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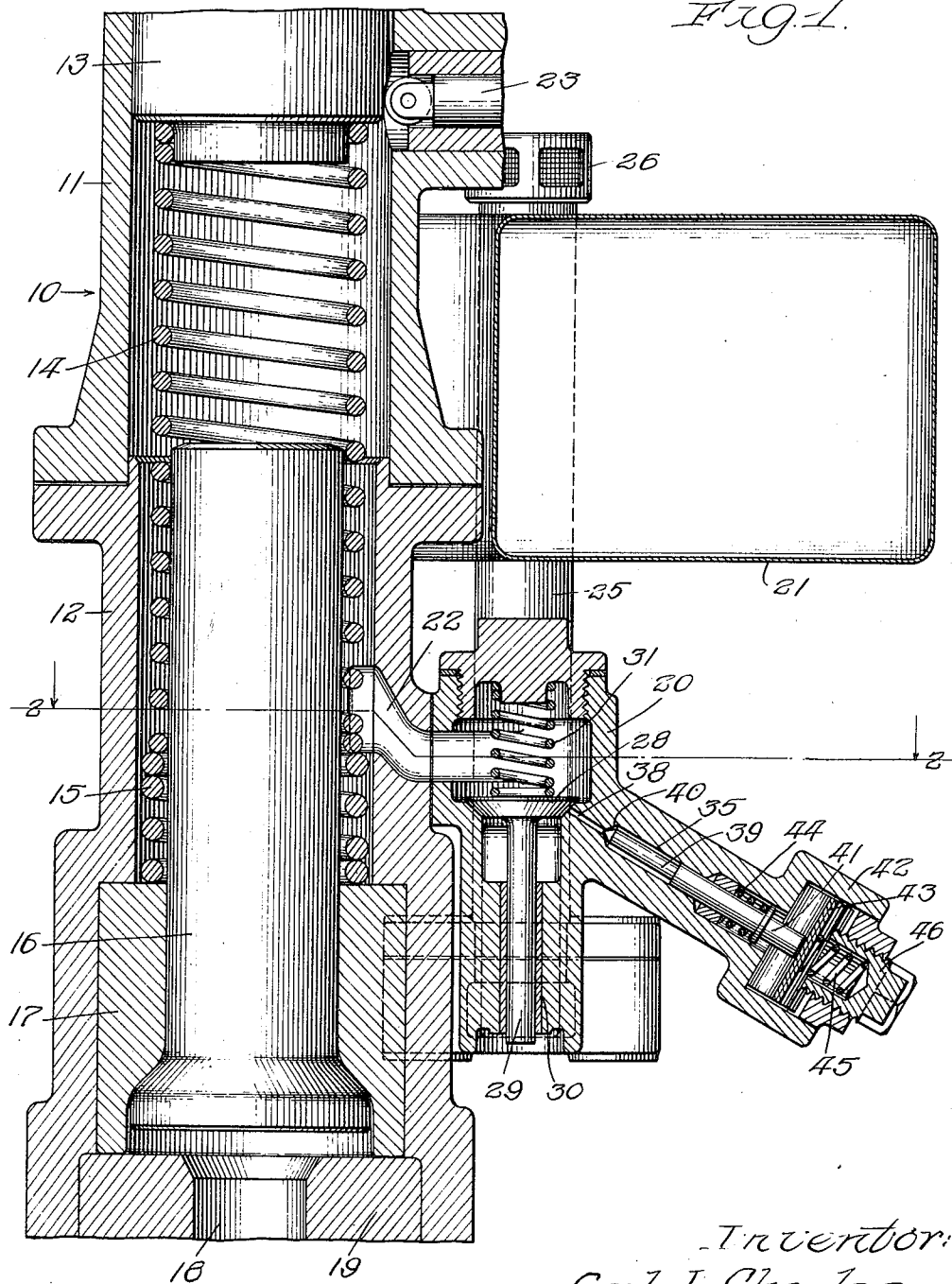
C. L. CHARLES

2,089,112

INTERNAL COMBUSTION HAMMER

Filed March 25, 1937

2 Sheets-Sheet 1



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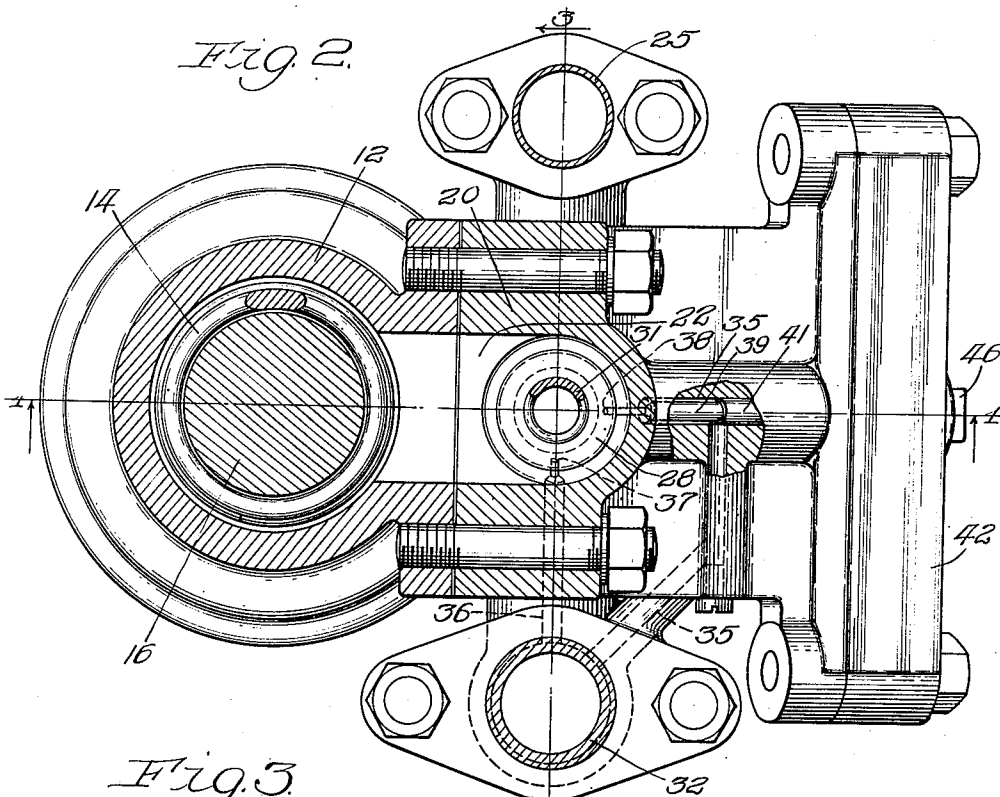
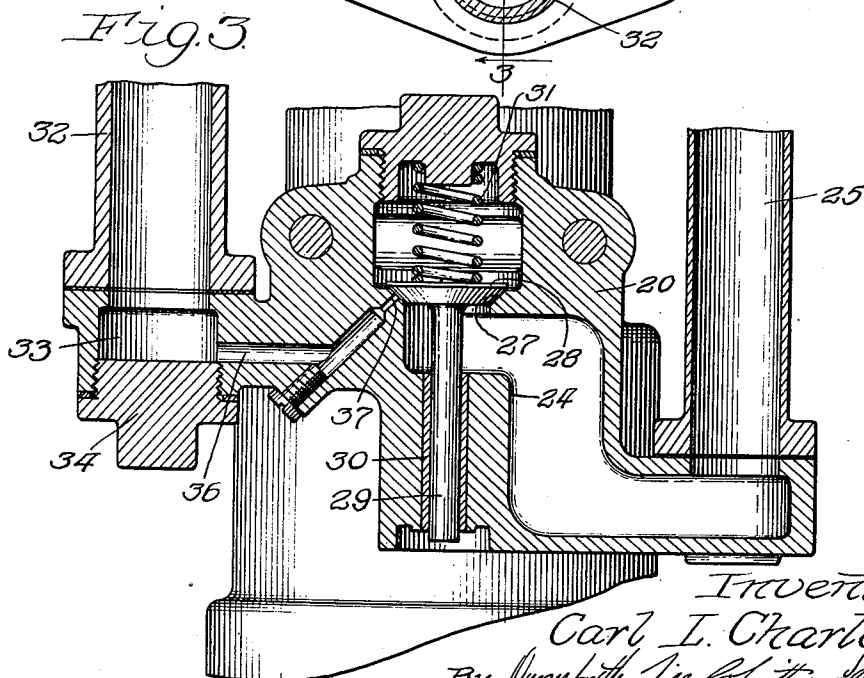
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,089,112

INTERNAL COMBUSTION HAMMER

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11 Claims. (Cl. 123—7)

This invention relates to an internal combustion hammer and more particularly to an improved carburetor therefor.

One feature of this invention is that it provides means for automatically varying the mixture of air and fuel in accordance with the temperature of the hammer; another feature of this invention is that it provides improved operation of an internal combustion hammer by proper regulation of the combustible charge fed thereto; yet another feature is that the carburetor is particularly adapted to withstand the vibrations inherent in a free piston hammer; other features and advantages will be apparent from the following specification and the drawings, in which:—

Figure 1 is a fragmentary vertical sectional view of a hammer embodying this invention; Fig. 2 is a horizontal sectional view along the line 2—2 of Fig. 1; and Fig. 3 is a detailed sectional view of the carburetor along the line 3—3 of Fig. 2.

A free piston hammer, since it has no fly wheel or other means for storing energy, must fire upon every reciprocation of the piston in order to keep running. Such hammers are most frequently used in road construction work, tamping work, and the like, where they are exposed to wide variations in temperature, and consequently require different mixtures of fuel and air for a proper combustible charge. That is, a cold hammer must have a mixture rich in fuel, whereas considerations of economy and efficiency require that the mixture be leaner when the hammer has reached normal operating temperature. Automatic means for varying fuel and air mixture in accordance with temperature have long been known and used in connection with carburetors of engines of the type used in automobiles, for example, but such means is completely unsuited to operation under the conditions existing in a percussive tool or hammer, and could not even be adapted for such use through modifications of design or structure.

The present invention achieves the desired result and obviates the objections inherent in known devices for automatically regulating the mixture by providing two orifices through which fluid fuel is fed to the air being drawn into the cylinder of the hammer: one of these orifices provides a flow of such proportions as to provide a proper mixture when the hammer has warmed up to normal operating temperature; and the other orifice is of sufficient size to provide additional fuel flow to meet the requirements of a cold hammer, and has valve means in connection

therewith thermally actuated to completely close said orifice when the hammer has reached normal operating temperature. After the first few minutes of operation of the hammer the valve member is urged by the thermal means into contact with a seat or stop about the last mentioned orifice, so that there is no floating member adapted to wear or shift from proper position as a result of the terrific vibration of such a hammer.

In the particular embodiment of this invention illustrated herewith a hammer 10 is shown comprising a cylinder 11 and an anvil housing 12 fixedly mounted thereon, providing an internal bore in which is situated a free piston hammer 13, springs 14 and 15 urging said piston upwardly, and an anvil 16 journaled in a sleeve bearing 17 and adapted to transmit blows from the piston to a tool inserted through the opening 18 in the impact absorbing means 19. The carburetor 20 is adapted to mix fuel from the tank 21 with air and supply the resultant combustible charge through the passage 22 to the sub-piston compression space, from which it is subsequently transferred to the combustion chamber above the piston in accordance with conventional two cycle engine practice. Appropriate ignition means for firing the charge in the combustion chamber is provided, not here shown, controlled by the timer 23. The hammer is of the free piston type, without crank shafts, cams, or the like, and is adapted to have the piston driven downward by the explosion of the combustible charge to strike a blow on the tool, and to have it returned by the spring assembly. Inasmuch as the general construction and operation of such a hammer is well known in the art, it is not fully shown and described here. Such a hammer is fully illustrated, for example, in Mould Patent No. 1,997,072.

The carburetor body 20 has therein a passage 24 adapted to have air flow therethrough into the hammer, the air being drawn in through the pipe 25 terminating in the air cleaner device 26 upon a demand for air by the hammer, as when the piston exerts a suction by its upward travel. The passage 24 has in one portion thereof a tapered annular seat 27 adapted to be engaged by the correspondingly tapered edge of a valve member 28. The valve has a stem portion 29 slidably journaled in the guide 30 and having a portion thereof projecting outside of the carburetor body to enable the valve member to be manually lifted from its seat against the pressure of the spring 31. This spring is of sufficient tension to keep the valve member in the seat when the hammer is inoperative, and thus 55

seal the orifices, to be subsequently described. The spring is light enough, however, that the valve member may be readily raised by the suction created upon a demand for air by the hammer, so that air may flow through the passages 24 and 22.

The fluid fuel, generally in the form of a volatile liquid such as gasoline, is fed to the carburetor by gravity from the tank 21 through the pipe 32. This pipe terminates in the carburetor body and a chamber or pocket 33 closed by the cap 34, and having two passages 35 and 36 leading therefrom. The passage 36 terminates in an orifice 37 in the seat 27, which orifice is always open to the fuel supplied through the pipe 32 and thus supplies said fuel to the air passing through the passage 24 whenever it is unsealed by the lifting of the valve member 28 from the seat 27. This orifice is restricted in diameter to a size such that it will provide only enough fuel for a proper mixture when the hammer is warmed up to normal operating temperature, the flow being so restricted that the mixture is too lean for a cold hammer.

The passage 35 terminates in the second or auxiliary orifice 38 also adapted to supply fuel to air passing between the valve member and the seat whenever the valve member is raised. This orifice is of sufficient size that, in combination with the first mentioned orifice 37, sufficient fuel may be supplied to furnish a mixture rich enough for proper combustion when the hammer is cold, as at starting. Where the hammer is particularly cold and it is desired to prime it with a very rich mixture for the first explosion, the valve member may be manually raised from its seat for a short time, whereupon fuel will flow out of the orifices into the passage, wetting the walls thereof and forming a pool insuring a heavy charge of vapors being drawn in upon the first movement of the piston. The orifices are so chosen, however, that even though the hammer is particularly cold sufficient fuel will flow through the orifices to operate the hammer after the first explosion without any necessity of further manual choking.

Means is provided in connection with the auxiliary orifice 38 for automatically varying the flow of fuel therethrough in accordance with the temperature of the carburetor, which is, of course, a function of the temperature of the cylinder. This means comprises a valve member 39 in the passage 35 having a conical end portion adapted to abut a stop or seat 40 to close the orifice 38 and prevent any flow of fuel therethrough. The valve member has a stem 41 projecting into a thermostat housing 42 and adapted to lie in contact with a bimetallic or thermally actuated element 43. A spring 44 presses against a shoulder on the stem 41 to urge the same outwardly, and a coil spring 45 seated in a cap 46 serves to urge the bimetallic element 43 inwardly. The valve stem 41 and element are thus kept in contact with each other, and movement of the thermal element 43 inwardly or outwardly as a result of changes in temperature effects a corresponding movement of the valve member 39 toward or away from the seat 40. It is to be understood, of course, that the thermal element is anchored to the housing 42 at its extremities in such a way as to permit movement of the center as a result of distortion or bending of the element.

The thermal element and springs are so chosen

that when a hammer, and thus the carburetor, is cold the valve member 39 will be away from the seat 40, thus permitting flow of fuel through the passage 35 and orifice 38 as well as the passage 36 and orifice 37. As the hammer warms up, as a result of the combustion of charges while it is operating, the thermal element 43 so changes its position as to force the valve member 39 closer and closer to the seat 40, until when the hammer has warmed up to normal operating temperature, where the cylinder wall temperature is in the neighborhood of 400° to 600° F., the valve member firmly abuts the said seat. During the major portion of the time the hammer is in operation, therefore, the valve member is tightly urged against a stop, so that there is no movement thereof either longitudinally or transversely as a result of the terrific vibrations set up in the entire structure of a free piston hammer of the type disclosed. This enables automatic variation of the mixture in accordance with temperature, a function which cannot be accomplished by a butterfly valve or other similar means known and used in connection with internal combustion engines of the type incorporating crank shafts and fly wheels. The spring 45, of course, serves to keep the thermal element tightly in contact with the stem and to prevent wear therebetween.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as possible in view of the prior art.

I claim:

1. An internal combustion percussive hammer of the character described, including: a cylinder; a piston reciprocable therein; means for supplying to said cylinder a combustible charge comprising air and a fluid fuel; and means for automatically varying the proportion of fuel to air in accordance with the temperature of said hammer.

2. A hammer of the character described, including: a cylinder; a piston freely reciprocable therein and adapted to impart blows to a tool; means for supplying to said cylinder a combustible charge comprising air and a fluid fuel; and means for varying the proportion of fuel to air by and in accordance with the temperature of said hammer.

3. A hammer of the character described, including: a cylinder; a piston freely reciprocable therein and adapted to impart blows to a tool; means for supplying to said cylinder a combustible charge comprising air and a fluid fuel; and valve means for varying the proportion of fuel to air by and in accordance with the temperature of said hammer, said valve means being urged into contact with stop means when said hammer has reached normal operating temperature.

4. A hammer of the character described, including: a cylinder; a piston freely reciprocable therein and adapted to impart blows to a tool; means for supplying to said cylinder a combustible charge comprising air and a fluid fuel; and means for mixing said fuel with said air, said means including at least two orifices adapted to have fuel flow therefrom, one of said orifices having co-operating valve means so constructed and arranged as to permit flow when the temperature of said hammer is low and prevent flow when said

temperature has risen to a normal operating level.

5. A carburetor of the character described for an internal combustion percussive tool, including: means for supplying air to said tool; means for mixing with said air a quantity of fluid fuel which results in a proper combustible mixture for the tool at normal operating temperature; and means for automatically supplying to said air a greater quantity of fuel when said tool is at a lower temperature.

6. A carburetor of the character described for an internal combustion percussive tool, including: a carburetor body having a passage for supplying air to said tool, said passage having a seat therein; a valve member adapted to engage said seat to close said passage, said member lifting upon a demand for air by said tool; means for supplying liquid fuel to said air, said means comprising an orifice in said seat; and means for varying said supply of fuel by and in accordance with the temperature of said tool.

7. Apparatus of the character claimed in claim 6, wherein said supplying means includes two orifices, the flow through only one of said orifices being affected by the fuel varying means.

8. A carburetor of the character described for an internal combustion percussive tool of the type having a cylinder with a free piston therein, including: a carburetor body having a passage for supplying air to said cylinder; means for supplying liquid fuel to said air to form a combustible charge, said means including an orifice so restricted that the amount of fuel supplied is insufficient for proper combustion when said cylinder is cold; and auxiliary fuel supply means

including thermally operated control means permitting flow when said cylinder is cold and preventing flow when it has warmed to a normal operating temperature.

9. Apparatus of the character claimed in claim 8, wherein said control means includes a movable valve member urged into contact with a stop when said cylinder has reached normal operating temperature.

10. A carburetor of the character described for an internal combustion percussive tool of the type having a cylinder with a free piston therein, including: a carburetor body having a passage therethrough for supplying air to said cylinder, said passage having a seat therein; a valve member adapted to engage said seat to close said passage, said member lifting upon a demand for air by said tool; an orifice in said seat; means for supplying liquid fuel to said orifice to form a combustible charge with said air, said orifice being so restricted that the amount of fuel supplied is insufficient for proper combustion when said cylinder is cold; a second orifice in said seat; and means for supplying said second orifice with liquid fuel, said means including a valve member preventing flow when the tool has warmed to a normal operating temperature.

11. Apparatus of the character claimed in claim 10, wherein said last mentioned means includes a bimetallic strip urged into contact with said valve member by a spring to urge said member into contact with a seat about said orifice when said cylinder has reached normal operating temperature.

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