March 18, 1924. 1,487,675

K. STEINBECKER

INTERNAL COMBUSTION ENGINE

Filed Sept. 11. 1922 2 Sheets-Sheet 1

Fig. 1.

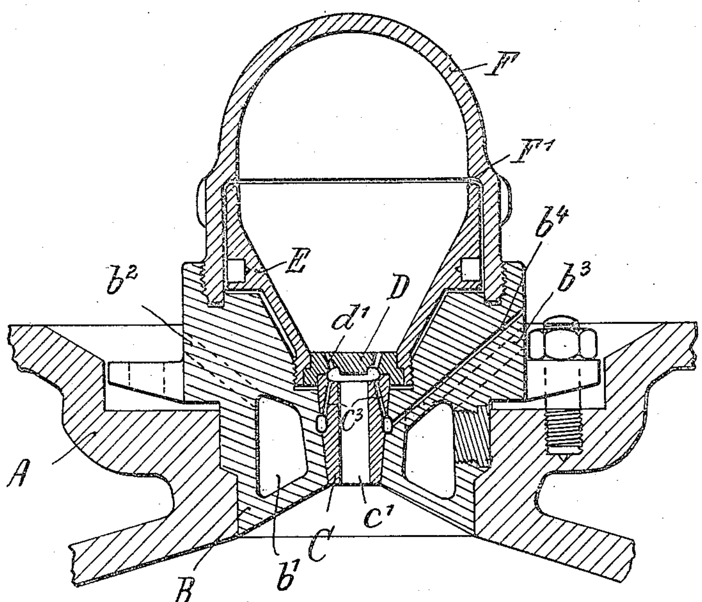

Fig. 4.

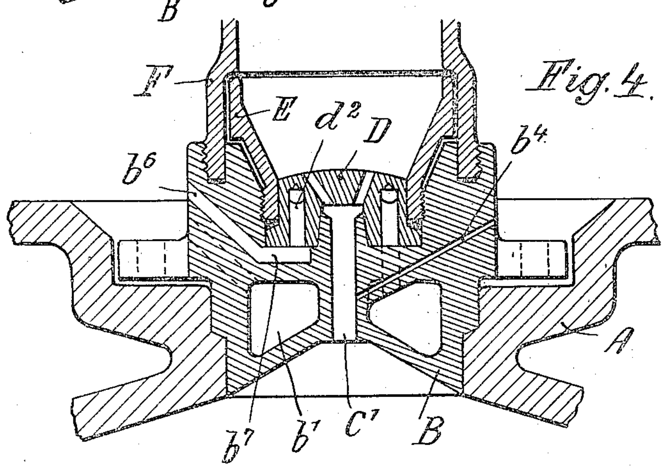

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Fig. 2.

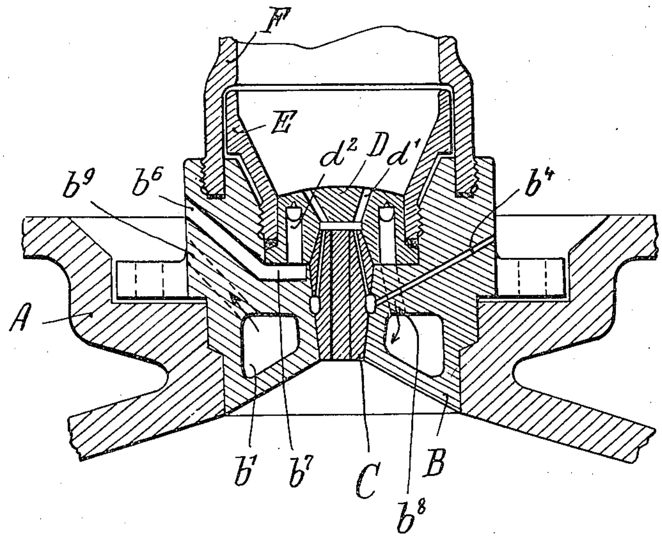
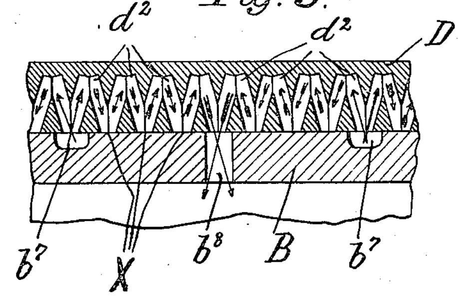


Fig. 3.



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UNITED STATES PATENT OFFICE.

KARL STEINBECKER, OF CHARLOTTENBURG, GERMANY.

INTERNAL-COMBUSTION ENGINE.

Application filed September 11, 1922. Serial No. 587,550.

To all whom it may concern:

Be it known that I, Karl Steinbecker, a citizen of the Republic of Germany, residing at 6 Langobarden Allee, Charlottenburg, Germany, have invented certain new and uesful Improvements in and Relating to Internal-Combustion Engines, of which the following is a specification.

This invention relates to solid injection internal combustion engines, in which the fuel is atomised in a hot bulb. In this type of engine the main cylinder is uninterruptedly in communication with a bulb by means of a passage, through which during the upward stroke of the piston a portion of the compressed working air is forced at a great velocity into the bulb. Owing to the fact that, shortly before the piston arrives at the upper dead centre, the working fuel is forced laterally into the connecting passage in the form of a fine jet, the compressed air blows the first particles of the jet of fuel entering the passage into the bulb, where, on impinging on the hot walls of the bulb, which must be kept constantly above a certain high temperature, they are ignited. In consequence of the sudden increase in pressure in the bulb caused by the ignition, the contents of the bulb are forced backward towards the main cylinder and drive the working fuel, which continues to be forced into the connecting passage, into the cylinder where, after self-ignition it is burnt and performs work.

It has been found by experience, that it is important for the complete combustion of the mixture of fuel and air ignited in the bulb, that the atomization in the bulb shall be as perfect as possible. For this purpose the atomising passage, which connects the bulb with the main cylinder, is subdivided towards the bulb into a number of separate passages, from the orifices of which according to their angular position, the whole interior of the chamber is uniformly sprayed. This branching of the atomiser or induction passage, has, however, the disadvantage that the highly heated flue gases impinge on each other at the point where the main passage branches off, and that owing to the eddying thus caused, such an intense heat is developed that the walls of the passages at this point will be destroyed. In addition to this, owing to the intense heat, there is the danger of permature ignition and carbonisation taking place, which will have a bad effect on the efficiency of the bulb.

It is the object of the present invention to overcome these drawbacks. This is effected by the induction passage and more particularly the point where it branches being specially well cooled in such a manner that the effect of the cooling extends up to immediately below the bottom of the inserted part (rose), which faces the bulb and in which the induction passage branches. At the same time means are provided according to the invention, whereby the internal temperature of the bulb is not reduced too much through the intensive cooling of the inserted part or rose of the induction passage, which is essential for the proper working of the engine.

The cooling medium for the atomiser may be supplied by the introduced working fuel, which is sprayed directly against the bottom of the rose, or a special cooling medium (water or the like) may be used, which is introduced through a suitable system of cooling passages up to immediately below the bottom of the rose, as far as the point where the induction passage branches. In certain cases one of the two cooling media may be sufficient.

The necessary temperature of the walls of the bulb is secured by a separate part inserted in the bulb, the walls of which part extend with a certain amount of lateral clearance into the bulb, so that, owing to their insulated position in the bulb, they become more heated than the bulb itself and can easily be kept at the temperature required for the operation of the engine.

In the accompanying drawing three constructional examples of the subject of the invention are shown.

Fig. 1 is a longitudinal section of a constructional form of the invention.

Fig. 2 is a part longitudinal section of a modification.

Fig. 3 is a developed cylindrical section through the cooling passages shown in Fig. 2.

Fig. 4 is a part vertical section of a further modification.

Fig. 1 shows a constructional form, in which the direct cooling of the rose is effected by the fuel alone. A is the cylinder cover, in which the cooled inserted part B is mounted, into which part the conical part C containing the induction passage is inserted. The cooling medium is conveyed to the hollow space b' of the part B through the passages b^2, b^3, which are indicated by dotted lines in the drawing, as they do not lie in the plane of the section. The rose D which rests on the conical part C and contains the small branched off passage d' is held tightly on the conical part C by means of the screw-cap E. The strong cooling of the rose D is effected by the fuel introduced through the passage b^4 into the annular passage b^5, being injected by means of a smaller passage c^3 in the conical part C directly against the bottom of the rose. This applies to the whole of the working fuel and not only to that part which reaches the bulb F.

In spite of this strong cooling of the rose, the temperature of the walls required in the interior of the bulb F is kept at the required height, owing to the arrangement and the special construction of the part E inserted in the bulb, which is formed so as to constitute a screw-cap for holding the rose in position. This screw-cap E is so designed that only its lower, constricted, threaded end is in metallic contact with the inserted part B, while there is a certain amount of clearance between its upper part and the bulb F. This form of construction of the screw-cap with its constricted lower part, which as it were forms the neck of the bulb, allows of a bulb being used which is closed at the top and is of large diameter, as its inner surface can easily be tooled through the large bottom opening. The clearance between the screw-cap and the bulb or the inserted part B of the cylinder cover allows the screw-cap to expand freely. Owing to the fact that the hot gases penetrate into the gap between the screw-cap and the bulb, the pressure on either side of the walls of the screw-cap is completely balanced, so that they may be made as thin as desired. Hence the walls of the screw-cap very rapidly assume the temperature required for the operation of the engine, so that the lower part of the actual wall of the bulb, which is covered by the screw-cap, can cool to a greater extent without in any way affecting the operation of the engine. The lower end of the bulb itself is screwed to the cooling insertion B or directly to the cylinder cover A, if there is no separate cooling insertion. The projecting shoulder F^1 of the bulb F prevents the screw-cap of the inserted part E from becoming loose while the engine is in operation.

In order to make the cooling of the rose still more effective, the constructional form shown in Fig. 2 may be adopted, in which, besides the cooling of the points where the induction passage branches, special water cooling means are provided, which extend right up to the branching points. In this case, the cooling water passes through the passage b^6 into a recess b^7 in the part B inserted in the cylinder cover and is distributed from there towards both sides of the cooling passages d^2 of the rose D. Fig. 3 represents a developed cylindrical section through this system of cooling passages. From each of the common points x two inclined passages d^2 are bored, which extend to just below the bottom of the rose and there intersect with the adjacent holes. The water is thus forced to travel in a zigzag manner, which is particularly effective, as it extends right to the branching points of the fuel passages. The cooling water flows away from the rose through the passage b^8, shown in dotted lines, into the annular space b' of the part B from which it escapes by the passage b^9 also shown in dotted lines.

The constructional form shown in Fig. 4 differs from that just described only in this, that there is no cooling by means of the fuel, which is possible in certain cases in view of the particular effectiveness of the water cooling. In the constructional form as shown in Fig. 4, the fuel, as it is not required for cooling the rose, is introduced in a known manner directly into the induction passage proper c', which is located directly in the part inserted in the cylinder cover.

As already stated, the two cooling media, (oil and water) may be used separately (Figs. 1 and 4) or in combination (Fig. 2). It is essential that the cooling media shall be brought right up to below the bottom of the rose which faces the bulb, means being preferably provided for keeping the inner surface of the bulb at the requisite temperature, in spite of the strong cooling to which the rose is subjected.

What I claim is:—

1. An arrangement for the operation of solid injection internal combustion engines of the Diesel type, in which a small part of the fuel is atomised in a bulb comprising a cylinder, an atomising bulb, an induction passage branching towards the bulb into a plurality of separate passages forming a rose, and means for cooling said rose extending into the top part of the rose, which faces the bulb.

2. An arrangement as claimed in claim 1 having means for spraying the working fuel directly against the bottom of the rose.

3. An arrangement as claimed in claim 1, comprising a system of cooling passages reaching in among the branching passages of the induction passage and extending to immediately below the top of the rose.

4. An arrangement as claimed in claim 2, comprising a system of cooling passages reaching in among the branching passages of the induction passage and extending to immediately below the top of the rose.

5. An arrangement as claimed in claim 1 comprising a separate piece inserted in the lower part of the bulb and forming a lower constricted part of the said bulb, which piece extends with a certain amount of clearance into the lower part of the bulb, whereby the said separate piece, owing to its position, becomes more intensely heated than the lower part of the bulb.

6. An arrangement as claimed in claim 5, in which the inserted piece makes metallic contact with the part on which it is mounted only at its lower attaching part and is formed as a screw-cap capable of holding in position the parts forming the rose.

In testimony whereof I have signed my name to this specification.

KARL STEINBECKER.