

Description

TECHNICAL FIELD

[0001] The present invention concerns a tank for a work vehicle.

[0002] The present invention finds its preferred, although not exclusive, application in work vehicles such as earth moving machines. Reference will be made to this application by way of example below.

BACKGROUND OF THE INVENTION

[0003] Work vehicles such as earth moving machines use power provided by power sources such as internal combustion engine or electric machines powered by batteries to operate a variety of utilities.

[0004] Making reference to hydraulic systems of the work vehicle, it is widely known that they are particularly energy consuming. In particular, the energy consumption of such hydraulic system is due to the energy need to carry the pumping means that feed hydraulic fluid at high pressure to operate the work vehicle system and to the energy losses

[0005] An example of prior art tank 1' that is used in hydraulic system of a work vehicle is shown exemplarily in Figure 1. Such tank 1' comprises a plurality of walls 2' that delimit a space 3' configured to house the hydraulic fluid coming from outlets of the hydraulic systems via an inlet 4'. The collected hydraulic fluid is then filtered and provided to inlet of the hydraulic system via an outlet 5'.

[0006] Due to the increasing need to provide environmental friendly vehicles, it is felt to improve efficiency of the vehicles by reducing the overall power consumption of the vehicle.

[0007] In view of the above, the need is felt to optimize the energetic balance of the work vehicles provided with hydraulic systems in order to reduce the overall power consumption of these latter.

[0008] An aim of the present invention is to satisfy the above mentioned needs in a cost-effective and optimized manner.

SUMMARY OF THE INVENTION

[0009] The aforementioned aim is reached by tank, a hydraulic system and a vehicle as claimed in the appended set of claims.

BRIEF DESCRIPTION OF DRAWINGS

[0010] For a better understanding of the present invention, a preferred embodiment is described in the following, by way of a non-limiting example, with reference to the attached drawings wherein:

- Figure 1 is perspective view of a prior art tank of a hydraulic system of a work vehicle;

- Figure 2 is perspective view of a tank according to the invention of a hydraulic system of a work vehicle;
- Figure 3 is a lateral view of the tank of figure 2; and
- Figures 4a-4e are schematic representations of a portion of the tank according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Figure 1 discloses a tank 1 for a hydraulic system (not shown) of a work vehicle (not shown) such as an earth moving machine or an agricultural vehicle.

[0012] The tank 1 comprises a plurality of walls 2 connected together to define a space 3 for housing a hydraulic fluid such as an operative fluid of the hydraulic system, e.g. oil or water. Preferably, the hydraulic system is an hydraulic oil system of the work vehicle.

[0013] In the disclosed example, the tank 1 has a substantially parallelepiped shape, i.e. comprising a top plate 2a, a bottom plate 2b and a plurality of lateral walls 2c connecting together the top and bottom plates 2a, 2b.

[0014] The walls 2 are connected together to define a space 3 configured to house the aforementioned hydraulic fluid. In particular, the top and bottom plates 2a, 2b are spaced along a first axis A, vertical, and delimit the space 3 along such direction and the lateral walls 2c connects the top and bottom plates 2a, 2b along their perimeter and delimit the space 3 along a second axis B, transversal, direction.

[0015] The tank 1 further defines an inlet 4 and an outlet 5 configured to be respectively connected to an outlet and an inlet of at least a hydraulic system of the work vehicle.

[0016] In particular, the inlet 4 is realized in top plate 2a while outlet 5 is realized in the bottom plate 2b. Preferably, as shown, the inlet 4 and the outlet 5 are defined by conduits 4', 5' carried by the respective plate 2a, 2b and extending from this latter within space 3. Such conduit 4', 5' is fluidly connected to the aforementioned outlet/inlet of the hydraulic systems, e.g. by dedicated conduits or hoses.

[0017] Preferably, at least fluidically upstream to outlet 5, the tank 1 is provided with filtering means 6 configured to filter the hydraulic fluid before sending the latter towards the inlet of hydraulic systems. Similar filtering means may be provided also downstream to the inlet 4, even if not explicitly shown herewith.

[0018] Such filtering means may be also be integrated into pumping means, here further not shown, according to the specific need of the work vehicle and/or of the hydraulic systems.

[0019] Preferably the tank 1 further comprises a separation wall 7 housed within space 3 and configured to divide this latter in a first portion 3' and a second portion 3". In particular, the separation walls 7 is carried by a pair of lateral walls 2c and the first portion 3' houses the inlet 4 and the second portion 3" houses the outlet 5.

[0020] In detail, the separation wall 7 extends along the first axis direction A and is preferably spaced from

the top plate 2a and the bottom plate 2b thereby defining an upper gap 8' and a lower gap 8". The hydraulic fluid coming from inlet 4 flows passing from lower gap 8" towards the outlet 5 and, in case of overflow, may pass from upper gap 8'.

[0021] According to the invention, the tank 1 is provided with energy generation means 10 configured to generate electric energy from hydraulic fluid movement from the inlet 4 towards the outlet 5.

[0022] Accordingly, energy generation means 10 are housed in space 3 so that the movement of fluid between inlet and outlet 4, 5 allows the generation of electrical energy. Preferably, the energy generation means 10 are housed in space 3, more in detail in the first portion 3' and advantageously in proximity of lower gap 8".

[0023] In detail, the energy generation means 10 comprises a rotating portion 11 and a supporting shaft 12, the rotating portion 11 is carried engaged in rotation with the supporting shaft 12 and is configured to be propelled by the movement of hydraulic fluid therethrough.

[0024] The supporting shaft 12 carried by housing 2 in a rotatably free manner and is connected to an energy generation device G, e.g. mechanically, such as a generator configured to produce electrical energy via supporting shaft 12 rotation.

[0025] Preferably, in the disclosed embodiment, the supporting shaft 12 is carried by two lateral walls 2c so that the supporting shaft 12 can rotate about an axis perpendicular to axis A and B.

[0026] The rotating portion 11 is shaped in order to receive a pushing force by the hydraulic fluid in movement in order to produce a rotation of the supporting shaft 12. In particular, the rotating portion 11 may comprise at least a vane configured to be pushed by the hydraulic fluid.

[0027] Figures 4a to 4e discloses different embodiments of the rotating portion 11 comprising each different number and typology of shovels. In particular, but not in a limitative way, the shovel may be one or more among a squirrel cage darricus shovel (figure 4a), a H-darricus shovel (figure 4b), a darricus shovel (figure 4c), a gorlov shovel (figure 4d) or a savonius shovel (figure 4e).

[0028] The operation of the embodiment of the invention as described above is the following.

[0029] During the operation of the vehicle, the hydraulic fluid is stored in the tank 1 passing from inlet 4 towards outlet 5 through space 3 and in particular through gap 3". During such passage its velocity is therefore at its maximum value in gap 3'; therefore, fluid passes from the energy generator means 10 that are housed in the proximity of the gap 3'. The rotating portion 11 is therefore pushed by the passage of the fluid that makes rotate the supporting shaft 12 whose rotation is used by generation means G to produce electrical energy. Such electrical energy may be used for operating other electrical elements of the vehicle.

[0030] In view of the foregoing, the advantages of tank, hydraulic system and vehicle according to the invention

are apparent.

[0031] The proposed tank arrangement allows to recovery part of the kinetic energy that is still available in the flow and that would be otherwise wasted.

[0032] In detail, the energy generation means 10 may be used for any typology of hydraulic fluid and in any shape and typology of tank, thereby being adapt to be installed also in existing tanks with minor modifications.

[0033] In detail, the use in oil hydraulic systems in work vehicle, due to density and pressures of oil, allows to recovery a considerable energy quantity without increasing the pressure drop in the related hydraulic circuits.

[0034] The peculiar positioning in the lower gap where the speed is maximized allows to use the maximum of kinetic energy of the fluid to be provided to the generator.

[0035] It is clear that modifications can be made to the described tank, hydraulic system and vehicle which do not extend beyond the scope of protection defined by the claims.

[0036] For example, the shape of the tank may vary such as the shape and number of inlet and outlet.

[0037] Similarly, the tank may comprise more energy generation means of different size and shapes provided they comprise the operational claimed features.

[0038] Moreover, the energy generation means 10 could be placed within one between inlet 4 and outlet 5 conduits, in particular in inlet 4.

30 Claims

1. Tank (1) for a hydraulic system of a vehicle, said tank (1) comprising a housing (2) defining a space (3) for housing a hydraulic fluid, said tank (1) comprising an inlet (4) and an outlet (5) configured to allow the filling and spilling of said hydraulic fluid to/from said space (3) with respect to said hydraulic system, said tank (1) comprising energy generation means (10) configured to generate electrical energy from the movement of said hydraulic fluid from said inlet (4) towards said outlet (5).

2. Tank according to claim 1, wherein said energy generation means (10) comprises a rotating portion (11) and a supporting shaft (12) carried in a rotatably free manner by said housing (2), said rotating portion (12) being configured to be pushed by the movement of said fluid, said supporting shaft (12) being connected to a generator (G) configured to generate electrical energy from the rotation of said supporting shaft (12).

3. Tank according to claim 2, wherein said rotating portion (11) is carried in a rigid manner by said supporting shaft (12).

4. Tank according to claim 2 or 3, wherein said rotating portion (11) comprises one or more among a squirrel cage darricus shovel, a H-darricus shovel, a darricus

shovel, a gorlov shovel or a savonius shovel.

5. Tank according to any of the preceding claims, wherein said housing (2) comprises a top and a bottom walls (2a, 2b) and a plurality of lateral walls (2c), said energy generation means (10) are carried by said lateral walls (2c). 5
6. Tank according to claim 5, wherein said tank (1) comprises a separation wall (7) housed within said space (3) and dividing this latter into a first portion (3') connected to said inlet (4) and a second portion (3'') connected to said outlet (5), said separation wall (7) defining an upper gap (8') and a lower gap (8'') with respectively said top and bottom walls (2a, 2b), said energy generation means (10) being housed in said first portion (3'). 10 15
7. Tank according to claim 6, wherein said energy generation means (10) is housed in proximity of said lower gap (8''). 20
8. Tank according to any of claims 1 to 5, wherein said energy generation means (10) are integrated in one between inlet and outlet (4, 5) conduits. 25
9. Hydraulic system for a vehicle comprising a tank as claimed in any of the preceding claims.
10. Work vehicle comprising at least one hydraulic system as claimed in claim 9. 30

35

40

45

50

55

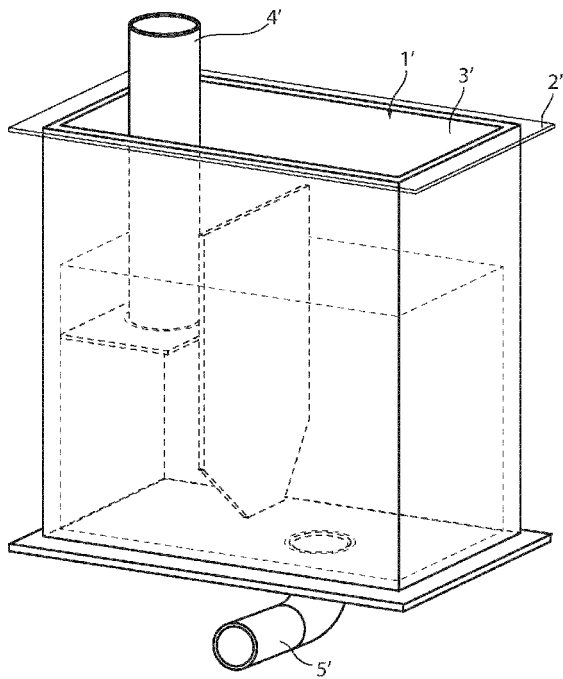


FIG. 1 PRIOR ART

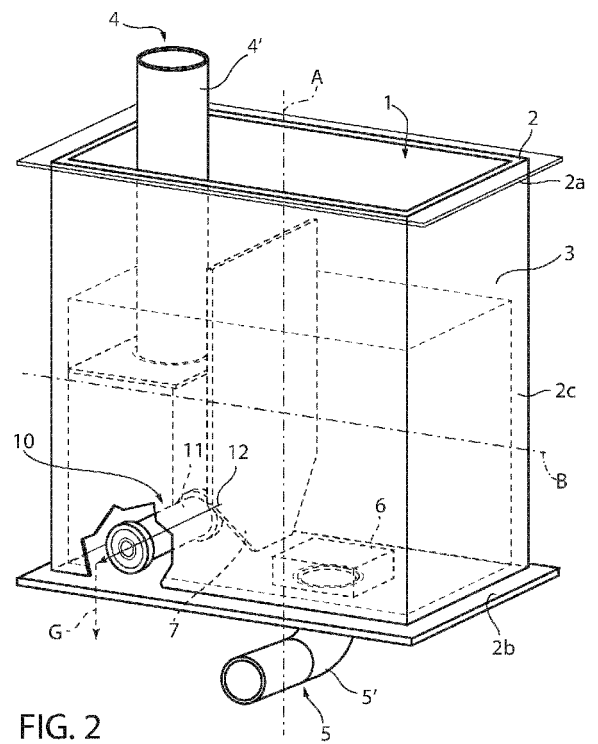


FIG. 2

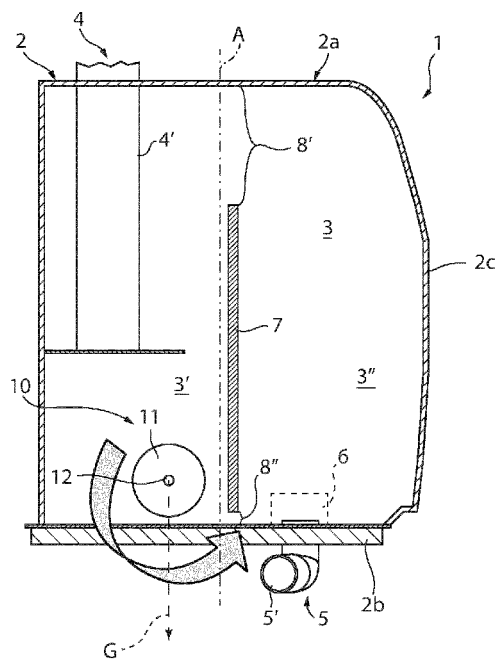
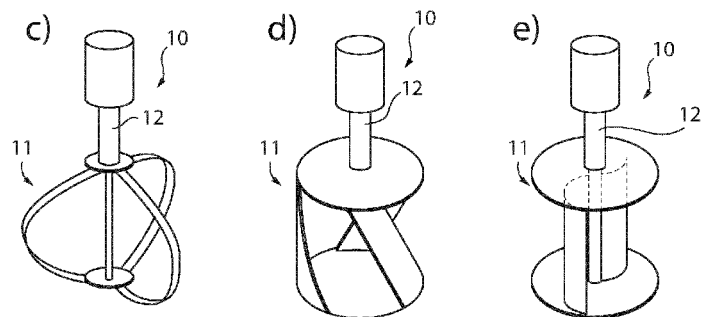
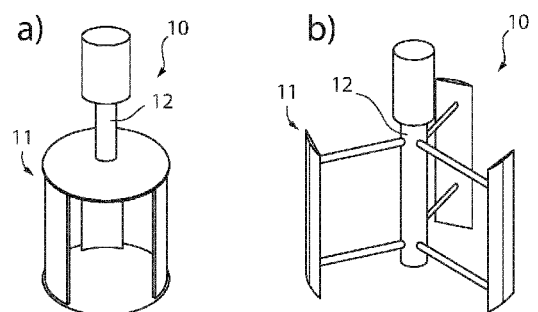


FIG. 3

FIG. 4





EUROPEAN SEARCH REPORT

Application Number

EP 24 15 4275

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 114 855 923 A (LIUZHOU LIUGONG EXCAVATORS CO LTD ET AL.) 5 August 2022 (2022-08-05) * figures 1-5 *	1-10	INV. E02F9/22
A	KR 2004 0083168 A (ULSAN IND EDUCATION FOUNDATION) 1 October 2004 (2004-10-01) * paragraph [0020] - paragraph [0026]; figure 2 *	1-10	
A	US 2018/347152 A1 (MCNEALY ANTHONY DEAN [US] ET AL) 6 December 2018 (2018-12-06) * figures 1-2 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			E02F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		10 June 2024	Rocabruna Vilardell
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 24 15 4275

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-06-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 114855923 A	05-08-2022	NONE	
KR 20040083168 A	01-10-2004	NONE	
US 2018347152 A1	06-12-2018	CN 108980150 A US 2018347152 A1	11-12-2018 06-12-2018