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Engine/transmission drive connection

Motor-Getriebe-Antriebsverbindung

Liaison d'entraînement moteur-transmission

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Description

The present invention relates to a drive connection between an engine output member and a transmission input member as disclosed e.g. in document GB-A-1 123 093.

A drive connection between an engine and torque converter incorporates a flex plate to accommodate misalignment between the centreline of the engine and the transmission as well as movement due to hydraulic forces in the torque converter. The flex plate is typically connected by threaded fasteners to both the engine crankshaft and lugs welded to the torque converter input shell. It is customary to employ threaded fasteners connected to both the engine flywheel and a flange on the torque converter. In either event, the flex plate is bolted to one member prior to joining the engine and transmission. To assemble the units, they are aligned and a nose on the torque converter is slid into a bushing, or pilot, in the engine crankshaft. The other connection is then made by inserting a bolt through an access aperture and threading it to an opening in the proper unit. The engine and transmission must then be rotated on their respective axes until another threaded opening is presented to the access aperture so another bolt may be threaded in position. This process is continued until twelve or more bolts are installed and properly tightened. This is a time consuming process. Moreover, the process is subject to errors in that a bolt can be omitted, not completely tightened or cross threaded. In fact, this assembly process may require the need for two employees on a paced assembly line. The disadvantages are compounded every time it is necessary to disassemble the connection for repairs or inspections.

An alternative is to provide a slide-together assembly in the form of a spline or toothed connection. With slide-together interfaces, the engine flywheel and a flange on the torque converter are mated at assembly. The drive interface is maintained by the securement between the housings. However, due to the amount of movement caused by misalignment and/or hydraulic forces in the torque converter, a dry spline or toothed connection does not meet the durability requirements for commercial, on-highway vehicles. Thus, this type connection tends to require lubrication. As a result, these drive interfaces have been limited to off-highway and track-laying types of vehicles where continual maintenance is employed.

It is, therefore, an object of the present invention to provide an improved drive connection between an engine and transmission.

To this end, a drive connection in accordance with the present invention is characterised by the features specified in the characterising portion of Claim 1.

The present invention provides an improved drive connection interface between an engine and transmission, as above, wherein the installation time is maintained at a minimum; wherein a slide together assembly is provided; wherein a flex plate is secured to one drive transmitting member and frictionally mated with another drive transmitting member by the tightening of a single threaded member; and wherein the flex plate has a rim portion and clamp assembly frictionally engaging an axial wall at the interface.

In general, a drive connection interface embodying the concepts of the present invention overcomes the disadvantages of the prior art by utilising an operative slide-together concept which does not employ the historically unacceptable spline connections. The drive interface presented herein is a flex plate provided with an axially extending annular rim that is disposed circumferentially an annular wall on either an engine flywheel or a flange secured to the torque converter. A band clamp is disposed circumferentially the rim of the flex plate. The band clamp incorporates a single threaded fastener which, when tightened, is effective to reduce the diameter of a band portion of the band clamp such that a normal force is applied to the interface between the rim of the flex plate and the annular wall on the drive member other than that to which the flex plate is secured. This band clamp connection establishes a friction force which is sufficient to prevent the flex plate from rotating relative to the annular wall.

The flex plate is connected in a conventional bolt-together fashion to a flange on the other drive member. The flex plate is bolted to the flange at a location where the flange is easily accessible. For example, the flex plate may be bolted to the engine crankshaft prior to the installation of the transmission, while the end of the crankshaft is accessible. At assembly between the engine and transmission, the shafts are aligned, the nose is positioned in the bushing and the rim, with the band clamp loosely in place, is slid onto the annular wall. The clamp fastener is accessed through an opening and tightened to complete the drive connection.

The band clamp is trapped on the rim of the flex plate which is preferably stamped from sheet metal and has radial, and axial, slots at the outer periphery that permit the rim to compress about, or otherwise accommodate to, the outer surface of the wall. During the formation of the slots in the outer rim, an outward lip is formed, and a plurality of raised fingers are formed on opposite sides of the rim. The lip and fingers cooperate to trap the band clamp on the rim prior to, and during, assembly of the engine and transmission.

The band clamp is preferably a simple strap of metal with a threaded device connected therewith to draw the ends of the band toward each other as it is tightened on the rim. Prior to assembly the band clamp inner surface is preferably coated with a solid lubricant to effect a uniform stress field and clamp load around its circumference.

At assembly, the flex plate and clamp assembly is bolted at the inner diameter to either the torque converter or an engine crankshaft adapter. The annular wall is provided on the other of the engine or torque converter
in the form of a flywheel or an adapter ring respectively. As the engine and transmission are pushed together, the flex plate and clamp assembly slip over the annular wall. The transmission and engine housings are bolted together at their flanged, external split-line and the clamp is tightened by accessing the threaded device through an access aperture in one of the housings.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a side elevational view, partly in section, of an engine and transmission drive connection interface incorporating the concepts of the present invention;

Figure 2 is a frontal elevational view of a flex plate and band clamp assembly used with the present invention;

Figure 3 is a radially oriented sectional view taken substantially along line 3-3 of Figure 2;

Figure 4 is a view similar to Figure 3 depiction the outer rim of an alternative design of the flex plate;

Figure 5 is a view similar to Figure 2 depicting an alternative design of the threaded fastener;

Figure 6 is a view taken substantially along line 6-6 of Figure 5; and,

Figure 7 is a view taken substantially along line 7-7 of Figure 5.

Referring to the drawings, wherein like characters represent the same or corresponding components, a conventional engine 10 is depicted as being drivingly connected to a conventional torque converter 11 by a flex plate 13. The torque converter 11 is a component in a conventional transmission 14 which as is well known is selectively operable to establish a plurality of ratios between the engine 10 and the drive axle of a vehicle, not shown. The engine 10 has a mounting wall 15 to which a transmission, or flywheel, housing 17 is connected at the split-line 18. The torque converter 11 has a mounting, or guide, nose 20 which is disposed in a bushing, or pilot, 21 secured in a flange, or adaptor, 23 on the crankshaft of the engine 10.

Also connected to the flange 23 is a flywheel 24 which incorporates a radially extending, annular wall 25, the outer periphery of which terminates in a starter ring gear 27. An annular, adapter plate 28 is secured to the annular wall 25, as by a plurality of fasteners 30. The adapter plate 28 presents an axially extending, annular wall 31. A rim 33 on the flex plate 13 is disposed in substantially continuous annular contact with the annular wall 31.

The flex plate 13 is substantially annular and presents a mounting annulus 34 near the inner periphery 35 of the flex plate 13. The mounting annulus 34 has a plurality of equiangularly spaced openings 37 which accommodate threaded fasteners 38 for securement of the flex plate 13 to a flange 40 on an input shell 41 of the torque converter 11. The nose 20 and the bushing, or pilot, 21 cooperate to align the centreline 43 of the crankshaft of the engine 10 with the centreline 44 of the torque converter 11 perpendicular to the plane of the split-line 18. In a majority of the engine-transmission assemblies, the mounting faces of these components will be perpendicular with the centrelines 43 and 44 such that the engine 10 and transmission 11 will be coaxially disposed. However, in some instances, one or both of the mounting faces at the split-line 18 will be slightly out of perfect alignment as a result of machining tolerances. This modest misalignment will cause a slight angularity between the centrelines 43 of the engine crankshaft and the centreline 44 of the input shell 41 that could result in a slight wobble of the input shell 41 were this misalignment permitted to continue. Prior art connections would result in significant wear at the bearings supporting the torque converter 11 in the transmission housing 17.

The rim 33 of the flex plate 13 is maintained in frictional contact with the annular wall 31 by a band clamp 45 that encircles the rim 33. The band clamp 45 has a threaded fastener assembly 47 which is tightened after assembly of the transmission 14 to the engine 10. As best seen in Figure 2, the fastener assembly 47 has head portions 48 and 50 secured to respective ends 51 and 53 of a flexible band portion 54. A threaded fastener 55 is inserted through an opening 57 in the head portion 48 and threaded into the head portion 50. By tightening the fastener 55 in the head portion 50, the ends 51 and 53 of the flexible band portion 54 are drawn toward each other to compress the band portion 54 onto the rim 33. The force thus exerted on the rim 33 creates a frictional engagement between the rim 33 and the annular wall 31. This engagement will provide for the transmission of torque between the engine 10 and the torque converter 11 without slippage therebetwehen.

The flex plate 13 is preferably formed from flat plate 60 of sheet metal, as shown in phantom line in Figure 3, by a stamping operation. During the stamping operation, the outer portion 58 of the flat plate 60 is provided with radial slots 61. These slots 61 accommodate the compression of the rim 33 on the annular wall 31. Also during the stamping operation, a lip 63 is formed at the outer edge of the rim 33 on segments 64 defined between adjacent slots 61, and a plurality of fingers, or tabs, 65 are also formed on the rim 33 in opposition to the lip 63. In the configuration of the flex plate 13 depicted in Figure 3, the distal edge of the fingers 65 are separated from the main body of the flex plate 13. To the contrary, in the configuration of the embodiment depicted in Figure 4, the tabs 65 are formed by the displacement of metal without separation from the main body of the flex plate 33.

The lip 63 and fingers 65 will limit the axial movement of the flexible band portion 54 on the rim 33 received therebetwehen in order to ensure against dis-
placement of the flexible band portion from the rim during assembly of the rim 33 onto the annular wall 31. During assembly of the transmission 14 to the engine 10, an access cover 67 is removable from the transmission housing 17 to permit access to the fastener 55. The rim 33 is preferably coated with a solid lubricant and is sufficiently expanded at assembly to allow installation thereof over the annular wall 31. The lubricant will reduce the resistance to installation and will provide a uniform stress field between individual segments 64 to ensure a uniform clamping load. The nose 20 and bushing, or pilot, 21 will establish the alignment of the components. When the transmission 14 has been fully installed with the rim 33 surrounding the annular wall 31, the fastener 55 is tightened into the head portion 50 drawing the rim 33 tight onto the annular wall 31 to ensure the integrity of the assembly.

An alternate construction of the fastener assembly 47A is shown in Figures 5 through 7. The fastener assembly 47A has a pair of head members 68 and 70 secured by welding, to the respective ends 51 and 53 of the flexible band portion 54. Each head member 68 and 70 have respective bifurcated loop portions 71 and 73 in which are disposed respective pins 74 and 75. The pin 75 has a longitudinally extending threaded portion 77 which passes through a sleeve portion 78 formed on the pin 74. The threaded portion 77 is engaged by a locking type nut 80 that will ensure against loosening during operation of the engine 10.

The fastener assemblies 47 and 47A do not draw the ends 51 and 53 of the flexible band portion 54 into abutment such that the assembler will be aware of the tightening torque being applied to the fastener assembly 47 and 47A. Accordingly, an automatic torque wrench is suggested for use in effecting assembly of a drive connection embodying the concepts of the present invention.

The fastener assembly 47 or 47A can create an unbalance in the drive interface. To accommodate this unbalance, an equivalent mass, or balance weight, 81 is secured to the flexible band portion 54 diametrically opposite the assembly 47 or 47A. Thus, during rotation of the flywheel 24, the assembly will remain in dynamic balance. Other means of balancing are possible.

The flex plate 13 may also be secured at the inner periphery to the engine crankshaft flange 23 and at the outer periphery to the input shell 41. With this installation, the annular wall 31 is presented from the input shell 41. The annular wall 31 can be welded to the input shell 41 prior to assembly of the torque converter 11 or can be integrally formed on the input shell 41 during the manufacturing of the input shell 41.

As should now be apparent, the present invention not only teaches that a drive connection between an engine and a torque converter embodying the concepts of the present invention requires only one threaded member but also that the other objects of the invention can likewise be accomplished.

Claims

1. A drive connection between an engine output member and a transmission input member (41), the drive connection comprising a flex plate (13) having an inner hub portion (34) secured for rotation with one of the engine output member or the transmission input member, characterised by an outer axially extending, annular rim (33) on the flex plate; by an annular drive wall (31) disposed on the other of the engine output member or the transmission input member disposed radially inwardly of and circumferentially abutting the rim; and by clamp means (45) having an annular band portion (54) disposed circumjacent the rim, and tightening means (47, 47A) for tightening the annular band portion about the rim for frictionally securing the rim with the annular drive wall.

2. A drive connection as claimed in claim 1, wherein the rim (33) has axially spaced lip (63) and finger (65) portions to position the annular band portion (54) axially on the rim.

3. A drive connection as claimed in claim 1 or claim 2, wherein the annular band portion (54) has spaced open ends (51, 53); and the tightening means (47A) has a threaded member (50) operatively connected with one of the open ends, a receptacle (48) operatively connected with the other of the open ends, and means (55) threadably engaging the threaded member and co-operating with the receptacle for drawing the open ends toward each other.

4. A drive connection as claimed in any one of claims 1 to 3, wherein the flex plate (13) includes an outer portion (58) defined by a plurality of segments (64) presenting radially oriented slots (61) at the annular rim (33) to permit radial contraction of the rim during tightening of the tightening means (47, 47A).

Patentansprüche

1. Eine Antriebsverbindung zwischen einem Motorausgangsglied und einem Getriebeeingangs- und -ausgangsglied (41), wobei die Antriebsverbindung eine Biegeplatte (13) mit einem inneren Nabenteil (34) umfaßt, das zur Drehung mit einem von dem Motorausgangsglied oder dem Getriebeeingangs- und -ausgangsglied gesichert ist, gekennzeichnet durch einen äußeren, sich axial erstreckenden, ringförmigen Kranz (33) auf der Biegeplatte, durch eine ringförmige Antriebswelle (31), die auf dem anderen von dem Motorausgangsglied oder dem Getriebeeingangs- und -ausgangsglied radial innerhalb von und in Umfangsrichtung anstoßend an dem Kranz angeordnet ist; und durch Klemmenmittel
2. Eine Antriebsverbindung wie in Anspruch 1 beansprucht, worin der Kranz (33) axial befestigte Lippen (63) und Fingertaille (65) aufweist, um den ringförmigen Bandteil (54) axial auf dem Kranz zu positionieren.

3. Eine Antriebsverbindung wie in Anspruch 1 oder Anspruch 2 beansprucht, worin der ringförmige Bandteil (54) befestigte, offene Enden (51, 53) aufweist, und das Anzugsmittel (47A) ein Gewinde- glied (50), das betrieblich mit einem der offenen Enden verbunden ist, eine Aufnahme (48), die betrieb- lich mit dem anderen der offenen Enden verbunden ist, und Mittel (55) aufweist, die über ein Gewinde in das Gewindeäquivalent eingreifen und mit der Aufnahme zusammenwirken, um die offenen Enden aufeinander zu ziehen.

4. Eine Antriebsverbindung wie in einem der Ansprü- che 1 bis 3 beansprucht, worin die Biegeplatte (13) einen äußeren Teil (58) umfaßt, der durch eine Vielzahl von Segmenten (64) definiert ist, die radial orientierte Schlitze (61) an dem ringförmigen Kranz (33) aufweisen, um eine radiale Kontraktion des Kranzes während des Anziehens der Anzugsmittel (47, 47A) zu erlauben.

Revendications

1. Liaison d'entraînement entre un élément de sortie de moteur et un élément d'entrée d'une transmission (41), la liaison d'entraînement comprenant une plaque souple (13) ayant une partie de moyeu intérieure (34) fixée de manière à tourner avec un élément parmi l'élément de sortie de moteur ou l'élément d'entrée de la transmission ; caractérisée par un rebord en anneau (33) extérieur s'étendant axialement sur la plaque souple ; par une paroi d'entraînement en anneau (31) disposée sur l'autre élément parmi l'élément de sortie de moteur ou l'élément d'entrée de la transmission qui est disposé radialement vers l'intérieur du rebord et qui aboutit circonférentiellement le rebord ; et par un moyen de blocage (45) ayant une partie en anneau (54) disposée de manière adjacente autour du rebord, et des moyens de serrer de façon à fixer par friction le rebord à la paroi d'entraînement en anneau.