

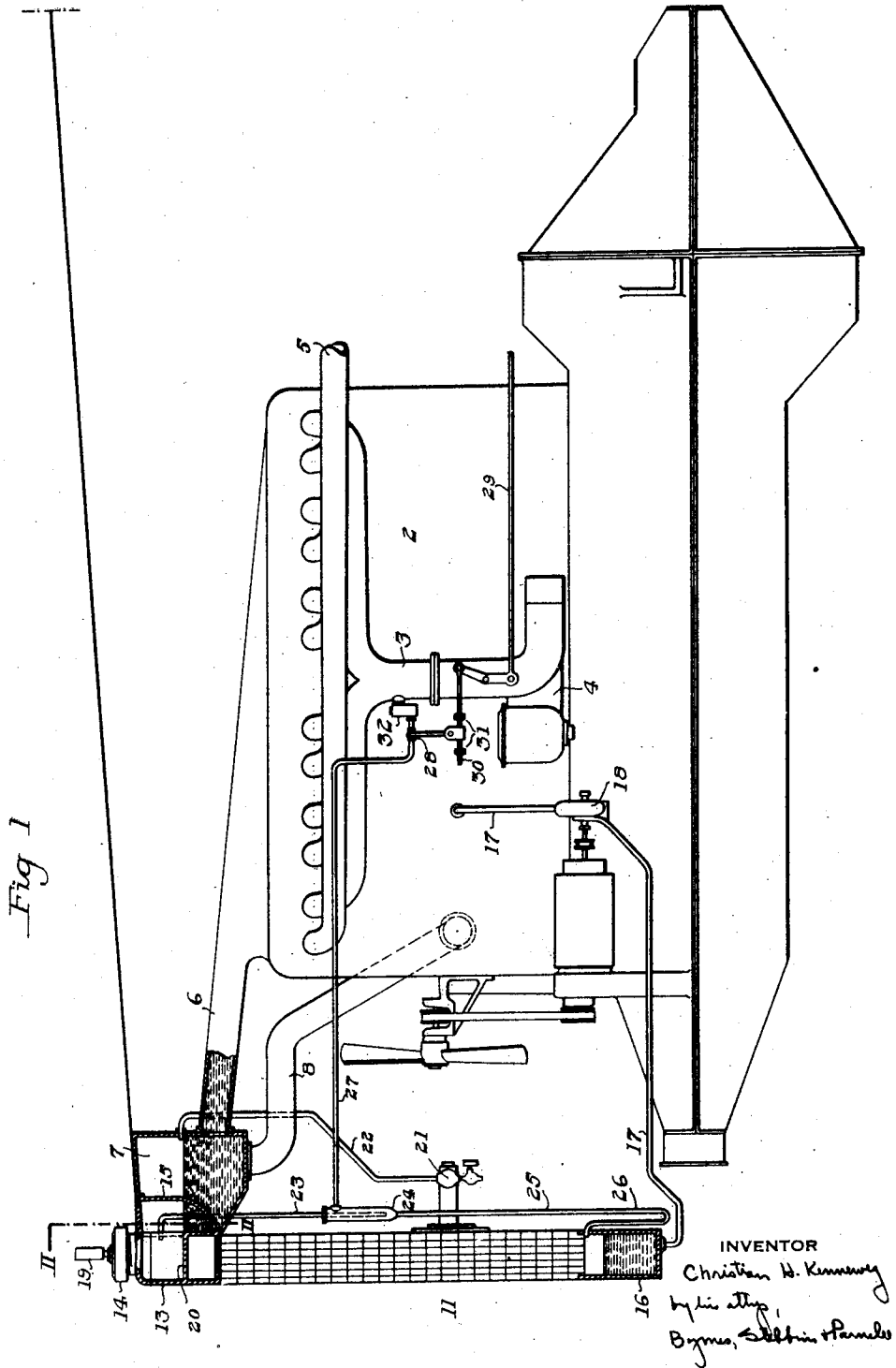
March 26, 1929.

C. H. KENNEWEG
INTERNAL COMBUSTION ENGINE

1,706,693

Filed Sept. 25, 1925

2 Sheets-Sheet 1



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Fig 3

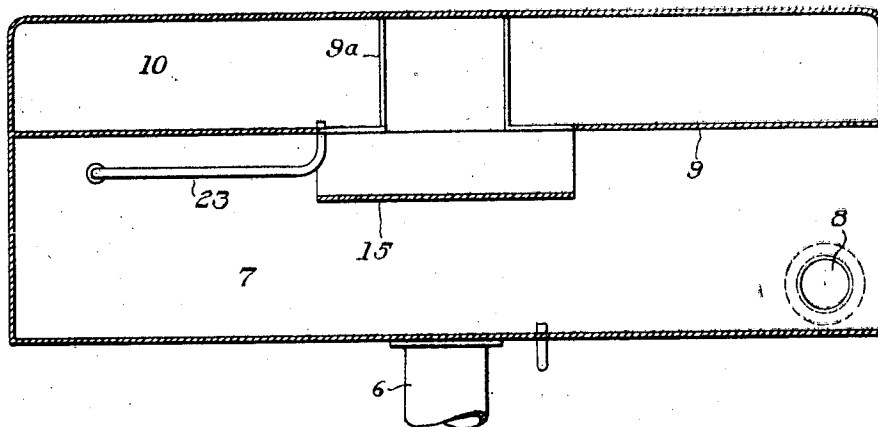


Fig 2

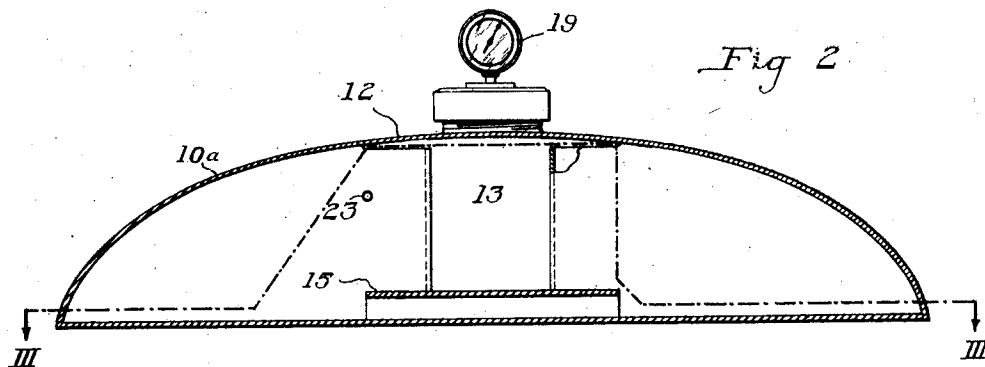
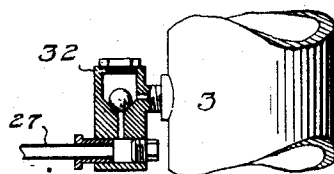


Fig 4



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INTERNAL-COMBUSTION ENGINE.

Application filed September 25, 1925. Serial No. 58,510.

This invention relates to internal combustion engines, and particularly to an improved method of cooling the same and improving the operation thereof by supplying vapor from the cooling system to the engine cylinders.

The ordinary water circulating system, whether it be pump or thermo-siphon, is operated at atmospheric pressure at all times and the disadvantages of this system are well known. It has been proposed in numerous prior patents to employ a cooling system wherein the water is maintained at substantially boiling temperature, thus maintaining a higher engine temperature and securing a greater efficiency. Many of these prior systems, while they have been operated satisfactorily on a block test have failed utterly on road tests for the reason that the systems were essentially incapable of taking care of the extreme and rapid variation in load condition which occurs in ordinary driving. All of these prior systems have been designed to operate at a definite pressure, generally atmospheric pressure but sometimes subatmospheric. Numerous vents and pressure valves have been provided to insure operation at predetermined pressure, but it has been found by actual test that when these various arrangements are used on the road where at one instant the engine may be idling and at the next instant turn over at maximum speed, the entire system fails and unsatisfactory results are secured.

In certain systems this failure is due to a large extent to the fact that water is carried to the condenser in addition to the steam which is to be condensed. As a result, the entire system becomes practically inoperative on the road. I provide a separating tank which makes it practically impossible for any water to ever enter the condenser and this is found in practice to be of considerable importance.

I provide a cooling system wherein the water is maintained at substantially boiling condition for whatever pressure then exists in the jacket and vary this pressure to points above and below atmosphere in accordance with the engine load.

Obviously the effective area of a condenser for use in automobile work can be varied only within small limits, as by shutters or the like, and this I believe is one of the

causes for failure of the systems heretofore proposed. By my system, if the pressure is permitted to rise in a system, then obviously the water temperature also rises and since this means a greater temperature difference between the steam in the condenser and the air which is used for cooling the condenser, the efficiency of the system is increased. Conversely, if the pressure drops, then the steam temperature more nearly approaches the air temperature and the condensing efficiency is lowered. Since the heat conducted through the engine cylinders to the cooling water increases with the load, it will be apparent that the provision of a system intended to operate at varying pressures automatically causes a variation of the condenser efficiency with the final result of a cooling system which has proved under severe road tests to be capable of operating in a perfectly satisfactory manner under the most extreme conditions.

I have further provided for withdrawing a certain amount of the vapor supplied in the system to the engine cylinders and for varying the amount of vapor supplied in accordance with the engine load. The steam is withdrawn from the cooling system from a space where there is no possibility of water getting into the engine and this has many advantages. In the first place the vapor is measured or controlled as a vapor and not as a liquid so that extreme delicacy of control may be secured and in the second place there is no danger of slugs of water being drawn into the cylinders and causing irregularity of operation.

In the accompanying drawings illustrating more or less diagrammatically a preferred embodiment of the invention

Figure 1 is a vertical section through a cooling system embodying my invention and showing its application to an automobile engine;

Figure 2 is a section on the line II—II of Figure 1;

Figure 3 is a section on the line III—III of Figure 2; and

Figure 4 is a section through a check valve shown in Figure 1 and attached to the intake manifold.

In the illustrated embodiment of the invention there is shown an internal combustion engine indicated generally by the ref-

erence character 2 and having an inlet manifold 3 connected to a carburetor 4 and an exhaust manifold 5.

A conduit 6 leads from the upper part of the engine jacket to a separating tank 7 from which a return line 8 to the jacket is provided. This provides a water circulating system which preferably is operated on the thermo-siphon principle. When the engine is put in operation the water begins to circulate to some extent. Because of the absence of any cooling means in the system it soon comes to a boil and a mixture of water and wet steam passes through the conduit 6 into the separating tank 7.

The front wall 9 of the separating tank 7 separates it from a steam chamber 10 which lies above a condenser 11 occupying the position on the automobile which is normally occupied by the radiator. The steam chamber 10 has a top 10^a to which the wall 9 is secured as clearly shown in Figure 2. The wall 9, however, does not extend quite up to the top of the separating and steam chambers, thus leaving a space 12 through which steam may pass from the separating chamber into the steam chamber as will be apparent from Figures 2 and 3. The steam chamber is divided in two parts at its upper portion by reason of extensions 9^a of the wall 9 which are directed toward the front of the automobile and leave a small box-like aperture 13 below the filling cap 14. With this arrangement it is very easy to fill the system with water in the ordinary way and there is no likelihood of the water getting into the condenser. A baffle 15 is provided adjacent the aperture 13 to prevent any slug of water which may possibly move with some rapidity through the conduit 6 from being forced into the aperture 13 and causing water to enter the condenser. This baffle is preferably as wide as the opening 12. The opening 12 provides a free and unrestricted steam passage but substantially prevents the passage of water.

The steam in the chamber 10 passes downwardly into the condenser 11 and the condensate is conducted to a tank 16 therebelow. A conduit 17 leads from the tank 16 to the water jacket of the engine and a pump 18 is placed in the conduit to secure a return of the condenser water to the system. In operation the pressure within the system varies considerably with the engine load and may show a vacuum as high as 15 inches of mercury or a pressure of 5 or even 6 pounds above atmosphere. A pressure gauge 19 is provided on the filling cap for indicating the pressure existing in the system. This gauge is arranged to indicate pressures either above or below atmosphere, and if desired may have characteristic markings such as normal, sub-normal, and so on. No attempt is made to hold the system to a pre-

determined pressure as it is found in operation that a variation of pressure and a consequent variation in condenser efficiency is exceedingly desirable.

In filling the system with water the filling cap 14 is removed and water is poured in until it is at a level with the bottom 20 of the box-like aperture 13. This is the normal water level for the system and it is preferred to put in just the amount of water necessary to secure this level. However, in order to insure proper operation even in careless filling, a blow off valve 21 is provided. This blow off valve is connected to the separating tank 7 by a conduit 22 and the outlet of the conduit is on a level with the wall 20. Even though an excess of water is put in a system, sufficient pressure will soon be generated to operate the blow off valve 21 at which time the excess water is automatically ejected and the system then operates as designed.

In order to supply the vapor from the system to the engine cylinders, there is provided a conduit 23 leading from the steam chamber 10. Since the conduit finds its outlet from the steam chamber where it is impossible for water to enter, nothing but steam will ever be drawn into the engine.

The conduit 23 leads to a separator 24 in which any water which may condense out of the steam during its passage through the conduit 23 collects. From the separator 24, the condensed water flows through a conduit 25 having a trap 26 therein and terminating in the condensate tank 16. After the trap is filled with water, which occurs in a very few moments, there is no danger of the condenser system being affected by pressure conditions existing in the separator 24.

A conduit 27 leads from the separator 24 to the intake manifold 3. A valve 28 is provided in this conduit for regulating the amount of vapor which is admitted to the engine. This valve is operatively connected to the throttle control rod 29 by means of a sliding rod 30 having adjustable nuts 31 thereon. The valve 28 is so constructed that it will always admit a small amount of vapor to the intake manifold and as the throttle is opened this amount is increased. A check valve 32 is also provided in the conduit. The conduit 27 is preferably run for a short distance along the outside of the exhaust manifold 5. The conduit should not go inside the manifold where it would be burned up, but if it is laid along the side as shown in Figure 1 it will be found that this offsets any tendency of the steam to condense in the conduit 27.

By reason of the fact that the engine jacket is maintained at considerably higher temperatures than ordinary, the efficiency of the engine is materially increased and this, in connection with the injection of

steam to the cylinders, results in remarkable increased efficiency.

While I have illustrated a preferred embodiment of the invention, it will be understood that it is not limited to the form shown as it may be otherwise embodied for practice within the scope of the following claim.

I claim:

10 The method of cooling an automobile internal combustion engine having a cooling system of the boiling and condensing type which consists in extracting vapor from the

condensing system and feeding this vapor to the engine fuel mixture charge in direct proportion to said fuel charge, thereby simultaneously reducing the excess pressure and the temperature in the condensing system as well as cooling the explosive charge in the engine on intermittent heavy engine loads in order to produce a substantially uniform, constant working temperature in both cooling system and engine cylinders. 15 20

In testimony whereof I have hereunto set my hand.

CHRISTIAN H. KENNEWEG.