METHOD AND DEVICE FOR STARTING THE ENGINE OF A VEHICLE

The present invention falls within the field of assisting with starting the engine of a vehicle, particularly in vehicles that transport and handle load, which may have repeated cycles of prolonged stoppage, for loading and unloading phases, and of travel.

The invention will find a preferred but not in any way limiting application in vehicles for handling containers within a harbor installation. Such vehicles may be of the crane type, for loading and unloading containers from a land vehicle to a watercraft, and vice versa.

As mentioned earlier, the invention relates to vehicles that may have repeated cycles of prolonged stoppage and of travel.

In the known way, when used, such vehicles are subjected to numerous cycles of travel and of standby, with significant lengths of time spent stopped during the phases of loading and unloading the containers.

Most of these vehicles are equipped, for moving them around, with combustion engines that are fitted with an electric starter. That component has difficulty tolerating frequent start-ups, resulting in premature wear of its components, such as the brushes, the ring gear or the starter pinion, but also causing overheating of the windings and wear and tear on the battery because of the significant currents drawn to turn the line of shaft.

As a result, it is preferable for the engine to be stopped only if the vehicle is completely inactive. Thus, the engine is kept running, when the vehicle is

at a standstill, during loading and unloading phases. Although keeping it running improves the life of the aforementioned components, it carries a major disadvantage associated with the needless consumption of highly expensive fuel, requiring regular replenishment. This needless running of the engine also inevitably generates gas emissions and therefore greater atmospheric pollution.

In addition, this type of engine is still very noisy, creating noise pollution in its surroundings.

This is why the idea as been had to carry engine start assist modules on such vehicles. In brief, these modules are able to accumulate energy while the vehicle is moving around and then restore it when this vehicle needs to be restarted.

Such solutions are described in documents US 4 959 962 and US 3 384 027. In particular, an accumulator in the form of a hydraulic motor stores energy while the vehicle is moving around and restores it, directly to the driving of the engine, at the time of its restart.

More specifically, at the time of starting, the driving of the engine or even of the running means is made easier by the restoration of stored hydraulic energy.

However, such devices do not allow the engine to be started without intervention on the starter, namely without the driver initiating contact. Thus, the electric starter is still subject to significant wear and tear.

It is an object of the invention to alleviate the drawbacks of the prior art by proposing a method of starting the engine of a vehicle without actuating the electric starter.

Such a method of starting involves coupling hydraulic energy accumulating means to said engine; while said engine is operating, energy is accumulated by compressing a hydraulic fluid; then when the engine stops, the accumulated energy is restored to drive and start said engine.

Advantageously, the energy of pressurizing said fluid is accumulated during the vehicle deceleration phase.

More specifically, at the time of starting, it is operation of the throttle pedal that controls the restarting of the engine, without involving the starter. In brief, forcing the engine to turn over by delivering the accumulated energy causes this engine to start without any demand on the starter.

Thus, the present invention allows the engine to be stopped during phases in which the vehicle is at a standstill, and allows said engine to be restarted with less wear and tear on its components. This solution allows a considerable reduction in fuel consumption and in pollutant emissions and surrounding noise pollution, because the engine is stopped when the vehicle is not moving around.

In addition, fuel replenishments are more widely spaced, increasing the length of time for which the vehicle is available for use.

To do this, the present invention relates to a method for starting the engine of a vehicle, in which hydraulic energy accumulating means are coupled to said engine; while said engine is operating, energy is accumulated by compressing a hydraulic fluid; then when the engine stops, the accumulated energy is restored to drive and start said engine; characterized in that at the moment of starting said engine, the restoration of

the accumulated energy is commanded by operating the throttle pedal.

The invention also relates to a device for implementing the method according to the invention, comprising hydraulic means of accumulating energy by compressing a hydraulic fluid, said accumulating means being provided, firstly, with means of connection intended to be coupled to said engine, and secondly with means of monitoring the restoration of the accumulated energy, characterized in that it comprises means of controlling the restoration of accumulated energy in the form of a controller that detects operation of the throttle pedal.

The invention also relates to a vehicle, notably of the harbor vehicle type for loading and unloading containers, comprising an engine fitted with such a starting device.

Other features and advantages of the invention will emerge from the detailed description which follows of some nonlimiting embodiments of the invention, made with reference to the attached figure.

The present invention relates to the starting of the engine 1 of a vehicle.

The principle of the invention involves storing energy in order later to restore it at the time of starting of the engine 1. To do this, the invention plans to use a pressurized and hydraulic accumulation and storage of this energy which is delivered at the time of starting.

Thus, the method of starting the engine 1 involves coupling to said engine 1 hydraulic energy accumulating means. In addition, it involves at least the following steps, namely while said engine 1 is running,

accumulating energy by compressing a hydraulic fluid; then when the engine 1 is at a standstill, restoring the accumulated energy to turn over and start said engine 1.

In other words, the running of the engine 1 pressurizes a fluid which is then kept in that condition, even when the engine 1 is at a complete standstill, then when the time comes to restart the engine 1, the pressure thus accumulated is delivered to facilitate, force or simply start the engine 1.

It will be noted that the accumulation of energy is performed preferably while the engine 1 is running. For example, when the vehicle stops, the engine 1 may allow energy to be accumulated so that the engine can be later restarted.

According to an alternative embodiment, the energy of pressurizing said fluid is accumulated during vehicle deceleration phases.

The invention also relates to a device for implementing such a starting method. This starting device therefore comprises hydraulic means of accumulating energy by compressing a hydraulic fluid.

Such accumulating means may comprise at least a hydraulic pressure accumulator 4, in the form of a pressurized gas reservoir capable of containing a variable volume of fluid, such as oil or water in the case of a oleo-hydraulic accumulator. Such an accumulator 4 is able to supply a significant flow rate of said fluid in a fairly short space of time.

In addition, said accumulating means are provided with connection means 5 intended to be coupled to said engine 1.

As a result, the starting of the engine 1 is obtained by turning over its transmission means, particularly its line of shaft. This turning over can be obtained via said coupling, through the connection means 5, for example through a mechanical connection to the crankshaft of said engine 1.

As a result, during the restart, actuation is performed directly on the drive system on the output side of the engine 1, restarting the latter by forcing it to start while at the same time starting the vehicle moving. Thus, there is absolutely no demand on the electric starter.

More specifically, at the time of starting of said engine 1, the restoration of the accumulated energy is commanded by operating the throttle pedal.

To do this, said device may incorporate means of controlling the restoration of the accumulated energy which take the form of a mechanical or electronic controller that detects actuation of the throttle pedal.

As a result, there is absolutely no need to involve the starter, simply depressing the throttle pedal causing the energy to be restored and the vehicle restarted.

According to the preferred embodiment, said accumulating means also comprise means 10 of monitoring the restoration of accumulated energy. These means allow the restoration of stored energy to be controlled, but also control the filling of said accumulator 4 and manage the pressure within the latter.

To do that, said monitoring means 10 may comprise means 6 of measuring the accumulated pressure, such as a pressure sensor that checks the pressure level of the fluid within the entire device and also within the accumulator 4.

Said monitoring means 10 may also comprise a supply member 8, such as a directional control valve, that acts as a check valve 10 on the flow rate of fluid. Depending on the flow rate of fluid, it is therefore possible precisely to control the starting of the engine 1.

In addition, said monitoring means 10 may also comprise additional means for supplying fluid and for keeping said accumulating means 4 under pressure. Specifically, if it is detected that the pressure is not high enough to allow the later starting of the engine 1, these supply means, controlled by said monitoring means 10, recharge said accumulator 4 in order to attain a fluid pressure that is high enough.

In particular, this pressure may be determined variably, notably by the monitoring means 10, according to various parameters connected with the engine 1 and with its load, connected with the vehicle, connected with the load that is to be transported, or the like.

When combined with the monitoring means 10, the supply means guarantee that the store of pressurized fluid within the accumulator 4 is adequately filled but also that it continues to be replenished during operation.

According to the preferred embodiment depicted in the figure, said supply means may comprise a supply member 9, notably of the hydraulic directional control check valve type. A pressure generator 11 allows fluid to be delivered through this supply member 9.

They also comprise a nonreturn check valve 7, preventing return from said accumulating means. In other words, this check valve 7 prevents, notably under the action of said pressure generator 11, return of fluid from the accumulator 4 to said supply means, notably when a threshold or set pressure is attained within the accumulator 4.

It will be noted that the various elements described hereinabove are connected to one another via suitable hydraulic circuits.

Advantageously, according to the preferred embodiment depicted in the figure but which is not in any way limiting, such an engine may comprise a hydraulic motor 2 coupled to a combustion engine 3.

In that scenario, the starting according to the invention is performed directly on the hydraulic motor 2 which then passes on the delivered energy to the combustion engine 1. As mentioned earlier, the coupling can then be performed in the traditional way through a motor coupled directly to the translational drive pump, the latter being mounted along the axis of the crankshaft and driven by a coupling connected to the flywheel.

Moreover, the hydraulic components used are clearly designed to be fluidtight, with a low level of internal leakage so as to allow a start to be performed after a prolonged length of time for which the vehicle has been completely inactive or at a standstill.

In this regard, the present invention also relates to a harbor vehicle for loading and unloading containers, particularly of the container-handling crane type,

comprising an engine equipped with an abovementioned starting device.

According to one preferred embodiment that has already been mentioned hereinabove, such a harbor vehicle may comprise a combustion engine 1 provided with a hydraulic motor 2 coupled to a hydraulic pump 3, said starting device being coupled to said hydraulic motor 2 in such a way as to restore the accumulated hydraulic energy to said combustion engine 1, via said hydraulic motor 2.

In particular, said coupling may be performed via the means 5 of connection to the crankshaft of said combustion engine 1 so that the restoration of energy turns said crankshaft. Said actuation can then be performed through a rotary motor, the source of power thereof being delivered by the accumulating means, notably the accumulator 4.

In addition, it must be noted that the system can operate in the other direction, namely under the action of the combustion engine 1 on the hydraulic motor 2 it can recharge the accumulating means and store the energy required for the next start.

The present invention therefore offers a system for starting the engine of a vehicle, particularly a harbor vehicle, without making any modifications to the existing combustion engine 1. This system is economical because of the controlled cost of its components but also because of its ease of installation and its durability.

The invention therefore allows a significant saving on fuel but also improves the life of the combustion engine 1, reducing repairs and maintenance thereon, particularly the change of the starter motor which no

longer has demands made of it. It also reduces pollutant emissions and noise pollution in its surroundings.

Its use, which as far as the driver is concerned is hidden, through operation of the throttle pedal, makes restart operations considerably easier.

CLAIMS

1. A method for starting the engine of a vehicle, in which:
- hydraulic energy accumulating means are coupled to said engine;
- while said engine is operating, energy is accumulated by compressing a hydraulic fluid; then
- when the engine stops, the accumulated energy is restored to drive and start said engine;
characterized in that at the moment of starting said engine, the restoration of the accumulated energy is commanded by operating the throttle pedal.

2. The method of starting as claimed in claim 1, characterized in that the energy of pressurizing said fluid is accumulated during the vehicle deceleration phase.

3. A device for implementing the method as claimed in either one of claims 1 or 2, comprising hydraulic means (4) of accumulating energy by compressing a hydraulic fluid, said accumulating means (4) being provided, firstly, with means of connection intended to be coupled to said engine, and secondly with means of monitoring the restoration of the accumulated energy, characterized in that it comprises means of controlling the restoration of accumulated energy in the form of a controller that detects operation of the throttle pedal.

4. A vehicle, notably of the harbor vehicle type for loading and unloading containers, comprising an engine fitted with a starting device as claimed in claim 3.

5. The vehicle as claimed in claim 4, characterized in that said engine comprises a hydraulic motor (2) coupled to a combustion engine (1), said starting

device being coupled to said hydraulic motor (2) so as to restore the accumulated hydraulic energy to said combustion engine (1) via said hydraulic motor (2).

6. The vehicle as claimed in claim 5, characterized in that said coupling is performed via means of connection (5) to the crankshaft of said combustion engine (1) such that the restoration of energy turns said crankshaft.