—208 X
1,915,287	6/1933	Bott	308—187
2,953,039	9/1960	McRae	74—798 X
2,977,161	3/1961	Cobb	308—187
3,021,730	2/1962	Banker	74—798
3,204,476	9/1965	Rouverol	74—198
2,828,907	4/1958	Oehrli	74—796
2,874,592	2/1959	Oehrli	74—796
2,905,026	9/1959	Oehrli	74—796
2,913,932	11/1959	Oehrli	74—796

FOREIGN PATENTS

313,969	6/1930	Great Britain.

MARK NEWMAN, Primary Examiner

T. C. PERRY, Assistant Examiner

U.S. Cl. X.R.

74—198, 208; 308—187

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. **RE. 26,978** Dated **November 17, 1970**

Inventor(s) **Lubomyr O. Hewko**

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 54,

"or" should read "on"

Column 8, line 8,

"relative movement" should be deleted.

Signed and sealed this 21st day of December 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents