HYDRAULIC MILLING MACHINE FOR EXCAVATORS

Inventor: Mirco Risi, Bologna (IT)

Correspondence Address:
Dara I. Onofrio
Onofrio Law
Suite 1600
1133 Broadway
New York, NY 10010 (US)

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ABSTRACT
A hydraulic milling machine for excavators characterized by the fact that the driving shaft (1) for the transmission of the torque from the grooved rotor (2) of the central hydraulic motor to the milled tool holding drums (4) is subject only to the torsion stress since all the other dynamic stresses on the drums are dumped on the supports (5) fixed on the frame structure.
HYDRAULIC MILLING MACHINE FOR EXCAVATORS

FIELD OF THE INVENTION

[0001] The present invention concerns the technology of the mechanisms for the motion transmission from a hydraulic motor to milling rotating tools.

BACKGROUND OF THE INVENTION

[0002] Employment of a hydraulic motor to activate rotating operating tools and in particular in milling machines that operate on stony compact materials is known. The known equipment, besides transmitting the necessary torque to operate the heavy milling operations, must also bear the bending stress and shocks caused by the rapid impact of the tools against the rocky walls and surfaces. The bending stress is increased by the fact that the milling drums are assembled overhanging on the motor shaft in order to perform penetrations in the rocky walls.

[0003] Such operational needs have demonstrated that the motor shaft is often not able to bear for long the combined effect of the heavy stresses during the milling operations. The problem to be solved is to increase the overall resistance and the life of the transmission components.

SUMMARY OF THE INVENTION

[0004] Accordingly, it is a general object of the invention to provide an optimal solution for the problems that still affect this field of technology.

[0005] A specific object of the present invention is to provide a hydraulic milling machine for excavators that has smaller dimensions, is more economic to operate and is more convenient during maintenance operations than other known machines.

[0006] Another object of the invention is to provide a hydraulic milling machine for excavators comprising supports (5) fixed onto a frame structure (7), at least one milling drum (4) supported by the supports (5) and by bearing (10), and a hydraulic motor (12) mounted on the frame structure (7). The hydraulic motor (12) further comprises a rotor (2) with a grooved shaft (1) driven by the hydraulic motor such that the grooved shaft (1) is directly connected to the milling drum (4) and the grooved shaft (1) directly drives the milling drum (4). The motor is subjected only to the torsion stress since all other dynamic stresses on the drums are damped on the supports (5).

[0007] Another more specific object is to provide a hydraulic milling machine for excavators where the grooved shaft (1) directly drives the milling drum (4) by means of axial grooves (11) having axial grooves compatible with the grooved shaft. The shaft may be partially grooved for the invention embodiment with a single side drum or may have grooves the same axial length of the grooved shaft for the invention embodiment with two milling side drums.

[0008] Another more specific object is to provide a hydraulic milling machine for excavators where the grooved shaft (1) can be readily inserted and extracted from the rotor (2) of the hydraulic motor.

[0009] Other objects, features and advantages of the present invention will be apparent when the detailed description of the preferred embodiment of the invention are considered with reference to the drawings which should be construed in an illustrative and not limiting sense as follows:

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 shows the grooved transmission shaft of the invention;

[0011] FIG. 2 shows the grooved transmission shaft and a milling drum;

[0012] FIG. 3 is a schematic illustration of the hydraulic motor according to the invention;

[0013] FIG. 4 is a cross section of the support for a milling drum;

[0014] FIG. 5 is a cross section of the side supports and frame structure of the invention;

[0015] FIG. 6 shows the grooved shaft inserted in the hydraulic motor;

[0016] FIG. 7 illustrates an embodiment of the invention with a single side drum;

[0017] FIG. 8 illustrates the embodiment of the invention shown in FIG. 7 with the grooved shaft inserted in the hydraulic motor;

[0018] FIG. 9 shows an external view of an embodiment of the invention with two side drums;

[0019] FIG. 10 shows an external view of an embodiment of the invention with a single drum;

[0020] FIG. 11 is a three-dimensional representation of the embodiment of the invention shown in FIG. 9;

[0021] FIG. 12 is a side view of the invention at the edge of an operator arm of a machine; and

[0022] FIG. 13 is a milling head with two side drums.

DETAILED DESCRIPTION OF THE INVENTION

[0023] The invention is now described with reference to the figures of the attached drawings that are provided for illustrative purposes and are not meant to be limiting in any sense.

[0024] In the figures each detail is marked as follows:

[0025] 1 is a grooved shaft that can be inserted and extracted in the groove rotor of a hydraulic motor;

[0026] 2 is the grooved rotor of a central hydraulic motor;

[0027] 3 is the inner groove of the hub of a milling drum;

[0028] 4 is a milling drum;

[0029] 5 is a support that is bolted to a central frame structure;

[0030] 6 is a hydraulic stator bolted to the central frame structure;

[0031] 7 is the central frame structure;

[0032] 8 is the closing cover of the invention embodiment with a single side drum;
[0033] 9 are the bolts for the application to the central frame structure;

[0034] 10 are the bearings for the support of the drums applied to support 5 bolted to the central frame structure;

[0035] 11 is a partially grooved shaft for the embodiment with a single side drum;

[0036] 12 indicates the distributor of the hydraulic motor;

[0037] 13 are elastic retaining rings of the extractable grooved shafts; and

[0038] 14 are milling tools applied to the drum of a milling machine.

[0039] FIG. 1 is a view of the extractable transmission shaft that transmits the torque from a central hydraulic motor with two milling side drums.

[0040] FIG. 2 is a view of an extractable transmission shaft that transmits the torque from a central hydraulic motor to a single side milling drum.

[0041] FIGS. 1 and 2 highlight the simplicity of execution of the transmission shaft that is inserted and extracted with surprising simplicity just because its only function is to transmit the torque of the hydraulic central motor without bearing any other stress that milling drums are likely to encounter during heavy excavation operations.

[0042] FIG. 3 is a schematic section of the rotor of a hydraulic motor that can be applied to a frame structure of an operator machine. As seen in the figure, a central groove 2 is present where the grooved shaft, that transmits the torque of the hydraulic motor without suffering any milling related stress, is inserted and extracted.

[0043] FIG. 4 is a cross section of a support for a milling drum. As seen in the figure, the grooved shaft can be inserted and extracted from the central grooves of the drum. The grooved shaft transmits to the milling drum only the torque of the hydraulic motor but it does not suffer the other stresses caused by the heavy milling conditions the central grooves of the drum.

[0044] FIG. 5 is a cross section of the side supports applied to the frame structure through the connecting bolts. As seen in the figure, the supports are inserted taper roller bearings upon which are assembled the hubs of the side milling drums. FIG. 5 illustrates the embodiment where the axial grooves of the side drums and of the hydraulic central motor can be inserted and then extracted the grooved shaft that transmits the torque to the milling drums held by the supports bolted to the frame structure. It is seen that the grooved shaft is not yet assembled or it has already been extracted.

[0045] FIG. 6 presents a grooved shaft already inserted in the groove of the side drums and in the main groove of the hydraulic motor.

[0046] FIG. 7 represents an embodiment of the invention with a single side drum. As seen in the figure, the grooved shaft has not been inserted yet or it has already been extracted from the central groove.

[0047] FIG. 8 represents the same embodiment as FIG. 7 with the grooved shaft already inserted in the relative grooves.

[0048] FIG. 9 schematizes an external view of the application of two side drums.

[0049] FIG. 10 schematizes an external view of the application of a single drum.

[0050] FIG. 11 is a three-dimensional representation of the application of two side drums.

[0051] FIG. 12 schematizes a side view of the application of the milling machine at the edge of an operator arm of a machine.

[0052] FIG. 13 schematizes in perspective a milling head with two side drums.

[0053] The figures presented highlight the simplicity and convenience of the maintenance operations for the replacement of the grooved shaft.

[0054] The extraordinary resistance of the device object of the present invention is obtained by the characteristic separation of two kinds of stresses. Only the torsion stresses for the transmission of the motor torque of the hydraulic motor are absorbed by the grooved shaft inserted in the central rotor while the other stresses are absorbed by the frame structure through the bolted side supports.

[0055] All the milling machines having a central transmission shaft, grooved and extractable, with the characteristics as fundamentally illustrated, described and hereinafter claimed, will be held as part of the present invention.

[0056] Finally, variations from the examples given herein are possible in view of the above disclosure. The invention of course allows several variations of practical realization, as far as the dimensioning and the structural proportioning are concerned and for the technological choices of the material for the realization of the details. Therefore, although the invention has been described with reference to certain preferred embodiments, it will be appreciated that other embodiments may be devised and used as described herein, which are nevertheless within scope and spirit of the invention as defined in the claims appended the hereto.

[0057] The foregoing description of various and preferred embodiments of the present invention has been provided for purposes of illustration only, and it is understood that numerous modifications, variations and alterations may be made without departing from the scope and spirit of the invention as set forth in the following claims.

1. A hydraulic milling machine for excavators comprising:

   supports (5) fixed onto a frame structure (7),

   at least one milling drum (4) supported by said supports (5) and by bearing (10), and

   a hydraulic motor (12) mounted on said frame structure (7);

wherein said hydraulic motor (12) comprises a rotor (2) with a grooved shaft (1) driven by said hydraulic motor such that said grooved shaft (1) is directly connected to said milling drum (4) and said grooved shaft (1) directly drives said milling drum (4), such that said
motor is subjected only to torsion stress and all other dynamic stresses on the drums are dumped on the supports (5).

2. The hydraulic milling machine for excavators as defined in claim 1, wherein said grooved shaft (1) is readily removable from the rotor (2) of said hydraulic motor.

3. The hydraulic milling machine for excavators as defined in claim 1, further comprising a second milling drum.

4. The hydraulic milling machine for excavators as defined in claim 1, wherein said frame structure is attached to the edge of an operator arm of a machine.

5. The hydraulic milling machine for excavators as defined in claim 1, wherein said grooved shaft (1) directly drives said milling drum (4) by means of axial grooves compatible with said grooved shaft (1).

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