June 28, 1955 J. P. KOVACS 2,711,725

APPARATUS FOR REMOVAL OF CARBON DEPOSITS IN INTERNAL COMBUSTION ENGINES

Filed July 9, 1953 2 Sheets-Sheet 1

Fig. 1.

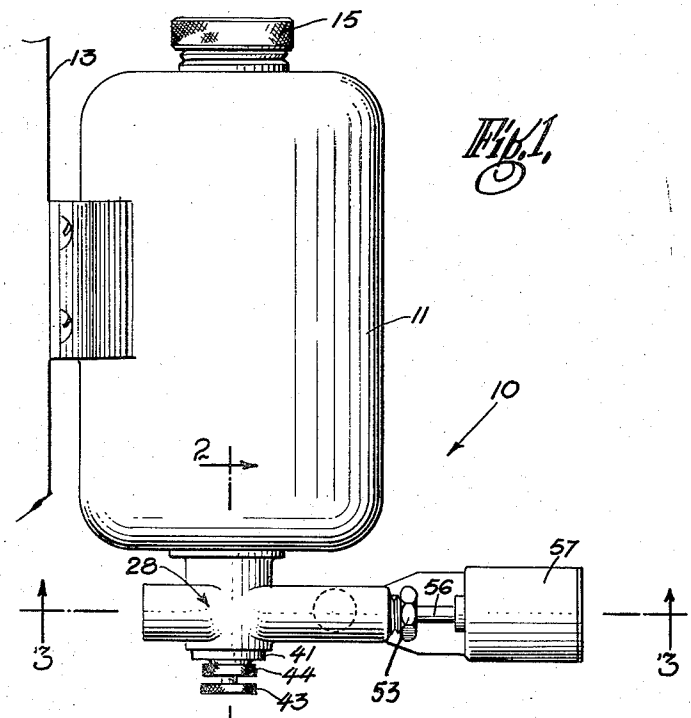
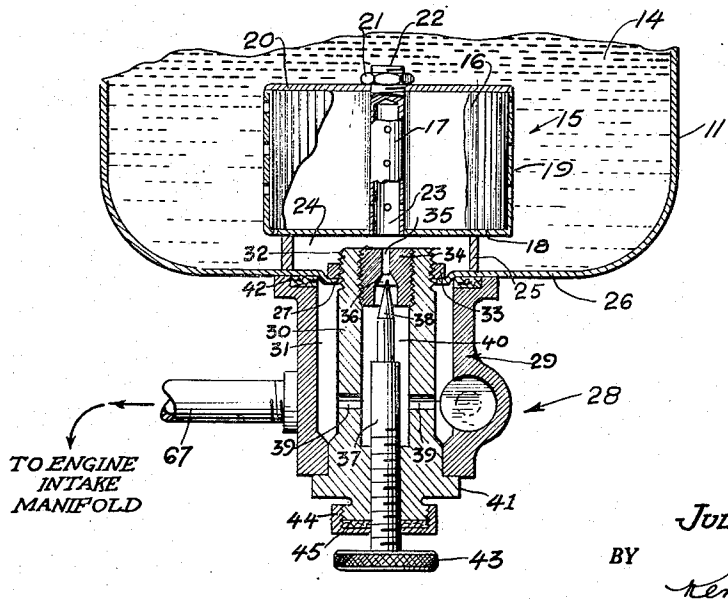


Fig. 2.



INVENTOR.
JULIUS P. KOVACS

BY Kenyon & Kenyon

ATTORNEYS

June 28, 1955 J. P. KOVACS 2,711,725

APPARATUS FOR REMOVAL OF CARBON DEPOSITS IN INTERNAL COMBUSTION ENGINES

Filed July 9, 1953 2 Sheets-Sheet 2

Fig. 3.

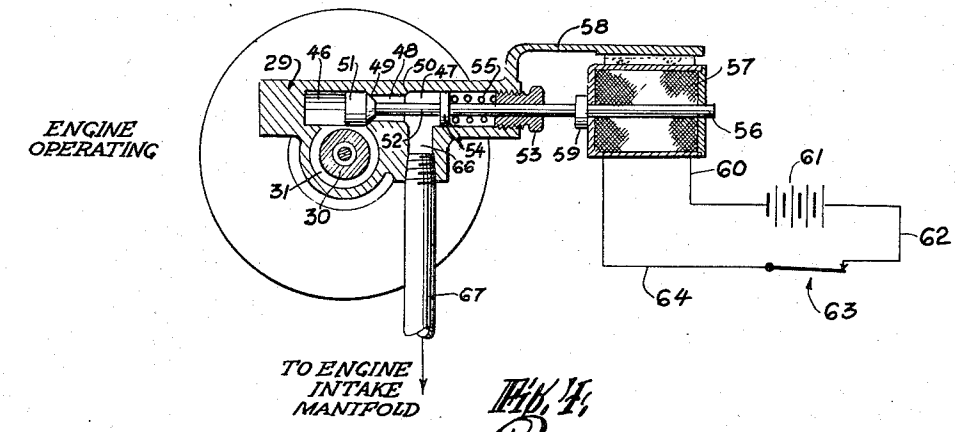


Fig. 4.

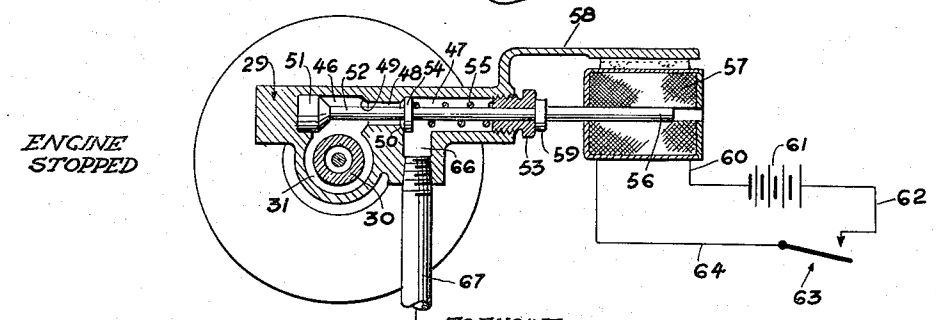
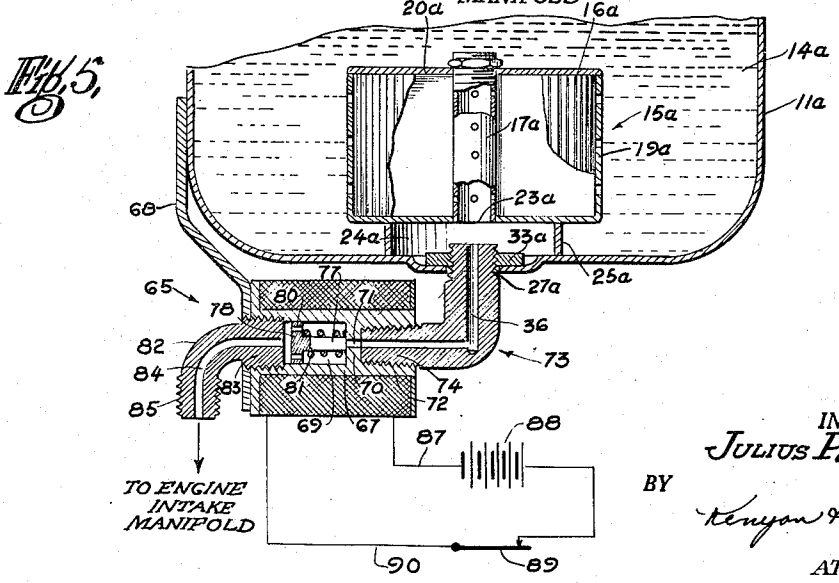


Fig. 5.



INVENTOR.
JULIUS P. KOVACS
BY
Kenyon & Kenyon
ATTORNEYS

United States Patent Office 2,711,725 Patented June 28, 1955

2,711,725

APPARATUS FOR REMOVAL OF CARBON DEPOSITS IN INTERNAL COMBUSTION ENGINES

Julius P. Kovacs, Westfield, N. J., assignor to Purolator Products, Inc., Rahway, N. J., a corporation of Delaware

Application July 9, 1953, Serial No. 367,062

5 Claims. (Cl. 123—198)

This invention relates to a method and apparatus for the removal of carbon deposits in internal combustion engines.

A principal object of this invention is to provide methods and means for delivering a carbon deposit removing fluid or solvent to the intake manifold of an internal combustion engine for distribution to the cylinders thereof, in order to remove the carbon deposits in the cylinders, on the pistons, and other internal parts of the engine.

It is a further object of this invention to provide means to accomplish this delivery automatically.

It is an additional object to provide methods and means for dissolving the carbon deposits while the engine is not running or at rest, so that the removal of such deposits will be effective and thorough.

The presence of carbon deposits in the cylinders, or pistons and around the valve seats, and other places has long been unwelcome and undesired in internal combustion engines, because of diminished engine efficiency engendered thereby. Although fluids for removing such deposits have been common for many years, as far as I am aware, no truly satisfactory system for utilizing these fluids has previously been devised. The primary fault with most of these prior systems and devices lies in the fact that the carbon dissolving fluid is injected during engine operation, either manually or automatically, with the result that most of the fluid is consumed during the combustion process. This necessarily occurs because the carbon removing fluid must be combustible, and simply does not have time to act to remove the deposits before it is burned. The device of this invention operates to deliver the carbon removing solvent or fluid to the engine in determined amounts only when the engine is not in operation, and is automatically operated by a solenoid whose actuation is effected by the running and stopping control means of the engine. As a result the fluid reaching the engine has adequate time while it is stopped to act upon the carbon deposits to rid the engine parts thereof, and to keep them clean.

Other objects and features of the invention will become apparent from the following description and accompanying drawings, wherein:

Fig. 1 is a side view of a preferred embodiment of the device used in practicing the present invention;

Fig. 2 is an enlarged sectional view taken along line 2—2 of Fig. 1 and viewed in the direction of the arrows;

Fig. 3 is a view, partially in section and partially schematic taken along line 3—3 of Fig. 1, showing the device in its no-flow or non-delivery position, while the engine is operating;

Fig. 4 is a view similar to Fig. 3 except that the device is shown in its final position after the engine has been stopped and a determined amount of fluid has been delivered to the engine; and

Fig. 5 is a sectional view of a portion of a modification of the device, shown in the no-flow position with the engine operating.

Referring now to Figs. 1 and 2, reference character

10 denotes generally the device of the invention. This device comprises a tank or receptacle 11 which may be mounted on the firewall 13 of the vehicle (not shown), or at some other convenient place relative to the engine (not shown). The receptacle or tank 11 serves as a reservoir for the fluid or carbon deposit removing solvent 14. This fluid 14 may be any of those commercially available. A removable filler cap 15 is provided for tank 11 to replenish its fluid 14.

A filter element 15 is supported in tank 11 so as to be immersed in the liquid 14. This filter element 15 may be of any conventional type and in itself does not constitute part of the invention. For example, it may consist of an annulus of pleated resin-impregnated paper filter medium 16 arranged about a perforated center tube 17. Such medium is known in the filter art. The center tube 17 is supported and extends axially from the bottom 18 of a perforated cup 19 which latter serves as a receiver and holder for the filter medium 16. A retaining cover 20 is provided for the cup 19 and its contents. This cover 20 is removably held in place by a nut 21 that engages a threaded portion 22 on the upper closed end of the center tube 17. The lower end 23 of center tube 17 is open and allows egress of filtered fluid from said center tube 17. The filtered fluid emerging from the open end 23 of said center tube flows into a space 24 defined by an annular member 25 which is secured both to the bottom 18 of said cup 19 and to the inner face of the bottom 26 of container 11. Said annular member is arranged about an opening 27 in said bottom 26 so that filtered fluid reaching such space 24 may pass out of said container 11 through a valving mechanism 28 supported from its bottom 26.

The valving mechanism 28 is secured at the bottom 26 of the tank 11, as shown in Figs. 1 to 4. It comprises a hollow multi-chambered casing 29. A tubular member 30 extends through one of the chambers 31 of the casing 28. This tubular member 30 has an externally threaded end 32 that extends through the opening 27 of the tank bottom 26 and threadedly engages a securing nut 33 fixed to the tank bottom 26 about its opening 27. A removable insert 34 is carried by the tubular member 30. This insert 34 has an outlet orifice or passageway 35 that communicates with the space 24. A valve seat 36 is provided for passageway 35. An adjustable needle valve 37 having tapered tip 38 is carried by the tubular member 30 being adjustable relative to said valve seat 36. Lateral passageways 39 in the tubular member 30 below the valve seat 36 provide communication between the bore 40 of said tubular member 30 and chamber 31 of the casing 29. A nut-like flange 41 on tubular member 30 externally located relative to casing 29 facilitates tightening of the threaded end 32 of said tubular member into nut 33 in tank 11 and also serves to hold the casing 29 securely against the bottom 26 of tank 11 about opening 27, a suitable sealing gasket 42 preventing leakage at the joint between casing 29 and bottom 26. Leakage around the outwardly protruding portion of the needle valve 37 which carries an adjusting knob 43 is prevented by the threaded collar 44 and packing 45.

As shown clearly in Figs. 3 and 4, a second chamber 46 is provided in casing 29. This chamber 46 communicates directly with chamber 31 of said casing 29. A third chamber 47 in said casing 29 communicates with chamber 46 via a passageway 48. A valve seat 49 is provided at that end or port of passageway 48 which opens into chamber 46. A second valve seat 50 is provided at the other end or port of passageway 48 which opens into chamber 47. Chambers 46, 47 and passageway 48 are axially aligned.

A valve head 51 is movable slidably in chamber 46 toward and away from valve seat 49. A rod or shaft

52 is secured to valve head 51. This shaft extends through the passageway 48 and chamber 47 and outwardly of the latter through a threaded closure plug 53 at the outer end of chamber 47. The shaft 52 is slidable in said plug. A valve collar 54 is fixedly mounted on shaft 52 and lies within chamber 47. A spring 55 is carried on shaft 52 and is confined between the valve collar 54 and the end member or plug 53. The portion 56 of shaft 52 which extends outwardly of plug 53 serves as the plunger or armature of a solenoid 57. This solenoid 57 is carried by a bracket 58 secured to the casing 29. A stop member 59 secured to portion 56 of shaft 52 in the space between the solenoid 57 and plug 53 limits movement of armature or plunger portion 56 into and out of solenoid 57.

The solenoid 57 is connected in an electric circuit including wire 60, a power source such as battery 61, wire 62, switch 63 and wire 64. Switch 63 may be the key operated engine operating control means such as the ignition switch of an automobile or a key operated switch of a Diesel engine fuel shut-off valve, or the like.

A lateral outlet passageway 66 in casing 29 communicates with the chamber 47 adjacent the port or valve seat 50. An outlet tube or duct 67 is connected to said passageway 66 to deliver the fluid reaching chamber 47 as will be described to the engine intake manifold and cylinders (not shown).

The operation of the device hereinabove described, is as follows:

When the automobile or other vehicle engine is running, the switch 63 is closed, as is shown in Fig. 3. As a result, the electric circuit through solenoid 57 is complete. Thus the solenoid 57 is energized or activated so that the plunger or armature portion 56 of shaft 52 is moved or drawn into solenoid 57 (and to the right as seen in Fig. 3) to the limit permitted by stop member 59. This movement compresses spring 55 and seats valve 51 on its seat 49 at the port or end of passageway 48 leading to the chamber 46 so that none of the liquid 12 from tank 11 reaching chamber 46 as will be described can flow via passageway 48 into chamber 47 and thence via passageway 66 into tube 67 leading to the engine intake manifold. When the engine has been stopped by operation of its ignition control means or switch to off position, the switch 63 is open as seen in Fig. 4, and the solenoid 57 is no longer activated as its electric circuit is then broken at said switch. As a result, spring 55 which has been compressed while the solenoid was activated is free to expand and thrusts against the valve collar 54 on shaft 52, thus moving the shaft 52 to the left (as seen in Fig. 4) until stop member or collar 59 abuts end member or plug 53. The valve member 51 also moves away from its seat 49 with shaft 52 and into abutment with the left end of chamber 46. At the same time, valve collar 54 moves with shaft 52 into seating position with valve seat 50. During the brief period in which the shaft 52 is sliding leftward under action of spring 55 and before valve collar 54 is seated, both ports or ends of passageway 48 are open and there is no impedance to flow of fluid from chamber 46 through passageway 48 into chamber 47 and outwardly therefrom via tube 67.

While the ports are open, fluid 14 from tank 11 (see Fig. 2) is free to flow out therefrom after passing through its filter element 15 including its filtering medium 16 and into its perforated center tube 17, being filtered in such passage. From center tube 17, the filtered fluid enters chamber 24 and passes outwardly thereof via orifice or passageway 35 passing needle valve tip 38 into the hollow portion 40 of tubular member 30 of casing 29. From hollow portion 40, the filtered fluid flows into chamber 31 of casing 29 via lateral passageways 39. Since chamber 46 is in direct communication with chamber 31 (see Figs. 3 and 4), the filtered fluid flows into chamber 46 and thence flows past valve seat 49 and through both ports of passageway 48 and past valve seat 50 and into chamber 47. From the latter the filtered fluid flows outwardly via passageway 66 and delivery tube 67 to the engine intake manifold whence it is distributed to the various cylinders of the engine. This flow can occur only for a brief period of time during leftward movement of the shaft 52 while both ports at the opposite ends of passageway 48 are uncovered as abovementioned. Completion of the said movement of shaft 52 to the left seals off the passageway 48 by the seating of valve collar 54 on seat 50 at the left port of said passageway and prevents further flow of fluid from the tank 11 to the engine. The determined amount of fluid that has flowed to the engine manifold via conduit 67 now has a chance to dissolve the carbon deposits on engine parts in the cylinders because of the fact that it has been admitted to the cylinders or added while the engine is stopped. To insure distribution of this fluid to the cylinders, the engine should be turned over a few times with its ignition off. The carbon dissolved or loosened by action of said fluid in the engine and the admitted fluid itself will eventually be burned up or otherwise driven out of the cylinders when the engine is again operated. The needle valve 38 and the insert 32 can be used as ways of varying the amount of fluid which flows to the engine during each leftward movement of the shaft 52. This is done by screwing the needle valve 32 in or out relative to the valve seat 36, or by replacing the insert 34 by one having a passageway or orifice 35 of larger or smaller dimensions.

Fig. 5 illustrates an embodiment which is a modification of the arrangement of Figs. 1 to 4, inclusive. In this embodiment, as shown in Fig. 5, all parts bearing reference characters similar to those of Figs. 1 to 4, inclusive, but with the subscript *a* are identical therewith. Thus, the tank 11*a*, which is only partially shown, is identical with tank 11 and contains the fluid 14*a* which is similar to fluid 14. The tank 11*a* is filled with this fluid 14*a* in the same way as tank 11 is filled. This tank 11*a* is supported similarly to tank 11.

The filter element 15*a* is supported in tank 11*a* in the same way as filter element 15 and the component parts of said filter element 15*a* are identical with those of element 15. The valving mechanism 65, however, replaces the valving mechanism 28 of Figs. 1 to 4 and the component parts of the latter.

The valving mechanism 65 comprises a solenoid 66 wound on a non-magnetic core 67. The core 67 carrying said solenoid 66 is supported from the tank 11*a* by conventional means, such as a bracket 68. An axially extending bore or chamber 69 is provided in the core 69. This bore 69 extends axially from one end of said core and terminates internally thereof at partition 70. A centrally-located passageway 71 of smaller dimensions than bore 69 is provided in the partition 70. A threaded socket 72 is provided at the other end of said core 67 and this socket is axially aligned with the passageway 71 and said bore 69 of said core. An elbow shaped fitting or pipe 73 has one of its threaded ends 74 screwed into socket 72. The other threaded end 75 of elbow shaped pipe 73 threadedly engages in the fixed nut 33*a* carried by the tank 11*a*. The pipe passage 76 communicates at one of its ends with the chamber 24*a* in tank 11*a* and at its other end with the passageway 71 in core 67.

A solenoid armature or plunger 77 of magnetic material is contained within the bore 69 of said core 67. This plunger 77 has a diameter that is larger than that of the port at the left end of passageway 71 so that the right end of plunger 77, as seen in Fig. 5, may close off and seal the said port of passageway 71 which opens into bore 69. A head 78 is provided at the other end of plunger 77. This head 78 fits slidably within the bore 69 and serves to maintain the plunger 77 axially aligned with the passageway 71. A plurality of passageways 80 are provided in the head 78 for purposes presently to be described. A spring 81 is carried by the plunger 77 be-

tween its head 78 and the partition or wall 69 of said core for purposes presently to be described. An outlet pipe or fitting 82 has one end 83 which is threaded into the core 67 at the outer end of bore 69 and the pipe passage 84 communicates with bore 69 through a port at said end 83. The other end 85 of outlet pipe 82 may be connected to a conduit (not shown) leading to the engine intake or manifold (also not shown).

The overall axial length of solenoid armature or plunger 77, and its head 78, are less than the axial length of bore 69 between partition 70 and the end 83 of pipe or fitting 82 so that said plunger and its head 77 may move rightwardly or leftwardly in said bore 69 for purposes to be described.

The solenoid 66 is connected in an electric series circuit including wire 87, battery 88, switch 89, and wire 90. Switch 89 like switch 63 of the modification of Figs. 1 to 4, inclusive, may be the ignition switch of the vehicle or any other control switch which is used to run or stop the engine by movement to on or off positions.

The device of Fig. 5 operates generally in a manner similar to the preferred embodiment of Figs. 1 to 4, inclusive. When the switch 89 is closed (engine operating), as shown, the solenoid is activated, thus pulling armature or plunger 77 to the right as seen in Fig. 5 against the opposition of spring 81. The right hand end of the plunger 77 is thus forced against the port at left or exit end of passageway 71 and seals it against flow of fluid from tank 11*a*. When the switch 89 is opened (engine stopped), the electric circuit to the solenoid is broken and the solenoid 66 is no longer activated. The spring 81 which has been compressed while solenoid 66 was activated now forces the plunger 77 to the left away from passageway 77 until head 78 abuts pipe end 83. During the interval of the plunger movement leftward as just described, the port at the exit end of passage 71 and the port at the entrance end of pipe passage 84 are both uncovered and filtered fluid flows from the tank 11*a* from its chamber 24*a* via pipe passage 76 and passageway 71 into chamber 69, through the passages 80 in head 78 and out through passage 84 of fitting 82, and then into the engine intake or manifold for delivery to the cylinders of the engine. Upon completion of the leftward motion by plunger 77, the passages 80 of its head 78 and the port of the outlet pipe passage 84 of fitting 82 are sealed off by the abutment of said head 78 against the inner face of fitting end 83. This prevents further flow of fluid to the engine intake manifold. The determined fluid that has been delivered to the engine intake or manifold during said short interval of time acts while the engine remains stopped to rid its internal parts of carbon deposits in the same way as that described for the first embodiment. As before to insure proper distribution of this delivered fluid from the manifold to the engine, the latter should be turned over a few times with its ignition off.

It can readly be seen that this invention provides simple means for delivering determined amounts of carbon solvent fluids into engine cylinders to act upon carbon deposits therein while the engine is not running by causing selected fluid passages to open and close when the engine control means such as its ignition switch is turned off by de-activating a solenoid that controls operation of valving mechanism to accomplish this result.

While specific embodiments of the invention have been described, variations within the scope of the claims are possible and are contemplated. There is no intention therefore, of limitation to the exact details shown and described.

What is claimed is:

1. A carbon removing device for an internal combustion engine comprising a receptacle for carbon removing fluid, mechanism for delivering determined amounts of said fluid from said receptacle to said engine, said mechanism having valve controlled ports through which

said fluid must pass in transit from the receptacle to the engine and valve means movable relative to said ports for permitting flow of fluid through said ports only during movement of said valve means, a solenoid, a switch for running and stopping the engine, a power source, an electric circuit including said switch, said power source and said solenoid, said solenoid being energized whenever said switch is closed during running of the engine and being deenergized whenever said engine is stopped by opening of said switch, and means controlled by said solenoid and connected to said valve means for effecting movement of said valve means between said ports whereby said fluid will flow from the receptacle and through the ports of said mechanism and to said engine only during movement of said valve means between said ports occurring upon opening of said switch, thereby permitting delivery of a determined amount of said fluid from said receptacle to said engine for action therein while said engine is stopped so that said fluid will act upon carbon deposits within the engine while it is not running.

2. A carbon removing device for an internal combustion engine comprising a receptacle for carbon removing fluid, valving mechanism for delivering determined amounts of said fluid from said receptacle to said engine, said mechanism having valve controlled ports through which said fluid must pass in transit from the receptacle to the engine and valve means movable relative to said ports for permitting flow of fluid through said ports only during movement of said valve means, means for regulating the determined amount of fluid flowing through said valving mechanism, switch means movable to closed and open positions for running and stopping the engine, and means operated by said switch means and connected to said valve means for effecting movement of said valve means between said ports to allow said determined amounts of said fluid to be delivered to the engine only during movement of said valve means between said ports and after and by movement of said switch means to its open position to stop the engine so that the fluid delivered to the engine will act on carbon deposits therein while the engine is not running.

3. A carbon removing device for an internal combustion engine comprising a receptacle for carbon removing fluid, movable valving mechanism for delivering determined amounts of said fluid at a time from said receptacle to said engine only during movement of said valving mechanism, a removable insert in said valving mechanism having an orifice through which said fluid must flow in its passage through said valving mechanism and whose dimensions regulate the determined amount of fluid flowing through said valving mechanism, switch means movable to closed and open positions for running and stopping the engine, and means operated by said switch means for effecting said movement of said valving mechanism to allow said determined amounts of said fluid to be delivered to the engine only during said movement of said valving mechanism and after and by movement of said switch means to its open position to stop the engine so that the fluid delivered to the engine will act on carbon deposits therein while the engine is not running.

4. A carbon removing device for an internal combustion engine comprising a receptacle for carbon removing fluid, movable valving mechanism for delivering determined amounts of said fluid from said receptacle to said engine only during movement of said valving mechanism, adjustable needle valve means in said valving mechanism for regulating the determined amount of fluid flowing through said valving mechanism, switch means movable to closed and open positions for running and stopping the engine, and means operated by said switch means for effecting said movement of said valving mechanism to allow said determined amounts of said fluid to be delivered to the engine only during said movement of said valving mechanism and after and by movement of said switch means to its open position to stop the engine

so that the fluid delivered to the engine will act on carbon deposits therein while the engine is not running.

5. A carbon-removing device for an internal combustion engine comprising a receptacle for carbon-removing fluid, mechanism for delivering determined amounts of said fluid to said engine, said mechanism having a pair of valve-controlled ports through which said fluid must flow in transit from the receptacle to the engine, a separate valve for each port, said valves being interconnected to move in unison so that one only of said valves may be seated on its port at any given time, the seating of any one of the valves on its port cutting off flow of said fluid from said receptacle to said engine, and both said valves being required to be unseated from their respective ports for said flow to occur, means biasing the two valves into a first position wherein one of said valves closes its port, solenoid means acting when energized to move the two valves in opposition to said biasing means to a second position wherein the other one of the two

valves closes its port, electric circuit means for energizing said solenoid means and an openable switch in said circuit for de-energizing said solenoid means when open whereby the biasing means will then return the two valves to said first position, and said flow of fluid occurring only while the two valves are in actual movement between their said two positions, and being cut off when said valves arrive at either of their said positions.

References Cited in the file of this patent

UNITED STATES PATENTS

2,022,725	Lazarus et al.	Dec. 3, 1935
2,194,007	Clementson	Mar. 19, 1940
2,277,749	Eckel et al.	Mar. 31, 1942
2,428,915	Keller	Oct. 14, 1947

FOREIGN PATENTS

609,163	Great Britain	Sept. 27, 1948