Sept. 4, 1934. E. C. HORTON ET AL 1,972,842

NEGATIVE PRESSURE ACCESSORY SYSTEM

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Fig. 1

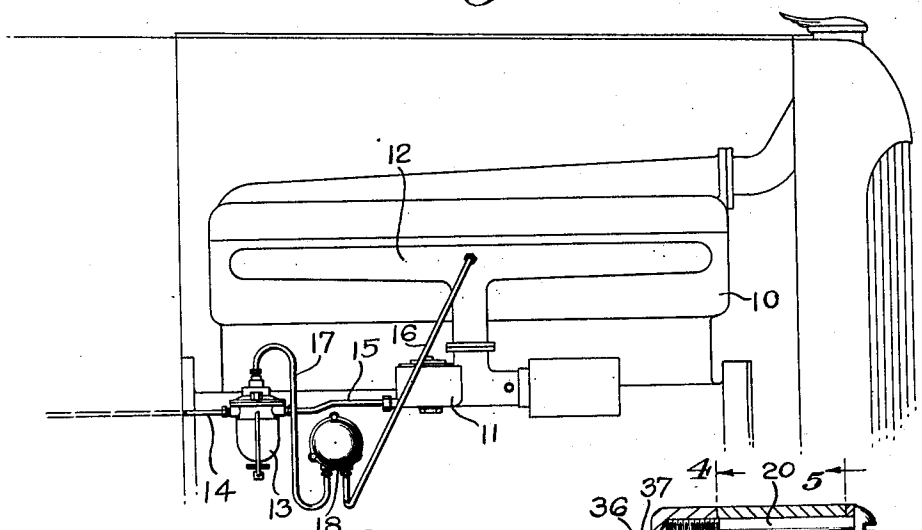


Fig. 2

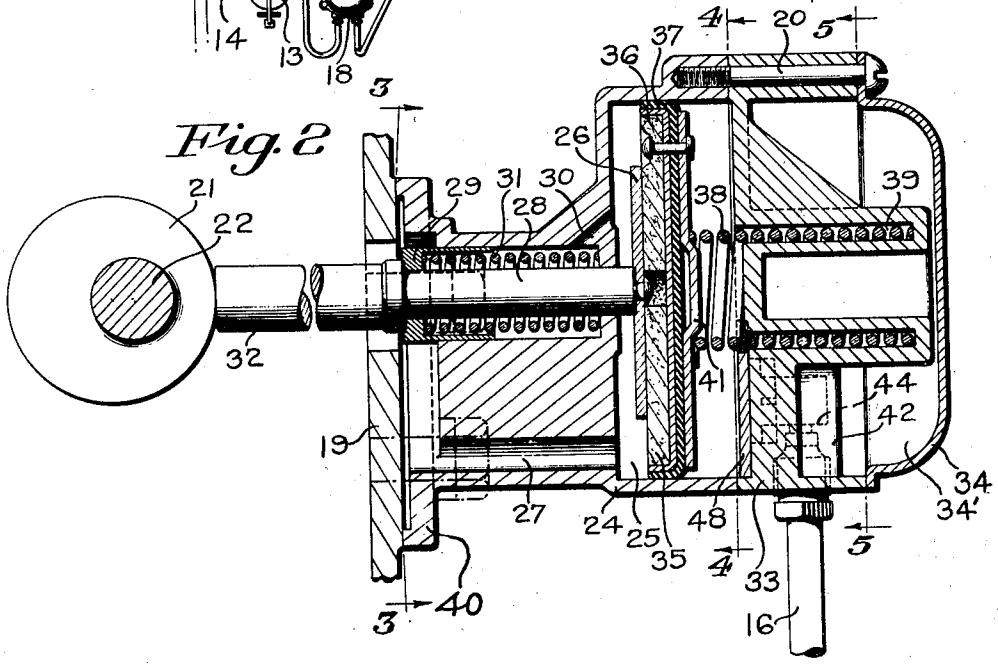
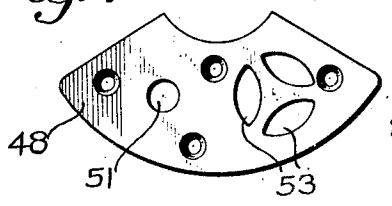


Fig. 7



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Fig. 3

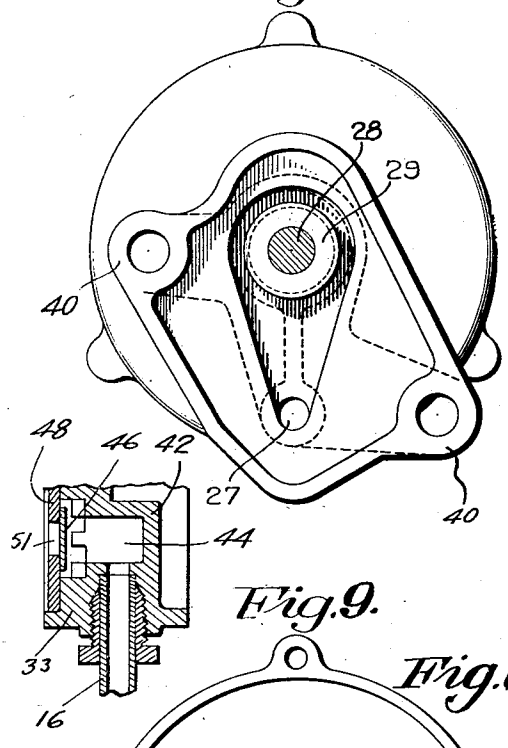


Fig. 4

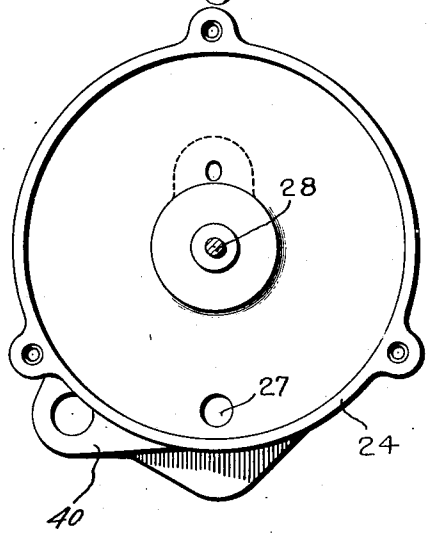


Fig. 9.

Fig. 6

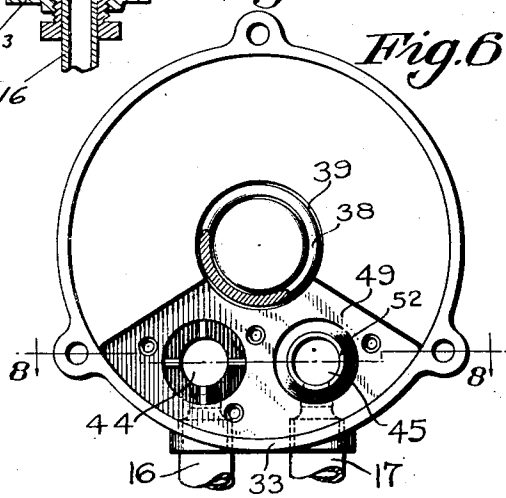


Fig. 5

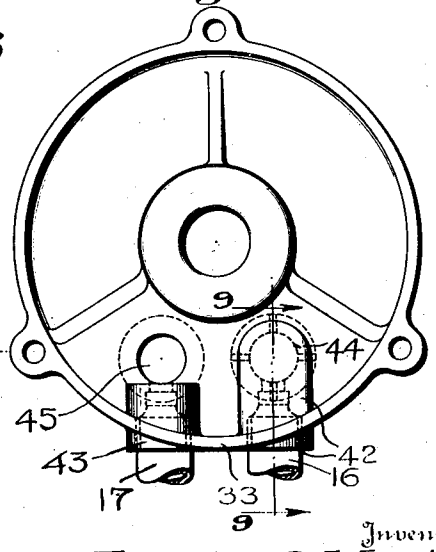
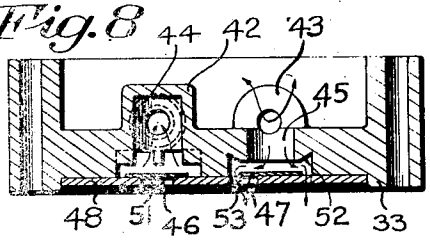


Fig. 8



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UNITED STATES PATENT OFFICE

1,972,842

NEGATIVE PRESSURE ACCESSORY SYSTEM

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Application January 2, 1931, Serial No. 506,230

9 Claims. (Cl. 123—139)

The present invention relates to suction pumps, and more particularly to auxiliary means therewith for sustaining the degree of suction or negative pressure that is created in the intake manifold of internal combustion engines or other source.

Automobile accessories including fuel pumps or lifts are commonly actuated by the difference in fluid pressure between that maintaining in the atmosphere and that in the intake manifold or other part of the engine of the automobile. Because of the varying conditions of speed and load imposed upon the automobile and its engine, such pressure differential is likewise subject to great variation, the pressure difference being usually greatest when the engine is under light load or traveling at low speed, the throttle then being substantially closed, and lowest when the throttle is wide open. As a result when the vehicle is accelerating or moving at high speed or under heavy load at lower speeds, the pressure differential is greatly reduced, so much so, that it has been found insufficient at some of such times to maintain a suction actuated accessory in operation.

Heretofore various means have been proposed to augment or intensify this suction during the periods of low pressure differential. Such means have comprised a cylinder and a piston movable therein by the vehicle engine to effect a rarefaction of the gases in the suction line during periods of low pressure differential, and means to automatically cause the device to become ineffective during periods of normal pressure. Due to the inertia of the valves in such augmenting means, which caused slight delay in the opening and closing movements thereof, and due to the high speed of operation and the resulting frequency of reversals of direction of the piston of such means, the degree of suction maintaining at the vacuum operated accessory was susceptible of fluctuation resulting in the case of a suction operated fuel pump, in slightly impaired pumping efficiency and relatively heavy shocks to the pump elements.

It is among the purposes of the present invention to provide a suction augmenting device of simple and durable construction which will be rendered effective, by rotation of the engine cam shaft or other part, to augment and intensify the suction or difference of pressure between the atmosphere and that maintaining in the operating line of a suction operated accessory when such augmentation is necessary. Means are contemplated by the invention for decreasing to a negligible degree the fluctuations in the degree of suction in such line whereby the accessory action will be more uniform, efficient and sufficient to meet the demands imposed upon it. The pressure fluctuation decreasing means also functions to reduce the force of impact between the members of the suction augmenter which are engageable and disengageable to effect the commencement and discontinuance of the augmenting function of the device.

These and other objects and advantages will become apparent from a perusal of the following description of a typical device embodying the principles of our invention, reference being made to the accompanying drawings wherein:—

Fig. 1 is a side elevation of a fuel feeding system including a suction operated fuel lift and the suction augmenting device, these elements being illustrated as applied to the fuel intake parts of a motor vehicle engine;

Fig. 2 is a transverse sectional view taken through the center of the suction augmenting device, the vehicle engine casing and operating or cam shaft being shown in operable association therewith;

Fig. 3 is a vertical section taken along line 3—3 of Fig. 2;

Fig. 4 is a disassembled elevational view of the casing section of Fig. 3 as it appears when viewed in the manner indicated by the line 4—4 of Fig. 2;

Fig. 5 is a view similar to Fig. 4 and showing the adjacent casing section when viewed as indicated by line 5—5 of Fig. 2;

Fig. 6 is a disassembled view of the casing section of Fig. 5 when viewed from the opposite side thereof;

Fig. 7 is a valve seat and retainer element adapted to be assembled with the casing section of Fig. 6; and

Fig. 8 is a section taken along the line 8—8 indicated in Fig. 6, depicting the valve seat and retainer element in assembled relationship.

Fig. 9 is a fragmentary vertical section taken along line 9—9 of Fig. 5.

As shown in Fig. 1 the motor vehicle engine 10 is, as according to conventional practice, provided with a carburetor 11 for mixing air and fuel into a combustible vapor which is drawn into the engine cylinders through an intake manifold 12. A suction operated fuel pump or lift 13, preferably of the type shown in our co-pending application Serial No. 431,587, filed February 26, 1930, is disposed adjacent the engine carburetor 11 for lifting liquid fuel thereinto from the vehicle fuel tank, which is usually disposed at the rear of the chas-

sis. The fuel is drawn by suction into the pump 13 through a supply line 14 and is expelled by pressure means into the carburetor 11 through a line 15.

The lift 13 is actuated by suction maintaining in the manifold 12, which is induced into the lift through a pair of suction lines 16 and 17 which are respectively connected to the manifold and lift, and between which the suction augmenting device 18 is attached. The latter is mounted upon the engine crank case 19, as shown in Fig. 2, adjacent to a cam 21 which is formed upon the engine cam shaft 22 or other rotating element.

The pressure augmenting and sustaining device 18, as depicted in the drawings herewith, consists of a cylinder casing 24 having a cylindrical chamber 25 therein. The casing is provided with a flange 40 for securement against the engine crank case 19, and has a vent or passage 27 cooperating with a recess in the casing end to open communication between the interior of the engine casing 19 and the cylinder 25. Within the cylinder is disposed a pusher disk or drive member 26 that is mounted upon a drive rod 28 that extends through the casing 24. The rod 28 is preferably provided with an enlarged head which retains a cupped sleeve 29 slidable in a bore in the casing 24, the sleeve being held against the rod head by a coiled compression spring 31. A vent passage 30 is provided in the casing 24 between the spring well and the cylinder 25 to avoid losses due to the compression of air in the well.

Movement is imparted to the rod and sleeve by a drive tappet 32 that engages the head of the rod 28 and the cam 21, the latter rotating when the engine is operating. During one half of each such rotation the cam, through the tappet 32, will force the rod 28 outwardly, or to the right as viewed in Fig. 2 against the compression of the spring 31. During the remaining half of each such rotation, the rod 28 will be moved inwardly by the spring 31, which will retain the tappet in constant contact with the cam.

A cylinder head casing section 33 closes the cylinder 25, being secured to the casing 24 by bolts 20. The latter also engage a cover member 34 which forms with the section 33 a vacuum capacity chamber 34' of relatively large volume as compared with the cylinder 25. A piston 35, including a cushion 36 and a packing cup 37, is fitted within the cylinder and is normally held in contact with the plate 26 by the pressure of a coiled compression spring 38. The latter is seated in an annular well 39 formed in the section 33 and is centered relative to the piston by a centering button 41 formed with the piston.

The tubes 16 and 17 are threaded or otherwise attached to respective extended tubular terminal portions 42 and 43 formed with the head casing section 33, the opening through portion 43 communicating directly with the chamber 34' as indicated in Fig. 5 and Fig. 8 and the tubular portion 42 communicating with the cylinder 25 through a port 44 as shown in Fig. 6, in Fig. 8 and in Fig. 9. A port 45 extends through the casing section 33 between the cylinder 25 and the chamber 34'. Ports 44, 45 are provided with valves 46, 47 respectively, a plate 48, depicted in Figs. 7 and 8, being fitted in a recess 49 in the head casing wall for retaining the valves. Valve 46 is adapted to seat against the plate 48 covering an opening 51 formed therein and the valve 47 is adapted to close against a seat 52 to prevent passage of fluid through the plate apertures 53 and port 45.

The valves comprise light disks which are readily movable from open to closed position or vice versa by the impingement of air or other fluid thereagainst. In normal operation, with the engine moving under normal throttle opening, the difference between the pressure of the atmosphere and that maintaining in the intake manifold 12 will be sufficient to operate the pump or lift 13. During such a period air under less-than-atmospheric pressure will be drawn through the tubes 16 and 17 into the manifold 12, the path of movement thereof being through tube 17, passage 43, chamber 34', port 45, cylinder 25, port 44 and tube 16. The pressure maintaining on the outer side of the piston 35 (to the right as shown in Fig. 2) is sufficiently less than that on the opposite side thereof, so that the piston will be moved to its outward limit position against the pressure of the spring 38. Movement of air through the augmenting device will cause both valves 46, 47 to remain unseated.

The reciprocating movement of the rod 28 and the attached plate 26, effected by the rotation of the cam 21 and the pressure of the spring 31 will, under such normal conditions, not affect the piston 35 which will be held outwardly beyond the range or path of movement of the plate by the partial vacuum maintaining in the outer part of the cylinder 25.

The spring 38 is of such strength, however, that it will, upon a slight decrease in the degree of such suction, or a slight lessening of the pressure differential by which the accessory 13 is actuated force the piston inwardly (toward the left as viewed in Fig. 2) causing the piston to engage the drive plate 26. Thereafter, until the normal degree of suction within the chamber 34' and line 17 has been again developed, the piston will reciprocate with the rod 28 and plate 26, the spring 38 retaining the piston in contact with the plate. During this phase of operation the piston 35 on inward movement under the urge of spring 38, will draw air from the chamber 34' into the cylinder 25 through the port 45, the valve 47 unseating and the valve 51 seating to close communication between the line 16 and the cylinder. Upon outward movement of the piston, against the pressure of the spring 38, air will be forced from the cylinder into the exhaust line 16, the valve 47 being seated and the valve 51 unseated by the fluid in motion.

When a sufficient degree of evacuation has been developed, in the chamber 34', cylinder 25, and line 17, either by reason of the evacuating movement of the piston 35 or by reason of a drop of pressure in the intake manifold, the atmospheric pressure upon the inner face of the piston will oppose the spring 38 and force the piston to a position where it will not be operably engaged by the plate 26.

It will be understood that while the piston is in reciprocating movement, and at other times, atmospheric pressure will maintain in the cylinder 25 inwardly of the piston, due to the vent opening to the crank case interior provided by the passage 27, the recess in the inner end of the casing section 24 as shown in Fig. 3, and the opening in the crank case shown in Fig. 2. The vent passage will also function to admit lubricating spray from the crank case to the cylinder 25. Chamber 34' being of large capacity will maintain an operating degree of evacuation for a considerable time, and when the fluid pressure does increase beyond this necessary degree, the rate of increase will be gradual, allowing the piston 35 to move slowly inwardly to engage the

reciprocating plate 26 in order that the piston may engage the plate when the latter is near the end of its inward stroke and consequently moving slowly. The force of impact of these parts is thereby reduced to a minimum, greatly increasing the effective life of the device. The large capacity of the chamber 34' will also function to render the operation of the lift 13 more uniform and to reduce the fluctuations of pressure in the line 17.

It will be understood that the specific device described is to be regarded as illustrative of one embodiment of and not as specifically limiting the invention as defined by the following claims.

What is claimed is:

1. A suction augmenting device for a suction line, comprising a cylinder casing, a reciprocating drive element therein, a piston movable in said casing, a resilient member for urging said piston into contact with said reciprocating drive element, a capacity chamber in communication with said cylinder, check valve means for passing fluid from said capacity chamber to said cylinder, and check valve means for passing fluid from said cylinder, whereby upon increase of pressure in said capacity chamber said resilient member may become effective to urge said piston into engagement with said drive element to draw fluid from said chamber.

2. In combination with a fuel feeding system for an engine having an intake manifold, a suction operated fuel lift and a suction line between said manifold and lift, a capacity chamber associated with said suction line, a cylinder casing communicating with the capacity chamber and suction line, a piston movable therein, drive means adapted to effect reciprocation of said piston only when the fluid pressure in said chamber rises above a predetermined normal, and valve means whereby movement of fluid from said manifold into said chamber is prevented, and whereby reciprocation of said piston will cause fluid to be withdrawn from said capacity chamber.

3. Means for augmenting suction in a suction line comprising a capacity chamber associated with said suction line, a casing in communication with said chamber and suction line, said casing having a pump element movable therein, drive means for said element, and means effective upon increase of pressure in said chamber to effect operable association of said element and drive means and to effect an operable dissociation of said element and means when said pressure falls below a predetermined pressure, and valve means for causing said element to withdraw fluid from said chamber when in operable association with said drive means.

4. A suction augmenter for a suction line, comprising a cylinder having valved inlet and outlet ports, a piston freely reciprocatory in the cylinder, means urging the piston in one direction of movement, a drive member separate from and engageable with the piston to move it in the opposite direction, and a capacity chamber communicating with the suction line and with said cylinder through said valved inlet port, whereby movement of said piston into engagement with said drive member upon increase of pressure in said suction line will be retarded.

5. An automotive vehicle having an engine, an intake manifold for the engine, a suction operated accessory, a cylinder having a movable piston therein, a capacity chamber communicating with said cylinder, valving means in said cylinder for permitting a uni-directional flow through said cylinder, means for moving said piston in one direction whereby fluid enters through the entrant valving means from said capacity chamber, a reciprocatory disk free within said cylinder, means for actuating said disk, means effective upon an increase of pressure in said capacity chamber for urging the disk into operative relationship with said actuating means, and a conduit communicating with said manifold, accessory and capacity chamber.

6. A device for augmenting suction in a suction line, comprising a cylinder having a piston movable therein, a cylinder head having valved inlet and outlet ports and a capacity chamber therein, said capacity chamber communicating with said cylinder through said inlet port, resilient means for urging said piston away from said cylinder head, and actuating means free of and engageable with said piston to urge it toward said head, whereby said piston may be held out of engagement with said actuating means against the urge of said resilient means by a vacuous condition in said cylinder adjacent said head and in said capacity chamber, and whereby upon lessening of said vacuous condition in said portion of said cylinder said capacity chamber will function to retard movement of said piston into engagement with said actuating means.

7. In combination with an internal combustion engine intake manifold and a suction operated accessory, of a suction booster pump having a valved outlet connected directly to the manifold, said pump having a head provided with a chamber, said pump having an inlet leading from the chamber, and said chamber itself having an inlet leading from the accessory, one of said inlets being valved for cooperating with the valved outlet in directing a uni-directional air flow through the pump from the accessory.

8. In a suction producing apparatus associated with a suction line extending to a suction operable device, a cylinder chamber and a piston movable therein for enlarging and contracting said chamber, a check valved inlet passage opening into the chamber and a check valved exhaust passage leading therefrom, a capacity chamber communicating with the check valved inlet passage whereby fluid may pass from the capacity chamber into the cylinder chamber, a fluid passage for connecting said capacity chamber to the suction line, drive means adapted to engage and actuate said piston, and means for causing said piston to engage said drive means for actuation thereby when the fluid pressure in said capacity chamber exceeds a predetermined degree.

9. In combination with an internal combustion engine intake manifold and a suction operated accessory, a cylinder chamber and a capacity chamber, a check valved passage for permitting fluid passage from the capacity chamber into the cylinder chamber, a check valved connection between the cylinder chamber and the intake manifold for permitting fluid passage from the cylinder chamber into the intake manifold, a fluid passage connecting the capacity chamber to the suction operated accessory, and piston means for alternately enlarging and contracting the cylinder chamber.

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