Oct. 9, 1928. 1,687,090

D. HEAD

AIR CLEANER

Filed Dec. 9, 1925

Fig. 1

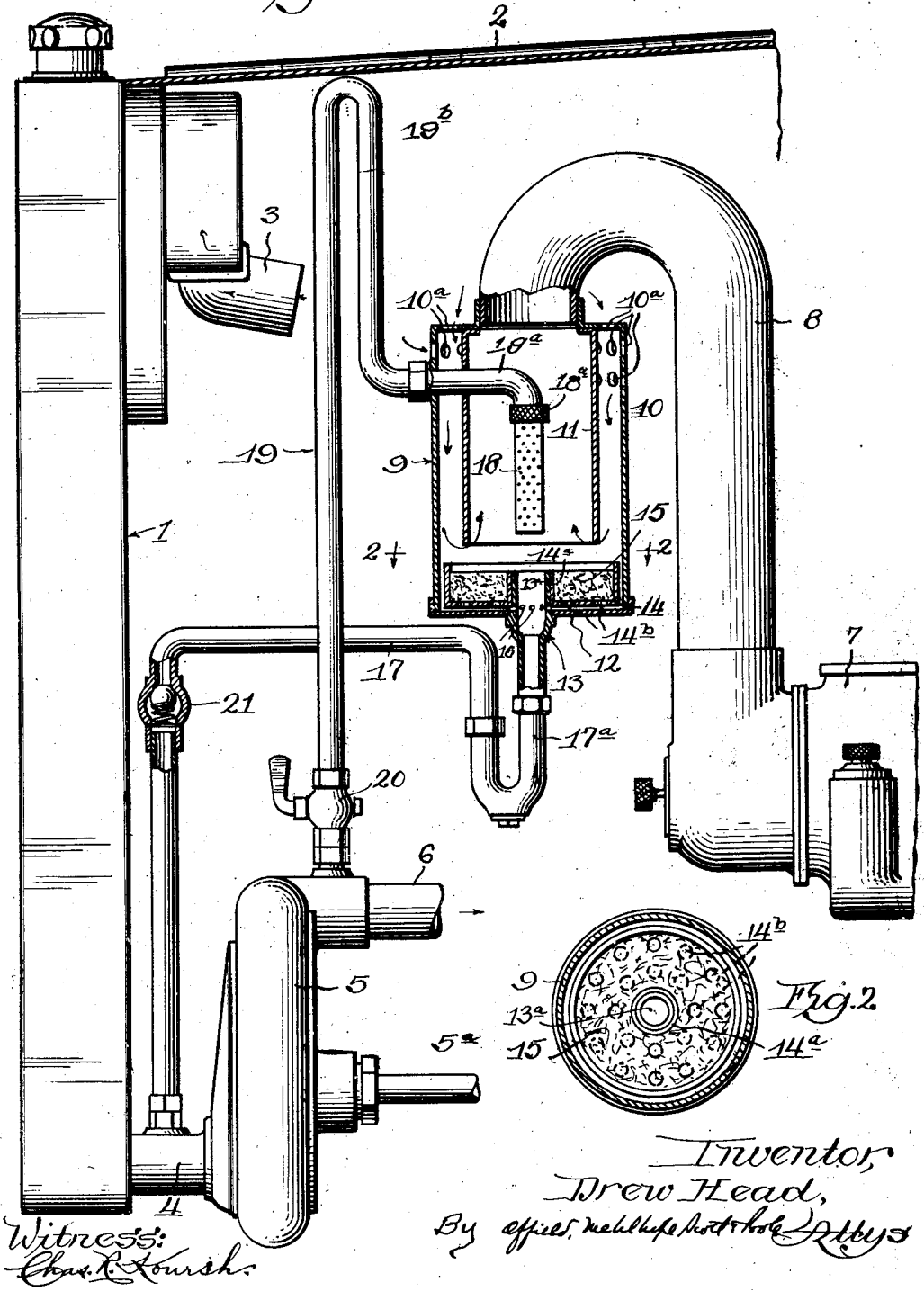


Fig. 2

Witness:
Chas. R. Kourich.

Inventor,
Drew Head,
By Offield, Mehlbye, Rothrock & Abbys

Patented Oct. 9, 1928. 1,687,090

UNITED STATES PATENT OFFICE.

DREW HEAD, OF CHICAGO, ILLINOIS.

AIR CLEANER.

Application filed December 9, 1925. Serial No. 74,225.

This invention relates to improvements in air cleaners, and more particularly to air cleaning devices for removing dust and other solid matter from the air entering the carburetor of internal combustion motors.

Devices of the character described are primarily intended for use with automobile motors, and as such, serve to protect the same from the destructive results of dust and grit being carried into the cylinders with the explosive mixture from the carburetor, namely, the scoring of cylinder walls and pistons, and the formation of excessive carbon deposits on cylinder head, valves and spark plugs.

The object of the present invention is to provide an efficient and economical air cleaning device, characterized by the use of the principle of air washing, whereby the air is passed through a spray of water drawn from the cooling system of the motor.

The further objects of the invention pertain to the arrangement and design of the various parts constituting the complete and operative device, all of which are to be hereinafter fully described in connection with the accompanying drawings, in which

Figure 1 is a view in side elevation of the forward portion of a typical automobile motor compartment, showing the essential parts of the cooling system, and the cleaning device in vertical section; and

Figure 2 is a view in cross-section taken on line 2—2 of Figure 1.

Referring to the essential parts which function in the complete installation of the cleaning device, the radiator 1 is located in the usual position, forward of the motor (not shown) and at the front of the motor compartment, housed by the hood or cover 2. The radiator is of the usual vertical celluar type which has an inlet connection 3 at its upper end and an outlet connection 4 at its lower end, said inlet being connected directly with the water jacket of the motor by a hose connection.

The purpose and action of the cooling system is so well known that a detail discussion will not be necessary, except to point out that two systems are in general use, one, in which gravity is depended upon for circulating the cooling water, called the thermo-siphon system, and the other, in which the water is circulated by a pump driven from the motor, and variously termed to distinguish it from the former.

The cooling system of the present disclosure is of the force feed or pump type, and while it seems probable that a pump or its equivalent is necessary to create sufficient pressure to operate the cleaning device, it is evident that such might be readily supplied in a thermo-siphon system.

Referring, therefore, to the present disclosure, a pump 5 is connected with the discharge connection 4 of the radiator, the same being of the centrifugal type driven from the motor through a shaft 5^a. Leading from the discharge side of the pump to the motor is a pipe or hose 6.

On the intake side of the motor is the carburetor 7, the air outlet thereto having the form of a tube 8, with a U-shaped bend at its upper end which communicates with the top of the cleaning device 9, which is suitably supported in close proximity to the carburetor.

The cleaning device comprises, in general, an outer cylindric casing 10 and inner casing or shell 11, both being disposed vertically and in concentric relation with each other. At the upper end of the outer casing is a flanged opening 12, into which fits the end of the tube 8. Immediately below this opening is the inner casing 11, extending downwardly therefrom to a point above the lower end of the outer casing, said inner casing being open at its lower end and forming in effect an extension of the tube 8, within the outer casing 10. Between the inner casing and the cylindric wall of the outer casing, is an annular space or passage communicating with the atmosphere at its upper end through a plurality of apertures 10^a distributed in regular order about the top and sides of the upper end portion of said outer casing. The lower end of the outer casing is closed by a removable cap 12 fitting over the end of the casing, and supporting at its center, a liquid discharge fitting 13 extending upwardly through said cap and terminating a short distance below the lower edge of the inner shell or casing 11 in an upstanding open-ended stem 13^a. Surrounding the stem 13^a is a shallow receptacle 14, circular in shape, and having a central tube 14^a which fits over the stem 13^a. The bottom wall of the receptacle 14 is spaced above the bottom surface of the end cap 12, and in this bottom wall are holes or perforations 14^b. The annular side wall of the receptacle is spaced a short distance from the side wall of the outer casing 10, it being observed that

its upper edge extends a short distance above the opening or mouth of the stem 13ª. Within the receptacle is a body of filtering material 15, filling the same to the level of the mouth of the stem. This body or mass of filtering material may assume any desired form, such as a solid mass of porous substance, or a quantity of loose material confined within a suitable perforated container.

The discharge fitting 13 has further communication with the outer casing through a series of small openings 16 located in line with the space separating the bottom wall of the receptacle and the bottom of the outer casing. Moreover, this fitting is connected with a pipe 17, having a U-shaped trap 17ª, immediately below the cleaning device. The purpose of the pipe together with its connections will hereinafter be set forth.

Mounted centrally of the inner shell 11 of the air cleaning device, is a spray nozzle 18, consisting of a cylindric shell having a multitude of small perforations throughout, directed laterally. Its lower end is closed and imperforate, and at its upper end is provided with a suitable threaded connection or coupling 18ª which is connected with the downturned end of a pipe 19 having a lateral branch 19ª extending through the side walls of the outer and inner casings 10 and 11.

Referring now to the pipe 19, the same leads to the nozzle 18, from the cooling system, at a point just beyond the pump 5. that is, on the discharge side of said pump. Thus, as shown, the connection is made directly with the outlet of the pump, there being provided at that point a shut-off valve or cock 20. From the valve, the pipe extends vertically upward to a point just beneath the hood 2, where a U-shaped bend 19ᵇ is made and thence vertically downward to the lateral branch 19ª entering the cleaning device. The purpose of the vertical U-bend extending above the cleaning device, is to elevate the riser or inlet side of the pipe above the level of water in the cooling system, so that the water will not continue to flow after the motor is stopped and the pump ceases to supply pressure, and while the water in the system is seeking its level.

The discharge pipe 17 already mentioned as connected with the base of the cleaning device, leads from the trap 17ª forwardly toward the radiator, and thence downwardly and connected with the cooling system at the connection 4 between the radiator and the pump 5, or in other words, on the intake side of said pump. At some point in the pipe 17, shown here as in the vertical branch leading to the cooling system, is a ball check valve 21. This valve is arranged to normally open when the water is flowing through the pipe from the cleaning device, but closes immediately upon the cessation of the flow. Manifestly, the presence of this valve prevents a back pressure or flow, which otherwise would cause the cleaning device to be flooded, as soon as the motor was stopped and the pump became inactive.

The operation of the device will be clearly understood from the following: As is well known, air is supplied to the carburetor by suction created in the cylinders during their suction strokes. The same action takes place in the cleaning device so that the air is drawn into the outer casing 10 through the openings 10ª, passing downwardly through the annular passage between the outer and inner cylindric walls, thence making an abrupt turn at the lower end of the casing, thence upwardly in the opposite direction through the inner casing 11 and the tube 8, and finally into the carburetor.

During its passage upwardly through the inner casing 11, the air encounters or passes through a spray or multitude of fine streams of water issuing from the nozzle 18, these streams being directed outwardly in a horizontal direction from all sides. The contact of the air with the water removes the fine particles of dust and dirt, it being contemplated that the larger or heavier particles will have been thrown out at the base of the cleaner, due to the sudden change in direction of the air stream and the inertia of the particles, this being a principle commonly utilized in various kinds of air cleaners now in use.

The water thus delivered from the nozzle into the stream of air, strikes the sides of the inner casing and drains onto the bed of filtering material, where it is filtered to remove the dirt held in suspension. The filtered water is discharged through the holes 16, after it has passed through the filter bed, and thence into the discharge pipe 17. It is contemplated, however, that in case the volume of water is too large to be filtered with sufficient rapidity, that the excess will overflow the upper end of the stem 13ª and thus escape, and although not wholly filtered, will leave the greater part of the dust particles behind to be absorbed by the filtering material. Any dirt that escapes, however, will be caught in the trap 17ª which is provided with a drain plug 22, to permit periodic cleaning, or when necessary. Similarly, the filtering bed can be renewed from time to time and accumulations of dirt removed.

The advantage of a cleaning device embodying the features herein described, resides primarily in the utilization of the water of the cooling system for washing the air, in addition to the separation brought about by the circuitous passage of the dust-laden air through the device, which latter method is effective to a limited extent only, since the finer particles are carried with the air and can only be separated out by actual contact with water in much the same manner as

the atmosphere is clarified by a shower of rain.

A further feature of the device is the moistening of the air as it passes through the spray, this being advantageous from the standpoint of carburation. However, the amount of water thus dissipated as moisture is not sufficient to cause any considerable drain on the cooling system, the major portion not only being returned thereto but in filtered condition.

It will be noted that the pipes leading to and from the cleaning device form a secondary circulating system, which in no wise interferes with the primary or main cooling system. Thus if desired or necessary, the entire secondary system may be shut off by closing the shut-off cock 20 without affecting the cooling system. This may be done whenever conditions require, or during seasons when the atmosphere is relatively clear of dust, as for instance, during the winter or rainy seasons. This suggests another advantage, namely, that when the air washing feature is dispensed with, there is still a substantial cleaning effected by the passage of the air through the device.

Having set forth the construction and advantages of the device embodying the invention, I claim:

1. In a cleaning device of the character described, the combination with an internal combustion motor including a cooling system and a carburetor, of a casing having a vertical passage communicating at its upper end with said carburetor and at its lower end with the atmosphere and the bottom of said casing, a nozzle mounted in said passage and connected with said cooling system for directing a spray of water transversely of said passage, and a pipe connected with the bottom of said casing and leading to said cooling system.

2. In an air cleaning device, the combination with a motor having a cooling system and a carburetor, of a casing communicating with the atmosphere and having vertical air passage connected with said carburetor at its upper end and opening into the bottom of said casing at its lower end, a nozzle located in said passage and connected with the pressure side of said cooling system, means at the bottom of said casing for collecting and filtering the water delivered from said nozzle, and a pipe leading from the bottom of said casing to the suction side of said cooling system.

3. In an air cleaning device, the combination of a motor, a cooling system therefor including a pump, a carburetor, a casing provided with an opening communicating with atmosphere, means for directing the air in opposite directions through said casing and thence to the intake of said carburetor, a nozzle mounted in said casing and adapted to discharge water transversely of the path of the air prior to its discharge from said casing, a pipe leading to said nozzle from the high pressure side of said cooling system, a receptacle below said nozzle, and a pipe leading from said receptacle to the low pressure side of said cooling system.

4. In an air cleaning device, the combination with an internal combustion motor having a cooling system and a carburetor, of a casing provided with air inlet openings near the top, and a filtering receptacle at the bottom thereof, an inner casing within said outer casing having communication with said carburetor at its upper end, and open at its lower end above said filtering receptacle, a nozzle in said inner casing, and a secondary circulating system comprising pipes connected with said cooling system on opposite sides of said pump, one of said pipes extending to said nozzle and the other from said filtering receptacle.

5. In an air cleaning device, the combination of a motor having a cooling system and a carburetor, of an outer casing provided with an opening communicating with atmosphere, an inner casing open at its lower end to said outer casing and at its upper end with the intake of said carburetor, a nozzle mounted in said inner casing and adapted to discharge water transversely thereof, a pipe leading to said nozzle from the high pressure side of said cooling system, a filter receptacle in said outer casing below said nozzle, and a pipe leading from said receptacle to the low pressure side of said cooling system.

6. In an air cleaning device, the combination with an internal combustion motor provided with a cooling system and a carburetor, of a casing provided at its upper end with air inlet openings and at its lower end with a receptacle having a water outlet, an inner casing communicating at its upper end with said carburetor and opening at its lower end above said water receptacle, a spray nozzle located in said inner casing, a pipe leading to said nozzle from said cooling system, and a return pipe from said water outlet to said cooling system and a check valve in said return pipe.

7. In an air cleaning device, the combination with an internal combustion motor having a cooling system including a pump and a carburetor, of a casing provided with air inlet openings near the top and a filtering receptacle at the bottom thereof, an inner casing within said outer casing having communication with said carburetor at its upper end, and open at its lower end above said filtering receptacle, a spray nozzle in said inner casing, and a secondary circulating system connected with said cooling system and including a pipe leading to said nozzle from the high pressure side of said pump,

and a return pipe leading from said filtering receptacle to the low pressure side of said pump, and a check valve in said return pipe.

8. In an air cleaning device, the combination with an internal combustion motor provided with a pump operated cooling system and a carburetor, of a casing provided at its upper end with air inlet openings and at its lower end with a receptacle having a water outlet, an inner casing within said outer casing connected at its upper end with said carburetor and open at its lower end, a spray nozzle mounted in said inner casing, a pipe connected with the cooling system on the high pressure side of said pump and extending vertically above the normal water level in said cooling system and thence to said nozzle, a return pipe leading from said water outlet to the low pressure side of said pump, and a check valve in said return pipe.

Signed at Chicago, Ill., this 4th day of December 1925.

DREW HEAD.