ARRANGEMENT OF AN ELECTRICALLY OPERATED OIL PUMP OF AN AUTOMATIC TRANSMISSION

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ABSTRACT
An arrangement of an electrically operated oil pump (2) of an automatic transmission (1) is proposed, in which the electrically operated oil pump (2) is arranged partially inside a housing (3) whose housing wall (4) is not connected with the inside space of a transmission housing (5).
ARRANGEMENT OF AN ELECTRICALLY OPERATED OIL PUMP OF AN AUTOMATIC TRANSMISSION

[0001] This application claims priority from German Application Serial No. 10 2007 041 584.4 filed Sep. 1, 2007.

FIELD OF THE INVENTION

[0002] The present invention relates to the arrangement of an electrically operated oil pump of an automatic transmission.

BACKGROUND OF THE INVENTION

[0003] In motor vehicles with automatic transmissions, as a rule, a transmission oil pump mechanically driven by the combustion engine is used to supply the pressure and lubrication oil required for its operation, in particular for the supply of oil to shift elements, gearsets and bearings.

[0004] With automatic transmissions interactions often arise in which, even when the combustion engine is not running, a complete or partial supply of pressure and lubrication oil in the transmission must be ensured.

[0005] For example, this is the case in motor vehicles which have an automatic start-stop function in which to achieve additional fuel saving, the engine is automatically switched off when the vehicle is at rest and is also automatically started again, for example when a driver's wish to move off is recognized. To control an automatic transmission in this so-called MSA or Motor-Start-Automatic mode, according to the prior art an auxiliary hydraulic pump is needed in order to maintain the hydraulic supply to the transmission, since this is no longer available from the pump driven mechanically by the engine when the engine is switched off.

[0006] By maintaining the hydraulic supply by way of the electrically driven auxiliary pump, it is advantageously made possible to remain in the last gear that was engaged before the engine was switched off. In this way, thanks to the use of crankshaft starter generators or belt starters very short engine start times of between 200 and 800 ms are achieved.

[0007] Remaining in the gear that was engaged before the engine was switched off is necessary, since the manual gear selector lever signals to the driver his desired position or the gear engaged. If the hydraulic system were not supplied further by the auxiliary pump, a pressure drop caused by switching off the engine or a pressure surge caused by the build-up of the supply by the mechanical transmission pump when the engine is started, could result in erroneous settings of the valves in the hydraulic switchgear.

[0008] Furthermore, in the case of hybrid drivetrains, which have one or more electric machines between the combustion engine and the transmission or have electric machines in or on the transmission and with which driving is also possible purely under electric power, an oil pump that is independent of the combustion engine is found to be particularly important since it provides the oil pressure needed to engage starting elements or shift elements, even when the main transmission oil pump driven by the combustion engine is delivering no pressure because the engine is switched off.

[0009] In vehicles with a CVT transmission, according to the prior art, an oil pump independent of the combustion engine is also needed so that during a towing process the wrap-around means in the variator is tensioned sufficiently to prevent over-running of the variator during the towing process and the associated component damage.

[0010] From EP 1 223 365 A2 an automatic transmission is known, which comprises a main oil pump driven by the drive engine and an auxiliary oil pump driven by an electric motor, which is controlled with reference to the measured pressure values in the transmission control system in such a manner that the necessary system or clutch pressure is maintained in the transmission.

[0011] Another example of an automatic transmission with an auxiliary oil pump driven by an electric motor is described in the context of DE 101 62 973 A1. In this, controls are provided for maintaining the necessary clutch pressure in the transmission, for example in the Motor-Start-Automatic mode, the operating voltage of this pump being controlled as a function of the oil temperature detected.

[0012] In the transmissions known from the prior art which have an electrically driven oil pump, the pump is arranged outside the transmission, which increases the structural space needed.

[0013] The purpose of the present invention is to indicate an arrangement of an electrically operated oil pump of an automatic transmission, by virtue of which the structural space required for fitting the oil pump is reduced.

SUMMARY OF THE INVENTION

[0014] It is proposed to arrange the electrically operated oil pump of an automatic transmission partly inside a housing whose housing wall is not in communication with the inside space of the transmission housing.

[0015] Preferably, the electrically operated oil pump is arranged partly inside the housing of a starting element of the transmission, preferably inside the converter or clutch bell. In this case, the oil pump extends through a housing wall which is not in communication with the inside space of the transmission housing, close to the starting element.

[0016] In an advantageous embodiment of the invention, the electric portion of the electrically operated oil pump is arranged largely outside the housing, and the hydraulic portion of the oil pump is arranged largely inside the space of the housing of the starting element that is open toward the drive engine.

[0017] In an advantageous further development of the invention, it is proposed that in the case when a transmission oil pump driven by the combustion engine is provided, the electrically operated oil pump is connected by a pressure line on its fluid side with a pressure channel of the transmission oil pump driven by the combustion engine, and that it is connected by a suction line to the oil filter in order to draw oil from an oil sump of the transmission housing.

[0018] In this case, the oil filter is preferably located in an at least largely enclosed inside space of the transmission housing and, in the case when a transmission oil pump driven by the combustion engine is provided, it is also connected on its fluid side with a suction channel of the transmission oil pump driven by the combustion engine.

[0019] Alternatively, for the electrically operated oil pump an oil filter of its own, associated only with the electrically operated pump can be provided, which is preferably arranged in an at least largely closed inside space of the transmission housing. It can also be provided that the pressure line of the electrically operated oil pump is connected, not to a pressure channel of the transmission oil pump driven by the combus-
According to the invention, the pressure line of the electrically operated oil pump is arranged completely inside the space of the housing of the starting element that is open towards the drive engine. The suction line of the electrically operated oil pump is partly or along a section thereof, arranged inside the space of the housing of the starting element that is open towards the drive engine and partly or along a section thereof in the inside space of the transmission housing.

In addition, it can be provided that the pressure and/or the suction line of the electrically operated oil pump is partly, or along a section thereof, integrated in the housing of the starting element or the transmission.

Preferably the electrically operated oil pump is actuated by the electronic control unit of the transmission or alternatively via a CAN interface.

It is particularly advantageous for the electrically operated oil pump to be of such size and design that the transmission oil pump driven by the combustion engine can be omitted and the transmission can be supplied by the electrically operated oil pump in any driving condition.

In that case, in any driving condition the electrically operated oil pump can be operated in such a manner that no more than the necessary oil pressure and volume flow are produced, which results in efficiency optimization of the transmission.

Thanks to the concept according to the invention, the structural space required for fitting an electrically operated oil pump is reduced significantly. Furthermore, an existing transmission with no electrically operated oil pump can be retrofitted with an electrically operated oil pump with relatively little effort. All that is necessary is to drill a bore in the converter or clutch bell to receive the pump, and provide the additional pipework and a new filter housing.

REFERENCES DRAWINGS

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

FIG. 1 is a schematic sectional view of an automatic transmission comprising an electrically operated oil pump, which is arranged in accordance with the present invention, and

FIG. 2 is a schematic perspective view of an automatic transmission.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1 and 2 show an automatic transmission which, for supplying pressure and lubrication oil to the shift elements and gearing of the transmission, comprises an electrically operated auxiliary oil pump for use if the main oil pump of the transmission, which is driven by the combustion engine, is not delivering enough pressure and lubrication oil or when the main oil pump is not operating.

According to the invention, the electrically operated oil pump 2 is arranged partially within a housing 3 whose housing wall 4 is not in communication with the inside space of a transmission housing 5. In the example embodiment shown, the electrically operated oil pump 2 is arranged partially inside the converter or clutch bell 3, and the pump 2 extends through the housing wall 4 near the starting element.

As can be seen from the attached Figures, an electric portion 6 of the electrically operated oil pump 2 is arranged essentially outside the housing 3, while a hydraulic portion 7 of the oil pump 2 is arranged essentially inside the space of the housing 3 or the converter or clutch bell that is open toward the drive engine.

On its fluid side, the electrically operated oil pump 2 is connected by a pressure line 8 to a pressure channel of the transmission oil pump driven by the combustion engine, and comprises a suction line 9 by which it is connected to the oil filter in order to draw oil from an oil sump of the transmission housing.

In this case, the oil filter is preferably arranged in an at least largely closed inside space of the transmission housing and, on its fluid side, is also connected to a suction line of the transmission oil pump driven by the combustion engine.

According to the invention and with reference to FIGS. 1 and 2, the pressure line 8 of the electrically operated oil pump 2 is arranged completely inside the space of the converter or clutch bell 3 that is open toward the drive engine. The suction line 9 of the electrically operated oil pump 2 is partly, or along a section thereof, arranged inside the converter or clutch bell 3 and partly, or along a section thereof, in the inside space of the transmission housing 5.

Of course, any design version and in particular any spatial arrangement of the components of the electrically operated oil pump, in itself or relative to one another and insofar as technically appropriate, falls within the protective scope of the present claims, without influencing the arrangement as indicated in the claims, even if such versions are not explicitly represented in the Figures or in the description.

REFERENCE NUMERALS

1. transmission
2. electrically operated oil pump
3. housing of the starter element, converter or clutch bell
4. housing wall
5. transmission housing
6. electric portion of the electrically operated oil pump
7. hydraulic portion of the electrically operated oil pump
8. pressure line
9. suction line

1-10. (canceled)
11. An arrangement of an electrically operated oil pump (2) of an automatic transmission (1), wherein the electrically operated oil pump (2) is arranged partially inside a housing (3) having a housing wall (4) which is not connected with an inside space of a transmission housing (5).
12. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein the electrically operated oil pump (2) is arranged partially inside the housing (3) of a starting element of the transmission (1).
13. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein the electrically operated oil pump (2) is arranged partially inside one of a converter or a clutch bell (3).
14. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein an electric portion (6) of the electrically operated oil pump (2) is arranged outside the housing (3), and a hydraulic portion (7) of the electrically operated oil pump (2) is arranged completely inside the housing (3) or the converter or clutch bell that is open toward the drive engine.
operated oil pump (2) is arranged inside a space of the housing (3) that is open toward a drive engine.

15. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein a pressure line (8) of the electrically operated oil pump (2) is arranged completely inside a space of the housing (3) that is open toward a drive engine, and a first portion of a suction line (9) of the electrically operated oil pump (2) is arranged inside the space of the housing (3) and a second portion of the suction line (9) of the electrically operated oil pump (2) is arranged inside a space of the transmission housing (5).

16. The arrangement of the electrically operated oil pump (2) according to claim 14, wherein the hydraulic portion (7) of the electrically operated oil pump (2) is connected by a pressure line (8) to one of a pressure channel of a transmission oil pump, which is driven by the drive engine, or a pressure line of a control valve of the transmission oil pump, which is driven by the drive engine.

17. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein the electrically operated oil pump (2) is connected by a suction line (9) to an oil filter for draining oil from an oil sump of the transmission housing (5), a transmission oil pump driven by a drive engine is connected by a further suction line to the oil filter.

18. The arrangement of the electrically operated oil pump (2) according to claim 11, wherein the electrically operated oil pump (2) is connected by a suction line (9) to an oil filter, and the oil filter is only associated with the electrically operated oil pump (2).

19. The arrangement of the electrically operated oil pump (2) according to claim 18, wherein the oil filter, only associated with the electrically operated oil pump (2), is arranged in an at least largely closed inside space of the transmission housing (5).

20. The arrangement of the electrically operated oil pump (2) according to claim 151 wherein at least one of the pressure line (8) and the suction line (9) of the electrically operated oil pump (2) is partially integrated in one of the housing (3) or the transmission housing (5).

21. An electrically operated oil pump (2) of an automatic transmission (1), the electrically operated oil pump (2) comprising an electric portion (6) and a hydraulic portion (7) and the automatic transmission (1), a housing comprising a transmission housing portion (5) and a converter or clutch housing portion (3),

wherein the electrically operated oil pump (2) is supported by the converter or clutch housing portion (3) such that the electric portion (6) of the electrically operated oil pump (2) is located exterior of the converter or clutch housing portion (3) and the hydraulic portion (7) of the electrically operated oil pump (2) in an interior of the converter or clutch housing portion (3).

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