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Self cleaning portable system and method for purification of used machine oil.

ABSTRACT

Self cleaning portable system for refinement of a blend of used machine oil having a mobile handcart with a self cleaning centrifuge separator, pipe line system, small debris container and a pump. Being pumped into the centrifuge chamber the blend of the used oil is separated into three phases such as purified oil, water, and smaller particles of waste each one of phases depleted thorough out a dedicated channel of the chamber. Level of purification of the oil is regulated by a rotational speed of the chamber and a number of purification cycles which are controlled by an instrumentation block.

BACKGROUND OF THE INVENTION

Many businesses are often confronted with a problem of utilization of waste materials and resource refurbishment. It is obvious, that every business owner is concerned with minimization of expenditures associated with such activities. In today's industry wide range of effective methods for utilization of wastes exist, however no cost-effective solutions are available for some kinds of wastes, which usually results in an excessive resource consumption and pollution.

The present invention relates to a system, method for refinement of used machine oil, which can be used in multiple setups for a variety of applications in such industries including machining, construction and automotive. Present invention allows purification of used mineral oils, effectively separating smaller particles of debris and waste which

damage engine components, separating waters presence of which dramatically lowers the overall effectiveness of the machined oil.

Among major features characterizing the present invention are self cleaning capabilities, compactness and mobility, allowing its usage in access challenged locations inaccessible by larger analogues, effective waste collection and simplicity of operation.

Finally, methods for purification and reusability of used mineral oils featured in this invention facilitate environment friendly approach as well as dramatic cost savings by introducing methods for utilization of used machine oil, decreasing high expenditures for used oil disposal or decommissioning.

BRIEF SUMMARY OF THE INVENTION

Oil cleaning system of the present invention comprises a mobile handcart containing a number of elements used for the purification purposes which can be conveniently carried towards the source of the blend. The entire system as well as purified oil tank used for storage of the purified oil and a waste tank used for storage of the debris separated by the centrifuge separation can be compactly stored on a truck, or any mobile platform which allows an easy access to a variety of machine shops, factories and other entities that may confront a problem of used oil utilization.

The system operates by connecting to the source of the blend facilitating the flow of fluids through process and control elements. A number of valves within the piping circuit facilitate redirection of streams of oil, wastes and water of the system, allowing self cleaning of the system, and regulating a number of processing cycles in order to achieve a required level of oil cleanliness.

Cleaning centrifuge separator carried in a handcart is used for purposes of refinement of the blend. Centrifuge chamber is engaged in a rotational motion by an external motor located on the cart. A used oil blend is fed into the machine chamber through the centrifuge stationary base. The centrifuge separates the blend into three separate phases such as purified oil, debris and water. Smaller debris separate while exposed to the centripetal force and accumulate through out the inner surface of the chamber wall. Debris slide downwardly along the chamber walls continuously being subjected to the force of gravity and exiting the chamber thorough designated channels located on the chamber base. Oil component of the blend moving towards the central axis of rotation, infiltrates though out plates towards the top oil collector falling downwardly to the output channels of the machine. Water component pushed upwardly in the chamber leaves the system through a water lid of the rotational centrifuge chamber.

Pump of the system facilitates the blend inflow from the blend tank provided by a third party. Additionally, pump can be used in order to fill the waste tank by small debris separated by the centrifuge separator.

IN THE DRAWINGS

Figure 1 is a piping and process diagram of the entire oil cleaning system of the present invention;

Figure 2 is an isometric view of a handcart;

Figure 3 is an isometric view of the centrifuge separator;

Figure 4 is front sectional view of a stationary base of the centrifuge oil separator machine of figure 3;

Figure 5 is a side sectional view of a stationary base of the centrifuge oil separator machine of figure 3;

Figure 6 is an isometric view of a stationary base of Figure 4;

Figure 7 is an isometric view of the central bushing;

Figure 8 is a side sectional view of a centrifuge chamber of figure 3;

Figure 9 is an isometric view of a bottom disk;

Figure 10 is an isometric view of a plate;

Figure 11 is an isometric view of a spacer;

Figure 12 is an isometric view of a plate set;

Figure 13 is a front sectional view of a plate set;

Figure 14 is a front sectional view of the centrifuge separator;

Figure 15 is sectional view of an upper section of a centrifuge oil separator;

Figure 16 is an exploded assembly view of main centrifuge components;

Figure 17 is a sectional view of a centrifuge separator illustrating the invention and the movement and outpouring of the small debris and water components of the blend;

Figure 18 is a front sectional view of a centrifuge separator illustrating the invention and the movement and outpouring of the clean oil component of the blend.

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DESCRIPTION OF A SPECIFIC EMODIMENT

140 For the purpose of illustration of the present embodiment, schematic view of the oil cleaning system is shown on Fig. 1. Sump tank (10), containing used oil blend is connected by a quick connection method to the system input hose (12). Sump tank (10) is provided by a third party and is not a part of the system of the present invention.

Blend entering the system can be preheated to a certain temperature by an electrical heater (20). Pump (14) of the system is installed on a pipe line (16) of the circuit supporting blend inflow towards centrifuge separator (18). Alternatively blend inflow can be achieved bypassing the pump (14) through pipe line (22).

150 On Fig. 1, valves (24) are used for an access control through a number of pipe lines of the system, redirecting the follow of liquids; check valves (26) secure a passage of liquids in a one-way direction; pressure indicators (28) and temperature indicators (30) are located through out the piping circuit for control purposes.

Pipe line (32), is used for filling up the clean oil tank (34) by the oil purified by the centrifuge separator (18). Quality of the purified oil is measured by the instrumentation block (36) of the system.

Pump (14) can additionally provide with a mechanism for removal of small debris located in small debris container (38). Small debris removal is done via pipe line (44); debris are stored in a waste tank (40). Water can be fed to the small debris container (38) by regulating valve (24a).

Pipe line (42) provides with an ability to perform an additional cycle of purification of the oil already purified by the centrifuge separator (18) having valves (24b) (24e) regulated manually or automatically.

Centrifuge separator, pump, small debris container, an electrical motor and number of pipe lines of the system may be conveniently stored on a mobile handcart as shown on Fig. 2 in order to provide with an easy access to the source of the blend. Clean oil tank (34) and a waste tank (40) typically remain stationary on a truck or any other mobile platform.

Small debris container (38) having flat rectangular upper and lower surfaces (52) (54), preferably of a rigid material capable of sustaining reasonable loads of weight as shown on Fig. 3. Stationary base (56) is attached firmly to the small debris container (38) by the base bolt fixtures (58) around entire perimeter of the flange of the base as shown on Fig. 3. Blend feeder input pipe (60) is built in within the stationary base (56) provides with a quick connection mechanism.

Rotational chamber (64) mounted on top of a stationary base (56) consists of a conical chamber bottom (66) cylindrical chamber body (68) and a chamber lid (70). Chamber lid (70) preferably a detachable piece that can fastened by metal clips (72) or any other means to the upper portion of the chamber body. Gasket (74) is serving the purpose of sealing the gap between the chamber lid and the upper edge of the chamber body. Water overflow pipe (76) attached to the upper portion of the chamber lid (70) skirts the entire rotational chamber (64) and the stationary base (56) fixated by a pipe mounting bracket (78). The entire rotational chamber (64) is engaged into a rotational motion preferably by

an electrical motor (80) attached by a motor mounting bracket (82) to the small debris container (38).

As shown on Fig. 3, a sheave (84) engaged by the electrical motor (80) connected to a belt drive (50) connected directly to the external drive mechanism (48) of a conical chamber bottom (66).

As shown on Fig. 4, 5 stationary base typically solid object comprises a cylindrical base body (86) and a hollow axis pipe (88). As shown of Fig. 6, flange (90) of the base body provides with a number of screw holes (62) serving the purpose of securing of the entire stationary base to the small debris container (38). On the upper surface of base body (86) a draining aperture (92) provides an entry to the small debris container (38) via a debris draining pipe (94) running through out the base body as show on Fig. 4. A feeding aperture (90) connected to a blend feeder pipe (60) facilitates a supply channel for the used machine oil filling the bottom and body sections of the centrifuge chamber when operated. Upper surface of a base body (86) contains an antifriction bearing mechanism that facilitates rotation of the entire chamber (64) mounted on top of the stationary base. Hollow axis pipe (88) runs through out the entire stationary base as shown on Fig. 6, provides an input channel (102) for the purified oil and connects to the purified oil output pipe (148). Additional antifriction bearing mechanisms are provided on the upper and lower ends of the axis pipe.

Central bushing (106) as shown on Fig. 7 is a sleeve like cylindrical part designed so that the internal radius of the sleeve slightly accedes the outer radius of the axis pipe (88). Central bushing (106) can be mounted on the axis pipe (88) through a round opening (108). Bearing mechanisms facilitate rotation of the central bushing around the hollow axis pipe. On the outer surface of the central bushing number of hollow channels (110) is provided along the entire height of the part.

As shown on Fig. 8 the rotational chamber is mounted on a stationary base (56) through the axis pipe (88), with conical chamber bottom (66) set firmly on the upper surface of the base of the body (86).

Bottom disk (112) comprises a cone like plate having a number of side blades (114) as shown on Fig.(9). Opening (100) provides with an access to the draining aperture (92) and the feeding aperture (90) to facilitate the draining of the solid waste and the inflow of the used oil blend inside the chamber. Side blades (114) and the plate bottom wall (116) of the bottom disk (112) are inclined upwardly at a slight angle once mounted on the stationary base.

Plate set (118) of Fig. (12) (13), preferably comprised of a plastic material is mounted on the axis pipe of the stationary base, with a bottom plate (120) set firmly on the side blades of bottom disk (112) or attached to it by glue or any suitable clasping mechanism.

Plate set (118) consists of plates (104) connected to one another by plate spacers (122). Plate set is mounted on the axis pipe following the central bushing.

Plate spacers (122) provide with a clamping mechanism on their upper and lower walls (124) (126) as shown on Fig 11. Their chamfered circumferential bottom and upper surfaces (128) provide with a mechanism for penetration of oil purified by a centrifuge separation towards hollow channels of the central bushing.

Plate of a plate set (118) comprises a circular base (120) with a round opening (164) conical plate walls (124) that form a slight angle upwards and plate arms (126) that are parallel to the circular base (120) of the plate as shown on Fig. 10.

The outer diameter of a plate arm (126) is smaller by a certain degree then the inner diameter of the cylindrical chamber body (128), thus creating a gap (130) as shown on Fig. 8. The gap results in formation of a cylindrical void capturing the entire space between outer edges of the plate arms of a plate set (118) and the inner wall of the chamber.

Upper disk (132) is secured on top of the plate set (118) is the upper plate of the plate set preferably constructed of a more rigid material than that of a remainder of the plates.

Top collector (134) mounted on the upper end of the hollow axis pipe (88) as shown on Fig. 8. Top collector comprises a sleeve (136) and the cylindrical upper oil capacitance (138). Around the outer surface of the oil capacitance, number of intake holes is situated. Inflow holes provide an access to the sleeve which sits directly on the top of the axis pipe (102).

Once mounted on the top of the axis pipe, top collector provides with a mechanism for the inflow of purified machine oil elevating along channels of the central bushing towards the upper opening of the top (102) of the axis pipe (88).

Chamber lid (144) is mounted on top of the chamber body as shown on Fig 8. Chamber lid consists of a conical bottom (146) and conical top (148) creating a water capacitance (150).

In the middle part of the conical bottom (146) a cylindrical sleeve (154) provides with a pocket around top collector (134). On the edges of the lid a number of high speed valves (152) is provided. High speed valves are secured to the wall of the rotational chamber (64) by bolts (156) as shown on Fig. 15. While engaged in rotational motion, high speed valves (152) open a passage for water situated on top of the chamber body towards water capacitance (150) of the lid. Such high speed valves can be adjusted to provide with an access to the water capacitance under different rotational frequency. Internal structure of such valves is well know in the art and requires no additional description.

In the middle of the disked top a water overflow pipe (76) provided for water capacitance drainage as shown on Fig. 14.

Metal clips (72) provide with a mechanism of securing the entire lid (144) to the upper portion of the chamber. The entire lid (144) can be completely removed once all metal clips around the edge perimeter of the lid are disengaged.

Gasket (74) securely fastened to the surface of the bottom edge of the upper wall of the tank, provided to facilitate water proof mechanism once the lid is closed.

STATEMENT OF OPERATION

The entire system can be carried in a truck or a mobile platform. Waste tank (40) and the clean oil tank (34) typically remain stationary. Centrifuge separator, small debris

container and a pump of the system can be easily placed by the source of the blend, being carried in a handcart (46) of Fig.2.

A number of pipe lines of the system facilitate cleaning the small debris container (38) and supplying the blend inside the centrifuge chamber by the means of a pump (14). Such modes of operation are supported by engaging and disengaging valves (24c) (24d).

Purity of the clean oil can be verified by readings of instrumentation block (36). A number of steps can be taken in order to adjust to desired level of purification:

1. Increasing or decreasing the rotational speed of a centrifuge chamber;
2. Redirecting the purified oil passing along pipe line (42) towards the blend feeder input tube of the stationary base of the centrifuge by regulating valves (24b), (24e)

Centrifuge of the system is easily assembled and disassembled as can be shown on Fig 16. Any part is accessible for cleaning, maintenance or repair purposes. Such as entire plate set (118) can be removed by disengaging upper components including water overflow pipe (76), chamber lid (70), and the central bushing (106). Alternatively each plate (104) or plate spacer (122) can be removed by itself.

In order to engage centrifuge separator, it should be connected to the pipe lines of the system. Blend feeder hose must be connected to the blend feeder input pipe (60). Small debris container (38) having capacity for small debris inflow. Purified oil output pipe (148) connected to the pipe linked to the refined oil reservoir. Water draining pipe (72) must be mounted on top of the chamber lid.

Once operated, the blend penetrating the conical bottom and the body of the chamber through the feeding aperture (90) subjected to a rotary motion around the axis pipe. Parts of debris are getting separated and filling the cylindrical void created by gap (130) due to a centripetal force of the rotation. Debris (160), being the higher density material among

the components of the blend, slide down the chamber walls as exposed to the gravitational force; penetrating the small debris container through the draining aperture (92) as shown by arrows on Fig 17.

Oil being the lower density material than that of the debris is getting pushed towards the center of rotation of the chamber eventually infiltrating plates through out the entire external surface of the plate set (118) with smaller debris parts trapped between plates. Pushed towards the center of the rotation, oil component is gradually elevating along the hollow channels (110) of the central bushing towards top collector (134) mounted on the upper open end of the hollow axis pipe (88). Filling top collector (134) oil component of the mix falls downwardly through the top opening (102) of a hollow axis pipe. Oil component is exiting the system through the purified oil output pipe (148) moving downwardly as shown on Fig 18.

Water, having lesser density among the three components is getting pushed upwardly inside the chamber, occupying the upper portion of the chamber creating pressure on the bottom surface of the upper disk (132), penetrating water capacitance (150) of the lid (70) through high speed valves (152). When the entire water capacitance (150) is filled, water drains through water overflow pipe (76) as shown by arrows on Fig 17.

Some maintenance may be necessary after an extensive centrifuge usage. Various channels and piping connections such as draining aperture (92), blend feeder pipe (60), top collector (134) may require some cleaning as some amount of smaller pieces of debris may block up passages during excessive machine operation.

The entire machine may require to be disassembled, some of the channels to be manually cleaned or placed in a cleaning solution.

Alternatively, an oil cleaning solution can be fed to the machine in the operational mode and run through a number of cycles.

While what has been shown and described herein constitutes a preferred embodiment of

the subject invention, it should be understood that various modifications and adaptions of such embodiment can be made without departing from the present invention, the scope of which is defined in the appended claims.

WHAT CALIMED IS

1. A mobile system for used oil cleaning which can be conveniently stored on a hand cart containing:

a mobile centrifuge for refinement of used machine oil blend by separating the blend into purified oil, solid debris and water components providing mechanisms for depletion of such components of the blend thorough out dedicated channels and an intake channel for the blend;

pipe lines connecting to the source of the blend facilitating fluid flow through out a number of circuits depending on a positioning of valves of the system;

small debris container, an electrical pump and an instrumentation block for directing liquid flows through pipe lines of the system;

2. Pipe lines as set forth in claim 1, delivering the blend to the centrifuge separator, comprise two branches where the first branch supplies the blend using the pump of the system, the second branch supplies the blend directly to the centrifuge separator.
3. Pipe lines as set forth in claim 1, carrying the oil purified by the centrifuge separator through the control element comprise two branches where the first branch supplies the fluid towards clean oil tank and the second branch supplies the fluid towards the intake channel for the blend of the centrifuge separator.
4. Instrumentation block as set forth in claim 1, comprising a valve control mechanism for regulating a stream of purified oil towards the clean oil tank or an additional cleaning cycle.
5. A centrifuge as set forth in claim 1, comprising:

stationary base with a hollow pipe like axis for mounting of integral centrifuge elements and a cylindrical base body;

central bushing with a channeled outer surface providing with a number of channels running throughout its entire height;

removable plate set where some space is left between each plate of the set allowing passage of liquids through out the plates;

top collector including a sleeve like lower portion and a cylindrical oil capacitance;

centrifuge chamber having a cylindrical body and a conical bottom;

removable lid of the chamber by its formation facilitating a capacitance capable of holding water or any other liquids.

6. Stationary base, as set forth in claim 5, comprising a hollow axis pipe having an opening on the top of the pipe.
7. Bottom portion of the axis pipe as set forth in claim 6, facilitatates a channel passage to the purified oil output pipe having its output end projecting over the outer surface of the stationary base body.
8. Stationary base as set forth in claim 5, comprising a cylindrical base body having blend feeder input pipe connected to a feeding aperture of the stationary base providing an input of the blend to the cylindrical chamber of the centrifuge.
9. The upper surface of a stationary base as set forth in claim 5, having a draining aperture provided for a discharge of solid waste component through debris draining pipe connected to a small debris container.
10. Central bushing as set forth in claim 5, comprising a sleeve like cylinder, with its internal diameter slightly smaller than that of the axis pipe allowing mounting of the central busing on the axis pipe.
11. Removable plate set as set forth in claim 5, comprising a number of plates connected to each other by a plate spacer of a predetermined height which determines the distance between plates in the set.
12. Plate as set forth in claim 11, having a round opening in its circular base which allows mounting of the entire plate set on the central busing of claim 6, conical

plate walls are slightly inclined upwardly once the base of the plate is positioned parallel to the base body of claim 9.

13. Plate spacer as set forth in claim 11, comprises a ring like construction which includes chamfered circumferential openings suitable for penetration of liquids towards channels of central bushing of claim 10.
14. Top collector as set of in claim 5, comprising a number of intake holes situated around the outer surface of the cylindrical oil capacitance.
15. Top collector as set forth in claim 5, includes a lower cylindrical sleeve mounted on the top of the axis pipe to facilitate a channel for liquids inside the oil capacitance falling towards the top of the hollow axis pipe.
16. Removable lid as set forth in claim 5, comprising a conical bottom with a sleeve like cylindrical pocket around the top collector and conical top, defines a water capacitance between its upper and lower walls.
17. Removable lid as set forth in claim 16, includes a number of high speed valves situated around the conical bottom of the lid, allowing penetration of liquids from the cylindrical chamber towards the water capacitance under certain rotational frequency of the centrifuge chamber.
18. Upper portion of a conical top of the lid as set in claim 16 includes a water overflow pipe facilitating liquid drainage after the entire water capacitance is filled.
19. Conical bottom of a centrifuge chamber as set forth in claim 5, includes an external drive mechanism which facilitates the rotation the entire chamber once engaged to a drive belt.