AUSTRALIA

CONVENTION 611708

Patents Act

APPLICATION FOR A STANDARD PATENT

~~I~~/We General Motors Corporation

of West Grand Boulevard and Cass Avenue,
Detroit,
Michigan,
UNITED STATES OF AMERICA.

hereby apply for the grant of a standard patent for an invention entitled:

DAMPING ASSEMBLY FOR A TORQUE CONVERTER AND CLUTCH ASSEMBLY

which is described in the accompanying complete specification.

Details of basic application

Number of basic application: 093,198

Convention country in which basic application was filed: UNITED STATES OF AMERICA

Date of basic application : 4 September 1987

Address for Service:

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Patent and Trade Mark Attorneys
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Dated: 17 August 1988

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
General Motors Corporation

By:

Our Ref : 104027
POF Code: 1221/1695

6012q/1

COMMONWEALTH OF AUSTRALIA

Patents Act

DECLARATION FOR A PATENT APPLICATION

INSTRUCTIONS
(a) Insert "Convention" if applicable
(c) Insert "of addition" if applicable

In support of the (a) Convention application made by GENERAL MOTORS CORPORATION (hereinafter called "the applicant") for a patent (c) for an invention entitled:-

DAMPING ASSEMBLY FOR A TORQUE CONVERTER AND CLUTCH ASSEMBLY

I, Michael John Denton, Chartered Patent Agent of Patent Section (F6), Vauxhall Motors Ltd, PO Box 3, Kimpton Road, LUTON, Beds, LU2 0SY, UK, do solemnly and sincerely declare as follows:-

1. I am authorized under a power of attorney from the applicant granted on 15 October 1984 to make this declaration on behalf of the applicant.

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

2.(f) Dennis Clinton Dull
26 Meadowlawn Drive
Arcanum
Ohio 45304
United States of America

is/~~are~~ the actual inventor(s) of the invention and the applicant is entitled to make the application by virtue of a service agreement(s) between the applicant and the inventor(s) as employee(s) and an assignment(s) from the inventor(s) to the applicant.

3. The basic application(s) for patent or similar protection on which the application is based is/~~are~~ identified by country, filing date and basic applicant(s) as follows:

United States of America
4 September 1987
Dennis Clinton Dull

4. The basic application(s) referred to in paragraph 3 hereof was/~~were~~ the first application(s) made in a Convention country in respect of the invention the subject of the application.

Declared at: Luton, United Kingdom

Dated: 10 August 1988

For and on behalf of
GENERAL MOTORS CORPORATION

Under Power of Attorney
M J Denton

(12) PATENT ABRIDGMENT (11) Document No. AU-B-21197/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 611708

(54) Title
DAMPING ASSEMBLY FOR A TORQUE CONVERTER AND CLUTCH ASSEMBLY

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(71) Applicant(s)

GENERAL MOTORS CORPORATION

(72) Inventor(s)

DENNIS CLINTON DULL

(74) Attorney or Agent
PHILLIPS ORMONDE & FITZPATRICK, 367 Collins Street, MELBOURNE VIC 3000

(57) Claim

1. A torque converter and clutch assembly comprising a clutch piston; a turbine; an impeller; control means for controlling the apply and release of the clutch piston for engaging the clutch piston with the impeller; a torque converter output shaft; a planetary gear arrangement including an input gear drivingly connected with the clutch piston, a reaction gear drivingly connected with the turbine, an output member drivingly connected with the torque converter output shaft, and pinion gears meshing with the input gear and the reaction gear for drivingly interconnecting the turbine and clutch piston at a drive ratio of the turbine to the clutch piston of less than 1:1; and one-way drive means disposed between the turbine and the torque converter output shaft for preventing the turbine from overrunning the torque converter output shaft.

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611708

COMPLETE SPECIFICATION
(ORIGINAL)

Class Int. Class

Application Number:
Lodged:

Complete Specification Lodged:
Accepted:
Published:

Priority

Related Art:

APPLICANT'S REFERENCE: MJD/LF/3078AUSTRALIA

Name(s) of Applicant(s):

General Motors Corporation

Address(es) of Applicant(s):

West Grand Boulevard and Cass Avenue,
Detroit,
Michigan,
UNITED STATES OF AMERICA.

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Complete Specification for the invention entitled:

DAMPING ASSEMBLY FOR A TORQUE CONVERTER AND CLUTCH ASSEMBLY

Our Ref : 104027
POF Code: 1221/1695

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

DAMPING ASSEMBLY FOR A TORQUE CONVERTER AND CLUTCH ASSEMBLY

This invention relates to torsional dampers and more particularly to torsional dampers for torque converter and clutch assemblies.

Clutch dampers which reduce torsional vibrations brought about by engine torque spikes are well known. Dampers for torque converter clutches have generally been spring-type dampers. In these dampers, springs are utilized to permit relative motion between the input and output members of the clutch. The energy stored in the springs is either returned to the output when the torque spike decreases or partially given up to a friction damper in parallel with the springs.

A viscous clutch in series with a friction clutch has also been used. The viscous clutch does not pass the torque spikes or torsional vibrations, similar to a fluid coupling, so that the operator does not feel the torsional vibrations downstream of the torque converter when the viscous clutch is engaged.

Another device for reducing the input torsional vibrations to a transmission is a slipping clutch. The slipping clutch is utilized in the same space as a fully engaged torque converter clutch. The slipping clutch is controlled by apply and release pressures so that complete engagement is not reached. Because of the slipping interface between the engine output and the clutch input, the torsional vibrations are not transmitted to the clutch member.

It is an object of this invention to provide an improved torque converter and clutch assembly having a planetary gear set disposed between the turbine, the clutch piston and the output shaft whereby torque spikes imposed on the clutch are dampened by the planetary gear set and the turbine.

To this end, a torque converter and clutch assembly in accordance with the present invention comprises a clutch piston; a turbine; an impeller; control means for controlling the apply and release of the clutch piston for engaging the clutch piston with the impeller; a torque converter output shaft; a planetary gear arrangement including an input gear drivingly connected with the clutch piston, a reaction gear drivingly connected with the turbine, an output member drivingly connected with the torque converter output shaft, and pinion gears meshing with the input gear and the reaction gear for drivingly interconnecting the turbine and the clutch piston at a drive ratio of the turbine to the clutch piston of less than 1:1; and one-way drive means disposed between the turbine and the torque converter output shaft for preventing the turbine from overrunning the torque converter output shaft.

The present invention seeks to provide dampening of the torsional vibrations at the clutch piston input by permitting the torque converter to absorb the vibrations. With this arrangement the clutch piston can be fully engaged so that no slippage at the clutch piston interface will occur. The torque converter turbine and the clutch piston are connected to separate members of a planetary gear arrangement which also has a member connected with a torque converter output shaft. The torque spikes or torsional vibrations are effectively absorbed by the torque converter.

The planetary gear arrangement has two input members which are connected to the clutch piston and torque converter turbine. These input members combine the power delivered by the engine and direct it through the planetary gear arrangement to the torque converter output shaft. When a torque spike is present at the clutch piston, the turbine effectively becomes a rotating reaction and will reduce in speed to absorb the instantaneous energy of the torque spike thereby preventing the torque spike from reaching the output shaft. Thus, no disturbance will be transmitted downstream of the clutch piston. The planetary gear arrangement can be sized to control the speed differential, during steady state, between the clutch piston and the turbine. Thus, the power transmitted is split between mechanical and hydraulic power paths.

The turbine and the output of the planetary gear arrangement are also coupled by a one-way clutch which prevents the turbine from overrunning the torque converter output shaft. When the clutch piston is disengaged, all the power is transmitted by the torque converter, through the one-way clutch to the torque converter output shaft. Generally the clutch piston is disengaged when the transmission is operating in the low forward ratio or in the reverse ratio.

The present invention also provides an improved turbine damped torque converter and clutch assembly wherein a planetary gear arrangement combines input power from a selectively engageable clutch piston and a turbine for delivery to an output member and also wherein a one-way clutch is drive connected between the turbine and the output member for delivering power to the output member when the clutch piston is disengaged and the turbine is attempting to rotate faster than the output member.

The present invention further provides an improved torque converter and clutch assembly wherein a planetary gear arrangement is disposed between the clutch piston, the turbine and the output member such that the turbine provides a reaction member for the engine torsional vibrations imposed on the clutch piston whereby turbine dampening occurs and the torsional vibrations are not transmitted downstream of the clutch piston to the output member.

The present invention still further provides an improved torque converter and clutch assembly wherein a planetary gear arrangement interconnects the clutch piston, turbine and torque converter output shaft such that the turbine is effective as a reaction element to absorb the energy of engine torsional vibrations imposed on the clutch piston and also wherein both the clutch piston and turbine deliver power to the torque converter output shaft and further wherein the planetary gear arrangement permits the turbine to rotate at a speed less than the clutch piston when both members are transmitting power to the output shaft.

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

Figure 1 is a cross-sectional elevational view of a torque converter and clutch assembly incorporating the present invention and a schematic representation of a control system; and

Figure 2 is a view taken along line 2-2 of Figure 1.

Referring to the drawings wherein like characters represent the same or corresponding parts throughout the views, there is seen in Figure 1 a torque converter and clutch assembly generally designated 10 which includes an input shell 12 welded to an impeller 14. The impeller 14 is in toroidal flow relation with a stator 16 and a turbine 18. The stator 16 is drivingly connected by way of a stator one-way brake 20 to a stator shaft 22 which is connected to a stationary portion of the transmission such as housing 24. The input shell 12 is drivingly connected to a shaft 25 by a spline connection 27. The shaft 25 is drivingly connected to a conventional hydraulic pump 26. Since the input shell 12 is continuously driven by the engine, the hydraulic pump 26 will be continuously driven by the engine. The hydraulic pump 26 is effective to draw fluid from a reservoir 28 and deliver the fluid to a control system 30.

A clutch piston 32 is disposed in an envelope or space 34 formed between the turbine 18 and the input shell 12. The turbine 18 and clutch piston 32 cooperate to form an apply chamber 36 while the input shell 12 and clutch piston 32 cooperate to form a release chamber 38. The control system 30 is effective to regulate fluid pressures and to distribute fluid under pressure to the apply chamber 36 and to the release chamber 38 depending upon the transmission operating condition and various vehicle parameters. This type of control system is well known and has been utilized in commercial vehicles for a number of years. The control system 30 can be a reverse flow control. When it is desirable to engage the clutch piston 32, a passage 40 is pressurized such that fluid under pressure is directed to the apply chamber 36. The fluid pressure in passage 40 passes through the torque converter and into the apply chamber 36 to enforce engagement of the clutch piston 32. When it is desirable to have the clutch piston 32 disengaged, a passage 42 is pressurized such that fluid under pressure is directed to the release chamber 38. Fluid in the release chamber 38 passes through the friction interface between the clutch piston 32 and the input shell 12 and into the torque converter and clutch assembly 10. The fluid is utilized by the torque converter and clutch assembly 10 to transmit power from the impeller 14 to the turbine 18 in a well known manner. The basic construction of these elements,and torque converters in general, is well known. It is not considered that a more complete description of these elements is necessary at this point.

The input shell 12 is driven from an engine crankshaft 44 which is a component of an internal combustion engine (not shown). The drive connection between the engine crankshaft 44 and input shell 12 is by way of a conventional flex plate 46 and a plurality of fasteners 48 which secure lugs 50 of input shell 12 to the flex plate 46. This input drive mechanism is a well known structure and has been utilized in many previous transmissions.

The clutch piston 32 has formed thereon a sun gear 52 near its inner periphery. The sun gear 52 meshes with a pinion gear 54 which is a portion of a stepped pinion gear 56. A larger diameter pinion gear 58, also a portion of the stepped pinion gear 56, meshes with a ring gear 60. The stepped pinion gear 56 is rotatably mounted on a carrier 62 by a plurality of pinion pins 64. The ring gear 60 is secured to or otherwise formed integral with a hub 66 which is secured to the inner diameter of the turbine 18. The carrier 62 is drivingly connected, through a spline connection at 68, to a torque converter output shaft 70 which is drivingly connected to a conventional transmission not shown. The sun gear 52, ring gear 60, stepped pinion gears 56 and carrier 62 cooperate to form a planetary gear arrangement generally designated 72 and best seen in Figure 2. Whenever the clutch piston 32 is engaged with the input shell 12, the sun gear 52 will rotate at the speed of the engine. The turbine 18 will attempt to rotate at some speed less than the impeller 14 because of the fluid and power transmission losses, that occur in a torque converter. Since the turbine 18 is drivingly connected with the ring gear 60, the ring gear must travel at the same speed as the turbine. By selecting the diameter ratios between the sun gear 52 and ring gear 60 and pinion gears 54 and 58, the steady state rotary speed of the turbine 18 can be controlled. For example, if the ring gear 60 has a diameter of five (5) units and the pinion gear 58 has a diameter of two (2) units, a 2% slip speed will occur if the sun gear 52 has a diameter of 2.13 units and the pinion gear 54 has a diameter of 0.87 units. Should it be desirable to have a larger percent slip, for example say 7%, this can be achieved by providing the sun gear 52 with the diameter of 2.1 units while the pinion gear 54 is given a diameter of 0.9 units.

Of course the exact diameters and slip ratio will be determined by the accepted gear design parameters and practice which are controlled and limited by the pitch diameter tooth size and other gear dimensions. These are selected to provide a properly sized planetary gear arrangement which will fit within the envelope given.

Assuming that the torque converter and clutch assembly 10 is operating at a steady state condition, that is the vehicle in which this torque converter is utilized is being driven on the road at a steady speed, the speed differential between the clutch piston 32 and turbine 18 is fixed. If a torsional vibration induced by engine roughness or a transient torque spike should be imposed upon the clutch piston 32, the clutch piston will try to accelerate. If acceleration of the clutch piston is permitted, the operator of course will feel the torsional vibration. To prevent the torsional vibration from being transmitted to the torque converter output shaft 70, the turbine 18 will reduce in speed thus providing a reaction member within the planetary gear arrangement 72. When the turbine 18 reduces in speed, the torque converter output shaft 70 will maintain a constant speed. Thus the torsional vibration is wholly absorbed within the torque converter and clutch assembly 10.

The hub 66 forms an outer race for a one-way clutch generally designated 74, which is comprised of a plurality of rollers 76 and the outer diameter of a portion of the carrier 62. The one-way clutch 74 is designed such that when the turbine 18 attempts to rotate faster than the torque converter output shaft 70, the one-way clutch 74 prevents such overrunning. Thus the turbine 18 can directly drive the torque converter output shaft 70. This occurs most often when the clutch piston 32 is disengaged. During vehicle operation with the clutch piston 32 disengaged, all of the power of the engine crankshaft 44 is directed to the impeller 14. The impeller 14, in a well known manner, directs power to the turbine 18 which in turn delivers power through the one-way clutch 74 to the torque converter output shafts 70 and hence to the transmission.

The claims defining the invention are as follows:-

1. A torque converter and clutch assembly comprising a clutch piston; a turbine; an impeller; control means for controlling the apply and release of the clutch piston for engaging the clutch piston with the impeller; a torque converter output shaft; a planetary gear arrangement including an input gear drivingly connected with the clutch piston, a reaction gear drivingly connected with the turbine, an output member drivingly connected with the torque converter output shaft, and pinion gears meshing with the input gear and the reaction gear for drivingly interconnecting the turbine and clutch piston at a drive ratio of the turbine to the clutch piston of less than 1:1; and one-way drive means disposed between the turbine and the torque converter output shaft for preventing the turbine from overrunning the torque converter output shaft.

2. A torque converter and clutch assembly as claimed in Claim 1, wherein the output member rotatably supports the pinion gears, and wherein the one-way drive means transmits power from the turbine to the torque converter output shaft when the clutch piston is released.

3. A torque converter and clutch assembly as claimed in Claim 1 or Claim 2, wherein the input gear and the reaction gear define a pair of input gears; and wherein the output member defines carrier means for rotatably supporting the pinion gears.

4. A torque converter and clutch assembly substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

DATED: 26 March 1991
PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
GENERAL MOTORS CORPORATION

David B Fitzpatrick

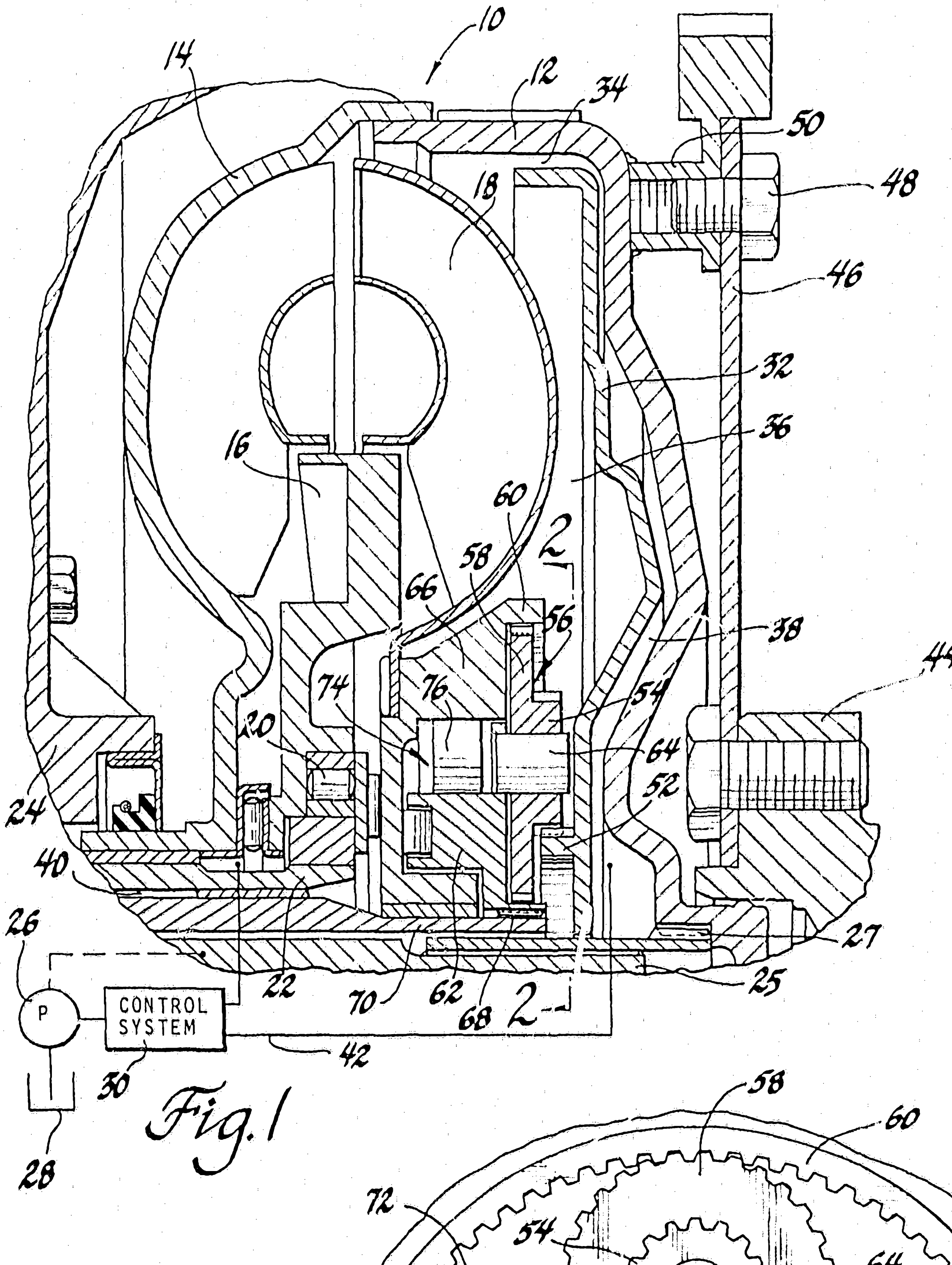
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Fig.1

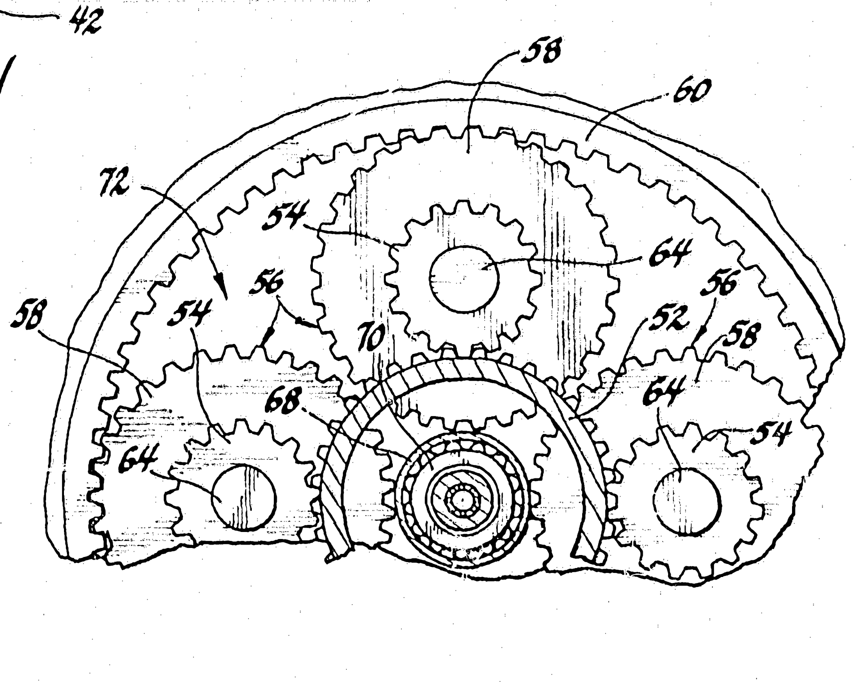
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Fig.2