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CENTRIFUGAL CLUTCH

Filed Nov. 1, 1960

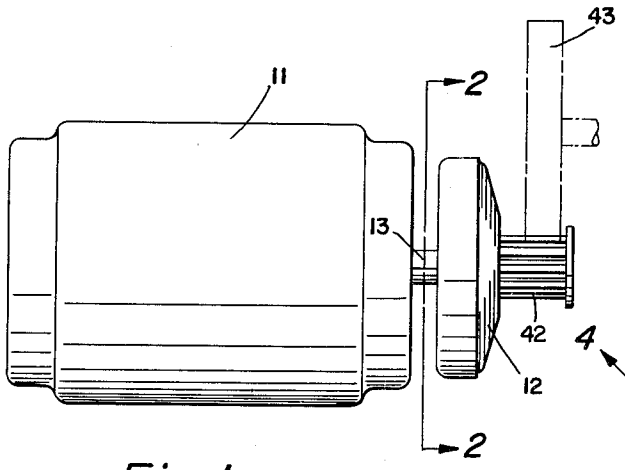

Fig. 1

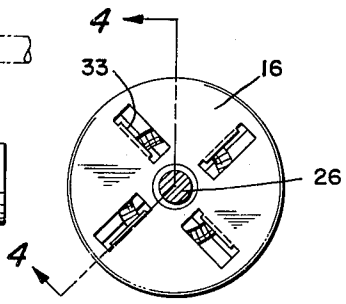

Fig. 2

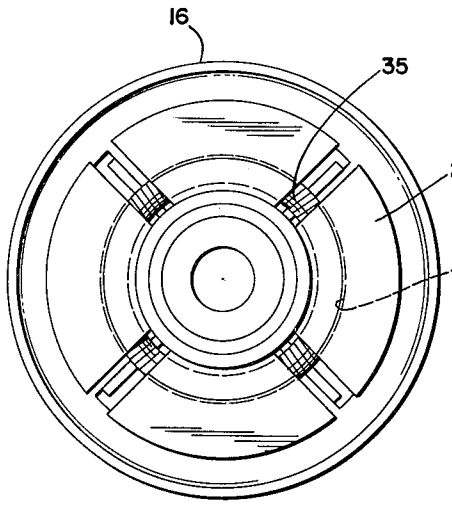

Fig. 3

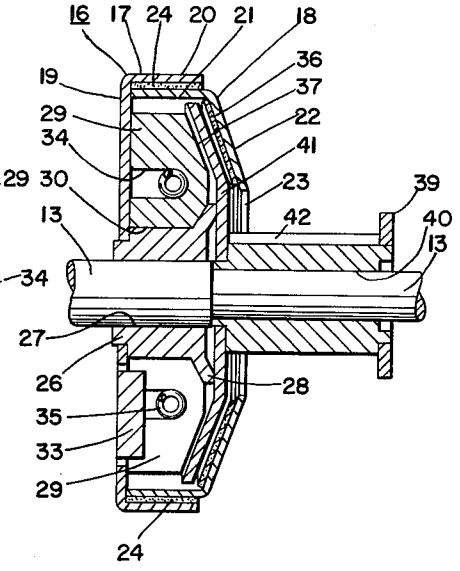

Fig. 4

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CENTRIFUGAL CLUTCH

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The invention relates in general to a centrifugal clutch and more particularly to a combined electric motor and clutch assembly.

The invention may be used with small electric induction motors, for example, which have limited torque outputs and yet are intended to drive a load having fluctuating torque requirements which on rare occasions may exceed the starting torque capabilities of the motor yet which most of the time have a torque requirement well within the starting torque of the motor. It is well known that the typical electrical induction motor has a lower starting torque than average running torque and thus an induction motor can drive a larger load than it will start.

Accordingly an object of the invention is to provide a combined induction motor and centrifugal clutch which combination will start a load which exceeds the starting torque capabilities of the motor alone.

Another object of the invention is to provide a simple and reliable centrifugal clutch.

Another object of the invention is to provide a centrifugal clutch with plural weight members urged into disengagement by a single spring.

Still another object of the invention is to provide a compact coaxial centrifugal clutch for attachment to an input shaft.

Another object of the invention is to provide a rugged centrifugal clutch which may easily be dynamically balanced yet which may be fabricated from steel stampings and cast metal parts with a minimum of machining.

Another object of the invention is to provide a centrifugal clutch wherein an output member is frictionally engaged on both sides to eliminate any deflection in the output member and thus this assures a definite point of engagement of the clutch.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is an elevational view of a combined motor and clutch combination embodying the invention;

FIGURE 2 is a sectional view on line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged front view of the clutch with the output member removed for clarity; and

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 2.

The figures of the drawing show the invention as embodied in the combination of a motor 11 and a centrifugal clutch 12. The motor 11 may be a fractional or subfractional horsepower electrical induction motor. The motor 11 has an output shaft 13. The centrifugal clutch 12 includes generally a housing 16 made in first and second parts 17 and 18. The housing first part 17 has a planar wall 19 and an outer annular axially parallel wall 20. The housing second part 18 has an outer annular wall 21 and a beveled wall 22 with an enlarged opening 23 therein. Adhesive 24 is an example of means to fasten together the housing parts 17 and 18 to make the composite housing 16.

An input hub 26 is coaxially fixed in the planar wall 19 of the housing 16. The hub 26 has an internal bore 27 fixed on the output shaft 13 of the motor 11. Accordingly the motor output shaft 13 becomes the input shaft of the clutch 12. An outer head 28 is provided on the hub 26 spaced from the planar wall 19. Four arcuate weight members 29 are disposed within the housing 16 between the planar wall 19 and the head 28 of the hub 26. Each weight member has an arcuate inner surface 30 riding on the hub 26. Each weight member is about 85° in arcuate extent. The housing 16 may be made of stamped or drawn sheet metal members and four integral radial tabs 33 are bent inwardly from the metal of the planar wall 19. These tabs extend radially between adjacent weight members and are generally at right angles to the planar wall 19 to prevent rotation of the weight members relative to the housing 16.

Each weight member 29 has an arcuate groove 34 therein which extends generally axially inwardly from the surface of each weight member adjacent the planar wall 19. A single coil-tension garter spring 35 is disposed in the grooves 34 and urges each of the weight members generally radially toward engagement with the hub 26. An annular friction washer 36 is fixed on the inner surface of the beveled wall 22 and the exposed surface thereof provides friction means on the inner surface of this beveled wall. Each weight member 29 has an arcuate beveled surface 37 disposed generally parallel to and spaced from the friction washer 36.

The clutch 12 has an output member 39 with an internal bore 40 journaled on the motor output shaft 13 for rotating and axially sliding movements. A beveled output disc 41 is fixed on the clutch output member 39 and is disposed between the beveled surfaces 37 of the weight members 29 and the friction washer 36. The clutch output member 39 may also include an output pinion 42 fixed as a part thereof as one example of a means to establish an output power train to an output gear 43, as shown in FIGURE 1. The output pinion 42 extends axially outwardly through the enlarged opening 23 in the beveled wall 22. As shown, the output member 39 includes the output disc 41 and the output pinion 42 fixed together. This assembly is journalled on the motor output shaft 13, and torque transmission from the motor to the output member is effected when weight members 29 move outwardly to frictionally engage the output disc 41 to rotate same.

Operation

The figures of the drawing, and especially the sectional view of FIGURE 4 show the clutch 12 in its stationary position. In this position the single spring 35 urges the weight members 29 into engagement with the hub 26. When the motor is energized and accelerates, a point in the acceleration curve will be reached when the centrifugal force of the weight members 29 exceeds the inward urging force of the spring 35 and accordingly the weight members 29 will move generally radially outwardly. In so doing, the arcuate beveled surfaces 37 will coact with the beveled output disc 41, and output pinion 42 fixed thereto is also moved axially, to axially moved disc 41 into engagement with the friction washer 36. Thus, the beveled output disc 41 will be axially pinched between the beveled surfaces 37 and the friction washer 36. Primarily because of the friction surface of the friction washer 36, the beveled output disc 41 will be brought up to the rotational speed of the housing 16. This has been found to be a smooth frictional engagement occurring at a definite rotational speed for smooth and positive drive of the output member 39. When the motor decelerates below a predetermined rotational speed the force of the spring 35 will overcome centrifugal force to release the frictional drive engagement of the clutch 12.

It will be noted that the principal component parts of the clutch 12 may be made from simple sheet metal stampings. The hub 26 may be formed from a generally hollow rivet headed on the two axial ends. The weight

members **29** are so designed as to be made by a casting process, such as cast steel, with use of only a two-part die or mold, inasmuch as the groove **34** extends axially. The use of four weight members **29** is only illustrative and any plurality may be used which are substantially symmetrically spaced. The integral metal tabs **33** are easily fabricated from the metal of the housing wall **19** and serve the purpose of insuring non-rotative connection of the weight members **29** relative to the housing **16**. The use of the plural weight members **29** in this particular configuration shown eliminates need for any expensive pivotal connection of the weight members to the housing **16** and also permits use of only a single spring to coact with all of the weight members. Further the use of the symmetrically spaced weight members **29** permits the entire clutch to be constructed for good dynamic balancing.

The complete motor and clutch combination provides a compact, simple and reliable package unit which will start a load exceeding the starting torque capabilities of the motor alone. The fact that the output disc **41** is frictionally engaged or pinched from both sides eliminates any deflection in this output disc which might occur if it were frictionally engaged from only one face. This establishes a definite operating point at which drive engagement takes place to provide a clutch with constant operating characteristics throughout a long life.

The beveled surface **37** on the weight members **29** coacts with the output disc **41**, during outward movement of the weight members, to cause axial movement, without bending of the output disc, and thus this movement engages the clutch. This engagement is at the contact between the output disc and the friction washer **36**, and also at the contact between the output disc and the weight members, inasmuch as the weight members are driven in rotation by the tabs **33** on the housing.

The clutch engaging action also may be considered to be caused by the coaction between the outer edge of the weight members and the beveled surface on the output disc **41**. In both modes of coaction, the axial thrust on the output disc **41** is resisted by first and second walls on the input member or housing **16**. The planar wall **19** is the first wall and the beveled friction wall **22** is the second wall. Also it will be noted that these first and second walls which resist this axial thrust are on one of the input and output members of the clutch **12**, so that there is no bending force placed on the output disc **41**. The force applied to the output disc is one which is equally balanced on both faces or axial sides of the output disc, which may be termed an axial pinching of this output disc. This assures engagement of the clutch at a predetermined speed throughout life of the clutch.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A centrifugal clutch comprising, in combination, an input housing having a planar wall and a friction wall axially spaced therefrom and relatively axially fixed thereto, a hub coaxially in said housing, input means to rotate said housing, an outer head on said hub spaced from said planar wall, a plurality of weight members substantially symmetrically disposed within said housing between said head of said hub and said planar wall, tab means fixed inside said housing between said weight members to provide rotation thereof with said housing, a surface defining an arcuate groove in each of said weight members with said groove extending generally axially from the surface of each weight member adjacent said planar wall, an annular tension spring disposed in said grooves urging said weight members inwardly toward said hub, a portion of one of said housing walls being beveled toward the other of said walls in a radially outward direction, an output member of said clutch coaxially journaled and axially movable relative to said input housing, and an output disc fixed as a part of said output member and disposed between said housing friction wall and said weight members, whereby when said housing reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force and coact with said beveled housing wall portion to axially move said output disc into engagement with said housing friction wall to thus frictionally drive said output member at the speed of rotation of said housing.

2. A centrifugal clutch comprising, in combination, an input housing having a planar wall and a friction wall axially spaced therefrom and relatively axially fixed thereto, a hub coaxially in said housing, input means to rotate said housing, an outer head on said hub spaced from said planar wall, a plurality of weight members substantially symmetrically disposed within said housing between said head of said hub and said planar wall, radial tab means fixed inside said housing between said weight members to provide rotation thereof with said housing, a surface defining an arcuate groove in each of said weight members with said groove extending generally axially from the surface of each weight member adjacent said planar wall, an annular tension spring disposed in said grooves urging said weight members inwardly toward said hub, an arcuate beveled surface near the outer edge of each of said weight members, an output member of said clutch coaxially journaled and axially movable relative to said input housing, and an output disc having a beveled surface generally parallel and overlying to the beveled surfaces on said weight members and fixed as a part of said output member and disposed between said housing friction wall and said beveled surfaces on said weight members, whereby when said housing reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said output disc axially into engagement with said housing friction wall to thus frictionally drive said output member at the speed of rotation of said housing.

3. A centrifugal clutch comprising, in combination, a housing having a planar wall and an annular beveled wall axially spaced therefrom and relatively axially fixed thereto, a hub coaxially in said housing, input means to rotate said housing, an outer head on said hub spaced from said planar wall, a plurality of weight members substantially symmetrically disposed within said housing between said head of said hub and said planar wall, tab means integral with said planar wall and extending inside said housing between said weight members to provide rotation thereof with said housing, a surface defining an arcuate groove in each of said weight members with said groove extending generally axially from the surface of each weight member adjacent said planar wall, an annular tension spring disposed in said grooves urging said weight members inwardly toward said hub, an arcuate beveled surface on each of said weight members disposed generally parallel to said beveled wall of said housing, an output member of said clutch coaxially journaled and axially movable relative to said input housing, and a beveled output disc fixed as a part of said output member and disposed between said housing beveled wall and said beveled surfaces on said weight members and overlying said beveled surfaces on said weight members, whereby when said housing reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially into engagement with said housing beveled wall to thus frictionally drive said output member at the speed of rotation of said housing.

4. A centrifugal clutch comprising, in combination, a housing having a planar wall and an annular beveled wall

axially spaced therefrom, an input hub fastened in said planar wall coaxially with said housing, an outer head on said hub spaced from said planar wall, a plurality of arcuate weight members substantially symmetrically disposed within said housing and held against axially outward movement by said head of said hub, tab means integral with said planar wall and extending inside said housing between said weight members to prevent rotation thereof relative to said housing, a surface defining an arcuate groove in each of said weight members with said groove extending generally axially from the surface of each weight member adjacent said planar wall, a single coil-tension garter spring disposed in the grooves of said weight members urging said weight members generally radially toward engagement with said hub, friction means on the inner surface of said beveled wall of said housing, an arcuate beveled surface on each of said weight members disposed generally parallel to said friction means, an output member of said clutch coaxially disposed and journaled relative to said hub, and a beveled output disc fixed as a part of said output member and disposed between said friction means and said beveled surfaces on said weight members, whereby when said input hub reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially outwardly into engagement with said friction means to thus frictionally drive said beveled output disc at the speed of rotation of said input hub.

5. A centrifugal clutch comprising, in combination, a housing having a planar wall, an outer axial wall and an annular beveled wall, an input hub fastened in said planar wall coaxially with said housing, an enlarged opening in said beveled wall with said beveled wall remotely spaced from said planar wall, an outer head on said hub spaced from said planar wall, a plurality of arcuate weight members substantially symmetrically disposed within said housing and held against axially outward movement by said head of said hub, integral radial tabs bent at right angles from said planar wall and extending inside said housing between said weight members to prevent rotation thereof relative to said housing, a surface defining an arcuate groove in each of said weight members with said groove extending axially from the surface of each weight member adjacent said planar wall, a single coil-tension garter spring disposed in the grooves of said weight members urging said weight members generally radially toward engagement with said hub, friction means on the inner surface of said beveled wall of said housing, an arcuate beveled surface on each of said weight members disposed generally parallel to said friction means, an output member of said clutch coaxially disposed and journaled relative to said hub and extending axially outwardly through said enlarged opening in said housing, and a beveled output disc fixed as a part of said output member and disposed between said friction means and said beveled surfaces on said weight members, whereby when said input hub reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially outwardly into engagement with said friction means to thus frictionally drive said beveled output disc at the speed of rotation of said input hub.

6. A centrifugal clutch comprising, in combination, a housing having a planar wall, an outer axial wall and an annular beveled wall, a hub fastened in said planar wall coaxially with said housing, said hub having an internal bore secured on a clutch input shaft, an enlarged opening in said beveled wall with said beveled wall remotely spaced from said planar wall, an outer head on said hub spaced from said planar wall, four weight members each approximately 85° in arcuate extent disposed within said housing and held against axially outward movement by said head of said hub, four integral radial tabs bent at right angles from said planar wall and extending inside said housing

between said weight members to prevent rotation thereof relative to said housing, a surface defining an arcuate groove in each of said weight members with said grooves extending axially from the surface of each weight member adjacent said planar wall, a single coil-tension garter spring disposed in the four grooves of said weight members urging said weight members generally radially into engagement with said hub, friction means on the inner surface of said beveled wall of said housing, an arcuate beveled surface on each of said weight members disposed generally parallel to said friction means, an output member of said clutch coaxially disposed and journaled on said input shaft and extending axially outwardly through said enlarged opening in said housing, and a beveled output disc fixed as a part of said output member and disposed between said friction means and said beveled surfaces on said weight members, whereby when said input shaft reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially outwardly into engagement with said friction means to thus frictionally drive said beveled output disc at the speed of rotation of said input shaft.

7. A centrifugal clutch comprising in combination, a first cup-shaped housing with a planar wall and an outer annular wall, a hub securely fastened in said planar wall coaxially with said housing, said hub having an internal bore secured on a clutch input shaft, a second cup-shaped housing having an outer annular surface secured to the first annular surface of said first housing and having a beveled wall remotely spaced from said planar wall, an enlarged opening in said beveled wall, an outer head on said hub spaced from said planar wall, four weight members each approximately 85° in arcuate extent disposed within said first housing and held against axially outward movement by said head of said hub, four integral radial tabs bent at right angles from said planar wall and extending inside said first housing between said weight members to prevent rotation thereof relative to said first housing, a surface in each of said weight members defining an arcuate groove near said hub with said groove extending axially from the surface of each weight member adjacent said planar wall, a single coil-tension garter spring disposed in the four grooves of said weight members urging said weight members generally radially into engagement with said hub, an annular friction washer fixed on the inner surface of said beveled wall of said second housing, an arcuate beveled surface on each of said weight members disposed generally parallel to said friction washer, an output member of said clutch coaxially disposed and journaled on said input shaft, a beveled output disc fixed as a part of said output member and disposed between said friction washer and said beveled surfaces on said weight members, and an output pinion coaxially fixed on said output member and extending axially outwardly through said enlarged opening in said second housing, whereby when said input shaft reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially outwardly into engagement with said friction washer to thus frictionally drive said beveled output disc at the speed of rotation of said first and second housings.

8. A combined motor and clutch assembly comprising, in combination, an electric induction motor having an output shaft, a centrifugal clutch having a first cup-shaped housing with a planar wall and a first annular generally axially parallel outer surface, a hub securely fastened in said planar wall coaxially with said housing, said hub having an internal bore secured on said motor output shaft, a second cup-shaped housing having an outer annular surface secured to the first annular surface of said first housing and having a beveled wall remotely spaced from said planar wall, an enlarged opening in said beveled wall, an outer head on said hub spaced from said planar wall, four

weight members each approximately 85° in arcuate extent disposed within said first housing and held against axially outward movement by said head of said hub, four integral radial tabs bent at right angles from said planar wall and extending inside said first housing between said weight members to prevent rotation thereof relative to said first housing, a surface in each of said weight members defining an arcuate groove near said hub with said groove extending axially from the surface of each weight member adjacent said planar wall, a single coil tension garter spring disposed in the four grooves of the weight members urging said weight members generally radially into engagement with said hub, an annular friction washer fixed on the inner surface of said beveled wall of said second housing, an arcuate beveled surface on each of said weight members disposed generally parallel to said friction washer, an output member of said clutch coaxially disposed and journaled on said motor output shaft, a beveled output disc fixed as a part of said output member and disposed between said friction washer and said beveled surfaces on said weight members, and an output pinion coaxially fixed on said output member and extending axially outwardly through said enlarged opening in said second housing, whereby when said motor output shaft reaches a predetermined speed in acceleration said weight members move generally radially outwardly under centrifugal force to urge said beveled output disc axially outwardly into engagement with said friction washer to thus frictionally drive said beveled output disc at the speed of rotation of said first and second housings.

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