Jan. 15, 1935. A. L. WERTZ 1,987,649

GEAR CASING CLEANING APPARATUS

Original Filed Feb. 11, 1929 4 Sheets-Sheet 1

Fig. 1.

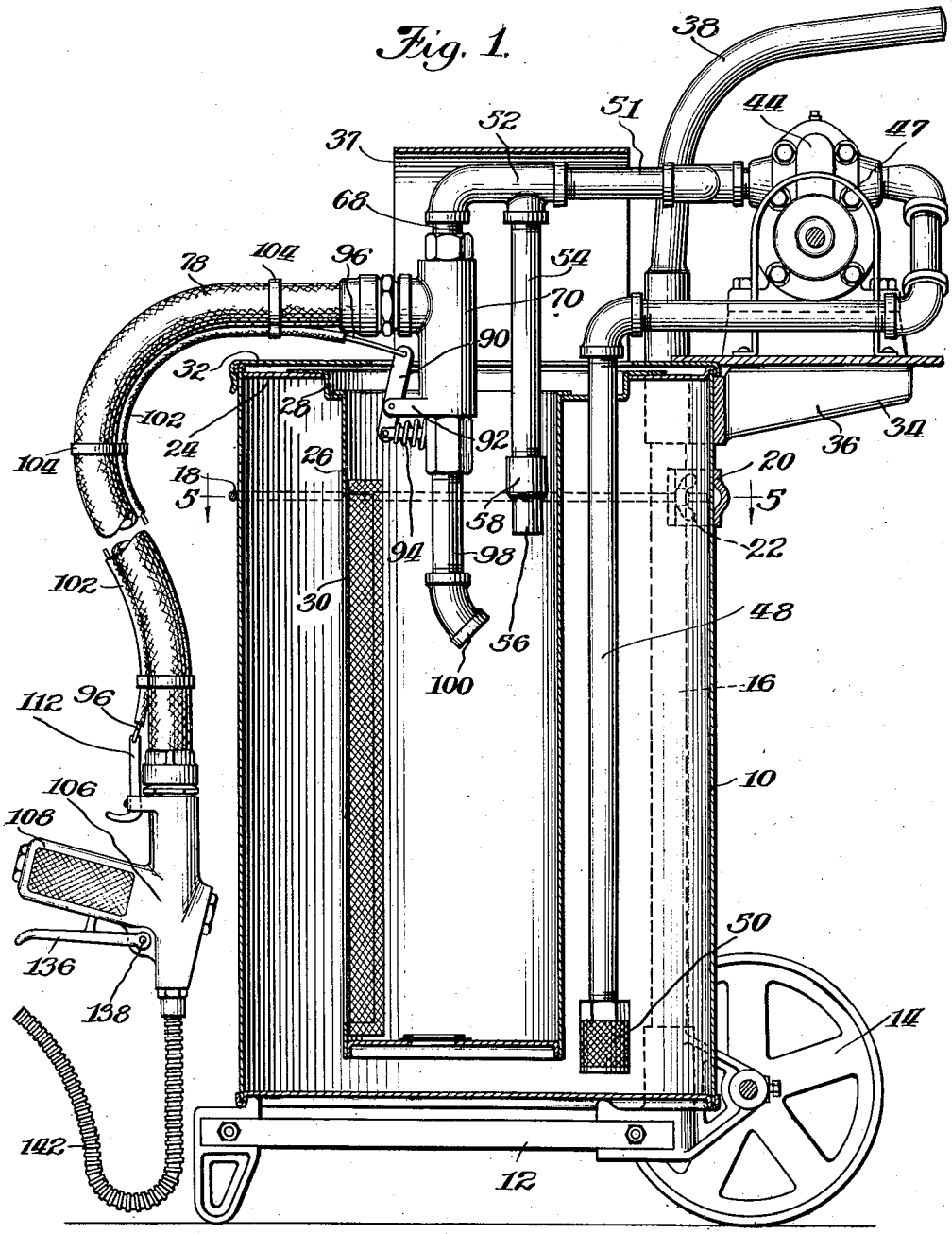

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Fig. 2.

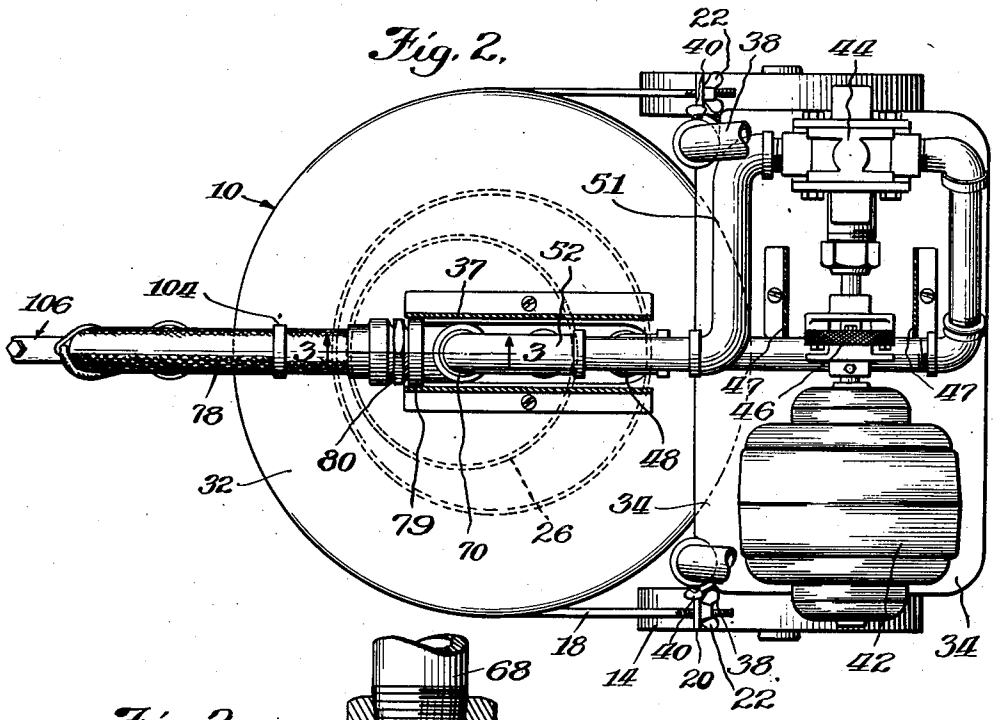


Fig. 3.

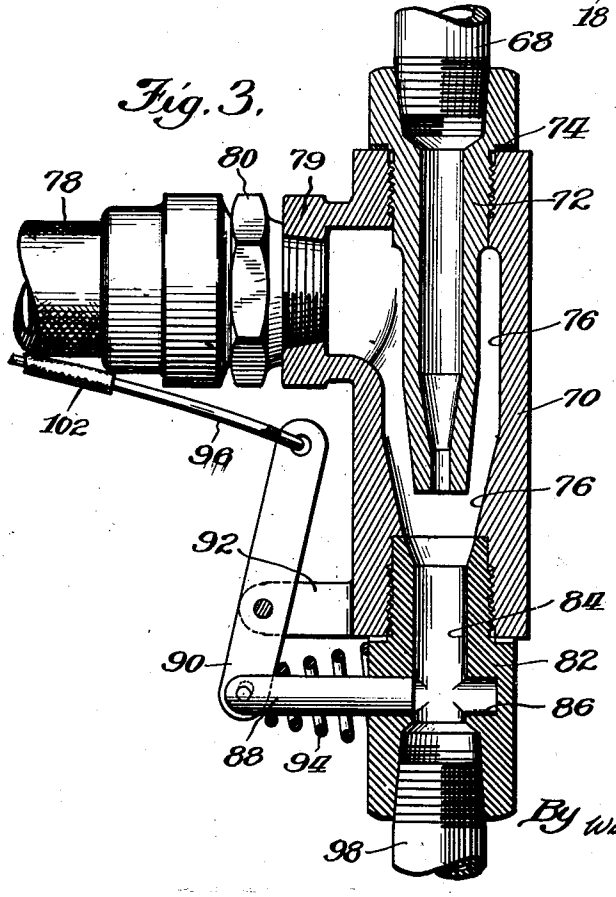
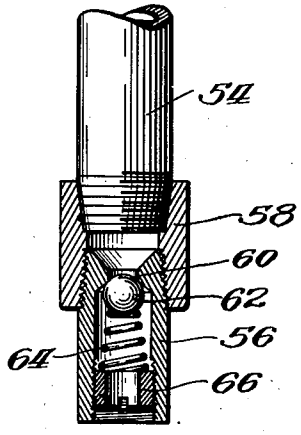


Fig. 4.



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GEAR CASING CLEANING APPARATUS

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Fig. 5.

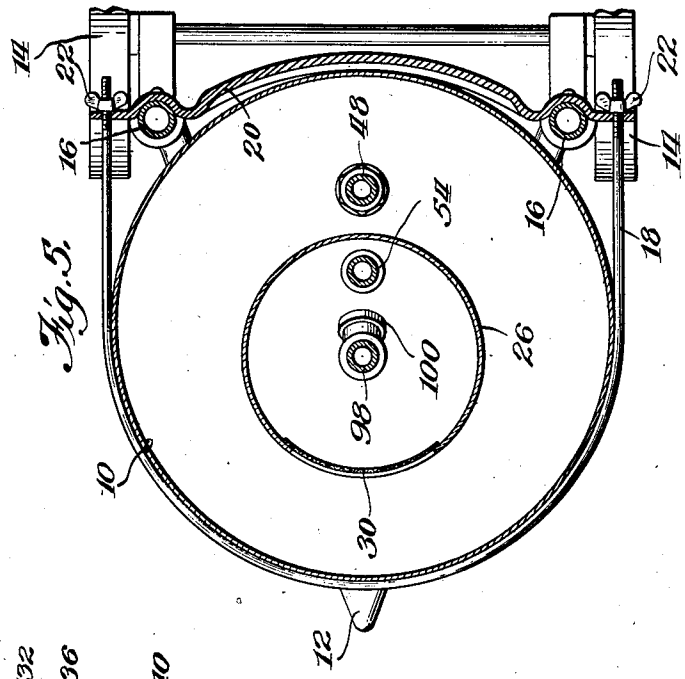

Fig. 6.

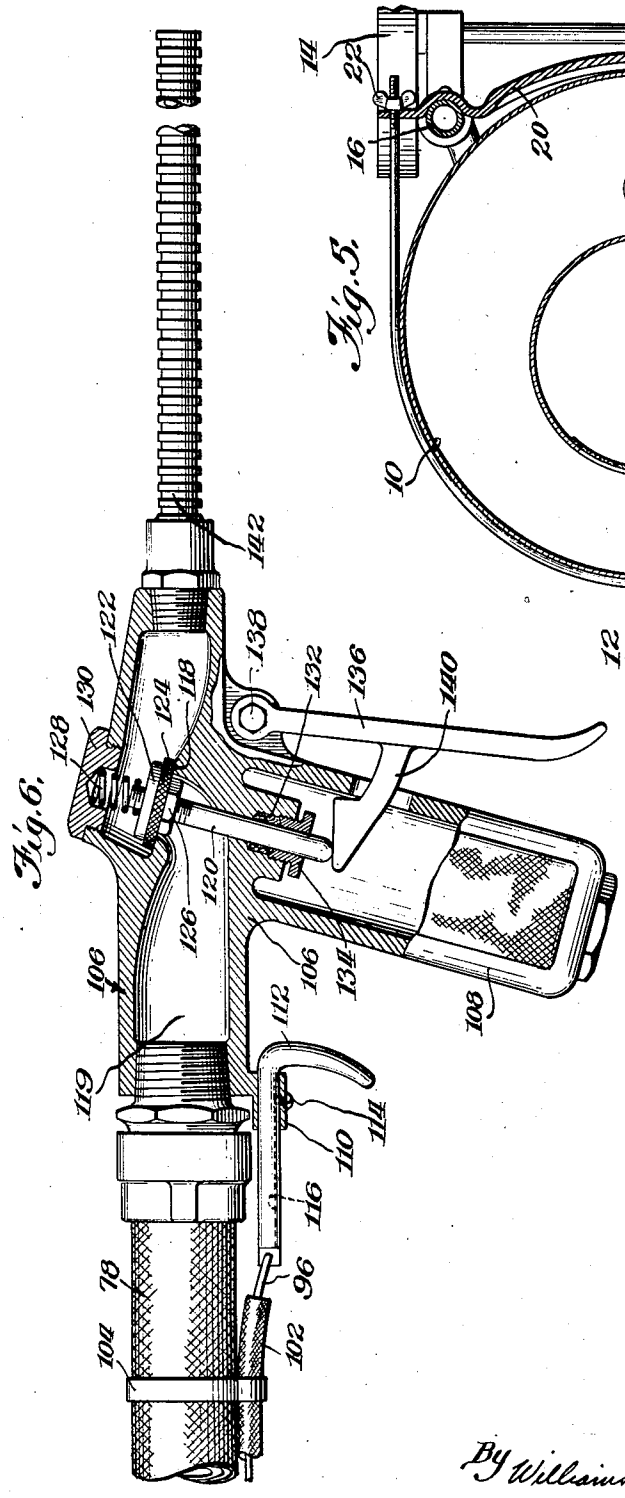

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Fig. 7.

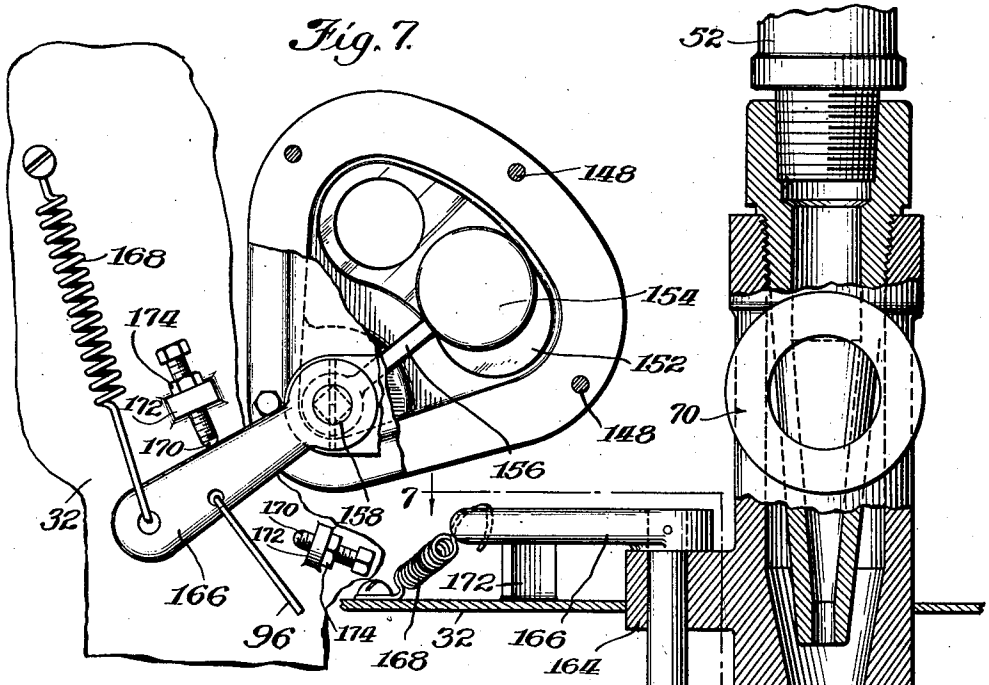


Fig. 9.

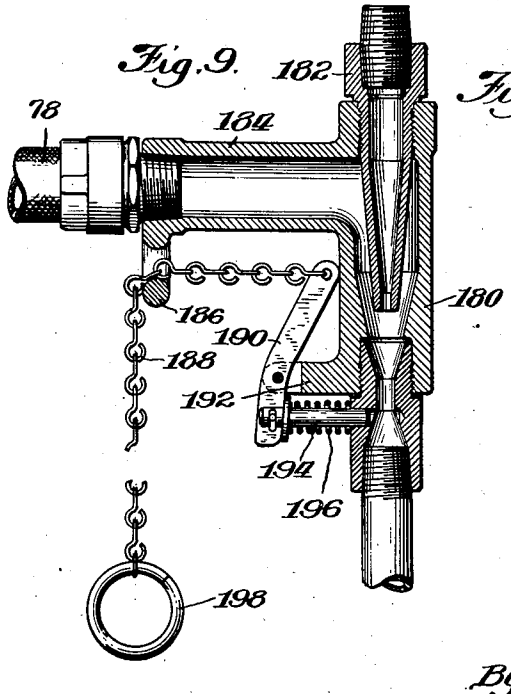
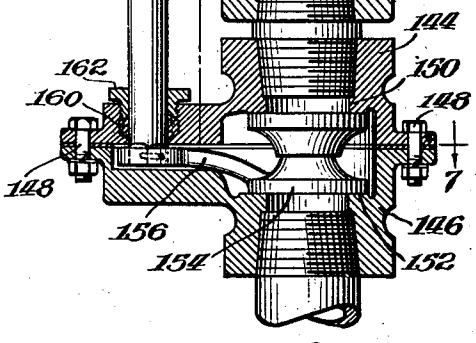


Fig. 8.



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UNITED STATES PATENT OFFICE

1,987,649

GEAR CASING CLEANING APPARATUS

Austin L. Wertz, Lakewood, Ohio

Application February 11, 1929, Serial No. 339,124
Renewed January 18, 1934

18 Claims. (Cl. 184—1.5)

My invention relates generally to apparatus for cleaning receptacles, containers, gear casings and the like, by flushing the parts to be cleaned with a suitable cleaning fluid and then withdrawing the cleaning fluid together with the dirt, grit and grease from the receptacle, etc., being cleaned.

It is an object of my invention to provide an improved, simple and effective apparatus particularly adapted for cleaning the differential and transmission gear casings of automotive vehicles.

A further object is to provide an apparatus of the above-described class in which a single conduit is used alternately to convey the cleaning fluid to the casing to be cleaned and to withdraw the fluid with the grease, dirt, etc., from the casing.

A further object is to provide an apparatus of the above-mentioned type in which the means for controlling the operation of the apparatus are located near the end of the single discharge and suction conduit.

A further object is to provide an improved ejector of the Venturi type and to provide means for controlling the outlet of the ejector so as to reverse the direction of fluid flow in a portion of the ejector.

A further object is to provide an improved flushing and cleaning apparatus of the above-described type having a unitary mounting for its pump and motor, so that the operating parts may readily be removed from the tank as a unit.

A further object is to provide aldjustable means to prevent overloading of the pump when the discharge from the ejector is shut off.

A further object is to provide adjustable means for limiting the degree of closure of the means for shutting off the discharge of the ejector.

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

Fig. 1 is a central vertical section of my improved casing flushing device;

Fig. 2 is a plan view thereof, a portion of the pipe guard and the transmission shaft guard being broken away to show the underlying parts;

Fig. 3 is an enlarged central vertical sectional view of the ejector and ejector shut off valve;

Fig. 4 is an enlarged central vertical sectional view of the pump relief valve;

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a broken sectional view of the control valve;

Fig. 7 is a plan view of a modified form or shut off valve arrangement;

Fig. 8 is a central vertical sectional view thereof; and

Fig. 9 is a central vertical sectional view of an additional modification of the control valve.

In gear and differential casing cleaning devices at present used, it is customary to have two conduits connected to the pumping and exhausting apparatus, respectively, one conduit being used to convey the cleaning fluid to the casing to be flushed and the other conduit being used to withdraw the dirty flushing fluid from the casing. Through the use of my invention it is unnecessary to provide two conduits for I have provided a simple means for making it possible to use a single conduit for both purposes and have provided means which may be actuated from the end of the conduit optionally to control the operation of the machine and determine whether the flushing fluid will be forced outwardly through the conduit or whether the pressure in the conduit will be decreased below atmospheric so that the dirty cleaning fluid may be withdrawn through the conduit. In the prior art devices it was necessary alternately to use the pressure conduit and the suction conduit since in most instances it was impossible, or at least inconvenient, to insert the ends of both conduits into the casing being cleaned. With the flusher of my invention the single conduit need not be withdrawn from the casing until the entire cleaning operation has been completed.

Figs. 1 and 2 illustrate the general arrangement of the parts of the flusher. A tank 10 is mounted upon a truck comprising a suitable frame 12, wheels 14 and a pair of pipe uprights 16. The upper end of the tank is clamped to the uprights 16 by means of a rod 18 which is bent circumferentially about the tank and the ends of which are threaded and passed through the ends of a saddle member 20 which is riveted to the upright pipes 16. The tank 10 is pulled and held against the saddle member 20 by thumb-screws 22 threaded over the ends of the rod 18.

The tank has an annular shelf 24 secured at its top, the shelf providing a rest for a straining and settling receptacle 26, the upper end of which is preferably welded to a pan 28, the flanges of which rest upon the shelf 24. The receptacle 26 has a large opening cut in one side thereof and has a screen 30 secured over this opening. A thin sheet metal cover 32 rests over the top of the tank to prevent dirt from falling into the receptacle 26. A pipe guard 37,

inverted U-shaped in cross-section, is suitably secured to the cover 32.

A base plate 34 is welded to a pair of brackets 36 which are in turn welded to a pair of handles 38. The lower ends of the handles 38 are socket-shaped to fit over the upper ends of the uprights 16 and may be detachably secured to the latter by suitable set screws 40. An electric motor 42 or other suitable source of power is mounted upon the plate 34 and has its shaft connected through a flexible coupling 46 to a suitable fluid pump 44 which is also secured to the base plate 34. A sheet metal guard 47 covers the coupling 46 and is secured to the plate 34.

The pump 44 may be of any suitable design which is effective to pump the required quantity of cleaning fluid at the required pressure. The inlet end of the pump is connected by suitable piping to the suction pipe 48, over the lower end of which is secured a comparatively coarse strainer 50. The outlet of the pump is connected by suitable piping 51 to a manifold 52. A pipe 54 is screwed into one of the outlets of the manifold and at its end carries a pressure relief valve shown in detail in Fig. 4. This valve comprises a body 56 which is secured to the pipe 54 by a union 58.

The body 56 has a valve seat 60 formed at the upper end thereof for a ball check valve 62 which is held against the seat by spring 64. The lower end of the spring rests upon a sleeve 66 which is threaded in the lower end of body 56 and may be adjusted to vary the degree of tension in the spring 64 and thus predetermine the pressure at which the valve 62 will be forced from its seat, to relieve the pressure against which the pump must operate.

An ejector, best shown in Fig. 3, is connected to the manifold 52 by a nipple 68. The ejector comprises a body 70, in the upper end of which a nozzle 72 is threaded, a gasket 74 sealing the connection. The nozzle 72 is threaded to the nipple 68. The body 70 has the usual tapering bore 76 forming in effect a Venturi passageway. The bore 76 is in direct communication with the end of a flexible conduit 78 which is connected to the body 70 at the suction inlet 79 by a suitable union 80. A plunger valve 82, threaded into the lower end of the body 70, has a passageway 84 forming a continuation of the bore 76 of the body 70 and a transverse bore 86 extending partially therethrough and intersecting the passageway 84. A longitudinally slidable plunger 88 fits snugly in the bore 86. The bore 86 is of smaller diameter than the passageway 84, so that the plunger 88, even when pushed to its innermost position, will not completely shut off the discharge from the ejector.

The plunger 88 has its end pivotally connected to a lever 90. The latter is pivoted upon a lug 92 formed integrally with the body 70. The plunger is normally held in its outer position, as shown in Fig. 3, by a compression spring 94 but may be forced inwardly by a pull upon a wire 96 secured to the opposite end of the lever 90. The wire 96 is guided in a flexible tubing 102 which is secured to the conduit 78 by clamps 104. A pipe 98 having a forty-five degree L 100 at its lower end is connected to the bottom of the plunger valve body 82.

A control valve 106 (Fig. 6) is secured to the end of the conduit 78 and has a pistol grip handle 108. The control valve has a rearwardly projecting lug 110 which is drilled to receive a sliding thumb-piece 112, the latter being prevented from rotating in said lug by a set screw 114, the end of which rests in a longitudinal slot 116 in the rearward extension of the thumb-piece 112. The thumb-piece 112 is connected to the end of the wire 96. The body 106 has a valve seat 118 formed across a passageway 119 extending the length thereof.

A valve comprising a stem 120, a disc 122 and having a suitable valve facing 124 clamped against the disc 122 by a nut 126, is held against the seat 118 by a compression spring 128. A recessed plug 130 is threaded in the body 106 and forms a seat for the spring 128. The stem 120 is guided for longitudinal movement in the body 106, leakage past the stem being prevented by a packing 132 and packing gland 134. A trigger 136, pivoted to the body at 138, has a rearwardly projecting camming lug 140 which is adapted to engage the lower end of the stem 120 and move it longitudinally to raise the valve from its seat. A flexible nozzle 142 is secured to the end of the valve body 106.

In operation, the tank is usually filled approximately three-fourths full of the cleaning fluid and the motor started. The fluid will thus be sucked from the bottom of the container through the strainer 50 and pipe 48 and discharged by the pump into a manifold 52. From the manifold the fluid will flow through the ejector 70, causing the pressure in the bore 76 thereof to drop considerably below atmospheric pressure.

If the contents of the casing or receptacle to be cleaned are sufficiently fluid to permit exhaustion through the conduit 78, the nozzle 142 is inserted in the casing and the valve at the nozzle opened by pressing the trigger 136, and the material in the casing withdrawn by suction. If the contents of the casing are not sufficiently fluid to permit them to be sucked through the conduit, the operator will pull forwardly (to the right, Fig. 6) on the thumb-piece 112, thereby moving the plunger 88 into the bore 86 and partially cutting off the discharge of the ejector 70. The cleaning fluid will therefore back up in the bore 76 and, whenever the nozzle valve is opened, be forced outwardly through the conduit 78. The cleaning fluid may thus be sprayed into the casing and will loosen and dissolve any greasy, soapy or caked material in the casing.

After the caked material has been loosened by spraying with the cleaning fluid, the operator will release the thumb-piece 112, thereby permitting the spring 94 to withdraw the plunger 88 from its bore 86. The ejector then will be permitted to operate in its normal manner as a suction device, and, upon opening the control valve by depression of the trigger 136, the mixture of cleaning fluid, used grease, grit, chips and filings from gears and other foreign matter, will be readily withdrawn from the casing.

The material sucked from the casing through the conduit 78 is discharged through the pipe 98 and L 100 against the wall of the receptacle 26. Due to the large area of the strainer 30, the level of the cleaning fluid will be substantially the same within the receptacle as within the tank 10. The heavier impurities carried from the casing by the cleaning fluid will settle to the bottom of the receptacle 26, and the lighter impurities will be prevented from passing into the tank by the strainer. The cleaning fluid may thus be used to flush out a large number of casings, since it is thoroughly strained and cleaned before it is reused.

To prevent the pump from becoming overloaded upon partial stoppage of the flow of oil, the pressure relief valve shown in Fig. 4 is provided. As soon as the pressure exceeds the predetermined maximum, the check valve 62 will be forced from its seat and relieve the pump.

Whenever the supply of cleaning fluid in the tank 10 is replenished it is desirable to clean out the receptacle 26. This may readily be done by loosening the set screws 40 by which the handles 38 are fastened to the uprights 16 and grasping the handles 38, lifting the plate 34 together with the motor and pump, the piping connected thereto, and the cover 32 bodily from the tank as a single unit. The sheet metal cover 32 will be carried with these parts since the guard 37 will rest upon the manifold 52.

In Figs. 7 and 8 I have shown in modified form the ejector shut off valve which may be substituted for the plunger type shut off valve shown in Fig. 3. The ejector is of substantially the same construction as that shown in Fig. 3 except that its relative dimensions differ slightly.

The gate valve body is composed of two halves 144, 146 which are secured together by bolts 148. Valve seats 150 and 152 are formed in the body halves 144, 146, respectively, and are adapted to be engaged by the double valve disc 154 which is carried by an arm 156. The arm 156 is non-rotatably secured to a rod 158 which passes through the upper body half 144 and is sealed by a packing 160 and a packing gland 162. The upper end of the rod is guided in a lug 164 and has an arm 166 pinned thereto at its extremity.

A tension spring 168 having one end anchored to the cover 32 and its other end secured to the free end of the arm 166, normally holds the latter against one of a pair of adjustable stop screws 170 which are threaded through suitable lugs 172 carried on the plate 32. A nut 174 is provided to lock each of the screws 170 in set position. The wire 96 is also attached to the arm 166 so that the latter may be operated by the thumb-piece on the control valve as previously described. By adjusting the set screws the valve 154 may be prevented from completely covering the openings at the valve seats, thus permitting a certain proportion of the discharge of the ejector to by-pass the valve. The fluid pressure which may be obtained when it is desired to flush the casing to be cleaned with the cleaning fluid may thus be varied to suit the individual requirements or desires since by decreasing the size of the minimum opening through the shut off valve by proper adjustment of one of the set screws 170, the fluid pressure obtainable is proportionately increased. Of course the pressure in the discharge conduit cannot go above that for which the relief valve 62 is set, and the by-pass thus serves as an additional means to relieve the back pressure on the pump and to prevent overloading of the motor.

In other respects the operation of the flusher utilizing the gate valve shown in Figs. 7 and 8 will be substantially the same as when the plunger type valve shown in Fig. 3 is used.

In Fig. 9 I have illustrated an additional modification of the control valve. In this construction the ejector body 180 is fitted with an ejector nozzle 182 in substantially the same manner as shown in the construction illustrated in Fig. 3. The body 180 has a pipe-like sidewardly projecting portion 184 to which the end of the flexible conduit 78 is connected by suitable fittings.

The portion 184 has an apertured lug 186 which is adapted to receive and guide a suitable chain 188. One end of this chain is attached to the upper end of a lever 190 which is pivoted adjacent the end of a lug 192. The other end of the lever 190 is operatively connected with the plunger valve 194 which is normally held in its outer position by spring 196. A ring 198 attached to the free end of the chain 188, facilitates gripping the end of the chain. The chain is sufficiently long so that it may be conveniently pulled by the operator when he is using the device to clean the gear casing.

In some instances it may be desirable to use a solenoid for actuating the shut-off valve, and I therefore contemplate the provision of such solenoid actuated valve controlled by suitable switch means conveniently located at the pistol grip of the nozzle whenever such control means is preferred.

The invention is capable of wide variation within equivalent limits and I contemplate such variation as may be desirable or useful in the particular adaptation of the invention shown, or in its adaptation to other apparatus. I do not restrict myself in any unessential particulars, but what I claim and desire to secure by Letters Patent is:

1. In a cleaning apparatus, a driven pump, a source of cleaning fluid connected to the inlet of said pump, an ejector connected to the outlet of said pump, a conduit connected to the suction inlet of said ejector, and means to impede the normal discharge of said ejector, thereby to cause said cleaning fluid to be discharged through said conduit.

2. In a device of the class described, the combination of a tank, a motor driven pump associated therewith, a conduit leading from said tank to the inlet side of said pump, an ejector connected to the discharge side of said pump and discharging into said tank, a conduit connected to the suction inlet of said ejector, and means to reverse the flow in a portion of said ejector, thereby to cause at least a portion of the discharge from said pump to flow outwardly through said conduit.

3. In a device of the class described, the combination of a portable tank, a motor driven pump associated therewith, means connecting the inlet side of said pump with said tank, an ejector connected to the discharge side of said pump for creating suction to withdraw fluid material from a casing to be cleaned, a valve for shutting off the discharge through said ejector, and means for relieving the pressure in said pump discharge conduit when said valve is closed, said last-named means comprising a spring pressed valve and means for adjusting the tension of the spring of said valve.

4. In a device of the class described, the combination of a tank, a straining receptacle within said tank, a driven pump associated with said tank and connected to withdraw cleaning fluid therefrom, an ejector connected to the discharge port of said pump, said ejector discharging into said receptacle, a conduit connected to the inlet of said ejector, a valved nozzle carried adjacent the end of said conduit, a valve for partially cutting off the discharge from said ejector, and control means adjacent said nozzle for operating said valve.

5. In a cleaning apparatus, a driven pump, a source of cleaning fluid connected to the inlet of said pump, an ejector connected to the outlet of said pump, a flexible conduit connected to the suction inlet of said ejector, a manually operable control valve near the end of said conduit, and

selectively operable means to impede the normal discharge of said ejector, thereby to cause said cleaning fluid to be discharged through said conduit when said manually operable valve is open.

6. In a device of the class described, the combination of a tank, a truck upon which said tank is mounted, said truck having a pair of uprights, a pair of handles having sockets fitting over said uprights and detachably secured thereto, and a pump and motor unit secured to said handles whereby said motor and pump and the parts connected thereto may be removed as a unit from said tank and truck by means of said handles.

7. In a device for cleaning gear casings and the like, a driven pump, a reservoir containing cleaning fluid connected to the inlet of said pump, an ejector connected to the outlet of said pump and discharging into said reservoir, a conduit connected to the suction inlet of said ejector, valve means to impede the normal discharge of said ejector, thereby to cause said cleaning fluid to be discharged through said conduit, and remotely situated means for operating said valve means.

8. In a device of the class described, the combination of a tank, a motor driven pump associated therewith, a conduit leading from a point adjacent the bottom of said tank to the inlet side of said pump, an ejector connected to the discharge side of said pump, a conduit connected to the suction inlet of said ejector, a valve for partially cutting off the discharge of said ejector, thereby to reverse the flow in a portion of said ejector and to cause the discharge from said pump to flow outwardly through said conduit, and adjustable stop means to prevent complete closure of said valve.

9. In a motor vehicle service station unit, the combination of a tank for a cleaning fluid, a straining receptacle removably mounted within said tank, a motor driven pump associated with said tank and connected to withdraw cleaning fluid therefrom, an ejector connected to the discharge of said pump, said ejector discharging into said receptacle, a conduit connected to the suction inlet of said ejector, a valved nozzle carried adjacent the end of said conduit, a valve for partially cutting off the discharge from said ejector, control means adjacent said nozzle for closing said valve, and resilient means tending to open said valve.

10. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, and means to impede the normal discharge from said ejector sufficiently to cause the cleaning fluid to flow into said conduit.

11. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, valve means to control the discharge of said ejector without materially affecting the flow of cleaning fluid into said ejector, and means adjacent the end of said conduit to control the operation of said valve means.

12. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, valve means to control the discharge of said ejector without materially affecting the flow of cleaning fluid into said ejector, means normally holding said valve means open, and manually operable means to move said valve means toward closed position.

13. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, valve means to control the discharge of said ejector without materially affecting the flow of cleaning fluid into said ejector, a spring for holding said valve means open, a tube secured to said conduit, and a wire guided in said tube and having one end operatively connected to said valve means and its other end adjacent the end of said conduit.

14. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, a valve for controlling the flow of cleaning fluid from the discharge of said ejector, and means to move said valve toward closed position to cause flow of the cleaning fluid outwardly through said conduit.

15. In a device for cleaning gear casings and the like, a motor driven pump, a tank containing cleaning fluid, a pipe connecting the inlet of said pump with said tank, an ejector connected to the outlet of said pump, a conduit connected to the suction inlet of said ejector, and a valve to cut off the normal discharge of said ejector, thereby to cause said cleaning fluid to be discharged through said conduit.

16. In a device of the class described, the combination of a tank, a straining receptacle within said tank, a driven pump associated with said tank and connected to withdraw cleaning fluid therefrom, an ejector connected to the discharge of said pump, said ejector discharging into said receptacle, a conduit connected to the inlet of said ejector, a pistol grip nozzle carried adjacent the free end of said conduit, a valve in said nozzle, a trigger for operating said valve, means for partially cutting off the discharge from said ejector, and a control element adjacent said trigger for operating said means, said trigger and element being so constructed as to be selectively or simultaneously operable with one hand.

17. A motor vehicle service station unit, comprising a tank, a cover therefor, a pair of handles detachably connected to said tank, a base plate secured between said handles, a motor and a pump mounted on said plate, conduits leading from said pump into said tank and passing freely through said cover, and means secured to said cover and passing over said conduits to lift said cover from said tank when said handles, motor, pump and conduits are removed from said tank as a unit.

18. Apparatus for cleaning gear casings and the like, comprising an ejector, means for supplying cleaning fluid under pressure to said ejector, a conduit connected to the suction inlet of said ejector, means to adjust the maximum pressure limit of the cleaning fluid pressure at the inlet of said ejector, and adjustable means for partially or wholly shutting off the discharge from said ejector, thereby to cause reversal of the flow of cleaning fluid in a portion of said ejector and to cause discharge of the cleaning fluid to said conduit.

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