Dec. 3, 1940. E. W. DAVIS ET AL 2,223,553

GEAR CASE CLEANING APPARATUS

Filed Nov. 22, 1937 2 Sheets-Sheet 1

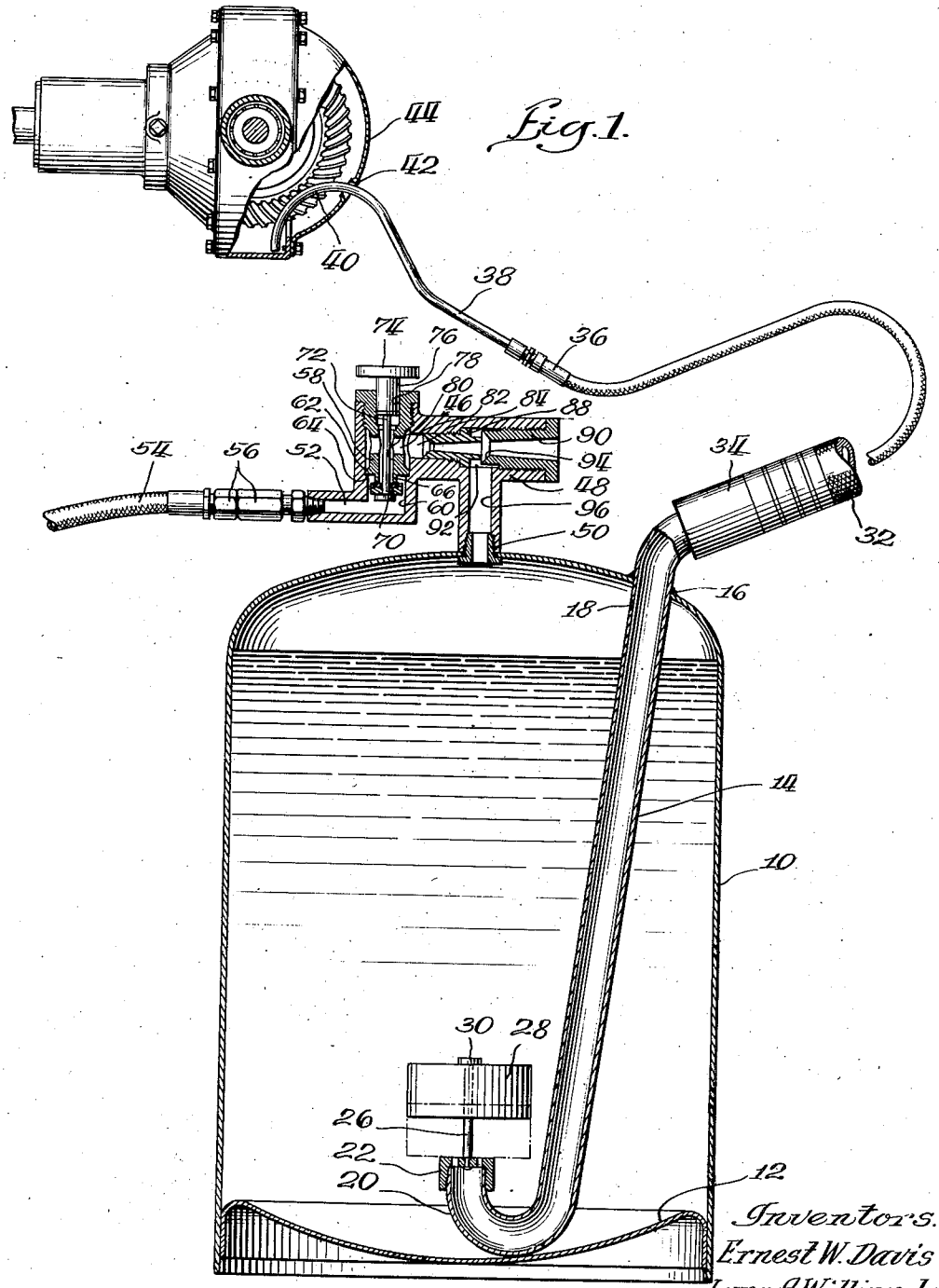


Fig. 1.

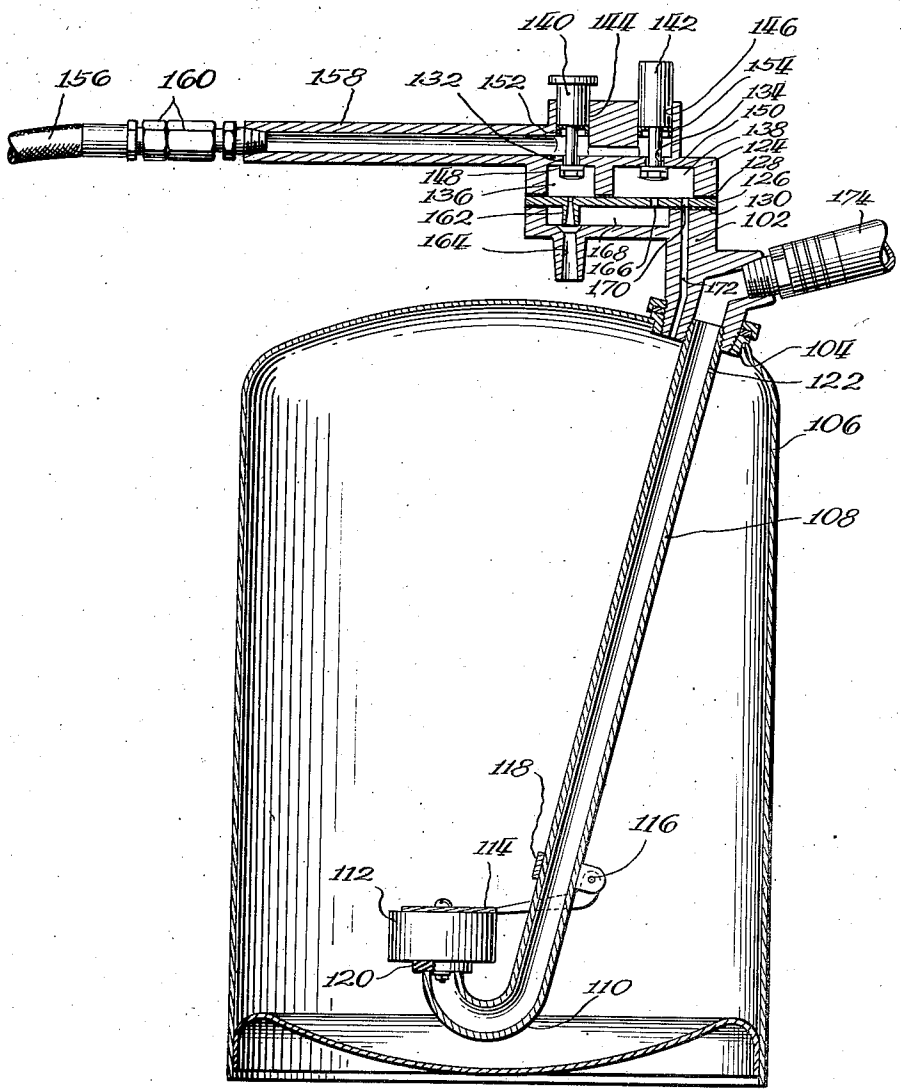
Inventors.
Ernest W. Davis
Lynn A. Williams, Jr.
By
Williams, Bradbury, McCaleb & Hinkle
Attys.

Dec. 3, 1940. E. W. DAVIS ET AL 2,223,553

GEAR CASE CLEANING APPARATUS

Filed Nov. 22, 1937 2 Sheets-Sheet 2

Fig. 2.



Inventors.
Ernest W. Davis
Lynn A. Williams, Jr.
By Williams, Bradbury, McCaleb & Hinkle
Attys

Patented Dec. 3, 1940 2,223,553

UNITED STATES PATENT OFFICE

2,223,553

GEAR CASE CLEANING APPARATUS

Ernest W. Davis, Oak Park, and Lynn A. Williams, Jr., Winnetka, Ill., assignors to Stewart-Warner Corporation, Chicago, Ill., a corporation of Virginia

Application November 22, 1937, Serial No. 175,770

3 Claims. (Cl. 184—1.5)

Our invention relates generally to gear casing cleaning apparatus, commonly referred to as gear casing flushers.

In connection with the lubrication and servicing of automobiles, it is highly desirable to remove the used grease from differential housing and transmission casings and flush the gears and casing walls with a suitable hydrocarbon solvent, such as kerosene. In this way, the metallic fragments worn from the gears are removed from the housing together with the used lubricant, so that upon resupplying the casing with grease or oil, the gears will be properly lubricated.

The usual manner of cleaning such casings is to suck the grease or oil from the casing by means of a suction pump and then flush the gears and interior of the casing with kerosene or the like by means of a hand operated suction and pressure pump. This method is not entirely satisfactory because of the manual effort involved in operating the pump, the slowness of the operation, and the tendency of the service station attendant to flush the parts an insufficient number of times.

We have therefore provided an improved flushing apparatus by means of which the flushing of gear casings and the like may be rapidly and efficiently accomplished.

A further object is to provide an improved flushing apparatus in which bubbles of air are introduced into the flushing liquid so as to enhance the scouring and flushing action of this liquid.

A further object is to provide an improved means for preventing air only from being ejected from the flushing apparatus.

Other objects will appear from the following description, reference being had to the accompanying drawings in which:

Fig. 1 is a central vertical sectional view of the improved flusher showing its conduit and spout in position to flush the interior of a differential gear housing of an automobile; and

Fig. 2 is a central vertical sectional view of a modified form of the invention.

Referring to Fig. 1, the flusher comprises a closed tank 10 having a bottom 12 welded or otherwise suitably secured thereto. A combined inlet and discharge pipe 14 projects through the top of the tank 10, being welded thereto at 16 to form a rigid and air-tight seal between the pipe and the tank. The pipe 14 is provided with a relatively small opening 18 at a point adjacent the top of the inside of the tank, and has a return bend 20 formed at its lower end. The upper extremity of the return bend is provided with an apertured cap 22 which forms a support for a guide rod 26 upon which a float 28 is freely reciprocable, its upward movement being limited by a head 30 formed at the upper extremity of the guide rod.

A discharge and suction conduit 32 is secured to the outer end of the pipe 14 by a suitable air and liquid-tight coupling 34, the free extremity of the conduit 32 being connected by a coupling 36 with a spout or nozzle 38. The spout 38 may be of any suitable form, but preferably has a return bend or gooseneck portion 40 of sufficiently small cross sectional diameter to enable it to be inserted in the usual opening 42 formed in the housing 44 of the differential gearing of an automobile. By virtue of the gooseneck portion 40, the waste lubricant may be sucked from the bottom of the housing 44.

The tank 10 is arranged to be alternately placed under superatmospheric and subatmospheric pressures by means of a pressure control member 46 comprising a body 48 secured to the top of the tank 10 by means of a flanged nipple 50. The body 46 has an inlet passageway 52 to which a suitable source of compressed air may be connected by means of a hose 54 and a detachable coupling 56. A control valve sleeve 58 is secured in a bore 60 formed in the body 48, the sleeve being provided with a shoulder 62 abutting against a complementary shoulder 64 formed in the bore 60 and also has a valve seat 66 which is cooperable with a valve 70 carried by a stem 72. The outer end of stem 72 has a suitable control button 74 provided with a shank 76 slidable in a suitable bore 78 formed in the sleeve 58. The sleeve is provided with a longitudinal passageway 80 and ports 82 to permit the flow of air from the passageway 52 to a passageway 84 when the valve 70 is moved away from its seat 66. A Venturi type nozzle 88 is threaded in the passageway 84, and a nozzle extension 90 is threaded in the counter bore 92. The nozzle 88 does not contact with the nozzle extension 90, and thus an annular space 94 is provided for communication with the interior of the tank 10 by way of a passageway 96.

It will be understood that when the button 74 is depressed to open the valve 70, the air under pressure will flow through the passageways of the nozzle 88 and its extension 90, and, due to the increased velocity of the air, the space 94 will be reduced to subatmospheric pressure, and thus create suction upon the conduit 32, causing the used lubricant in the gear housing 44 to

be withdrawn therefrom and deposited in the tank 10.

If desired, the lubricant thus sucked from the housing may then be ejected from the tank 10 by closing the end of the passageway in the nozzle extension 90 by placing the thumb or finger thereover, while retaining the button 74 depressed. Under these conditions, the pressure of the compressed air supply will be communicated directly to the tank 10 and cause the ejection of the used lubricant from the tank to any suitable place of disposal. Thereafter, the tank may be filled with kerosene or other flushing liquid by placing the end of the spout 38 in a supply of kerosene and by opening the valve 70, subjecting the tank to subatmospheric pressure. Then the fluid is ejected from the tank to the housing to be flushed by again placing the finger over the end of the passageway in the nozzle extension 90. Under these conditions, air under pressure will be supplied to the interior of the tank and cause flow of the flushing liquid outwardly through the pipe 14.

Due to the provision of the small opening 18 adjacent the upper end of the pipe 14, bubbles of air will be mixed with the flushing fluid as it flows past said opening. This admixture of bubbles of air with the flushing fluid is of considerable advantage since, due to the gradual expansion of bubbles of air as they pass outwardly through the conduit 32 and spout 38, the flow of the flushing liquid will be accelerated, and as the mixture of flushing liquid and air leaves the end of the nozzle or spout 38, the liquid will be ejected in intermittent slugs so as to increase the scouring and flushing effect of the liquid as it impinges against the gears and the surface interior of the gear housing. The operator of the apparatus will continue supplying the flushing liquid to the housing until the level of the liquid in the tank 10 drops sufficiently low to permit the float 28 to drop against the upper surface of the apertured cap 22 and thus close the apertures in the latter. When the float 28 is thus seated, the supply of liquid is cut off, and the operator may remove his finger from the outlet end of the nozzle extension 90, whereupon the interior of the tank 10 will again be subjected to subatmospheric pressure and suck the flushing fluid back into the tank 10 from the housing 44. This flushing operation may be repeated in rapid succession until the housing and the gears contained therein are properly cleansed, whereupon, after a final suction operation, the nozzle 38 may be removed from the housing and the housing refilled with fresh lubricant.

The flushing apparatus shown in Fig. 2 is generally similar to that shown in Fig. 1, but operates in a slightly different manner. In Fig. 2 a connection fitting 102 is threaded in a bushing 104 which latter is welded or otherwise suitably secured in a closed tank 106. The combined inlet and discharge tube 108 is threaded in the fitting 102 and has an upturned end portion 110. A float 112 is carried by an arm 114 hinged at 116 to a bracket 118 which may be clamped or welded to the tube 108. The float is provided with a valve facing 120, of leather or the like, which may be bolted or otherwise suitably secured to the float. The tube 108 is provided with a small air inlet port 122 corresponding to the aperture 18 of the apparatus shown in Fig. 1.

A valve body 124 is secured to the fitting 102, these parts being separated by an apertured plate 126 and gaskets 128 and 130. The valve body 124 is provided with a pair of ports 132 and 134 opening into chambers 136 and 138, respectively. Manually operable valve plungers 140 and 142 are slidable in bores 144 and 146, respectively, formed in the valve body 124, and have stem portions projecting through the valve ports 132 and 134, the stems thereof being provided with valves 148 and 150, respectively. Cup leathers 152 and 154, or other suitable packing means, are provided to seal the plungers 140 and 142 respectively. Air under pressure is supplied to the valve ports 132 and 134 from a suitable source through a flexible conduit 156 which is coupled to a handle extension 158 of the valve body 124 by means of a detachable coupling 160.

The plate 126 is provided with a Venturi type nozzle 162 which is directed into a similar nozzle 164 formed integrally with the fitting 102. Air may flow from the valve chamber 138, through a port 166 formed in the plate 126 into a chamber 168, and thence to the annular space between the lower end of the nozzle 162 and the upper end of the nozzle 164. Similarly, the chamber 138 is in communication with the interior of the tank 106 through a port 170 formed in the plate 126 and a passageway 172 formed in the body 102.

It will be noted that the valve plunger 140 is provided with a head to limit the extent of its inward movement so that the valve 148 can not be moved downwardly a sufficient distance to interfere with the flow of air through the nozzle 162. On the other hand, the plunger 142 may be pressed inwardly until the valve 150 abuts against the plate 126, thus closing the port 166. While it is not essential that the valve 150 seal perfectly over the port 166, it may easily be made to accomplish this result and thus prevent wasting compressed air. Both plungers are arranged to be operated by air pressure upon their return strokes, thereby eliminating the necessity of providing troublesome springs.

In operating the device shown in Fig. 2, the spout which is connected to the end of the combined discharge and suction hose 174 is placed in the casing or housing from which the lubricant is to be removed, and the valve plunger 140 is depressed, thus operating the valve 148 and permitting flow of air under pressure through the port 132, through the nozzle 162 and to the atmosphere through the nozzle 164. The rapid flow of air between the nozzles 162 and 164 causes a partial vacuum which is transmitted through the chamber 168, port 166, port 170, and passageway 172 to the interior of the tank 106, whereupon the lubricant will be drawn through the conduit 174 into the tank. After the tank has become filled, or all of the lubricant removed from the casing, the lubricant may be ejected from the tank 106 by pressing the valve plunger 142, whereupon compressed air will be permitted to flow through the port 134, chamber 138, port 170, and passageway 172 into the tank, raising the pressure therein and causing the ejection of the lubricant therefrom until flow is interrupted by the closure of the float control valve 120 when the level within the tank 106 drops to substantially the level of the top of the return bend portion 110 of the suction and pressure tube 108.

Thereafter, the tank may be filled with a suitable flushing liquid by immersing the spout at the end of the discharge hose 174 in a suitable container of the flushing liquid and pressing the valve plunger 140. In a manner similar to that previously described, the flushing liquid may be ejected from the tank into the casing or housing

to be cleaned, and sucked therefrom in alternate succession until the casing or housing and parts therein are thoroughly cleaned.

Whenever the gear casing or housing to be cleaned is of relatively small capacity, or the lubricant contained therein is so viscous that it can not readily be drawn from the casing by suction, the flushing operation may be commenced by partly filling the flusher tank with the flushing liquid and injecting this flushing liquid into the casing before endeavoring to remove the lubricant therefrom. Then by repeated flushing operations the lubricant may be loosened and dissolved by the flushing liquid.

As the flushing liquid is being ejected from the tank, small bubbles of air will be entrained with the flushing liquid and pass outwardly through the discharge hose 174 to the spout at the end thereof. As the bubbles leave the spout, they expand rapidly due to the sudden release of pressure, and in this manner greatly accelerate the speed at which the flushing liquid is projected against the interior walls of the casing, and in the gears or other parts contained therein. Due to the greater force with which the flushing fluid is thus projected against the parts to be cleaned, a very effective scouring action is obtained. The scouring and flushing action of the liquid is further improved by virtue of the fact that entrained air bubbles cause turbulence in the body of the flushing liquid temporarily in the housing or casing being cleansed, causing the packed lubricant to be rapidly loosened and causing conditions under which the fine metal chips and dust resultant from wear of the gears may be carried in suspension for a greater length of time and thus be withdrawn from the housing with the flushing liquid when the latter is sucked therefrom.

The float-controlled valve serves the very useful purpose of preventing a large blast of air only from being injected into the casing to be cleaned. If the float-controlled valve were not provided, air only would be forced into the casing in such volume and with such rapidity that the mixture of flushing liquid and grease would be ejected violently from the casing upon the operator of the apparatus and his surroundings as soon as all of the flushing liquid had been ejected from the tank.

While we have shown and described particular embodiments of our invention, it will be readily apparent to those skilled in the art that various and further modifications may be made without departing from the basic principles herein set forth. We therefore desire the following claims to include all such variations and modifications by which substantially the same results may be obtained by substantially the same means.

We claim:

1. In a flushing apparatus for gear housings and the like, the combination of a tank, manually operable means for selectively subjecting the contents of said tank to super-atmospheric and sub-atmospheric pneumatic pressures, a tube projecting into said tank and having its end adjacent the bottom thereof, said tube having a minute opening therein adjacent the upper end of said tank, and float operated valve means for closing the end of said tube when the level of the liquid therein drops below a predetermined minimum.

2. A device for flushing and cleansing gear casings and the like adapted to be connected to a source of air under pressure, comprising a tank, a discharge tube extending from the bottom of the inside of said tank through the top thereof, a float valve for closing the lower end of said tube, a restricted open passageway through the wall of said tube by-passing said valve, aspirating means, an air inlet connection, a valve for controlling the admission of air under pressure from said air inlet connection to said aspirating means for operating the latter, means for conducting air from said tank to said aspirating means, and a manually operable valve for connecting said tank directly to said air under pressure independently of said first valve.

3. In a device of the class described, the combination of a tank, and valve controlled means for alternately subjecting said tank to sub-atmospheric and super-atmospheric pressures, said means comprising a fitting having a chamber therein, an apertured plate covering said fitting, and a valve body secured over said plate, a pair of valves carried by said valve body for admitting air under pressure to the upper surface of the said plate, an aspirating nozzle supplied with actuating air under pressure through one of the apertures in said plate, and means for conducting air from said tank to the sub-atmospheric pressure point of said nozzle.

ERNEST W. DAVIS.
LYNN A. WILLIAMS, JR.