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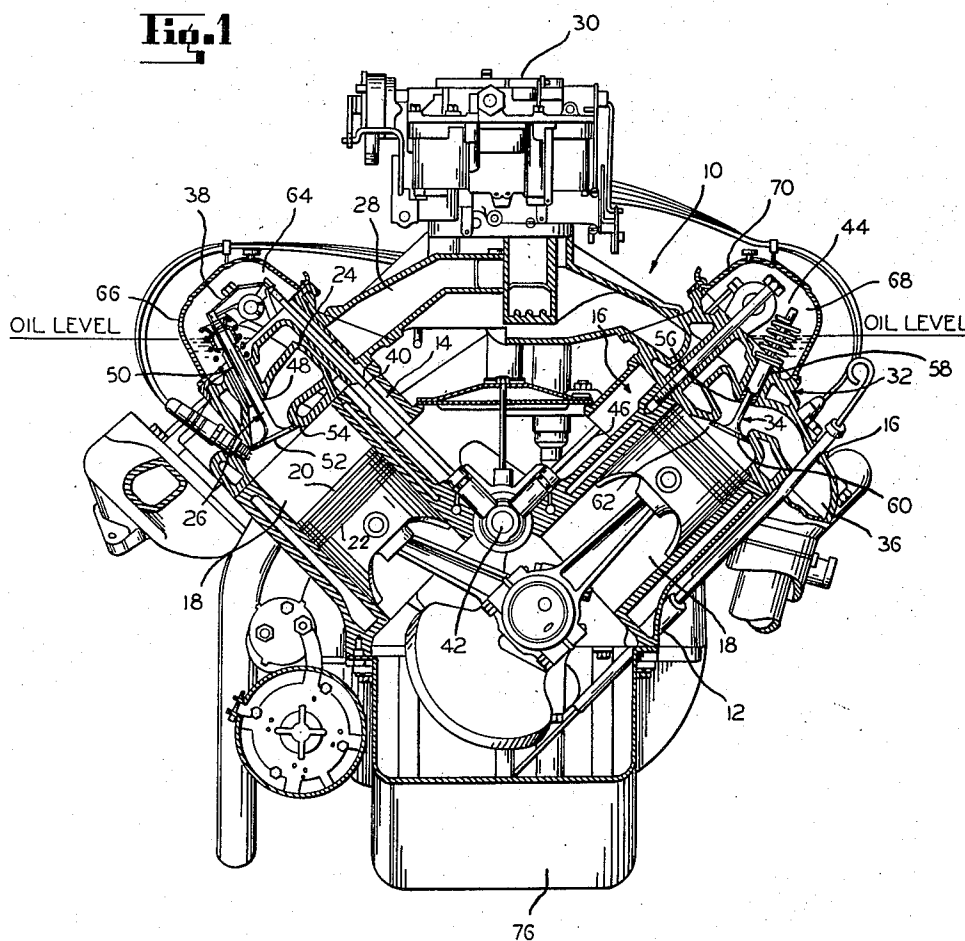
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2,881,102

METHOD OF CLEANING VALVE OPERATING MECHANISMS

Filed Nov. 14, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

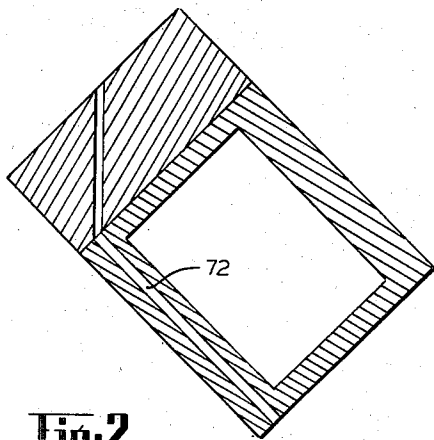


Fig. 2

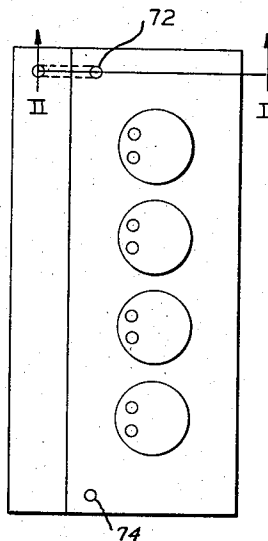


Fig. 3

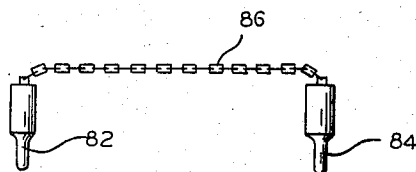


Fig. 4

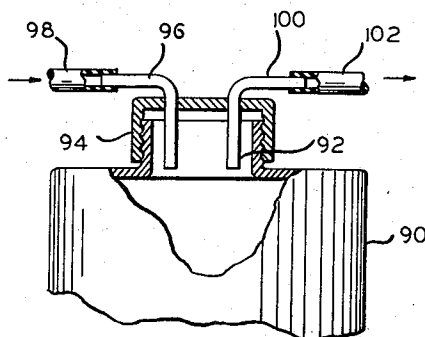


Fig. 5

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METHOD OF CLEANING VALVE OPERATING MECHANISMS

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7 Claims. (Cl. 134—20)

This invention relates to a method for cleaning internal combustion engines and more particularly to a method for removing carbon from internal surfaces of an internal combustion engine.

This invention is primarily directed to a method for removing carbon deposits from the valve stems and valve operating mechanisms of an internal combustion engine but also contemplates the removal of carbon from the valve heads, valve seats, cylinder walls, pistons, piston rings and cylinder heads.

After a period of use, internal combustion engines tend to accumulate gummy carbon deposits along the stems of the valves with the result that the valves tend to stick, particularly in cold weather. No satisfactory method has been devised to remove this carbon without removing the valves from the engine.

Solvent fluid has been introduced into engines through the air intake of the carburetor or has been added to the lubricating oil in an effort to remedy this condition. These measures have been unsuccessful since cleaning oil fed into the fuel-air mixture is quickly burned during the next subsequent power stroke and solvent-containing lubricating oil is normally in contact with the valve operating mechanisms for a time insufficient to effect any real dissolving action. This is particularly true in engines of the overhead valve type in which the lubricating oil usually drains back to the crankcase before any solvent action can occur.

Furthermore, internal combustion engines, after a period of use, have a tendency to accumulate carbon deposits on the cylinder walls, on the pistons and piston rings, on the cylinder head, and on the exhaust valves and exhaust valve seats. Many attempts have been made in the past to remove these carbon deposits without disassembling the engine. Lubricating oil containing a solvent has been introduced into the crankcase so that it may be fed either by a splash or positive pressure to the piston wrist pins from whence it might flow to the piston rings. A disadvantage of this method is that there is no way to feed these solvent oils to the piston crowns, to the upper piston walls, to the cylinder heads, or to the exhaust valves and seats. Another method that has been utilized to remove carbon deposits is to introduce a solvent oil into the spark plug opening of each cylinder, one at a time. This method has proved unsatisfactory since the oil introduced may be completely ignited during one ignition stroke and the products of combustion expelled during the next subsequent exhaust cycle. Since this ignition occurs while the exhaust valves are closed, the solvent oil thus introduced cannot dissolve or burn off the carbon on the exhaust valves and seats.

With this in mind, a primary object of the invention is to devise a method for decarbonizing internal combustion engines wherein carbon or other sticky deposits may be removed from the valve stems without disassembling the engine.

Another object of the invention is to devise a method for decarbonizing internal combustion engines which is

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continuously operative during each cycle of operation of the engine, and in which solvent oil may be introduced continuously during each intake and exhaust stroke of each cycle.

Another object of the invention is to devise a method for decarbonizing internal combustion engines wherein solvent oil introduced during an intake cycle is deposited on the cylinder walls and pistons and on the piston rings during the subsequent compression stroke, is burned by the subsequent ignition stroke, and in which additional solvent oil introduced during the exhaust stroke is ignited by the products of combustion of the solvent oil introduced during the intake stroke so that carbon on the exhaust valves and seats may be effectively removed.

A more particular object of the invention is to devise a method for decarbonizing internal combustion engines of the type having an engine block provided with a plurality of cylinders, a cylinder head, an overhead valve assembly for each of said cylinders, a ring-equipped piston reciprocally mounted in each cylinder, each of said valve assemblies having a plurality of reciprocable valves for the timed introduction of a fuel-air mixture into the cylinder and for the timed expulsion therefrom of exhaust gases, a crankcase, a valve compartment for said valve assemblies defined in part by a removable cover, drain passages in the engine block for removing lubricating oil from the valve compartment and bleeding this oil back to the crankcase, in which the drain passages are plugged and a quantity of solvent oil introduced into the valve compartment, and in which the engine is operated so that the solvent oil is fed by gravity and by the reciprocating movement of the valves along the valve stems and into the cylinders.

This invention contemplates a method for removing carbon from internal combustion engines of the V-type wherein one cylinder bank may be decarbonized according to the present method while the other cylinder bank may be operated at full efficiency to keep the engine running.

Another object of the invention is to devise a method for decarbonizing an internal combustion engine of the V-type in which a continuous gravity head of solvent oil is maintained for instantaneous flow into the cylinders at each intake and exhaust stroke.

These and other objects of the invention will be apparent from time-to-time as this specification proceeds and with reference to the accompanying drawing wherein:

Figure 1 is an elevational sectional view of a V-type internal combustion engine with which the present decarbonization method may be utilized;

Figure 2 is a vertical sectional diagrammatic fragmentary view taken on line II-II of Figure 3 a plane parallel to the plane of the sectional view of Figure 1 but showing the drain passage intercommunicating the valve rocker arm compartment and the crankcase;

Figure 3 is a plan view of the cylinder bank shown in Figure 2, certain parts being removed for the sake of clarity, showing the positions of the drain passages;

Figure 4 is an elevational view showing a plug assembly that may be used to prevent passage of oil through the drain passages; and

Figure 5 is an elevational view of a container that may be used for vacuumatically removing the solvent oil from the rocker arm compartment after conclusion of the cleaning steps of the present process.

As shown on the drawing:

The reference numeral 10 in Figure 1 indicates generally an internal combustion engine of the V-type with which the decarbonization process of the present invention may be employed. The engine 10 includes a V-shaped block 12 having cylinder banks 14 and 16 in

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which are formed cylinders 18. The total number of cylinders may be any even number, but in the present instance the engine 10 is shown as provided with a total of 8 cylinders, 4 in each cylinder bank. Within each cylinder of the bank 14 is reciprocally mounted a piston 20 provided with the customary sealing rings 22. Superimposed on the bank 14 is a cylinder head 24 in which is reciprocally mounted a plurality of valves, one intake valve and one exhaust valve for each cylinder. In the present instance, the cylinder head 24 is sectioned to show an intake valve 26 for regulating the supply of fuel-air mixture passing through a passage 28 from a conventional carburetor 30.

On the cylinder bank 16 is mounted a cylinder head 32 sectioned to show an exhaust valve 34 for regulating the flow of exhaust gases from a cylinder to an exhaust manifold 36. For operating the valves for the cylinders of the cylinder bank 14, a rocker arm assembly 38 is arranged on the cylinder head 24 and is actuated by a plurality of cam rods 40 operatively connected to a cam shaft 42. Similarly, a rocker arm assembly 44 is mounted on the cylinder head 32 for operation of the valves for the cylinders of the bank 16 through the medium of cam rods 46. Each of the intake valves 26 has a stem 48 slidably mounted in a guide sleeve 50 and a head 52 for engaging a seat 54 for closing off the passage 28 during the compression, power and exhaust strokes of the four stroke cycle. In like manner, each of the exhaust valves 34 has a stem 56 slidably received in a guide sleeve 58, and a head 60 selectively engageable with a seat 62 for closing off the exhaust passage during the intake, compression, and power strokes of the four stroke cycle.

The rocker arm assembly 38 is housed in a compartment 64 defined in part by a removable cover 66, while the rocker arm assembly 44 is housed in a compartment 68 formed in part by a cover 70.

Lubricating oil is normally supplied to the rocker arm assemblies 38 and 44 by means of suitable pressure passages (not shown). This lubricating oil leaks from the rocker arm assemblies into the compartments 64 and 68, and for this reason, as shown clearly in Figure 3, drain passages 72 and 74 are formed in each of the cylinder heads 24 and 32 and pass through the cylinder banks 14 and 16 for draining of this lubricating oil back to a crankcase 76.

After a period of operation, carbon deposits tend to collect on the valve stems 56 on the walls of the cylinder 18, on the pistons 20, on the sealing rings 22, on the under-surfaces of the cylinder heads 24 and 32, on the heads 52 of the intake valves 26, on the heads 60 of the exhaust valves 34 and on the valve seats 62 of the exhaust valves. According to the present method, carbon may be removed from all of the surfaces simultaneously by a substantially continuous flow of solvent oil into contact with the surfaces while the engine is operating.

According to the present method, solvent oil, which may be lubricating oil containing a solvent capable of dissolving free carbon and engine varnish, may be introduced alternately into the compartments 64 and 68 up to the level indicated. To prevent the immediate drainage of this solvent oil through the passages 72 and 74, these passages are first stoppered by a plug assembly 80, as shown in Figure 4. The plug assembly 80 includes a first plug 82, of neoprene or other elastomeric material resistant to attack by petroleum products, and a similar plug 84 which may be joined to the plug 82 by a connecting chain 86 to assure that both plugs are removed when the cleaning steps of the present process is completed.

The covers 66 and 70 may be of the type having an inlet for lubricating oil, in which case the filling of the respective rocker arm compartment is facilitated. Where, however, the engine is of the type having an oil filling tube located elsewhere, as in the present instance,

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the covers 66 and 70 may be initially replaced by similar covers to which oil inlets have been added. In the present disclosure, the covers 66 and 70 are shown as being replacement covers.

As pointed out above, the solvent oil is introduced into the compartment 64 and 68 one at a time so that full power is available in the other cylinder bank to keep the engine running. Approximately one pint of solvent oil is initially poured into one of the compartments 64 or 68, and the engine is operated for approximately 5 minutes, during which time the solvent oil is forced through the guide sleeves 50 and 58 of the intake valves 26 and the exhaust valves 34 respectively by the reciprocating action of these valves and by the gravity head of the oil itself. After this initial period of operation, an additional pint of solvent oil may be added to bring the oil in a compartment up to the level shown. It will thus be seen that a constant supply of solvent oil is available for passage through the several guide sleeves 50 and 58 to dissolve gummy deposits from the valve stems. This solvent oil is sprayed throughout the interior of the cylinders of one cylinder bank upon the actuation of each intake valve, this spraying action being, of course, caused by the movement of the fuel-air mixture into the cylinders. The next subsequent compression stroke of the piston 21 distributes the solvent oil over the cylinder walls and over the sealing rings 22. The oil thus admitted is burned along with the dissolved carbon and engine varnish during the next subsequent power stroke and, as the exhaust gases are expelled from the cylinders during the next exhaust stroke, additional oil is introduced through the exhaust valves. The oil flowing along the stems 56 of the exhaust valves 34 seeps into contact with the valve heads 60 and their mating seats 62 during their intake, compression and power strokes so that carbon deposits on these surfaces are dissolved and when the exhaust valves are opened during the exhaust strokes carbon deposits on the heads 60 and seats 62 are immediately burned off by the heat of the escaping exhaust gases.

After the valves of the cylinder head 24 have been thus operated for a period of approximately 10 minutes, the engine is stopped and the remaining solvent oil in the compartment 64 is removed. For this purpose, the method of the present invention contemplates the provision of vacuumatic means for extracting the remaining oil. Apparatus capable of carrying out this step is shown in Figure 5 in which the reference numeral 90 indicates a container having an opening 92 normally closed by a cap 94. The cap 94 is apertured for reception of a tube 96 to which may be frictionally connected a hose 98 from a suitable low-pressure source, such as the intake manifold of the engine. The cap 94 is also provided with an opening for reception of a tube 100 to which is frictionally connected a hose 102 the other end of which may be inserted through one of the inlets of the cover 66 and 70.

After the left side of the engine, as viewed in Figure 1, has been decarbonized, the right side may be similarly treated by introducing solvent oil into the compartment 68, as will be understood. By the above described method, carbon may be efficiently and effectively removed from the rocker arms, valve lifters, valve stems and valve guides, pistons and piston rings, cylinder walls, and cylinder heads. In addition, the piston rings are freed up for more efficient operation and engine ping is practically eliminated.

In order to assure equal treatment of all of the cylinders of a particular bank, the engine 10 is desirably leveled longitudinally before the solvent oil is introduced. Where the engine is installed in an automobile leveling may be effected by jacking up one end of the vehicle.

It will be understood that various modifications and variations of the present invention may be affected with-

out departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. A method for decarbonizing an internal combustion engine having an engine block provided with a plurality of cylinders, a cylinder head, an overhead valve assembly for each of said cylinders, a piston reciprocally mounted in each cylinder, said cylinders having sealing rings, said valve assembly having a plurality of reciprocable valves for the timed introduction of a fuel-air mixture into the cylinders and for the timed expulsion therefrom of exhaust gases, each of said valves having an elongated stem slidably mounted in said cylinder head and terminating in a valve head operable to engage a seat formed in said cylinder head, a crankcase, a plurality of rocker arms for actuation of said valves, a compartment for housing said rocker arms defined in part by a cover, one or more passages in said engine block for draining oil from said rocker arm compartment to said crank case, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, plugging said passages, introducing a solvent oil directly into said rocker arm compartment, operating the engine under its own power for a predetermined period of time so that the reciprocating movement of said valves forces the solvent oil along the valve stems and into contact with the valve heads and seats and into contact with the cylinder walls, pistons and piston rings for removal of carbon from the surfaces thereof, and exhausting the contaminated solvent oil with the used fuel-air mixture.

2. A method for decarbonizing an internal combustion engine having an engine block provided with a plurality of cylinders, a cylinder head, an overhead valve assembly for each of said cylinders, a piston reciprocally mounted in each cylinder, said cylinders having sealing rings, said valve assembly having a plurality of reciprocable valves for the timed introduction of a fuel-air mixture into the cylinders and for the timed expulsion therefrom of exhaust gases, each of said valves having an elongated stem slidably mounted in said cylinder head and terminating in a valve head operable to engage a seat formed in said cylinder head, a crank case, a plurality of rocker arms for actuation of said valves, a compartment for housing said rocker arms defined in part by a cover, one or more passages in said engine block for draining oil from said rocker arm compartment to said crank case, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, plugging said passages, introducing a solvent oil directly into said rocker arm compartment, operating the engine under its own power for a predetermined period of time so that the reciprocating movement of said valves forces the solvent oil along the valve stems and into contact with the valve heads and seats and into contact with the cylinder walls, pistons and piston rings for removal of carbon from the surfaces thereof, exhausting the contaminated solvent oil with the used fuel-air mixture, and vacuumatically removing the uncontaminated solvent oil from the rocker arm compartment.

3. A method for removing carbon from the internal surfaces of an internal combustion engine of the V-type having a pair of cylinder banks, a first rocker arm compartment for one of said cylinder banks, and a second rocker arm compartment for the other of said cylinder banks, a crankcase, a plurality of passages intercommunicating said compartments with said crankcase, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, plugging the drain passages of said first compartment, introducing a quantity of solvent oil directly into said first rocker arm compartment, and operating the engine under its own power for a predetermined period of time with normal efficiency in said second cylinder bank to feed the solvent oil into contact with the internal surfaces of said engine for removal of carbon therefrom.

4. A method for removing carbon from the internal surfaces of an internal combustion engine of the V-type having a pair of cylinder banks, a first rocker arm compartment for one of said cylinder banks, and a second rocker arm compartment for the other of said cylinder banks, a crankcase, a plurality of passages intercommunicating said compartments with said crankcase, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, plugging the drain passages of said first compartment, introducing a quantity of solvent oil directly into said first rocker arm compartment, operating the engine under its own power for a predetermined period of time with normal efficiency in said second cylinder bank to feed a small quantity of the solvent oil into contact with the internal surfaces of said engine for removal of carbon therefrom, and vacuumatically removing the uncontaminated solvent oil from said first compartment.

5. A method for removing carbon from the internal surfaces of an internal combustion engine of the V-type having a pair of cylinder banks, a first rocker arm compartment for one of said cylinder banks, and a second rocker arm compartment for the other of said cylinder banks, a crankcase, a plurality of passages intercommunicating said compartments with said crankcase, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, plugging the drain passages of said first compartment, introducing a quantity of solvent oil directly into said first rocker arm compartment, operating the engine under its own power for a predetermined period of time with normal efficiency in said second cylinder bank to feed the solvent oil into contact with the internal surfaces of said cylinder bank for removal of carbon therefrom, draining the solvent oil from said first compartment, opening the drain passages of said first compartment, plugging the drain passages of said second compartment, introducing a quantity of solvent oil directly into said second compartment, and operating the engine under its own power with normal efficiency in said first cylinder bank for a predetermined period of time to feed the solvent oil into contact with the internal surfaces of the second cylinder bank for removal of carbon therefrom.

6. A method for removing carbon from the internal surfaces of an internal combustion engine of the V-type having a four stroke cycle including an intake stroke, a compression stroke, a power stroke and an exhaust stroke and having a first cylinder bank provided with a rocker arm compartment and a second cylinder bank provided with a rocker arm compartment, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, introducing a quantity of solvent oil directly into the rocker arm compartment of said first cylinder bank so that a small quantity of the oil is fed into the cylinders thereof during the intake and exhaust strokes while simultaneously operating said second cylinder bank under its own power for removal of carbon from the internal surfaces of said first cylinder bank.

7. A method for removing carbon from the internal surfaces of an internal combustion engine of V-type having a first cylinder bank provided with a rocker arm compartment and passages for normally draining lubricating oil from said compartment, a second cylinder bank provided with a rocker arm compartment and passages for normally draining lubricating oil from said second rocker arm compartment, said engine having a four stroke cycle including an intake stroke, a compression stroke, a power stroke and an exhaust stroke, comprising the steps of leveling the rocker arm compartments of the engine longitudinally, closing off the drain passages of said first compartment, introducing a quantity of solvent oil directly into said first compartment so that a small quantity of the solvent oil is fed into the cylinders of said first bank during each intake and exhaust stroke while simultaneous-

ly operating said second cylinder bank under its own power for a predetermined period of time, removing the remaining solvent oil from said first compartment, opening the drain passages of said first compartment, closing the drain passages of said second compartment, introducing a quantity of solvent oil directly into said second compartment while operating said first cylinder bank under its own power in conventional manner so that a small quantity of the solvent oil in said second compart-

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ment is fed into the cylinders of said second bank during each intake and exhaust stroke.

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