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Ferguson

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[54] **PARTS CLEANING APPARATUS**

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[52] **U.S. Cl.** **134/141,** 134/143, 134/162

[51] **Int. Cl.** **B08b 3/06**

[58] **Field of Search** 134/141, 143, 162, 134/165

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[57] **ABSTRACT**

Apparatus for cleaning engine parts or the like wherein the engine parts are placed in a basket and the basket is reciprocated in a container filled with cleaning solution. A pneumatic basket reciprocator encloses a cylinder with a valved piston connected to the basket and the reciprocator functions automatically to drop the basket in a downward direction when the piston reaches the upper end of its stroke, and the piston reverses its direction in response to the differential in air pressure across the piston and to the flow of air through the valves of the piston or by tne engagement of the piston valves with the bottom of the cylinder, whereby the amplitude and frequency of the piston and basket movement are functions of the weight of the parts placed in the basket and the rate of air flow to the piston.

8 Claims, 5 Drawing Figures

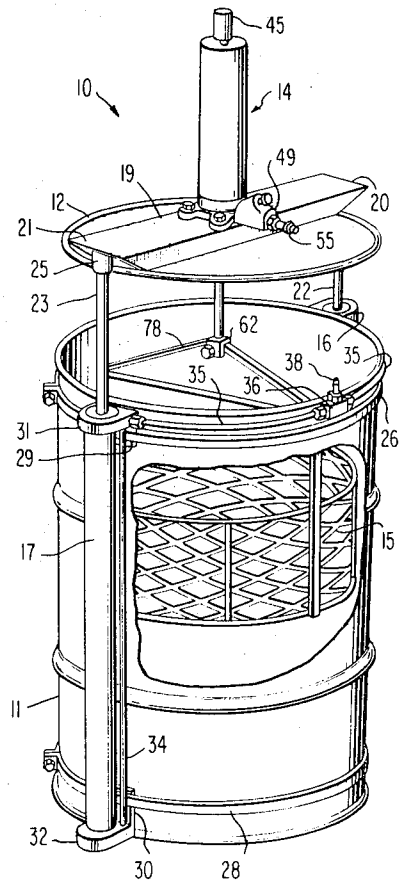
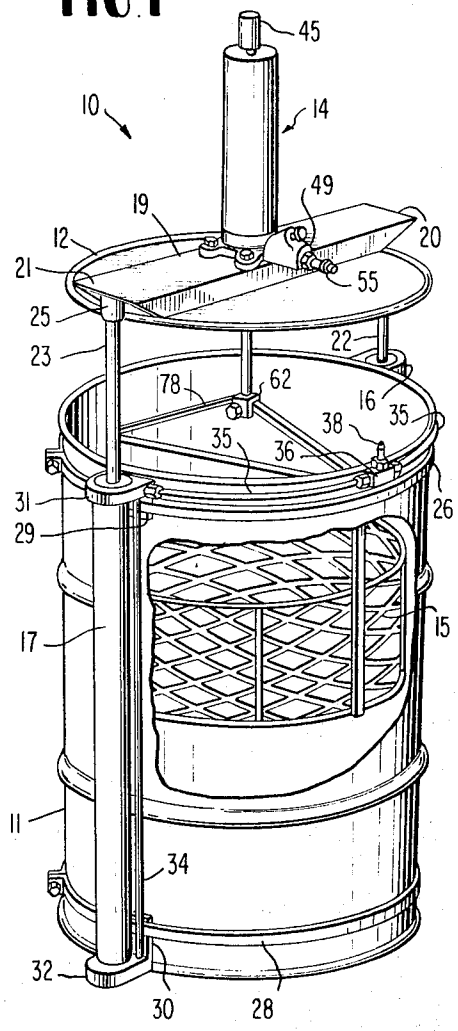


FIG. 1


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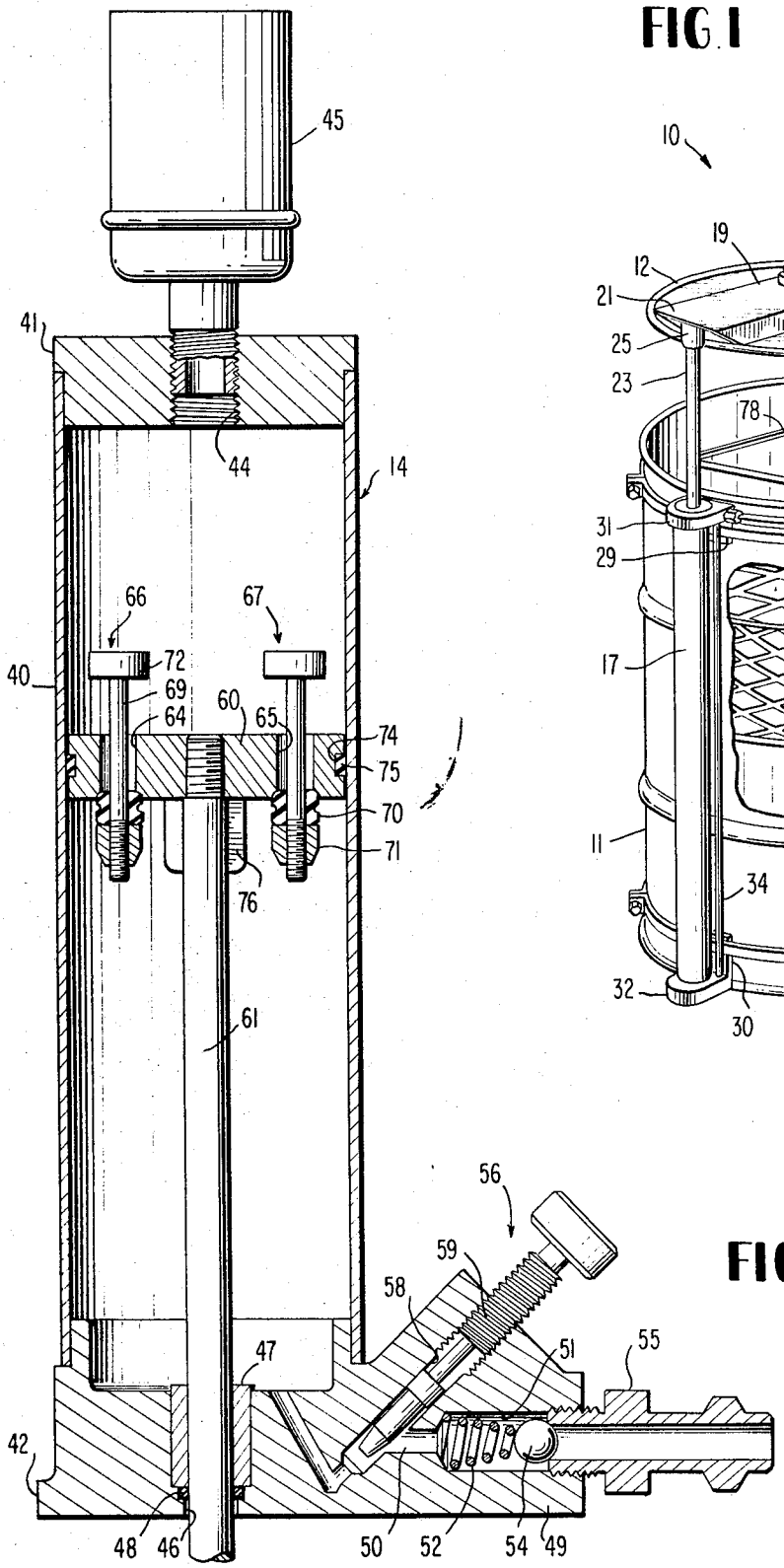

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FIG. 2

FIG. 3

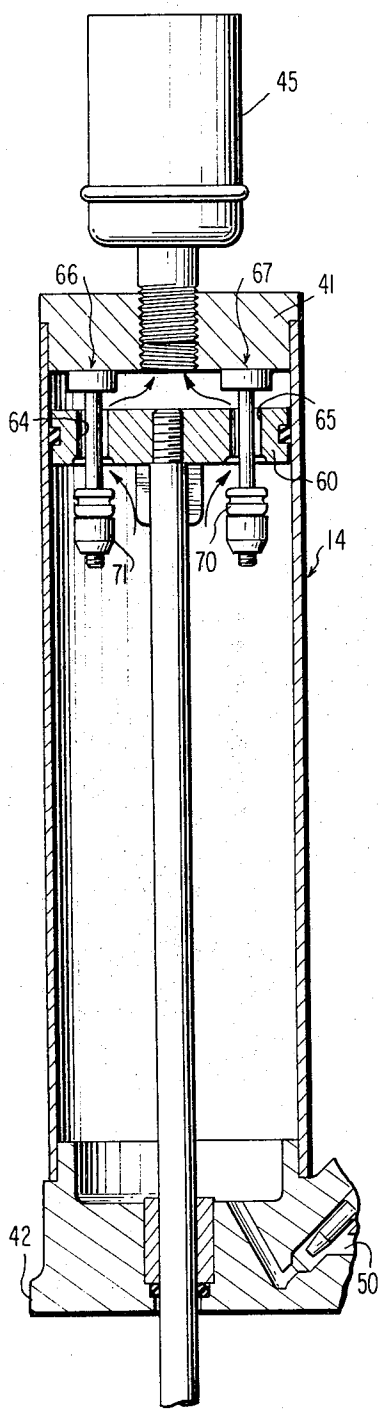


FIG. 4

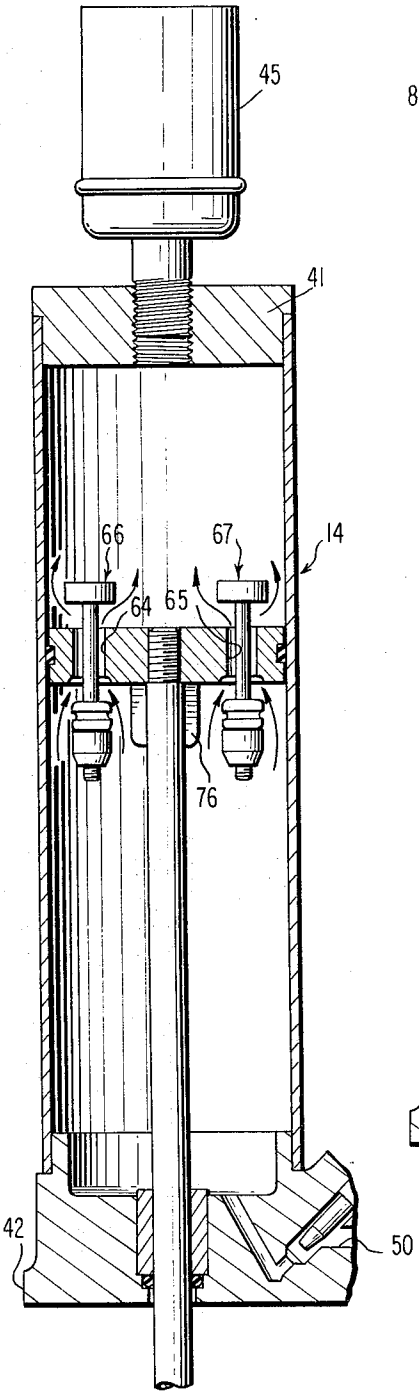
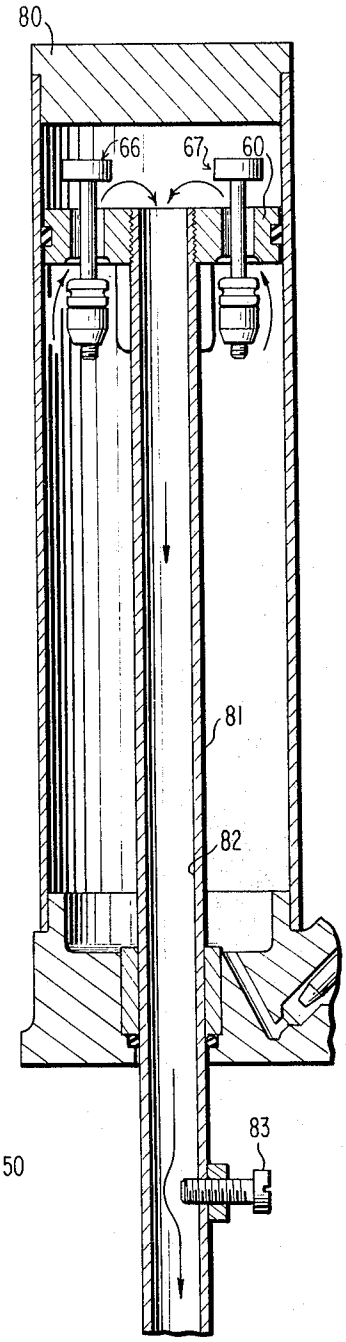


FIG. 5



PARTS CLEANING APPARATUS

BACKGROUND OF THE INVENTION

In machine shops, such as automobile machine shops, the mechanics and other workmen frequently clean the parts to be repaired, etc. The cleaning of the parts has been accomplished by placing the parts in a shallow vat filled with a cleaning liquid to soak the parts, and to rub the parts with a cloth saturated with cleaning liquid. The manual wiping of the parts requires the work and time of the mechanic and is therefore expensive, and the soaking of the parts is slow and not effective to adequately clean the parts without subsequent manual wiping of the parts.

While various mechanical devices have been developed to clean engine parts, etc., the mechanical devices have not proven satisfactory in that they do not thoroughly clean the parts, and the devices are expensive and cumbersome to operate.

SUMMARY OF THE INVENTION

The present invention obviates the problems of the prior art and, briefly described, comprises an apparatus for cleaning engine parts or the like wherein the parts are placed in a basket, the basket is lowered into a cleaning solution and reciprocated in a vertical direction to thoroughly clean the parts. When the cleaning of the parts has been automatically accomplished in this fashion, the basket is elevated from the cleaning solution to drain the cleaning solution from the parts and place the parts in an accessible position for retrieval by the mechanic. The power device for reciprocating the parts comprises a pneumatic cylinder having a valved piston which automatically functions to reverse its stroke, thus requiring no external valves or valve shifting devices.

Thus, it is among the objects of the present invention to provide an inexpensive apparatus for cleaning engine parts or the like, which is economical to use, comprises a small number of moving parts, which requires infrequent maintenance, and which functions automatically to thoroughly clean engine parts of grease, grime, etc.

Various other objects, features and advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the parts cleaner with portions broken away to show the internal components, and with the lid in its partially elevated position.

FIG. 2 is a cross-sectional view of the pneumatic agitation cylinder.

FIGS. 3 and 4 are schematic illustrations of the pneumatic agitation cylinder and show its operation.

FIG. 5 is a schematic illustration of a modified pneumatic agitation cylinder.

DESCRIPTION OF THE EMBODIMENTS

Referring now in more detail to the drawing, in which like numerals indicate like parts throughout the several views, FIG. 1 shows the parts cleaner **10** which includes a container **11**, lid **12**, pneumatic agitation cylinder **14**, basket member **15**, and lid lifting cylinders **16** and **17**. The container **11** illustrated in FIG. 1 is an upright cylindrical container closed at its bottom and open at its top, and lid **12** is approximately disc-shaped and sized and shaped to fit on and close the upper open end of container **11**. A reinforcing channel member **19** extends across lid **12** and forms a part of the lid, and the ends **20** and **21** of channel member **19** extend beyond the rim of lid **12**. Lid lifting cylinders **16** and **17** each include a piston (not shown) internally thereof, and a piston rod **22** and **23** which extends in an upward direction from the cylinders and engages the protruding ends **20** and **21** of channel member **19**. Sockets **25** are welded to the protruding ends **20** and **21** of channel member **19**, and the rods **22** and **23** protruding from lid lifting cylinder **16** and **17** are telescopically received in sockets **25**. In this manner, the lid **12** can be lifted vertically away from rods **22** and **23**, or placed back upon the rods **22** and **23** and maintained in its proper position by the cooperating arrangement of sockets **25** with respect to rods **22** and **23**.

Lid lifting cylinders **16** and **17** are attached to container **11** on opposite sides of the container by means of upper and lower straps **26** and **28** engaging the protruding feet **29** and **30** of the upper and low cylinder heads **31** and **32**, respectively. Fluid flow conduits **34** communicate with the lower end of each lid lifting cylinder **16** and **17**, and each fluid flow conduit **34** communicates at the upper end of container **11** with conduits **35** which are connected to a common fitting **36**. A quick disconnect nipple **38** communicates with fitting **36**, and a source of fluid pressure, such as pressurized air, can be attached to nipple **38** to pressurize the lower ends of lid lifting cylinders **16** and **17**, to simultaneously distend rods **22** and **23** and lift lid **12** from container **11**.

As is illustrated in FIG. 2, pneumatic agitation cylinder **14** comprises a pneumatic drive means having a cylinder **40** with upper and lower cylinder heads **41** and **42**. Upper head **41** defines central outlet opening **44**, and muffler **45** is threaded into outlet opening **44**. Lower cylinder head **42** defines rod opening **46** which is counterbored to accommodate bushing **47** and O-ring seal **48**. Included in the casting of lower cylinder head **42** is inlet conduit housing **49**. A flow passageway or conduit **50** communicates with the lower end of cylinder **40** through inlet conduit housing **49**. Passageway **50** is counterbored at **51** to accommodate coil compression spring **52** and ball valve **54**. A quick disconnect nipple **55** is threaded into counterbore **51**, and ball valve **54** is seated against the internal end of quick disconnect nipple **55** and functions as a check valve to prevent flow of fluid from cylinder **40** through the passageway **50** and out of quick disconnect nipple **55**.

Needle valve **56** comprises a needle valve bore **58** which intersects conduit **50** and valve element **59** which is threaded into bore **58**. Valve element **59** normally intersects conduit **50**, and when threaded deeply into bore **58**, tends to restrict the flow of fluid through conduit **50**. The amount of fluid flowing through conduit **50** can be adjusted by rotating needle valve **56**, in the conventional manner.

Valved piston **60** is positioned in cylinder **40** of pneumatic agitation cylinder **14** and is arranged to reciprocate therein. Piston rod **61** is rigidly connected to piston **60** and extends from piston **60** through the lower end of pneumatic agitation cylinder **14**, into container **11** (FIG. 1), and is connected at its lower end to basket member **15** by means of clevis **62**. Piston **60** includes valve openings **64** and **65** and valves **66** and **67** which

reciprocate in valve openings 64 and 65. Each valve 66 and 67 includes a valve stem 69 which extends through a valve opening 64 or 65, a valve element 70 connected to the valve stem 69 at its lower end below piston 60, retaining nut 71 threaded onto the lower end of valve stem 69 to retain the valve element on the valve stem, and cap 72 connected to the upper end of valve stem 69. Each valve stem 69 is smaller than its valve openings 64 or 65, while valve elements 70 and valve caps 72 are larger than the valve openings. Valve elements 70 are resilient and compressible, and when the valves 66 and 67 are moved in an upward direction with respect to piston 60 as illustrated in FIG. 2, valve elements 70 will function to block the fluid flow through piston from below the piston.

Piston 60 also includes annular peripheral groove 74, and an annular sealing ring 75 is seated in the groove and arranged to seal piston 60 to cylinder 40. A collar 76 is integrally connected to piston 60 and extends downwardly therefrom about piston rod 61. Collar 76 is broken on opposite sides to provide space for valves 66 and 67, and the height of collar 76 is approximately equal to the distance which valves 66 and 67 protrude in a downward direction from piston 60 when the valves are in their up positions, as illustrated in FIG. 2. With this arrangement when piston 60 is in its full down position in the lower portion of cylinder 40, collar 76 will tend to engage the lower portion of the cylinder and the valves 66 and 67 will not be crushed against the lower cylinder head 42.

As is illustrated in FIG. 1, basket member 15 is illustrated as an expanded metal basket structure having an upper yoke structure 78 attached at its ends to opposite sides of the basket structure and connected at its center to clevis 62. The openings in the basket structure are sufficient to allow free flow of fluid through the basket, and the openings are small enough to retain in the basket the various engine parts, etc., which are to be cleaned by the pneumatic parts cleaner 10.

OPERATION

When the parts cleaner 10 is to be placed in operation, container 11 is partialy filled with a cleaning liquid. If the parts cleaner has not been assembled, lid lifting cylinders 16 and 17 are clamped on opposite sides of container 11 by straps 26 and 28, lid 12 is mounted on the upper ends of rods 22 and 23 of lid lifting cylinders 16 and 17, and an air hose (not shown) is connected to the nipple 38 of fitting 36 to force air under pressure to the lower ends of lid lifting cylinders 16 and 17. This distends rods 22 and 23 and elevates lid 12. Basket member 15 is then moved in between lid 12 and container 11 and is connected to the lower end of piston rod 61 by the bolt of clevis 62. While the lid 12 and basket member 15 are in their raised configurations, the various engine parts, etc., which are to be cleaned by parts cleaner 10 are then placed in basket member 15. The air hose (not shown) is then removed from fitting 36, whereupon the air from lid lifting cylinders 16 and 17 is allowed to be exhausted to the atmosphere through fitting 36, thus causing lid 12 and basket member 15 to move in a downward direction until lid 12 rests upon and closes the upper open end of container 11.

The air hose is then connected to quick disconnect nipple 55 of conduit 50 to flow air to pneumatic agitation cylinder 14. If valves 66 and 67 are already closed because of piston 60 resting at the lower end of cylinder 40, the air flowing through the lower portion of cylinder 40 beneath piston 60 will cause the pressure to build up beneath the piston and lift the piston in an upward direction through cylinder 40. The upward movement of piston 60 also causes corresponding upward movement of piston rod 61 and basket member 15 in container 11. As is illustrated in FIG. 3, piston 60 soon reaches the upper end of cylinder 40, and the upper ends of valves 66 and 67 engage the upper cylinder head 41. The engagement of the valves 66 and 67 with the upper cylinder head 41 causes the valves to stop their upward movement while piston 60 continues its upward movement, which results in valves 66 and 67 moving in a downward direction with respect to piston 60 and opening valve conduits 64 and 65. The pressurized air beneath piston 60 then is allowed to escape through valve conduits 64 and 65 from beneath the piston to the area above the piston in cylinder 40, and then eventually through outlet opening 44 and muffler 45 at the upper portion of the pneumatic agitation cylinder 14. The cross-sectional areas of valve openings 64 and 65 with valves stems 69 extending therethrough together are larger than area of inlet conduit 50 of inlet conduit housing 49 at the lower end of the structure. Thus, the air below piston 60 in cylinder 40 is able to flow faster through the piston than the air is able to flow through inlet conduit 50 into the cylinder. This difference in flow is sufficient to allow the air beneath piston 60 to be depleted and to allow piston 60 to move in a downward direction. Of course, piston rod 61 and basket member 15 also move in a downward direction with the downward movement of piston 60.

As is illustrated in FIG. 4, when piston 60 is moving in a downward direction, the pressure of the air below the piston 60 is greater than the pressure of the air above the piston, which tends to urge valves 66 and 67 in an upward direction toward their closed positions. Moreover, the flow of air through the valve conduits of piston 60 further tends to urge valves 66 and 67 closed. If the air pressure and air flow conditions are not sufficient to close valves 66 and 67, piston 60 will continue in its downward direction until it approaches the lower end of cylinder 40, and the lower ends of valves 66 and 67 will engage the lower cylinder head 42 and stop their downward movement. Since piston 60 continues in its downward movement, the relative movements of valves 66 and 67 with respect to piston 60 cause the valves to close, and the cycle of reciprocation of piston 60 occurs again.

In the event that the pressure differential across piston 60 and the flow of air through valve openings 64 and 65 is sufficient to shift valves 66 and 67 to their closed positions prior to the engagement of the lower ends of the valves with lower cylinder head 42, piston 60 will stop its descent and begin it upward movement before it reaches the lower end of cylinder 40.

The amplitude and frequency of reciprocation of piston 60 and basket member 15 corresponds to the shifting of valves 66 and 67. As previously stated, the shifting of valves 66 and 67 is dependent upon the differential pressure across piston 60 and the flow of air through valve conduits 64 and 65. The air pressure and air flow characteristics are dependent upon the weight applied to piston rod 61 from basket member 15 and the items placed in the basket, the pressure of air entering the cylinder 40 beneath piston 60, the rate of air

flow into the cylinder, and the back pressure above the piston. While the air pressure can be varried with the use of a conventional air pressure regulator in the air line between the compressor (not shown) and air inlet conduit **50**, the air pressure usually will be maintained constant — say 60 pounds per square inch — and only the weight applied to the piston **60** from the various items placed in basket member **15** and the rate of flow of the air through conduit **50** will be varied. The air flow rate can be varied by manipulating needle valve **56** to open or close the restriction in air inlet conduit **50**.

When the relatively heavy load is placed in basket member **15**, the pressure beneath piston **60** must build to a higher level in order to cause the piston **60** to move in an upward direction and to begin the reciprocating movement of basket member **15**. A heavy load results in a relatively slow frequency of reciprocation of the basket member. When the piston **60** reaches the upper end of cylinder **40** and valves **66** and **67** engage the upper cylinder head **41**, the heavy weight applied to piston **60** will urge the piston in a downward direction at a rapid rate, and the extreme pressure differential across piston **60** will cause the air to escape at a rapid rate from beneath piston **60** through valve openings **64** and **65** in the piston. The usual result is that piston **60** and basket member **15** will drop through a relatively long distance, causing the reciprocation of the basket member to have a large amplitude.

If it is desired to increase the frequency of reciprocation of basket member **15** for a more vigorous cleaning action in container **11**, needle valve **56** can be opened to allow a faster flow of pressurized air through air inlet conduit **50** and into the lower end of cylinder **40**. This causes basket **15** to move in an upward direction at a faster rate. If it is desired to increase the amplitude of reciprocation of basket member **14**, muffler **45** can be adjusted to restrict the flow of air out of the upper end of cylinder **40** above piston **60** which functions to increase the back pressure above piston **60** and reduce the differential pressure across the piston. The reduction in the differential pressure causes valves **66** and **67** to stay open longer as piston **60** moves in its downward direction. Of course, if enough back pressure is maintained above piston **60**, the piston can be forced to move all the way to the bottom of cylinder **40** and valves **66** and **67** will not shift until they engage the lower cylinder head **42**.

As is illustrated in FIG. **5**, a more economical pneumatic agitation cylinder can be fabricated by replacing the upper cylinder head **41** with an impervious upper cylinder head **80**, and replacing piston rod **61** with a tubular piston rod **81**. The air passing through the valves of the piston will then flow in a downward direction from above the piston through the opening of the tubular piston rod **81** down into container **11**, where the air will be dissipated in the container. If desired, the opening **82** in the tubular piston rod **81** can be restricted by an adjustable valve element **83** to control the back pressure above the piston.

The proportions of the elements of the present application are chosen to suit the weight of the engine parts, etc., to be cleaned. For instance, the basket member **15** is of a strength sufficient to accommodate the heaviest of the engine parts to be cleaned, and the diameter of piston **60** together with the anticipated air pressure is sufficient to lift the heaviest of the parts, etc. The needle valve **56** and the muffler **45** or the adjustable valve element **83** (FIG. **5**) together with the pressure of the incoming air can be adjusted to obtain the desired amplitude and frequency of reciprocation, as previously described.

When the parts have been reciporcated with basket member **15** in container **11** for a period of time sufficient to clean the parts, the air hose (not shown) is disconnected from nipple **55** of pneumatic agitation cylinder **14** and connected to nipple **38** of fitting **36** at the upper side of container **11**. When the air hose is disconnected from the quick disconnect nipple **55** of pneumatic agitation cylinder **14**, ball valve **54** becomes seated and traps the air in the lower end of cylinder **40** beneath piston **60**, and if valves **66** and **67** are seated at the time, piston **60** will come to rest in an up position and suspended within cylinder **40**. When the air pressure is applied to fitting **36**, lid lifting cylinder **16** and **17** function to distent their rods **22** and **23** and lift lid **12** away from the upper open end of container **11**. This functions to lift pneumatic agitation cylinder **14** and basket member **15**, and rods **22** and **23** are of sufficient length to lift basket member **15** high enough so that its lower end is approximately level with the upper edge of container **11**. This presents all of the now cleaned parts at an accessible level for the mechanic, and all of the cleaning liquid tends to drain from basket member **15** and the parts located therein back down into container **11**. Also, basket member **15** is accessible from substantially 360° about container **11**, and parts can be retrieved from or placed in basket member **15** from virtually any position about the container.

While the invention has been disclosed as utilizing pneumatically operated cylinders, it will be understood by those skilled in the art that various different driving fluids can be used to operate the cylinders, including inert gases. Also, while this invention has been described in detail with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

I claim:

1. Apparatus for cleaning engine parts or the like comprising a cylindrical container open at its upper end, a lid for closing the upper end of said container, a pair of lid lifting cylinders positioned in upright attitudes on opposite sides of said container, a piston positioned in and movable along the length of each lid lifting cylinder, fluid flow means for communicating fluid simultaneously with the lower ends of both of said lid lifting cylinders, a piston rod connected to each of said pistons and extending in an upward direction out of said lid lifting cylinders and connected at their upper ends to said lid and arranged to move said lid vertically toward and away from said container while maintaining said lid in an approximately horizontal attitude, a parts receiving basket normally positioned in said container, a basket driving cylinder positioned in an upright attitude on the central portion of the upper surface of said lid, a piston positioned in said basket driving cylinder, a piston rod connected to the piston in said basket driving cylinder and extending in a downward direction through said lid and supporting said basket in said container, the piston in said basket driving cylinder comprising a valved piston with at least one valve therein constructed and arranged to block the flow of fluid through its piston from below its piston when in one po-

sition and to permit the flow of fluid through its piston when in another position, and fluid flow means for providing fluid under pressure to said basket driving cylinder below its piston.

2. Apparatus for cleaning engine parts or the like comprising a container open at its upper end for containing a cleaning liquid or the like, a lid for closing the upper end of said container, a basket member positioned in said container, fluid driving means connected to said basket member and arranged to reciprocate said basket member in said container, said fluid driving means comprising a cylinder, a piston in said cylinder, a piston rod connected to said piston and extending through one end of said cylinder and connected to said basket member, said cylinder defining a fluid inlet opening at one of its ends, said piston comprising at least one valve opening therethrough and a valve connected to said piston and arranged to close fluid flow through the valve opening of said piston as the basket moves in a downward direction in the container and to open fluid flow through the valve opening of said piston as the basket moves in an upward direction in the container.

3. The apparatus of claim **2** and wherein said cylinder is mounted in the center portion of said lid, and said piston rod extends from said piston through the lower end of said cylinder and through said lid into said container and is connected to said basket member.

4. The apparatus of claim **2** and further including lid lifting means comprising at least one upright fluid cylinder connected to said container, a piston in said cylinder, a piston rod connected to said cylinder and extending in an upward direction out of said cylinder and connected at its upper end to said lid.

5. The apparatus of claim **2** and further including lid lifting means comprising upright cylinders connected to said container, a piston in each cylinder, a piston rod connected to each piston and extending in an upward direction out of its cylinder and connected at its upper end to said lid, and fluid flow means for simultaneously pressurizing said cylinders below said pistons.

6. Apparatus for cleaning engine parts or the like comprising a container open at its upper end, a basket member normally positioned in said container, pneumatic drive means connected to said basket through the upper end of said container for reciprocating said basket in said container, said pneumatic drive means comprising a cylinder, a valved piston in said cylinder, and a piston rod connected at one of its ends to said valved piston and extending from said cylinder and connected at its other end to said basket member, a flow conduit communicating with one end of said cylinder and with a source of air under pressure, said valved piston comprising at least one valve conduit therethrough, and a valve element arranged to close said valve conduit as said basket is moving in a downward direction in said container and to open said valve conduit as said basket is moving in an upward direction in said container.

7. The apparatus of claim **6** and further including check valve means in said flow conduit and arranged to prevent the flow of air from said cylinder through said flow conduit, and control means for controlling the flow of air through said flow conduit toward said cylinder.

8. The apparatus of claim **6** and wherein said valve element comprises a valve, a valve stem connected at one of its ends to said valve and extending through and beyond the other side of said piston and arranged to engage the end of said cylinder as said piston moves toward the end of said cylinder and moves the valve away from said valve conduit.

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