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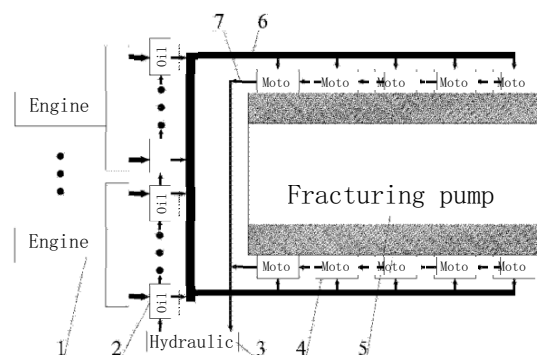
Fracturing Pump Transmission System
and Fracturing Truck

(57) Abstract

This invention relates to the technical field of fracturing trucks and discloses a fracturing pump transmission system and a fracturing truck. The fracturing pump transmission system includes one or more engines, multiple oil

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pumps, and multiple motors, wherein, when there is a single engine, the engine is used to drive multiple oil pumps, and when there are multiple engines, each engine is used to drive at least one oil pump; each oil pump is connected to at least one motor; and all the multiple motors are used to drive the fracturing pump. Compared with existing technology, the implementation of the fracturing pump transmission system according to the present invention can effectively expand the selection range of relevant components of a transmission system, can realize various matching configurations, can effectively reduce costs of relevant components, and can also effectively enhance reliability, as well as facilitates the forward and reverse rotation of the fracturing pump. The fracturing truck according to the present invention is equipped with this fracturing pump transmission system and can thus effectively reduce manufacturing costs and production difficulty of the fracturing truck, and can also effectively improve operational efficiency and maintainability.



1. A fracturing pump transmission system, characterized in that the fracturing pump transmission system includes one or more engines (1), multiple oil pumps (2), and multiple motors (4), wherein:

when there is a single engine (1), the engine (1) is used to drive multiple oil pumps (2), and when there are multiple engines (1), each engine (1) is used to drive at least one of the oil pumps (2); each oil pump (2) is connected to at least one motor (4); and all the multiple motors (4) are used to drive the fracturing pump (5).

2. The fracturing pump transmission system according to Claim 1, characterized in that the output of each oil pump (2) is respectively connected through a corresponding oil line to a first oil port of at least one motor (4), and a second oil port of that at least one motor (4) is connected to a hydraulic oil tank (3); or, the outputs of the multiple oil pumps (2) are connected via a first oil line (6) to the first oil ports of the multiple motors (4), and the second oil ports of the multiple motors (4) are connected to the hydraulic oil tank (3).

3. The fracturing pump transmission system according to Claim 1, characterized in that the fracturing pump (5) is a crankshaft-type plunger pump, both ends of the crankshaft-type plunger pump are equipped with power input gears (51), and each motor (4) engages with the power input gears (51) through a power output gear (41).

4. The fracturing pump transmission system according to Claim 3, characterized in that the number of the power output gears (41) engaged with the power input gears (51) at both ends of the crankshaft-type plunger pump is the same.

5. The fracturing pump transmission system according to Claim 4, characterized in that the power output gears (41) engaged with the power input gear (51) at either end of the crankshaft-type plunger pump are arranged evenly around the power input gear (51).

6. The fracturing pump transmission system according to any of Claims 1 to 5, characterized in that, when there are multiple engines (1), one of the engines is the chassis engine of the fracturing truck.

7. A fracturing truck, comprising a chassis (10) and a fracturing pump (5), characterized in that the fracturing pump transmission system according to any

of Claims 1 to 6 is installed on the truck body (11) of the chassis (10).

8. The fracturing truck according to Claim 7, characterized in that, when the fracturing pump transmission system does not include a chassis engine, the at least one engine (1) and the fracturing pump (5) are installed sequentially from front to rear on the truck body (11).

9. The fracturing truck according to Claim 8, characterized in that the fracturing truck further includes a hydraulic oil tank (3), and the hydraulic oil tank (3) is disposed in a first area above the multiple engines (1).

10. The fracturing truck according to Claim 8, characterized in that the fracturing truck further includes a cooling box (12), and the cooling box (12) is disposed in a second area above the multiple engines (1).

Fracturing Pump Transmission System and Fracturing Truck

Technical Field

[0001] This invention relates to the technical field of fracturing trucks, particularly to a fracturing pump transmission system and a fracturing truck.

Background Art

[0002] Fracturing operations are one of the most important methods for modifying oil and gas reservoirs. For low-permeability oil and gas wells, fracturing is generally necessary to achieve stable production and increase output. A fracturing truck is the primary equipment used in fracturing operations. Its function is to inject high-pressure, large-volume fracturing fluid into the formation, causing it to crack open and injecting proppants (such as fracturing sand) into the fractures to enhance the permeability of the formation, increase the fluidity of oil and gas, and improve the recovery rate of oil and gas.

[0003] Currently, common fracturing trucks use a "diesel engine—torque converter—drive shaft—fracturing pump" transmission scheme. In this scheme, after the diesel engine starts, it drives the fracturing pump via the torque converter, which adjusts the speed and torque, and the drive shaft, enabling the fracturing operation. Due to the large power required for fracturing operations, the diesel engine must have sufficient power (capable of meeting the maximum power requirement). Additionally, the diesel engine relies on a starter motor that draws power from the chassis engine to start.

[0004] In this transmission scheme, due to the need to use a diesel engine that meets the maximum power requirement, once the power exceeds a certain threshold (e.g., 1500 kW), the required cost increases rapidly, and selecting a right engine becomes difficult. This also leads to a narrow range of choices for supporting components like torque converters, which are also expensive. Another factor contributing to the difficulty in selecting components and the high costs of the transmission scheme is the disparity in the technological maturity and completeness of industry chains for fracturing-related components and parts across different countries. Components such as diesel engines, torque converters, or drive shafts in this transmission scheme need to be purchased from certain countries or regions, making fracturing trucks using this transmission scheme to have high costs and limited by the period and availability of imported parts.

[0005] Additionally, the safety redundancy (reliability) of this transmission scheme is low. If any one of the diesel engine, torque converter, or drive shaft fails, the fracturing operation will be halted. Since fracturing sites are often located in remote areas and these components are expensive and difficult to stock adequately, resuming fracturing operations can take a long time even in countries where fracturing technology is relatively advanced.

[0006] Therefore, how to address the above existing shortcomings and defects to better meet the needs of oil and gas development is a technical problem to be urgently solved by those skilled in the art.

Summary of the Invention

[0007] In view of the above, one of the objectives of this invention is to provide a fracturing pump transmission system to effectively reduce the selection difficulty and cost of relevant components for the fracturing pump transmission system while also effectively improving the safety redundancy of the fracturing pump transmission system.

[0008] Specifically, the fracturing pump transmission system includes one or more engines, multiple oil pumps, and multiple motors. When there is one engine, the engine is used to drive multiple oil pumps. When there are multiple engines, each engine is used to drive at least one of the oil pumps. Each oil pump is connected to at least one of the motors, and all the multiple motors are used to drive the fracturing pump.

[0009] Furthermore, the output of each oil pump is respectively connected through a corresponding oil line to a first oil port of at least one motor, and a second oil port of that at least one motor is connected to a hydraulic oil tank. Alternatively, the outputs of the multiple oil pumps are connected via a first oil line to the first oil ports of the multiple motors, and the second oil ports of the multiple motors are connected to the hydraulic oil tank.

[0010] Additionally, the fracturing pump is a crankshaft-type plunger pump, both ends of the crankshaft-type plunger pump are equipped with power input gears, and each motor engages with the power input gears through a power output gear.

[0011] Furthermore, the number of power output gears engaged with the power input gears at both ends of the crankshaft-type plunger pump is the same.

[0012] Additionally, the power output gears engaged with the power input gear at either end of the crankshaft-type plunger pump are arranged evenly around the power input gear.

[0013] Furthermore, when there are multiple engines, one of them is the chassis engine of the fracturing truck.

[0014] A second objective of this invention is to provide a fracturing truck to effectively reduce manufacturing costs and production difficulty of the fracturing truck while improving operational efficiency and maintainability.

[0015] Specifically, the fracturing truck includes a chassis and a fracturing pump, and the truck body on the chassis is equipped with the fracturing pump transmission system according to any of the aforementioned items.

[0016] Furthermore, when the fracturing pump transmission system does not include a chassis engine, the at least one engine and the fracturing pump are installed sequentially from front to rear on the truck body.

[0017] Additionally, the fracturing truck also includes a hydraulic oil tank, which is disposed in a first area above the multiple engines.

[0018] Furthermore, the fracturing truck also includes a cooling box, which is disposed in a second area above the multiple engines.

[0019] When using the fracturing pump transmission system of this invention, since at least one engine is used to drive multiple oil pumps, the multiple oil pumps supply pressure oil to multiple motors, and the multiple motors all drive the fracturing pump, this effectively broadens the selection range of relevant components of the transmission system, and effectively reduces the difficulty of implementation. It also facilitates the realization of various matching configurations and enables control over the speed and output power of the fracturing pump. Additionally, when multiple engines are used, the power load on each engine is reduced while still meeting the maximum power requirement, allowing for the use of common, low-power engines, which further broadens the selection range, and correspondingly, the selection range can also be further broadened for oil pumps and motors. Moreover, this transmission method allows for easy availability of engines, oil pumps, and motors, which are not limited by the need for imported or specialized components, thereby effectively reducing the costs of components for the fracturing pump transmission system.

Furthermore, if one engine, oil pump, or motor fails after adopting this transmission method, the entire transmission system can still ensure continued fracturing operations for a period of time, thereby effectively improving safety redundancy (reliability) and reducing the risk of operational losses for a construction company. Additionally, this transmission method facilitates hydraulic control, allowing for both forward and reverse rotation of the motors, which in turn enables forward and reverse rotation of the fracturing pump (in existing technologies, a fracturing pump can only rotate in one direction by following the diesel engine as limited by the transmission scheme thereof), thereby expanding the functionality of the fracturing truck.

[0020] In an optional scheme, one of the multiple engines serves as a chassis engine of the fracturing truck, fully utilizing the efficiency of the chassis engine by allowing it to function during both movement and operational processes.

[0021] The fracturing truck described in this invention is equipped with the fracturing pump transmission system, thereby effectively reducing manufacturing costs and production difficulty of the fracturing truck while improving operational efficiency and maintainability.

Brief Description of the Drawings

[0022] The figures that form part of this invention are provided to offer further understanding of the invention. The schematic embodiments and their explanations of the invention are used to describe the invention and should not be considered as improper limitations to the scope of the invention. In the figures:

[0023] Figure 1 is a schematic diagram of the composition of a fracturing pump transmission system provided in one embodiment of this invention;

[0024] Figure 2 is a schematic structural diagram of a preferred configuration where multiple motors drive the fracturing pump in the embodiment as shown in Figure 1;

[0025] Figure 3 is a schematic structural diagram of a fracturing truck provided in other embodiments of this invention.

[0026] Explanation of Figure Legends:

[0027] 1 Engine

[0028] 2 Oil pump

[0029] 3 Hydraulic oil tank

[0030] 4 Motor

[0031] 5 Fracturing pump

[0032] 6 First oil line

[0033] 7 Second oil line

[0034] 10 Chassis

[0035] 11 Truck body

[0036] 12 Cooling box

[0037] 41 Power output gear

[0038] 51 Power input gear

Specific Implementation

[0039] It should be noted that the descriptions of specific structures and the order of descriptions in this section are only intended to explain particular embodiments and should not be regarded as limiting the scope of the invention. Furthermore, the features of the embodiments in this section can be combined with each other as long as they do not conflict.

[0040] Please refer to Figures 1, 2, and 3. Below, the embodiments of the invention will be described in detail with reference to the figures.

[0041] As shown in Figure 1, the fracturing pump transmission system in this embodiment of the invention may include multiple engines 1, multiple oil pumps 2, and multiple motors 4. For clarity, Figure 1 also illustrates a fracturing pump 5. In this application, “multiple” refers to two or more.

[0042] Each engine 1 is used to drive at least one oil pump 2, multiple oil pumps 2 are used to supply pressure oil to multiple motors 4, and all the multiple motors 4 are used to drive the fracturing pump 5.

[0043] In specific implementation, the power output end of each engine 1 is

in transmission connection with the power shaft of at least one oil pump 2, and of course, components such as a transfer case can also be added to the transmission connection line as needed, which is not limited in embodiments of the invention. As shown in Figure 1, the oil intake port of each oil pump 2 is connected to a hydraulic oil tank 3, and the output port of each oil pump 2 can merge via a first oil line 6 and connect to the first oil ports of multiple motors 4, simultaneously providing pressure oil to multiple motors 4. The second oil ports of multiple motors 4 return the oil to the hydraulic oil tank 3 via a second oil line 7. It should be noted that in Figure 1, multiple oil pumps 2 supply oil to multiple motors 4 using a merging method, but in other cases, each oil pump 2 can be connected to at least one motor 4 through a corresponding oil line, that is, each oil pump 2 supplies pressure oil to at least one motor 4. Additionally, corresponding control valves (or control valve groups) can be installed on the oil lines between the oil pumps 2, motors 4, and hydraulic oil tank 3 to control the oil intake and return states of the motors 4. For schemes involving single or multiple oil pumps controlling single or multiple motors through control valve groups, refer to relevant description of the existing technologies, which will not be elaborated upon here.

[0044] Additionally, in specific implementation, there are various ways for multiple motors 4 to drive the fracturing pump 5, as long as the motors 4 can drive the fracturing pump 5 to rotate, which are not limited in the embodiments of the invention. In Figure 2, a preferred transmission connection method between motors 4 and a fracturing pump 5 is illustrated. As shown in Figure 2, the fracturing pump 5 is a crankshaft-type plunger pump. At both ends of the crankshaft-type plunger pump, there are power input gears 51, and each motor 4 engages at least with the power input gears 51 at one end of the crankshaft-type plunger pump through a power output gear 41 (whose pitch circle diameter is smaller than that of the power input gear). More preferably, the number of power output gears 41 engaged with the power input gear 51 at both ends of the crankshaft-type plunger pump is the same, which enables more balanced power transmission and distribution at both ends of the crankshaft-type plunger pump. More preferably, the power output gears 41 at either end of the crankshaft-type plunger pump are arranged evenly around the power input gear 51, which enables more reliable power transmission at either end of the crankshaft-type plunger pump.

[0045] The following describes the principles and technical effects of the fracturing pump transmission system in the embodiment above in combination with specific scenarios:

[0046] During use, the end of the fracturing pump 5 is connected to a distribution and manifold system. When in operation, multiple engines 1 are started, driving multiple oil pumps 2 into operation. The multiple oil pumps 2 supply pressure oil to multiple motors 4, causing the multiple motors 4 to rotate, the multiple motors 4 drive the fracturing pump 5 to rotate, and thus the fracturing pump 5 delivers fracturing fluid, which merges through the distribution and manifold system and is then output. Compared with existing technologies, the embodiment of the invention does not require the use of a single high-power diesel engine. Instead, multiple engines 1 are used, and the power load of each engine 1 can be effectively reduced while still meeting the maximum power requirement. Therefore, it allows for the use of common, low-power engines, which significantly expands the selection range. Correspondingly, the selection range of oil pumps 2 and motors 4 can also be effectively increased, and various matching configurations can be realized. Additionally, this transmission scheme makes engines 1, oil pumps 2, and motors 4 easier to obtain or purchase, without being restricted by imported or specialized components, thereby effectively reducing the component costs of the fracturing

pump transmission system. Moreover, if one engine, oil pump, or motor fails after this transmission scheme is adopted, the entire transmission system can still continue the fracturing operation for a certain period, thereby significantly improving safety redundancy and reducing the risk of losses for a construction party. Furthermore, this transmission scheme facilitates hydraulic control, allowing for both forward and reverse rotation of the motors, which in turn enables forward and reverse rotation of the fracturing pump (in existing technologies, a fracturing pump can only rotate in one direction by following the diesel engine as limited by the transmission scheme thereof), thereby expanding the functionality of the fracturing truck (e.g., reverse-pump cleaning function).

[0047] It should be noted that, in specific implementation of the above embodiment, one of the multiple engines 1 can adopt a chassis engine of the fracturing truck, which can fully utilize the efficiency of the chassis engine by allowing it to function during both movement and operational processes.

[0048] It should be noted that, in the above embodiments, there are multiple engines 1, which facilitates selection, cost control, and improved reliability (safety redundancy). However, in other embodiments, there may also be a single engine 1, that is, a single high-power engine (e.g., using a transfer case) is used to drive multiple oil pumps 2. This approach also facilitates the selection of oil pumps 2 and motors 4 and appropriately enhances the reliability of the transmission system, as well as facilitating the realization of the forward and reverse rotation of the fracturing pump 5.

[0049] As shown in Figure 3, other embodiments of this invention further provide a fracturing truck, which includes a chassis 10, a fracturing pump 5, and the fracturing pump transmission system in the above embodiment. This fracturing pump transmission system is installed on the truck body 11 of the chassis 10. Based on the technical effects of the fracturing pump transmission system described earlier, this fracturing truck can effectively reduce manufacturing costs and production difficulty of the fracturing truck while also effectively improving operational efficiency and maintainability.

[0050] In the specific implementation process, the fracturing truck can adopt the following preferred layout: multiple engines 1 (excluding the chassis engine) and the fracturing pump 5 are sequentially installed from front to back on the truck body 11 of the chassis 10. "Front" refers to the forward driving direction of the chassis 10. The oil pumps 2 can be positioned on one side of the corresponding engine 1 while the multiple motors 4 are grouped and placed respectively at two ends of the fracturing pump 5. Furthermore, the hydraulic oil tank 3 can be placed in a first area above the multiple engines 1, for example, the first area may be disposed in a location near the operator's compartment of the chassis. Additionally, the cooling box 12 of the fracturing truck can also be positioned in a second area above the multiple engines 1, for example, the second area may be disposed in a location near the fracturing pump 5. The cooling box 12 may be used for cooling the hydraulic oil.

[0051] The specific implementation process of other parts of the fracturing truck can be found in relevant description of existing technologies and will not be described in detail here.

[0052] The above description is merely a preferred embodiment of this invention and is not used to limit the invention. Any modifications, equivalent substitutions, or improvements made within the spirit and principles of this invention shall be included within the scope of protection of the invention.

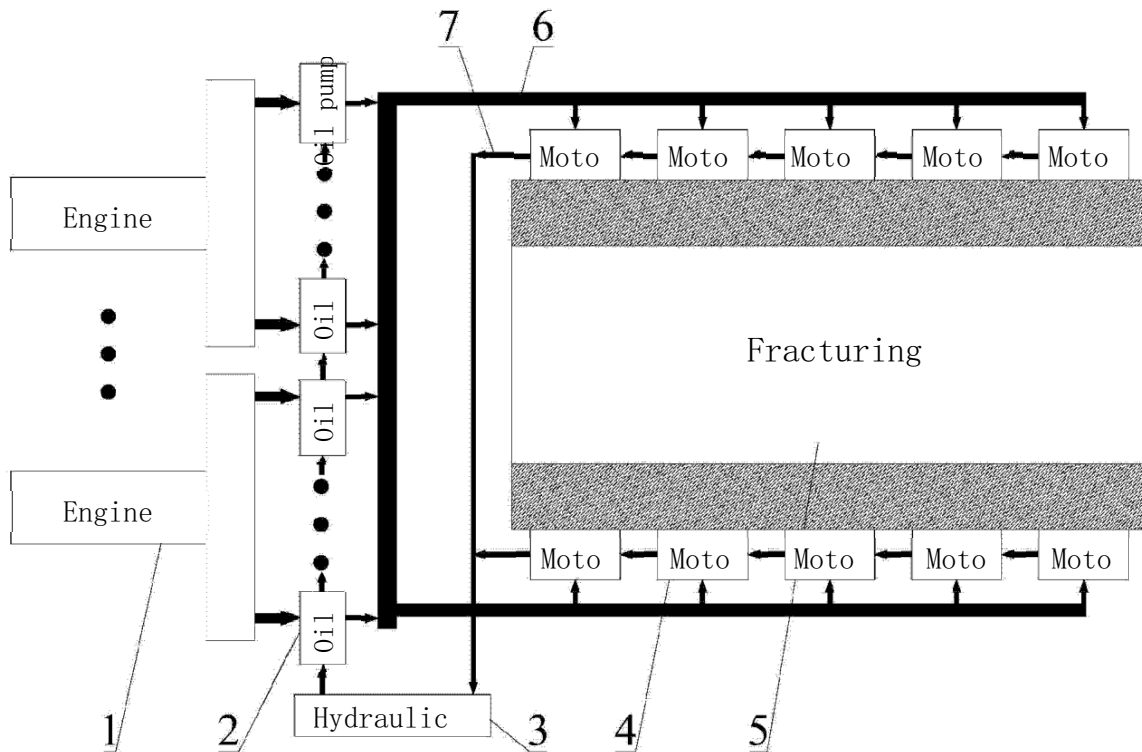


Figure 1

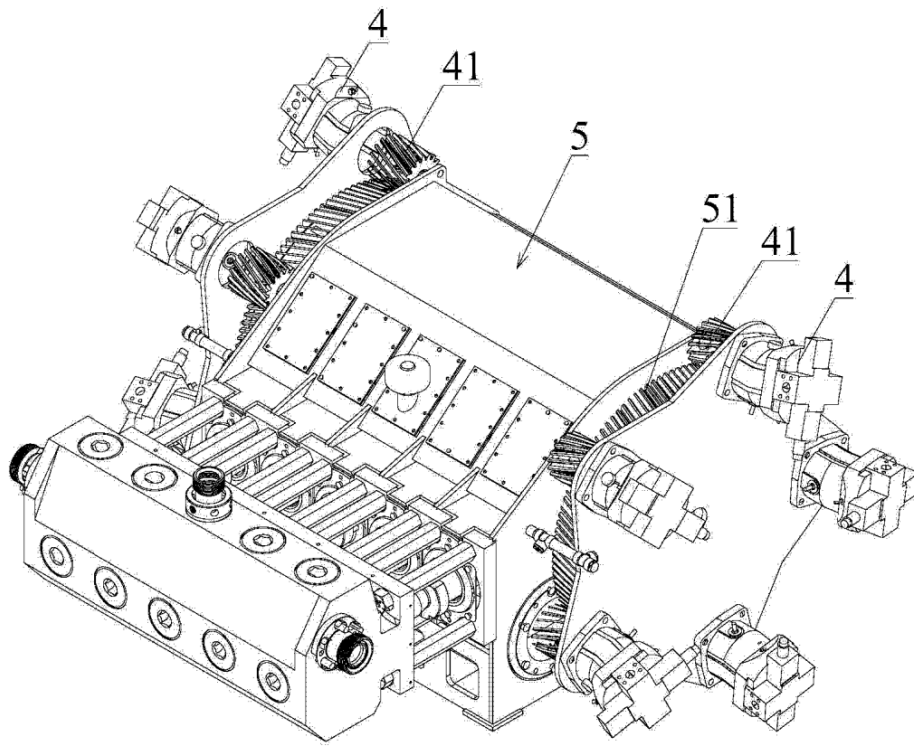


Figure 2

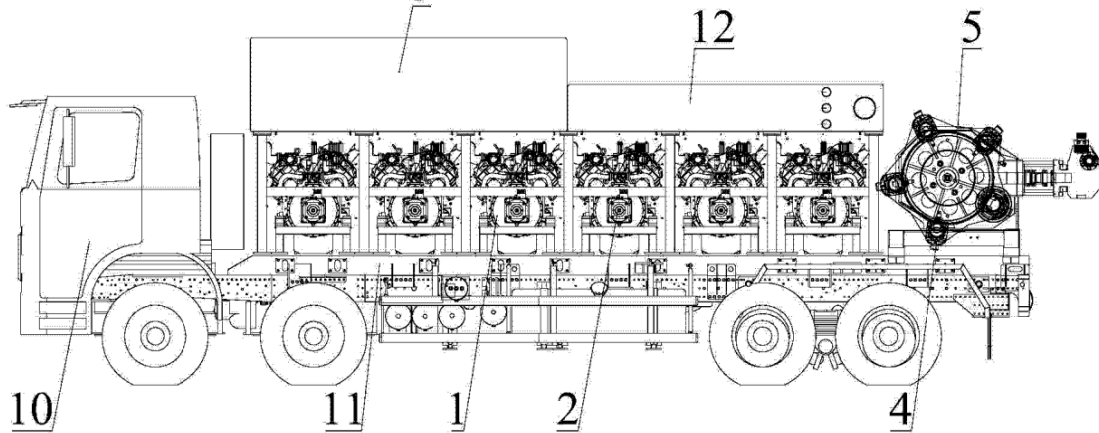


Figure 3



September 24, 2024

Certification

Welocalize Translations

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