E. G. HODGES.

AUTOMATIC AIR AND VAPOR DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 6, 1918.

1,316,953. Patented Sept. 23, 1919.

Fig. 1.

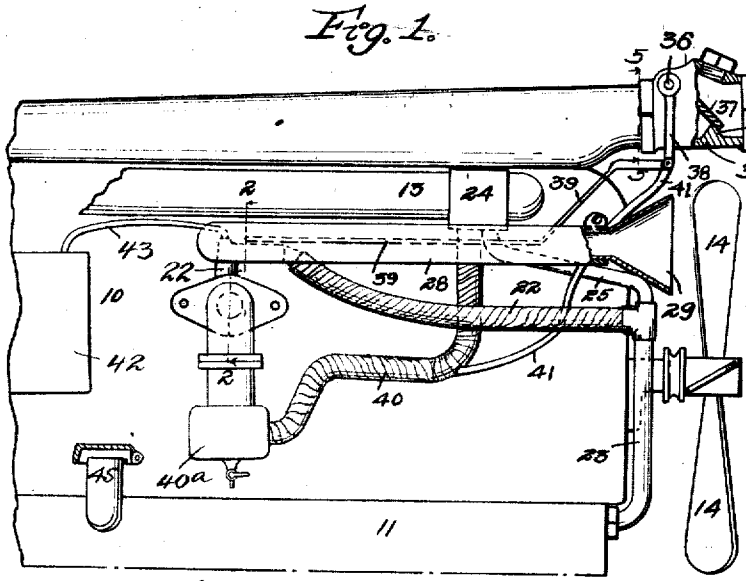


Fig. 6.

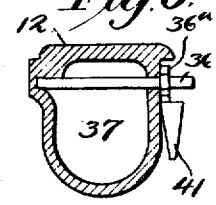


Fig. 3.

Fig. 4.

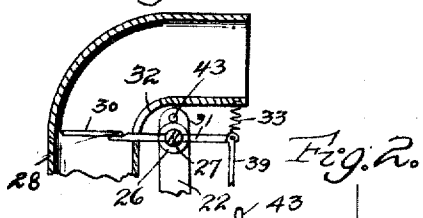


Fig. 2.

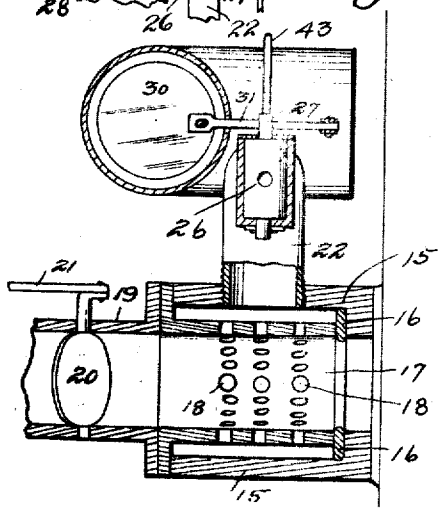
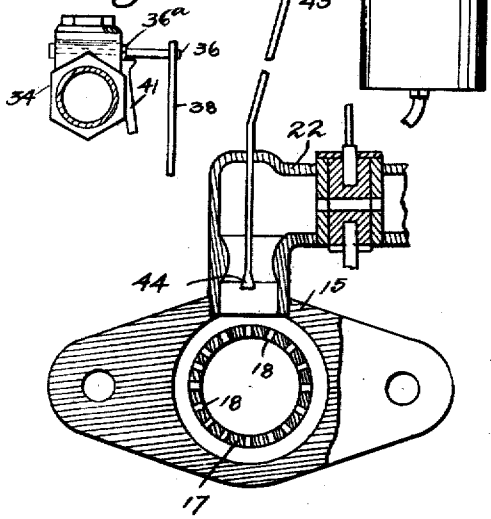


Fig. 5.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC AIR AND VAPOR DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,316,953. Specification of Letters Patent. Patented Sept. 23, 1919.

Application filed April 6, 1918. Serial No. 227,156.

To all whom it may concern:

Be it known that I, EDWARD G. HODGES, a citizen of the United States, and resident of Marshalltown, in the county of Marshall and State of Iowa, have invented a certain new and useful Automatic Air and Vapor Device for Internal-Combustion Engines, of which the following is a specification.

The object of my invention is to provide a device for supplying auxiliary air and vapor to the fuel mixture of an internal combustion engine, which device is automatically controlled by air pressure and the water cooling system of the engine.

A further object is to provide in such a device a tube for conducting warm air to the carbureter, and to provide in connection therewith a valve in the water circulating system of the engine, and a mixture tube for taking any leakage water from said valve to said warm air tube.

Still a further object is to provide in such a device an auxiliary air supply tube communicating with the crank case of the engine and communicating also with another source of warm air supply.

An additional object of my invention is to provide means for connecting the vacuum feed tank of a motor vehicle with said air supply pipe.

Still a further object is to provide a means whereby the auxiliary air from the supply pipe is thoroughly mixed with the fuel mixture without obstructing the fuel mixture passage.

Still a further object is to provide means whereby a draft of air may be conducted from one part of the machine to another and there utilized for controlling the auxiliary air valve.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation of an engine equipped with a device embodying my invention, parts of the device being shown in vertical cross section.

Fig. 2 shows a transverse, vertical, sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 shows a detail view partly in section illustrating the means for connecting the vacuum tank with the air supply pipe.

Fig. 4 shows a horizontal, sectional view of the tube with the automatically controlled swinging baffle plate therein;

Fig. 5 shows a transverse, vertical, sectional view taken on the line 5—5 of Fig. 1, and

Fig. 6 shows a transverse, sectional view illustrating the manner of mounting the valve in the water system.

In the illustration of my invention shown in the accompanying drawings, I have used the reference numeral 10 to indicate generally an engine having the crank case 11 and a water circulating system, including the pipe 12 which leads from the water jacket to the upper part of the ordinary radiator, not shown.

The engine has also the intake manifold included within the casing of the engine and the exhaust manifold 13. At the front of the engine is the ordinary fan 14.

Connected between the carbureter and the intake manifold is a short tubular member 15 having an internal, annular shoulder 16. Received within the tubular member 15 and abutting against the shoulder 16 and spaced from the walls of the member 15, is a cylinder 17 having in its wall a plurality of small perforations 18. The cylinder or tube 17 is of the same diameter as the fuel mixture tube and forms a part of the same.

Communicating with the cylinder 17 is a pipe or tube 19 for conducting fuel mixture from the carbureter.

Mounted in the tube 19 is the ordinary throttle valve 20 controlled by the rod 21.

Communicating with the tubular member 15 through the upper wall thereof is an air supply tube 22 which, in the form of the invention here illustrated, has a portion extending forwardly in the machine to a point near the front of the engine.

Communicating with and leading from the crank case 11 is a conducting tube 23 which is preferably slightly smaller in size than the tube 22 and communicates therewith.

Mounted on the exhaust manifold 13 is a heating drum or stove 24. A tube 25 leads from the heating drum or stove 24 to the tube 23 and communicates therewith preferably at or near the point of junction between the tube 22 and the tube 23. The

tubes 25 and 23 are preferably of such diameter as to have approximately the same combined carrying capacity as the tube 22.

For controlling air flow through the tube 22 there is provided an ordinary plug valve 26 having an upwardly extending stem 27.

Suitably mounted on the engine is a tube 28 having at its forward end, preferably near the fan 14, a flaring or bell-shaped portion 29 and having its rear end curved so as to discharge toward the engine. The tubes 22 and 28 are located near each other but are not connected.

Received within the tube 28, at the curved part thereof as shown on Fig. 4, preferably near the valve 26, is a swinging baffle plate 30 secured to which is a stem or arm 31 which extends through an elongated slot 32 in the wall of the tube 28, and is fixed to the stem 27 between the ends of said arm 31 as shown in Fig. 2. A spring 33 secured to the arm 31, normally holds the baffle plate 30 near one limit of its swinging movement.

It will be noted that the spring 33, or its equivalent, could be located at various places for accomplishing its purpose.

In the pipe 12 is a valve casing 34 in which is a seat 35. Mounted in the casing 34 is a stem 36 on which is a flap valve 37 adapted to coact with the seat 35.

Fixed on the stem 36 is an arm 38, which, in the form of the invention here shown, extends downwardly and is pivoted at its lower end to a rod 39, shown partly in full and partly in dotted lines in Fig. 1, which extends rearwardly in the machine and is pivoted at its rear end to the arm 31 (see Figs. 1 and 4).

When the engine is first started the spring 33 will tend to hold the swinging baffle plate 30 in its position shown in Fig. 4 and hold the valve 37 closed and hold the valve 26 closed. When, however, the pressure of the water moving in the circulating system becomes great enough, it will open the valve 37 and thereby open the valve 26 through the operation of the stem 36, arm 38, rod 39, arm 31, and stem 27.

It will be noticed also that the air passing through the pipe 28 will effect the swinging baffle plate 30 in coöperation with the action of the water on the valve 37 for controlling the valve 26.

It will be noted also in this connection that in the form of the invention shown herein, the valve 26 which controls the air passing through the air supply pipe, is located close to the point where the air is supplied to the fuel mixture, and that the air which acts on the swinging baffle plate 30 is conducted from one place in the machine to another place where it is desired to have such air effective.

I have shown in my drawings a pipe 40 leading from the heating drum or stove 24, and it may be mentioned that the pipe 40 is designed for conducting warm air to the carbureter 40^a in the ordinary way.

It is well-known that it is desirable to supply slightly moistened air to the fuel mixture.

It may be mentioned also that in a device of the kind herein described it is not desirable to pack the stem 36 tightly for the reason that it is highly desirable that the valve 37 should work very freely. Where the stem 36 is not packed tightly there will be a slight leakage of water while the engine is running.

In the form of the invention herein shown, I have provided a tube 41 for conducting such leakage water to the carbureter air supply pipe 40 for thereby supplying moisture to the fuel mixture. This leakage may be regulated by adjusting the nut 36^a, so that the proper amount of moisture may be supplied to the fuel mixture.

It is common in many of the later motor vehicles to have in connection with the fuel supply system a vacuum feed tank 42 of commonly known construction, and to connect the tank by means of a tube with the engine for drawing the air out of the tank and creating a vacuum therein.

There is an objection to the common construction just mentioned arising from the fact that the air drawn into the engine from the vacuum tank is drawn according to the requirements of the vacuum tank and without any regard for auxiliary air needed by the engine.

I have, therefore, in the form of my device herein shown, connected the vacuum tank 42 by means of the pipe 43, with the air supply pipe 22 near the point of discharge from said air supply pipe into the tubular member 15.

It will also be noted that I have extended the pipe 43 into the pipe 22 and provided a cone-shaped flaring end 44.

By the construction just shown, the air will be drawn from the vacuum tank and mingled with the air passing through the air supply pipe 22 to the fuel mixture of the engine.

It will, of course, be obvious that the discharge end of the pipe 43 is subject to suction from the engine, and on account of the enlarged or flaring end 44 there will be a tendency to draw or suck the air from the pipe 43 on account of the passing of the air in the pipe 22 adjacent to the end 44.

It will also be noted that the objectionable feature found in the ordinary vacuum tank system is overcome with my device, for the reason that the air is drawn from the pipe 43 substantially according to the needs of the fuel supply for the engine.

It will, of course, be obvious that the air passing from the pipe 43 is so small in com-

parison with the volume passing through the pipe 22, as to have very little if any effect in itself on the amount of air supplied to the fuel mixture.

I have shown in Fig. 1 the ordinary breathing tube and oil filling tube 45 connected with the crank case, whereby it is made possible to maintain a proper and free circulation of air through the crank case to the tube 23.

In the practical operation of my improved device, it will be obvious that when the engine is being started there will be comparatively little draft of air past the baffle plate 30, and comparatively little circulation of water through the tube 12, so that the valve 27 will be practically closed during the starting of the engine, and the mixture will pass from the carbureter to the engine cylinders in the ordinary way. As the engine acquires greater speed the blast of air against the baffle plate 30, and the movement of the water whereby the valve 37 is actuated, will serve to open the valve 26 for allowing a greater amount of air to pass through the tube 22 to the mixture.

I have found by experiments that without my device, especially while the engine is running with a light load or is idling, where the carbureter throttle is open sufficiently to supply enough mixture to the cylinders to secure a proper explosion, the mixture is richer than necessary. On the other hand where the throttle is moved toward closed position, there is not sufficient fuel and air supply to secure proper compression.

Where my device is used, it will be seen that when the engine is idling or running rapidly with a light load, as for instance an engine is running at high speed on level ground or running down grade, there is supplied to the mixture passing into the cylinders air from the air supply pipe 22, whereby the mixture is thinned for effecting a substantial saving of fuel, while at the same time furnishing to the cylinders a constant volume of mixture for securing compression.

Thus when little or no power is needed to drive the engine, after I get the car up to the desired speed, I close or nearly close the throttle valve and allow the engine to take in air through the air pipe 22. Where a little more power is necessary to keep up the required speed, the throttle is opened slightly allowing more of the mixture in the carbureter to come up and mix with the air coming from the air supply pipe 20, and on account of the engine receiving the full volume on each charge I secure proper compression and a clean explosion sufficient to maintain the required speed. When the engine is subjected to greater load, as in going up grade, or under any condition where greater power is needed, the throttle valve is opened for permitting the engine to take more of its charge through the carbureter.

I have found that when the engine is being started and until it has reached a certain speed, particularly if the car is not moving, the blast of air on the baffle plate does not open the valve 26 as much or as evenly as may be desired, and have found that the gradual opening of the valve 26 is better secured by the use of the water flow governor combined with the air governor. After the engine has acquired speed, and particularly after the car is running at high speed, I have found that the air blast carried by the fan and by the movement of the car assists the water flow governor in operating the valve 26.

Wherein a device of this kind is used it frequently happens that when the engine is idling it becomes loaded up with fuel and lubricating oil, and then when it is necessary to secure quick action from the engine in climbing a hill or the like it is necessary to clean out the surplus fuel. Where my device is used there is no such loading up with fuel, and hence no scavenging of the engine is necessary in order to secure quick action.

Where a device of this kind is not used, it will sometimes happen that when the engine is idling or running at high speed with a light load, the throttle is closed to reduce the speed or avoid the increase of speed, and as a result the volume of mixture supplied is not sufficient and the greater vacuum in the cylinders causes lubricating oil to be drawn up from the crank case into the cylinders in an amount greater than is necessary, thereby resulting in the formation and deposit of carbon in the cylinders. This objectionable feature is also obviated by supplying a full volume of mixture in the manner hereinbefore described.

An incidental advantage occurring from the use of my combination governor arises from the fact that the valve 37 and the spring 33 tend to prevent the circulation of water through the circulating system until after the engine has become heated.

As the water becomes hot the pressure on the valve 37 increases and when the water becomes hot enough the valve 37 is opened. When the vehicle is in motion the blast of air from the fan and through the radiator operates on the baffle plate and assists in opening the valve 26 and also assists in opening the valve 37 for permitting proper circulation of water through the circulating system. The tension on the spring 33 should be adjusted so that both the valve 37 and the baffle plate 30 are moved to position for opening the valve 26 when the car has acquired its usual high speed.

In addition to furnishing the proper volume of air to the fuel mixture I have herein provided a means for taking care of the leakage due to the installation of the valve 27 and prevent such leakage water from injuring any of the parts of the engine and have conducted that leakage water to the ordinary carbureter air supply pipe 40.

I have also connected my auxiliary air supply pipe 22 with the crank case 11, and also with another source of heated air supply.

The connecting of the air supply pipe 22 with the crank case has obvious advantages in that it results in furnishing to the fuel mixture warm clean air rather than cold air.

In this connection it may be noted that the air drawn from the crank case 11 rarely will be cold.

The drawing of the air from the crank case has a number of substantial advantages.

In this connection it should be noted that the air must be taken from somewhere and that by taking it from the crank case I have secured the following advantages.

With the air drawn through the pipe 22 there will be drawn a certain amount of oil vapor, whereby the valve 26 will be properly and uniformly lubricated.

If, at any time, the engine should not be drawing sufficient oil in the cylinders directly from the crank case, some oil will be drawn in vapor form from the crank case through the tubes 23 and 22 and will be thereby supplied to the cylinders and thoroughly distributed in the cylinders. It will be noted that the last mentioned advantage applies to the supply of lubrication to the intake and exhaust valves and the pistons and piston rings.

The maintenance of a constant circulation of air through the crank case assists in keeping the bearings cool. The drawing of the air from the crank case also draws out any moisture that might collect in the crank case.

It is well-known that when the heated engine is stopped and the vehicle is allowed to stand, the inside of the crank case will "sweat" or collect moisture of condensation. Such moisture which may be in the crank case when the engine is started again, will be drawn out with the air drawn through the pipe 23 as the engine becomes heated, and such moisture becomes vaporized.

It will be noted also that the drawing of air and vapors from the crank case will draw out of the crank case any gases which may escape from the cylinders into the crank case, or which may form from the lubricating oil in the crank case.

This is an important advantage resulting from my construction for the reason that particularly where low grade fuels are employed some of the fuel may escape from the cylinders into the crank case and if allowed to remain will injure the lubricating qualities of the oil in the crank case and result in serious injury to the bearings.

It will be noted in this connection that the ordinary breathing tubes are provided with a screen, so that the air taken from the crank case is clean screened air.

It is my intention to cover by my claims any changes in the form of my device or any use of mechanical equivalents which may be included within their reasonable scope.

It will be obvious that many parts of the device may be re-arranged or different forms of valves and the like may be used.

I claim as my invention:

1. In a device of the class described, the combination of a water cooled internal combustion engine having a crank case with an automatic auxiliary air and vapor device comprising an air supply pipe, connected to the fuel mixture passage between the carbureter and intake manifold, means for controlling the passage of air through said pipe for maintaining a constant volume of air and fuel mixture supply for said engine, an air actuated baffle plate operatively connected with said means, means designed to be actuated by the flow of water through the circulating system of an engine, operatively connected with said first means, said air supply pipe being in communication with the crank case of said engine.

2. In a device of the class described, the combination of a water cooled internal combustion engine having a crank case with an automatic auxiliary air and vapor device comprising an air supply device, means for controlling the passage of air therethrough, an air actuated baffle plate operatively connected with said means, means designed to be actuated by the flow of water through the circulating system of an engine, operatively connected with said first means, said air supply pipe being in communication with the crank case of said engine and also with an additional source of warm air supply.

3. In a device of the class described, an auxiliary air supply pipe, means for controlling the passage of air therethrough, an air conducting tube having one end designed to be adjacent to the fan of a motor vehicle engine and formed with a bell-shaped or flaring portion, and a swinging baffle plate in said air conducting tube operatively connected with said means, and means designed to be actuated by the flow of water through the circulating system of a motor vehicle engine operatively connected with said first means.

4. In an auxiliary air supply system for

motor vehicle engines, an air supply tube located between the throttle valve and intake manifold for supplying air to the fuel mixture, means in said tube for controlling the passage of air therethrough, controlling means for said first means, said last means including a valve designed to be mounted in the water circulating system of an engine having a stem, means for operatively connecting said stem with said first means, and a leakage tube for conducting leakage water from around said stem to the air supply tube.

Des Moines, Iowa, March 5, 1918.

EDWARD G. HODGES.