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(54) Multi-purpose truck for re-establishment of safe and practicable road conditions, after car accidents.

(57) Improved multi-purpose truck (430) for re-establishment of safe and practicable road conditions, after car accidents, through cleaning of the road platform, said truck being equipped by:

- a water tank (414), containing clean water or a solution (434) of water mixed to a special washing liquid (*ecological surfactant*) and a special treatment liquid for the road platform (so called *molecular chain destroyer,* to be sprayed on oil and related oil products), and a suction tank (405) containing emulsion (436) obtained by collection of the washing/treatment liquids and the polluting liquids (435);
- a high-pressure water gun (408), including a rain jet adjustment, providing a jet of the above said solution (434) on the road platform, where polluting functional liquids (435) (lubricating oils, fuels, cooling substances, etc.) have been eventually lost by vehicles as a consequence of car accidents or breakdown;
- a suction system (433) suitable to remove, from the road platform, the above resulting emulsion (436), obtained from polluting liquids (435) mixed to the washing/treatment solution (434); furthermore, through the terminal element or suction tube (407), solid and not biodegradable debris are removed/aspirated, these debris being related to typical car equipments (broken glasses, parts made of plastic, metals, remaining parts of structures, etc.),

characterized in that further comprising:

- two separate and independent modules, one of which, that is the module of the powers (426) is related to the generation of power that is necessary for the functioning of the belonging parts, and the other one, so called module of the tools (427) is placed towards the center of the road, at the left side of the multi-purpose truck (430), that is the driver's side, and containing said high-pressure water gun (408) system and said suction system (433) necessary to carry out the washing and suction operations, so that to reduce weight and encumbrance and to facilitate the movements of operators (428, 429), during the cleaning steps;
- a security system for controlling the filling of said suction tank (405), consisting of a switching valve (423), with both manual and automatic activation, positioned between a depressor (406) and said suction tank (405); the automatic switching of the valve (423) prevents to continue the suction of air from the tank (405), when the liquid in said suction tank (405) has reached an upper limit, or when a manual switching occurred after that all the polluting liquid (435) has been aspirated from the road platform, thus preventing the aspiration of wet air and/or air mixed with particles of pollutant, that could compromise the correct functioning of the suction system (433); such switching determines the suction of outer air that conveyed into a pressure tube (425) can be used for the operation of drying the road, after that it has been washed; besides, in case of a routine maintenance of the overall system, the manual switching is very useful, as it allows the circulation of air only from the outer environment, capable of removing any particles of liquid and pollutants accumulated over time;
- a sensor of level (424) measuring the quantity of liquid in said tank (405) (electrolevel) that, when said level exceeds a maximum capacity allowed, is able to activate electrically some mechanical means causing the auto-

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matic switching of said valve (423) connecting to a source air point, not anymore from inside the tank (405) but from the external environment.

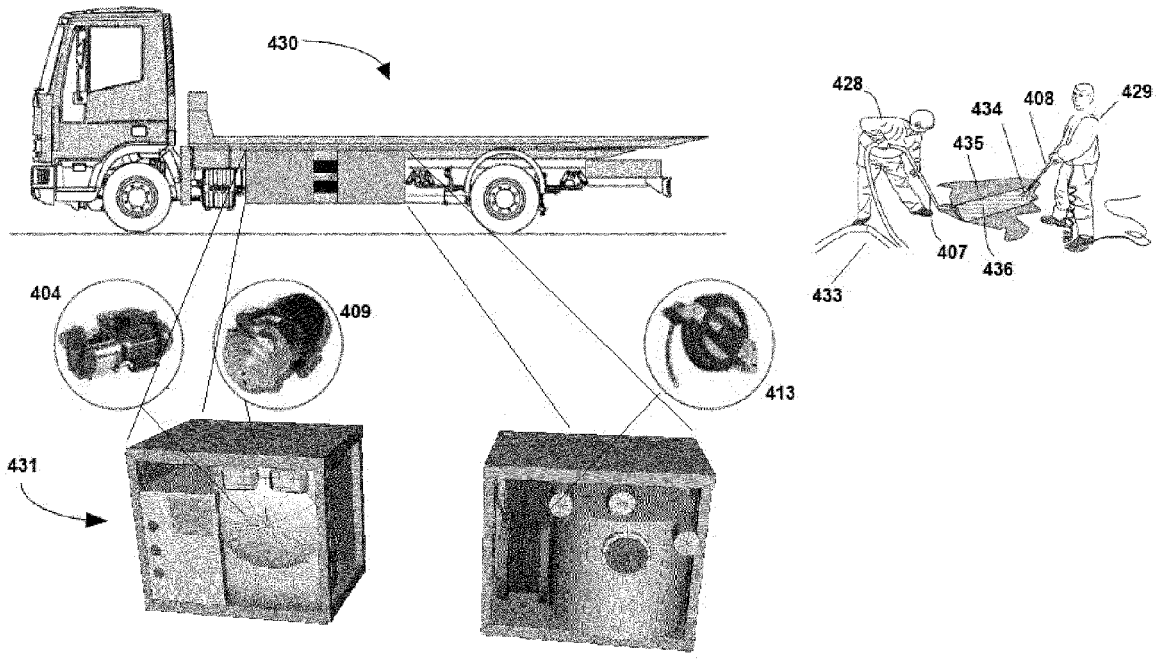


Fig. 1

Description

[0001] The present invention regards an improved multi-purpose truck for re-establishment of safe and practicable road conditions, after car accidents, through cleaning of the road platform.

[0002] The multi-purpose truck is able to support the re-establishment of safe and practicable road conditions using some specific devices installed on it, and to prevent, even in serious accidents, further damage to the environment. This is possible because it supports the cleaning of the road platform and the aspiration of functional polluting liquids (lubricating oils, fuels, cooling liquids, etc.) possibly lost by vehicles involved in the accidents. Further, the road platform is subject to a treatment using specific products, so that it is avoided any slippery surface; then, the solid debris related to typical car equipments (broken glasses, parts made of plastic, metals, remaining parts of structures, etc.) are collected and removed.

[0003] From the state of the art, some specific vehicles are known in order to collect the polluting substances lost on the road platform, after car accidents. In particular, it is known the multi-purpose motor vehicle described in the European patent application EP 10425290, that is adapt to provide the operations of re-establishment of safe and practicable road conditions, and the multi-purpose truck, subject of the European patent application EP 10425291, where the present invention represents an improvement of the same multi-purpose truck.

[0004] The multi-purpose truck of the European patent application EP 10425291 is particularly effective because it can support the interventions with specific devices providing a jet of a water solution and other devices having a high aspiration power. The water solution further contains specific products able to remove any slippery condition of surfaces, like the *ecological surfactant* and the *molecular chain destroyer*; these specific devices can further collect and contain the solid debris lost by vehicles involved in the accidents; and the emergency vehicles are equipped in order to reach the sites of accidents very quickly.

[0005] The multi-purpose truck of the prior art is characterised by the following features:

- three tanks for containing: clean water; a water solution composed of a *ecological surfactant* and a *molecular chain destroyer;* and an emulsion obtained by washing the road platform;
- a high-pressure water gun, including a rain jet adjustment, providing a jet of the above said solution on the road platform, where the polluting functional liquids have been eventually lost;
- a suction system suitable to collect and remove the above resulting emulsion, obtained from the polluting materials mixed to the washing/treatment solution, and solid debris lost by vehicles on the road platform;
- an hydraulic system wherein the power supply is directly provided by the engine and/or any other point of the kinematic chain of the vehicle, otherwise it is directly provided by a pneumatic or fluid dynamic circuit previously installed on the vehicle; in the latter case the system of energy transmission can include means of energy extraction, connected through one or more derivation points to the preinstalled circuit, that is activated by the engine of the same vehicle, and means of energy transmission towards a secondary hydraulic or fluid dynamic circuit supplying said high-pressure water gun and suction system; said derivation points include a three ways distributor extracting the energy from the circuit and transmitting it alternatively to the hydraulic engine, activating the water gun, and to the hydraulic or pneumatic engine activating the suction system; the water jet device pushes and directs the specific washing liquid under high pressure from the tank where it is contained to the water gun, and it is directed and sprayed with a high pressure on the road platform by an operator; the suction device aspirates the air from said tank leading it to a vacuum condition, so that the terminal of the suction device is directed by an operator in order to remove said resulting emulsion from the road platform and collect it inside the same tank.

[0006] However, the multi-purpose truck of the European patent application EP 10425291 presents some specific drawbacks. First of all, it is not included a mechanism controlling automatically the level of filling of the vacuum tank, wherein the emulsion and debris are collected from the road platform. In fact, if the liquid collected into said tank reaches and goes beyond a specific maximum level, there is the risk to aspirate air mixed to wet particles and/or polluting particles, until the extreme situation when the liquid contained inside could be directly aspirated. In such a case, air mixed to a liquid would reach the engine leading to a risk of serious damage and/or a the final breakdown.

[0007] Another drawback is represented by the missing of a drying system operating on the road platform, to be used after the washing procedure, in order to dry up the surface quickly and properly and permit the fast re-establishment of the normal traffic conditions.

[0008] A third drawback is given by the temperature of the oil in the oil-dynamic system. In fact, the oil flows in the system and warms up due to the friction, reaching temperatures that are very high and dangerous. Therefore, the high temperature oil can break down the hydraulic engines that supply the water pump and the vacuum pump that make it possible to activate the water gun and the suction device.

[0009] Another drawback is related to the opening of the drain valve in the tank collecting the aspirated materials, that could be very small leading to a slow rate of the emptying process when the materials are delivered

to disposal and recycle plants.

[0010] Another drawback is given by the aspirating hose having a big cross-section size, leading to a slow rate of aspiration decreasing therefore the aspiration power.

[0011] In order to overcome the above said drawbacks, the existing multi-purpose module has been improved by introduction of specific technical solutions, that have permitted to achieve improved efficiency and effectiveness of the same module.

[0012] Therefore, the main objective of the present invention is to propose a multi-purpose truck that supports the re-establishment of safe and practicable road conditions after car accidents through cleaning of the road platform by a process of aspiration and collection of polluting liquids and other debris possibly lost by vehicles in the accident. Another objective is that the equipment of the multi-purpose truck is contained inside two independent modules, where the first is related to the generation of power and the second is related to the instruments, with the equipment being lower in weight and distributed more in balance, so that to decrease the total amount of occupied space and to improve the work of operators during the cleaning process.

[0013] Another further objective is that the multi-purpose truck includes a water tank, having a unique compartment, so that it occupies a smaller space and it has a lower weight. Another objective is that the silencers of the hydraulic engines are removed, so that the total amount of occupied space and weight are decreased in the equipment, keeping a level of noise that is approximately the same.

[0014] Another further objective is that the multi-purpose truck includes a control system of the oil flow, with a priority valve that is connected to a flow sensor, in order to keep the oil flow under a safety level, fixed at 30 litres per minute (beyond that, the hydraulic engine would risk a total break down).

[0015] Another objective is that the multi-purpose truck includes a control system of the filling of the suction tank, composed of a safety valve with a manual and/or an automatic switch, connected to an electonic sensor of level, in order to avoid possible break down in the hydraulic engines due to aspiration of liquids, and in order to make easier the procedure of periodic maintenance of devices.

[0016] Another further objective is that the improved multi-purpose truck includes a cylindrical aspiration tank higher in respect to the prior art, in order to increase the capacity and avoid possible break down in the hydraulic engines due to aspiration of liquids. Another objective is that the equipment of the improved multi-purpose truck includes a pushing air hose that, activated by operator, receives air from the external environment and put it in circuit under pressure, so that it is possible a quick drying process of the road platform, after that this has been washed.

[0017] Another objective is that the multi-purpose truck includes a hydraulic engine having a decreased power, so that keeping the same oil flow the engine RPM results to be increased, leading to saving of energy and decrease of the polluting emissions. Another objective is that the multi-purpose truck has an increased diameter of the drain hole of the suction tank, in order to move the contained materials quickly and to make easier the emptying of the same tank.

[0018] Another further objective is that the multi-purpose truck includes a GPS system that is activated by a sensor of oil pressure, and communicates the geographic coordinates to a national Headquarter, by using a mobile phone network and/or a wireless network, in order to detect position of operators during the intervention and to monitor the procedures of periodic maintenance of devices.

[0019] Therefore, it is specific subject of the present invention a multi-purpose truck for re-establishment of safe and practicable road conditions, after car accidents, through cleaning of the road platform, said truck being equipped by:

- a water tank, containing clean water or a solution of water mixed to a special washing liquid (*ecological surfactant*) and a special treatment liquid for the road platform (so called *molecular chain destroyer*, to be sprayed on oil and related oil products), and a suction tank containing emulsion obtained by collection of the washing/treatment liquids and the polluting liquids;
- a high-pressure water gun, including a rain jet adjustment, providing a jet of the above said solution on the road platform, where polluting functional liquids (lubricating oils, fuels, cooling substances, etc.) have been eventually lost by vehicles as a consequence of car accidents or breakdown;
- a suction system suitable to remove, from the road platform, the above resulting emulsion, obtained from polluting liquids mixed to the washing/treatment solution; furthermore, through the terminal element or suction tube, solid and not biodegradable debris are removed/aspirated, these debris being related to typical car equipments (broken glasses, parts made of plastic, metals, remaining parts of structures, etc.),

characterized in that further comprising:

- two separate and independent modules, one of which, that is the module of the powers is related to the generation of power that is necessary for the functioning of the belonging parts, and the other one, so called module of the tools is placed towards the center of the road, at the left side of the multi-purpose truck, that is the driver's side, and containing said high-pressure water gun system and said suction system necessary to carry out the washing and suction operations, so that to reduce weight and encumbrance and to facilitate the movements of operators,

during the cleaning steps;

- a security system for controlling the filling of said suction tank, consisting of a switching valve, with both manual and automatic activation, positioned between a depressor and said suction tank; the automatic switching of the valve prevents to continue the suction of air from the tank, when the liquid in said suction tank has reached an upper limit, or when a manual switching occurred after that all the polluting liquid has been aspirated from the road platform, thus preventing the aspiration of wet air and/or air mixed with particles of pollutant, that could compromise the correct functioning of the suction system; such switching determines the suction of outer air that conveyed into a pressure tube can be used for the operation of drying the road, after that it has been washed; besides, in case of a routine maintenance of the overall system, the manual switching is very useful, as it allows the circulation of air only from the outer environment, capable of removing any particles of liquid and pollutants accumulated over time;
- a sensor of level measuring the quantity of liquid in said tank (*electrolevel*) that, when said level exceeds a maximum capacity allowed, is able to activate electrically some mechanical means causing the automatic switching of said valve connecting to a source air point, not anymore from inside the tank but from the external environment.

[0020] The present invention will now be described for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to figures of the enclosed drawings, wherein:

Figure 1 is a lateral view of an improved multi-purpose truck on which it is installed a module, including all the devices that are necessary in order to clean the area where an accident has occurred, so that it is achieved the re-establishment of safe and practicable road conditions;
Figure 2 is a schematic view of a oil-dynamic system, according to the prior art, where two modules are achieved: the first containing all the components regarding the aspiration and the second containing instead all the components related to the washing process;
Figure 3 is a schematic view of a oil-dynamic system, according to the present invention, where there are again two modules, but each of them including different devices: a first module containing the power systems, either of aspiration and washing, and a second module containing all the instruments, either of aspiration and washing.

[0021] It is here underlined that only few of the many conceivable embodiments of the present invention are described, which are just some specific non-limiting examples, having the possibility to describe many other embodiments based on the disclosed technical solutions of the present invention.

[0022] Figure 1 shows a multi-purpose truck 430 on which it is installed a module 431 containing all the devices usable in order to re-establish practicable and safe road conditions by washing the road platform involved in car accidents. In particular, it is shown a module 431 in the condition of being used with the open doors, so that operators 428, 429 can access to the devices contained inside, and it is shown a module 432 in the condition of transportation, with the doors closed to protect the devices contained inside.

[0023] The module 431 is power supplied directly from the engine of the truck 430 and includes the following components:

- a water tank 414, containing clean water or a solution 434 of water mixed to a special washing liquid (*ecological surfactant*) and a special treatment liquid for the road platform (so called *molecular chain destroyer*, to be sprayed on oil and related oil products), and a suction tank 405 containing emulsion 436 obtained by collection of the washing/treatment liquids and the polluting liquids 435;
- a high-pressure water gun 408, including a rain jet adjustment, providing a jet of the above said solution 434 on the road platform, where polluting functional liquids 435 (lubricating oils, fuels, cooling substances, etc.) have been eventually lost by vehicles as a consequence of car accidents or breakdown;
- a suction system 433 suitable to remove, from the road platform, the above resulting emulsion 436, obtained from polluting liquids 435 mixed to the washing/treatment solution 434; furthermore, through the terminal element or suction tube 407, solid and not biodegradable debris are removed/aspirated, these debris being related to typical car equipments (broken glasses, parts made of plastic, metals, remaining parts of structures, etc.).

[0024] The multi-purpose truck 430 is part of a national intervention network that is coordinated by an operative Headquarter that receives all the intervention calls coming from all around the national territory. When a telephone call arrives, related to an accident, a worker of the Headquarter calls the local operators 428, 429 ,and ask them to go urgently on site, and to start as soon as possible the activities of re-establishment of normal road conditions, through cleaning of the road platform.

[0025] The cleaning process starts when the connection pipes are installed, connecting the terminal devices of the hydraulic circuit to respective independent tanks, 414, 405, placed on the multi-purpose truck 430.

[0026] The operator 428 (possibly assisted by a second operator 429) can start the operations of cleaning the road platform and related parts on which there are polluting liquids and/or other not biodegradable materials. As a priority, the same operator 428 will remove im-

mediately, using the suction system 407, most of the existing polluting liquids 435 lost by vehicles in the accident, then he will wash the road platform using a solution of water and specific products (*ecological surfactant* and *molecular chain destroyer*). This solution is sprayed using a high-pressure water gun, including a rain jet adjustment, so that the polluting material 435 is removed from the platform, avoiding any slippery condition, and it is activated a degradation process of hydrocarbons provided by natural *bacteria,* washing the road platform at the same time.

[0027] Finally, the resulting emulsion is aspirated and collected in the proper container 405, and then temporary stocked at the site of the company that made the intervention, before to be definitely delivered to special and authorized plants, where they are processed and properly finished as required by the existent environmental laws.

[0028] In figure 2 it is illustrated the oil-dynamic system according to the prior art, where the components and the devices related to the aspiration are separate from the ones related to the washing process.

[0029] The first module is related to the washing process and contains the hydraulic engine 409, the water pump 417, the tank 415 of water, the tank 414 of water mixed to the additive, the reel 413 and the water gun 408. The second module is related to the aspiration process and contains the hydraulic engine 404, the suction device 406, the vacuum tank integrated with reel 405 and the aspirator 407.

[0030] However, this configuration makes it uncomfortable and difficult the use of these devices, resulting as an obstacle to the motion of operators 428, 429, during the aspiration process and the washing process, with the additional disadvantage of a not optimal distribution of weights on the same truck 430. In order to avoid the drawbacks of this configuration, the present invention proposes some improvements, regarding a better distribution of weights of the components.

[0031] With reference to figure 3 showing a schematic view of a oil-dynamic system according to the present invention, the components of the oil-dynamic system 400 are contained in a module that can be installed on the truck, but with a subdivision in two separated and indipendent components that are the called module of power 426 and the called module of instruments 427. The module of power 426 contains all the systems generating the energy, for aspiration and for washing, that are the hydraulic engine 409, the water pump 417, the water tank 414, the aspirating engine or suction device 406 and the entire oil-dynamic circuit previously installed on the multipurpose truck, that is activated by the motor engine of the same truck.

[0032] The module of the instruments 427 contains, instead, the tanks and the terminal devices, that are the aspiration tank 405, the safety valve 423, the sensor of level 424, the reel 413, the aspirating hose 407, the air pushing hose 425 and the water gun 408. The module of instruments is placed close to the middle of the road, at the left side of the multi-purpose truck that is the driver's side, so that the use of the terminal devices is made quick and comfortable to operators, said terminal devices being like the water gun 408, the aspirating hose 407, and the air pushing hose 425.

[0033] The different distribution of instruments and the use of light materials and structures has given a final weight of the module installed on truck decreased from 250 Kg. To 138 Kg.

[0034] In order to have an additional decrease of weight and occupied space, the truck now is equipped with a water tank 414 having a single compartment. The water inside could be mixed with additives immediately before its use.

[0035] Another modification, decreasing the total weight and occupied space of devices, regards the removal of silencers belonging to the hydraulic motor 404 of the prior art. The silencers made the motor 404 very heavy and of large size, without decreasing a significant amount of noise. For this reason it has been decided for their removal, gaining new space and permitting a significant decrease of weight of the same hydraulic motor 404.

[0036] The transfer of energy in the oil-dynamic system 400 is achieved by extracting oil in the tank of the hydraulic oil 403, where it is contained, and move it to the circuit 410, passing through a three-way distributor 402, said circuit 410 being pre-installed in the multi-purpose truck and being activated by the engine of the same truck. The switch of the three way valve 412 permits to extract energy from the oil under pressure in circuit 410 and to transmit it alternativaly to the hydraulic engine 409, supplying the water pump 417, and to the hydraulic engine connected to the hydraulic motor 404, that activates the suction device 406.

[0037] By using such instruments, the operators can start the aspiration and washing process.

[0038] In fact, the water pump 417 pushes and directs the specific washing liquid, contained in tank 414, under high pressure to the water gun 408 that, directed by an operator, sprays said liquid on the road platform. The suction device 406 aspirates air from the suction tank 405, making the vacuum inside it, and activating the aspiration process on the suction hose 407, that is directed by the other operator on the emulsion. The emulsion is composed of water mixed to a specific washing liquid and mixed to the polluting materials, and it is aspirated from the road platform into the suction tank 405. In order to assure that the process proceeds correctly, without damage on the mechanical systems, it is important that the oil circulates at the proper level of pressure. Therefore, the present invention is different, in respect to the previous versions in the prior art, by the fact that further includes a priority valve 422 placed after the three way distributor 402. Considering that oil is extracted from the hydraulic oil tank 403, belonging to circuit 410 pre-installed on truck, it can reach the three way valve 412 with

an excessive pressure, with a consequent risk to break down the hydraulic engine 409 and the hydraulic motor 404.

[0039] The presence, instead, of a priority valve 422, placed before the three way valve 412, prevents this problem by tuning properly the flow and consequently the speed, having the oil coming from the circuit 410. The maximum oil flow is fixed at 30 litres per minute so that, in case oil arrives to the priority valve 422 having a higher flow, the quantity in excess is forwarded to the original circuit because it cannot enter in circle. The oil pressure control is prefixed at the factory. The priority valve permits that oil can flow only at the standard rate. This solution is strictly necessary in order to protect the hydraulic motor 409, the pneumatic motor 404, and all the mechanical parts connected to them, or contained inside them.

[0040] The first step of the process cleaning the road platform comprises the aspiration of polluting liquids lost by vehicles, by using an aspiration hose 407. As a preliminary improvement, it has been thought to avoid the wasting of air aspirated out from the suction tank 405 and sent outside in the environment, and to reuse it in order to dry up the road platform that has been previously washed.

[0041] However it has been immediately recognized that the air inside the suction tank 405 is very wet and contains particles of polluting liquid, because it is in contact with the resulting emulsion aspirated from the road platform. Therefore, the use of this air could be very dangerous because the aspiration of liquids in the suction engine 404 could cause serious break down.

[0042] In order to avoid this problem, the suction tank 405 has been designed having an increased height, going from the old 25 cm to the new 40 cm, so that the capacity has been increased. Then, a safety valve 423 has been included before the aspiration tank 405. This valve 423, activated manually by a operator, or automatically by a sensor of level 424, switches the input of air from the suction tank 405 to the external environment. In such a way, the drying process does not involve air, that could be wet, that comes from the suction tank 405, but involves clean and dry air coming from the external environment, leading to significant advantages in the drying process and in the decreased risk of failure in the hydraulic engine 404. The safety valve 423 is usually a spherical valve and can be activated either manually or automatically. When the emulsion has been collected completely, and the operator realizes that is no more necessary to continue with the aspiration process, the same operator could switch the valve manually, closing the input from the suction tank 405, and opening the input from the external environment. The external air is directed to a hose pushing air 425, by which a high pressure air jet is sent on the road platform so that it is dried up.

[0043] The manual switch of the safety valve 423 is very useful also during the maintenance process of the hydraulic engine 404, because it achieves a continuous flow of fresh air; in fact the aspiration of air from the external environment, by the aspiration circuit, permits to clean the circuit from particles possibly entrapped inside.

[0044] In order to achieve the automatic switching of the safety valve 423, a sensor of level 424 has been introduced, said sensor is called electrical level control. It includes a control electronics by which, when a maximum safe level has been reached inside the suction tank 405, a electrical signal is generated, that activates an automatic switch of the safety valve 423 and the simultaneous switch off in the aspiration circuit, because there is no more difference of pressure between the two extremities of the same circuit.

[0045] Therefore, the sensor of level 424 is extremely important because it represents a safety device for the automatic monitoring of the level of filling of the tank 405. In case of absence, the operator could not realize that the liquid, contained inside tank 405, has reached the maximum level and he could continue with the aspiration of wet air until, in case of tank 405 totally full, the aspiration of the same collected liquid. This possibility represents a serious risk, because it could reach the components of the hydraulic engine 404 and it could cause the complete break down.

[0046] The liquid and solid materials, lost by vehicles in the road accidents, are aspirated from the road platform by using the aspirating hose 407, and collected in the aspiration tank 405, so that they can be temporary stored at the site of the company of intervention, and transported later to plants that are authorized and specialized for their treatment and recycle. In order to move these materials quickly and to make easier the emptying of tank 405, it has been increased the diameter of the drain hole of the tank 405 containing the collected materials.

[0047] In case of road accidents it is very important that the cleaning intervention is provided as soon as possible in order to re-establish the normal road traffic. For this reason, the improved multi-purpose truck 430 has been equipped with a GPS system (Global Positioning System) that is a system of georaphical position detection using satellites signals. When the oil reaches a defined level of pressure in the circuit, the sensor of pressure 421 short circuits a electrical terminal that activates the GPS electronics, in such a way that it can be achieved automatically a transmission to a national Headquarter of the geographical coordinates of the operating vehicle and the exact time of its arrival on site. This transmission is achieved by embedding a SIM card in the electronics, so that the communication can be provided by connection to a mobile phone network and/or to a wireless network.

[0048] Therefore, by automatic and immediate communication of the geographic position to a national Headquarter, it is possible the remote supervision and monitoring of the activities addressed to road intervention and also the activities addressed to periodic maintenance of devices.

[0049] The above examples show that the present invention achieves all the proposed objectives. In particu-

lar, it permits to obtain a multi-purpose truck that supports the re-establishment of safe and practicable road conditions after car accidents through cleaning of the road platform by a process of aspiration and collection of polluting liquids and other debris possibly lost by vehicles in the accident. Furthermore, the equipment of the multi-purpose truck is contained inside two independent modules, where the first is related to the generation of power and the second is related to the instruments, with the equipment being lower in weight and distributed more in balance, so that to decrease the total amount of occupied space and to improve the work of operators during the cleaning process.

[0050] In addition, the multi-purpose truck includes a water tank, having a unique compartment, so that it occupies a smaller space and it has a lower weight. Furthermore, the silencers of the hydraulic engines have been removed, so that the total amount of occupied space and weight have been further decreased in the equipment, keeping a level of noise that is approximately the same.

[0051] Then, the multi-purpose truck includes a control system of the oil flow, with a priority valve that is connected to a flow sensor, in order to keep the oil flow under a safety level, fixed at 30 litres per minute (beyond that, the hydraulic engine would risk a total break down).

[0052] Then, the multi-purpose truck includes a control system of the filling of the suction tank, composed of a safety valve with a manual and/or an automatic switch, connected to an electonic sensor of level, in order to avoid possible break down in the hydraulic engines due to aspiration of liquids, and in order to make easier the procedure of periodic maintenance of devices.

[0053] Furthermore, the improved multi-purpose truck includes a cylindrical aspiration tank higher in respect to the prior art, in order to increase the capacity and avoid possible break down in the hydraulic engines due to aspiration of liquids.

[0054] Then, the equipment of the improved multi-purpose truck includes a pushing air hose that, activated by operator, receives air from the external environment and put it in circuit under pressure, so that it is possible a quick drying process of the road platform, after that this has been washed.

[0055] Then, the multi-purpose truck includes a hydraulic engine having a decreased power, so that keeping the same oil flow the engine RPM results to be increased, leading to saving of energy and decrease of the polluting emissions.

[0056] Then, the multi-purpose truck has an increased diameter of the drain hole of the suction tank, in order to move the contained materials quickly and to make easier the emptying of the same tank.

[0057] Finally, the multi-purpose truck includes a GPS system that is activated by a sensor of oil pressure, and communicates the geographic coordinates to a national Headquarter, by using a mobile phone network and/or a wireless network, in order to detect position of operators during the intervention and to monitor the procedures of periodic maintenance of devices.

[0058] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is clear that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope, as defined in the enclosed claims.

Claims

1. Multi-purpose truck (430) for re-establishment of safe and practicable road conditions, after car accidents, through cleaning of the road platform, said truck being equipped by:

   - a water tank (414), containing clean water or a solution (434) of water mixed to a special washing liquid (*ecological surfactant*) and a special treatment liquid for the road platform (so called *molecular chain destroyer*, to be sprayed on oil and related oil products), and a suction tank (405) containing emulsion (436) obtained by collection of the washing/treatment liquids and the polluting liquids (435);
   - a high-pressure water gun (408), including a rain jet adjustment, providing a jet of the above said solution (434) on the road platform, where polluting functional liquids (435) (lubricating oils, fuels, cooling substances, etc.) have been eventually lost by vehicles as a consequence of car accidents or breakdown;
   - a suction system (433) suitable to remove, from the road platform, the above resulting emulsion (436), obtained from polluting liquids (435) mixed to the washing/treatment solution (434); furthermore, through the terminal element or suction tube (407), solid and not biodegradable debris are removed/aspirated, these debris being related to typical car equipments (broken glasses, parts made of plastic, metals, remaining parts of structures, etc.),

   characterized in that further comprising:

   - two separate and independent modules, one of which, that is the module of the powers (426) is related to the generation of power that is necessary for the functioning of the belonging parts, and the other one, so called module of the tools (427) is placed towards the center of the road, at the left side of the multi-purpose truck (430), that is the driver's side, and containing said high-pressure water gun (408) system and said suction system (433) necessary to carry out the washing and suction operations, so that to reduce weight and encumbrance and to facilitate the movements of operators (428, 429), during the cleaning steps;

- a security system for controlling the filling of said suction tank (405), consisting of a switching valve (423), with both manual and automatic activation, positioned between a depressor (406) and said suction tank (405); the automatic switching of the valve (423) prevents to continue the suction of air from the tank (405), when the liquid in said suction tank (405) has reached an upper limit, or when a manual switching occurred after that all the polluting liquid (435) has been aspirated from the road platform, thus preventing the aspiration of wet air and/or air mixed with particles of pollutant, that could compromise the correct functioning of the suction system (433); such switching determines the suction of outer air that conveyed into a pressure tube (425) can be used for the operation of drying the road, after that it has been washed; besides, in case of a routine maintenance of the overall system, the manual switching is very useful, as it allows the circulation of air only from the outer environment, capable of removing any particles of liquid and pollutants accumulated over time;
- a sensor of level (424) measuring the quantity of liquid in said tank (405) (*electrolevel*) that, when said level exceeds a maximum capacity allowed, is able to activate electrically some mechanical means causing the automatic switching of said valve (423) connecting to a source air point, not anymore from inside the tank (405) but from the external environment.

2. Multi-purpose truck (430), according to the previous claim 1, **characterized in that** comprising:

- an automatic system controlling discharge of the circulating oil, including a priority valve (422), able to calibrate the system and to give oil at the correct discharge and, accordingly, at the appropriate flowing speed; the system controlling oil discharge is automatic and precise, consequent to presence of the priority valve (422), that allows the passage of oil at a precalibrated level of discharge, thus avoiding the breakage of said hydraulic motor (409) and said hydraulic motor (404).

3. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that** further comprising:

- a three-way valve (412) that directs energy of oil under pressure to said hydraulic motor (409), that in turn activates a water pump (417), or alternatively to said hydraulic motor (404), that in turn activates said depressor (406),
in such a way to allow the execution of suction or washing operations.

4. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that** comprising:

- a GPS system (*Global Positioning System*), or a satellite system for detecting the geographical position, connected to said sensor of pressure (421) that, at a definted value of oil pressure, closes an electrical contact that activates the GPS; said GPS system further comprises communication means using a SIM card to allow the transmission of data, through a network of mobile and/or wireless communication, to an Headquarter, such data relating to geographical coordinates of the multi-purpose truck (430) and time of its arrival on the place of accident.

5. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that**:

- suction cylindrical tank (405) has an height greater than that of the prior art, so that to avoid suction of polluting liquids (435) contained inside, and preventing therefore a risk of breakage for the hydraulic motor (404).

6. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that**:

- the diameter of drain pipe connected to said suction tank (405) has been increased in respect to that of the prior art,
in such a way to facilitate and speed up the flow of such materials, when they are discharged to treatment and/or disposal plants.

7. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that** further comprising:

- a hydraulic motor (404) with a chamber size reduced in respect to that of the prior art,
so that, at the same flow rate, the number of revolutions is higher, with consequent savings in fuel consumption and pollutant emissions.

8. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that** further comprising:

- a water tank (414) having just one compartment, instead of two compartments as known from the prior art,
in such a way to contain water mixed to additives or just pure water, where is possible to add detergents immediately before beginning the

washing operations.

9. Multi-purpose truck (430), according to one or more of previous claims, **characterized in that**:

- a hydraulic motor (404) where heavy, bulky and inefficient silencers belonging to the prior art have been removed,
so that to obtain a saving of space and a significant decrease of overall weight.

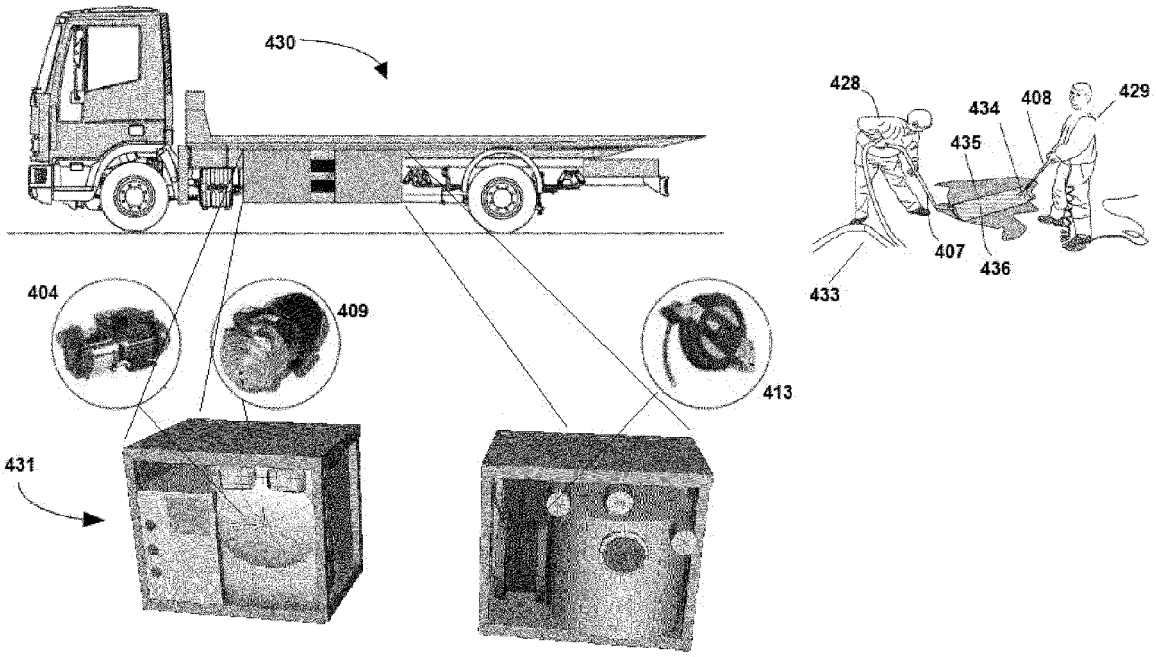
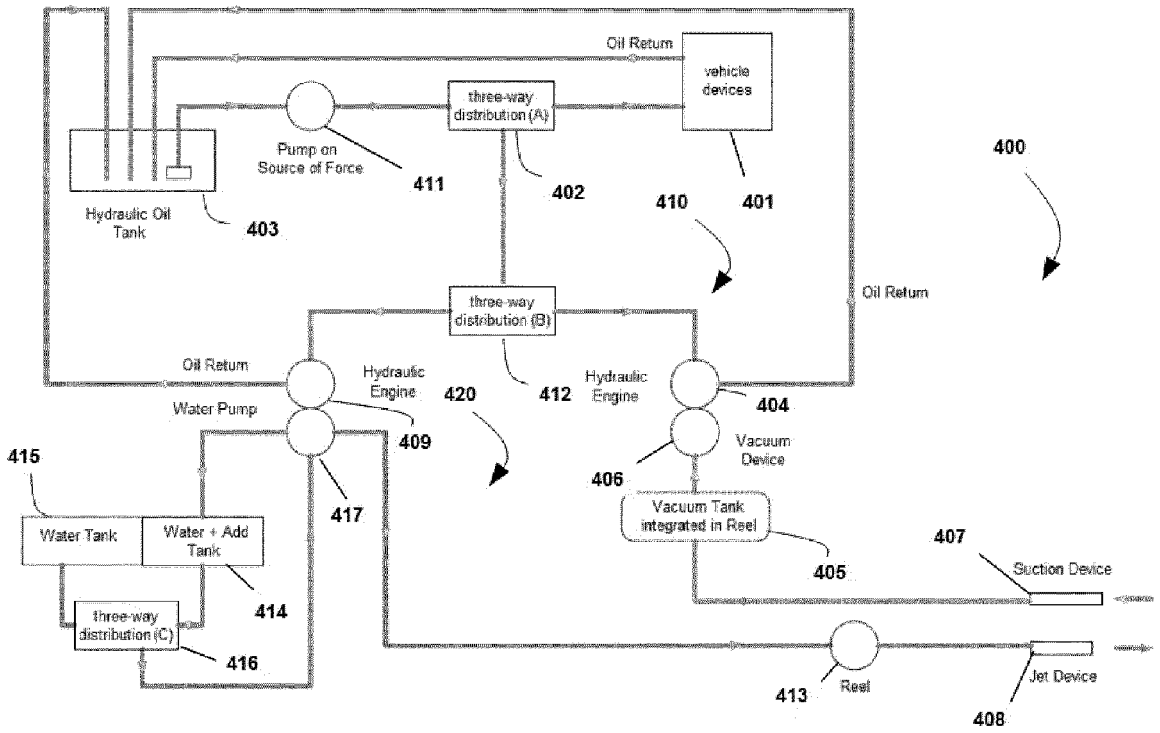


Fig. 1



(prior art)

Fig. 2

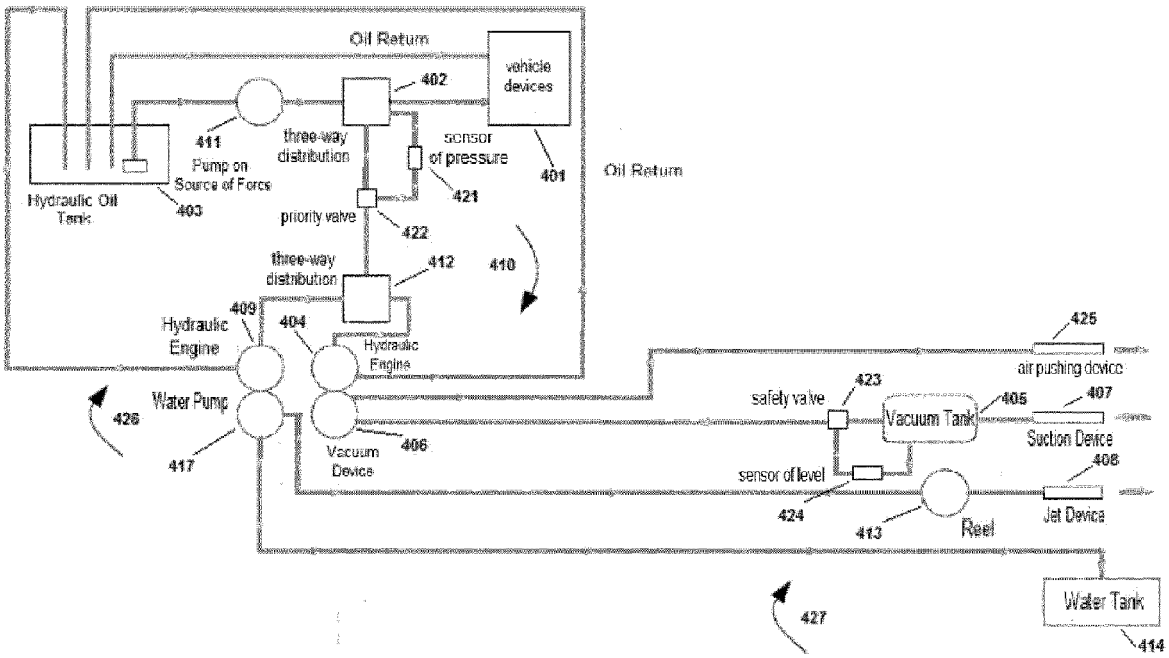

Oil Return
vehicle devices
402
411
Pump on Source of Force
three-way distribution
sensor of pressure
401
Oil Return
Hydraulic Oil Tank
403
421
priority valve
422
three-way distribution
412
410
409
Hydraulic Engine
404
Hydraulic Engine
425
air pushing device
423
safely valve
Vacuum Tank
405
407
Suction Device
426
Water Pump
406
Vacuum Device
417
sensor of level
408
424
413
Reel
Jet Device
427
Water Tank
414

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 13 18 7989

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The present search report has been drawn up for all claims

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Munich	10 February 2014	Saretta, Guido

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1

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