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K. HAAGE

2,740,385

HAMMER AND STARTING DEVICE THEREFOR

Filed June 19, 1951

2 Sheets-Sheet 1

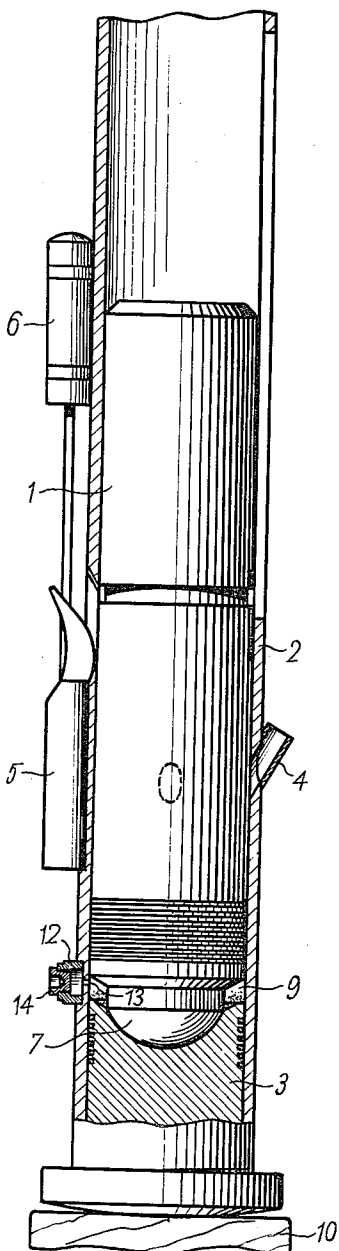


Fig. 1

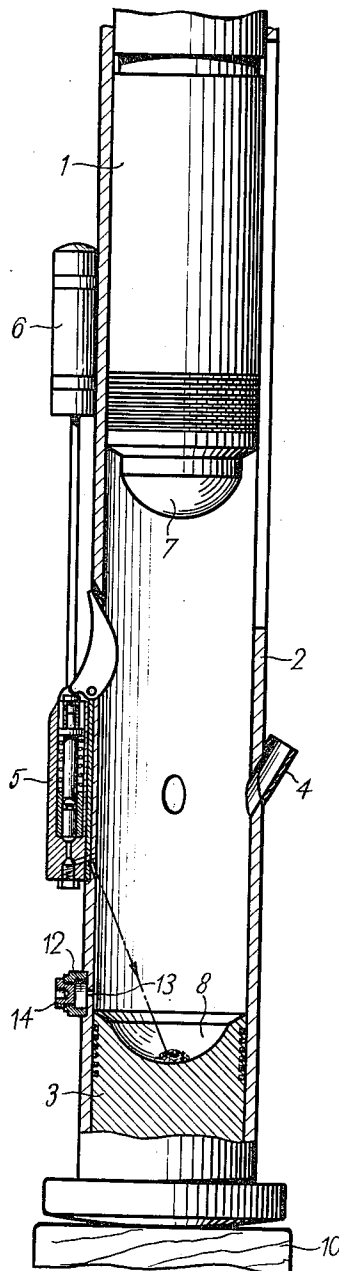


Fig. 2

Inventor
Konrad Haage
By Michael S. Stulken
att.

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K. HAAGE

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2 Sheets-Sheet 2

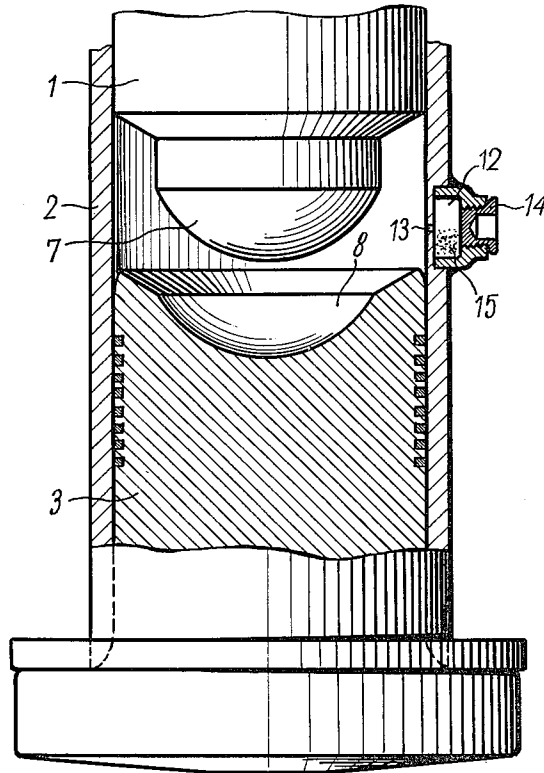


Fig. 3

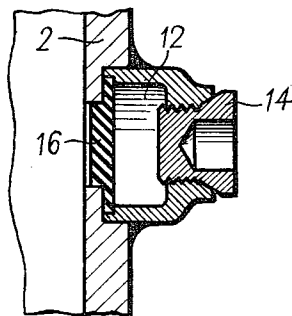


Fig. 4

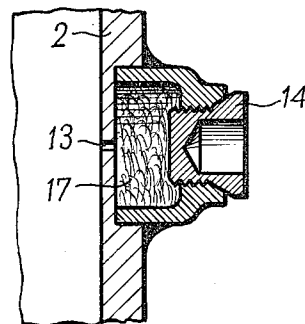


Fig. 5

Inventor
Konrad Haage
By Michael S. Striker
Att.

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HAMMER AND STARTING DEVICE THEREFOR

Konrad Haage, Esslingen-Kimmichweiler, Germany

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10 Claims. (Cl. 123—7)

The present invention relates to a process and apparatus for starting cold power devices which are driven by ignition of a fuel-air mixture due to compression of the atomized fuel in the compression chamber of the power device.

This type of power device is generally known in diesel engines, and it is generally a difficult matter to start this type of power device in cold and damp weather. Starting of this type of power device under such unfavorable conditions is extremely inconvenient, takes up much valuable time, and is almost impossible during stormy weather.

An object of the present invention is to provide an apparatus and process for starting such power devices under the most unfavorable circumstances and in a very short time.

A further object of the present invention is to provide a starting means and process of the type referred to above which are of a relatively simple construction and relatively simple to operate.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 shows a schematic, longitudinal, partial cross-section through a cylinder of a diesel ramming device to which the present invention may be applied, and in this figure the piston is shown in its lowermost position;

Fig. 2 is a partially sectional view similar to that of Fig. 1 where the piston is shown in its uppermost position;

Fig. 3 shows a fragmentary, partially sectional view on a larger scale of the downwardly moving piston adjacent to its lowermost position;

Fig. 4 is a cross-sectional view on a still larger scale through an embodiment of a starting device different from that shown in Fig. 3; and

Fig. 5 shows a still further embodiment of a starting device.

Referring to the drawings, there is shown the piston 1 of the diesel-type ramming device which is movable in the cylinder 2. At the starting of the device the piston 1 is raised to the position shown in Figure 2 by a winch (not shown) which is usually provided on a part of ramming devices of the type illustrated, and this feature does not form any part of the present invention. The piston 1 is releasably held in its uppermost position by a known release device (not shown) which is of no significance in the present invention and forms no part thereof. This release device permits the piston to fall by force of gravity from its uppermost position shown in Figure 2. While the piston is falling downwardly in cylinder 2, it pushes air in the cylinder 2 which is ahead of it out of the escape passages 4 into the open air surrounding the cylinder, and the piston 1 then compresses the air located beneath the passages 4 after the piston 1 moves downwardly beyond these passages so as to close the same.

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During its downward movement the piston operates on the pump device 5 which delivers an accurately controlled amount of fuel into the cylinder 2. This fuel is delivered to the pump 5 from the fuel tank 6. As is shown in Figure 2, the pump 5 delivers the fuel in the direction of the arrow onto the spherically shaped pan 8 of the ramming head 3 which forms the bottom of the cylinder.

The fuel which is gathered in the pan 8 is finely atomized by the blow of the piston 1 which strikes against the interior of the pan 8 with its spherical end 7, and the atomized fuel is sprayed into the ring-shaped compression chamber 9 located between the ramming head 3 and the piston 1, where the atomized fuel becomes immediately ignited as a result of the high compression in this chamber and explodes so as to throw the piston 1 upwardly in the cylinder 2. The ramming head 3 rests on the post 10 which is being rammed and transfers the force of the blow of the piston 1 against the ramming head 3 and also the force of the explosion to this post 10 so that the latter is forced into the ground.

The piston 1 which has been thrown upwardly by the explosion of the fuel frees the escape passages 4 during its upward movement, and in this way the exhaust gas which was under pressure flows for the most part outwardly through these passages 4.

As a result of its inertia, the piston 1 continues to move upwardly and in this way sucks fresh air into the cylinder through the short exhaust passages 4. Since these passages 4 are inclined upwardly, the fresh air newly admitted to the cylinder 2 flows into the lower part thereof and moves the gas already in the cylinder upwardly with the upwardly moving piston. After the piston 1 has reached its uppermost position, it again falls downwardly and moves the mixture of fresh air and spent gas remaining in the cylinder between piston 1 and passages 4 out through the passages 4 into the open air.

After the piston 1 has moved downwardly beyond the passages 4, it compresses the fresh air which is located beneath piston 1 while the measuring pump 5 delivers a fresh quantity of fuel into the pan 8. When the piston strikes the ramming head 3, the fuel located in the pan 8 is again atomized and the piston is again thrown upwardly by the explosion of the compressed fuel and air mixture, and this working cycle is repeated over and over.

While diesel-type ramming devices, as described above, work very satisfactorily in warm, dry weather, they have the disadvantage of being very difficult to start in cold, damp weather, especially when moisture from the air has condensed in the cold ramming device. As was mentioned above, the heating of the ramming device is time consuming, extremely inconvenient, and very difficult to accomplish in stormy weather.

Under these conditions, the present invention serves to overcome these difficulties. The temperature of the air compressed by the above-described ramming device is not sufficient to ignite diesel fuel oil under the above-described conditions of cold, damp weather. The temperature of the compressed air under the above conditions is adequate, however, to ignite a highly volatile fluid of a low ignition temperature, such as ether, for example. This easily ignitable fluid, according to the present invention, is admitted into the device at every cycle in amounts adequate for assuring the ignition of the conventional diesel fuel under the above conditions. The additionally added fluid serves only to aid in the ignition of the diesel fuel which, after it is thus ignited in the cold device, performs the major part of the work.

In order to admit this additional fluid to the ramming device during every cycle of the short starting period in the simplest possible manner, a chamber 12 is mounted on the cylinder 2 and the interior of this chamber 12

communicates with the ring-shaped compression chamber 9 (Fig. 1) through the relatively small bore 13. This chamber 12 is closed by a removable plug 14, which, for example, may be removably mounted on the chamber 12 by screw threads. When the chamber 12 is filled partially with a highly volatile fluid 15 having a low ignition temperature, a quantity of this fluid will enter into the compression chamber 9 during each cycle and cause the mixture therein to be ignited during the compression of the mixture. The amount of fluid 15 admitted during each cycle depends upon the size of bore 13.

The magnitude of the amount of easily ignitable fluid which is required to guarantee the ignition of the mixture when the device is cold depends upon the size of the ramming device, the degree of compression and the construction of the device. It is advisable to design the device so that there is admitted during each cycle a greater rather than a lesser amount of easily ignitable fluid, since a slight excess of the required additional fluid will not harm the operation in any way. The chamber 12 is designed to be of a sufficient size to contain an amount of easily ignitable fluid which will supply twenty to twenty-five cycles of the device. Such an amount is sufficient, since the ramming device becomes sufficiently warm after twenty to twenty-five working cycles to continue operation without any additional, easily ignitable fluid.

Instead of a single bore 13, a plurality of these bores may be provided. Also, as is shown in Figure 4, a porous wall section 16 may be provided in place of the bores 13. It also is suitable to provide in the chamber 12 a quantity of absorbent material 17 which is saturated with the easily ignitable fluid, instead of placing this fluid in liquid form into the chamber 12, as shown in Figure 3. The fluid which is carried by the absorbent material 17 is admitted to the compression chamber 9 in atomized form in the same way as the above described fluid 15.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of apparatus and process for starting power devices differing from the types described above.

While I have illustrated and described the invention as embodied in apparatus and process for starting cold diesel-type ramming devices, I do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of my invention.

Without further analysis, the foregoing will so fully reveal the gist of my invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a power device having a cylinder provided with a compression chamber and a piston movably mounted in the cylinder for igniting fuel in the compression chamber by compression of the fuel-air mixture, apparatus for starting the power device when it is cold comprising, in combination, a fuel chamber mounted on the outside of the cylinder adjacent the compression chamber; and duct means communicating with the interior of said fuel chamber and the interior of the compression chamber, whereby, when a volatile fuel having a low ignition temperature is located in said fuel chamber, said volatile fuel will pass to the interior of the compression chamber from said fuel chamber so as to be ignited by the movement of the piston in the compression chamber to thereby heat conventional fuel in the power device so that the latter will ignite the conventional fuel and become sufficiently

warm to operate only with a conventional fuel, said duct means comprising a portion of said cylinder wall which is porous.

2. In a power device having a cylinder provided with a compression chamber and a piston movably mounted in the cylinder for igniting fuel in the compression chamber by compression of the fuel-air mixture, apparatus for starting the power device when it is cold comprising, in combination, a closed fuel chamber mounted on the outside of the cylinder adjacent the compression chamber; and unobstructed duct means communicating with the interior of said fuel chamber and the interior of the compression chamber so that said fuel and compression chambers are in constant communication with each other, whereby, when an absorbent material saturated with a volatile fuel having a low ignition temperature is located in said fuel chamber, said volatile fuel will automatically pass to the interior of the compression chamber from said fuel chamber so as to be ignited by the movement of the piston in the compression chamber to thereby heat conventional fuel in the power device so that the latter will ignite the conventional fuel and become sufficiently warm to operate only with a conventional fuel.

3. A ramming apparatus comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through the wall thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; a chamber mounted on the outside of said cylinder about said passage means with the interior of said chamber communicating with said passage means, said chamber being formed in part by the wall portion of said cylinder which includes said passage means; and means for closing said chamber on the outside of said cylinder so that the interior of said chamber communicates only with said passage means, whereby, when the apparatus is cold and said chamber has a volatile fuel having a low ignition temperature located therein, said volatile fuel will pass to the interior of said cylinder between said ramming head means and piston means so that said volatile fuel will be ignited to heat conventional fuel in the ramming apparatus in order to start the same when it is cold.

4. A ramming apparatus comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through the wall thereof adjacent to said ramming head means, said passage means comprising at least one small opening formed in the wall of said cylinder; piston means slidably mounted in said cylinder; a chamber mounted on the outside of said cylinder about said opening with the interior of said chamber facing and communicating with said opening, said chamber being formed in part by the wall portion of said cylinder which includes said passage means; and means for closing said chamber on the outside of said cylinder so that the interior of said chamber communicates only with said passage means, whereby, when the apparatus is cold and said chamber has a volatile fuel having a low ignition temperature located therein, said volatile fuel will pass to the interior of said cylinder between said ramming head means and piston means so that said volatile fuel will be ignited to heat conventional fuel in the ramming apparatus in order to start the same when it is cold.

5. A ramming apparatus comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through the wall thereof adjacent to said ramming head means, said passage means comprising a porous cylinder wall portion; piston means slidably mounted in said cylinder; and a chamber mounted on the outside of said cylinder over said porous cylinder wall portion with the interior of said chamber communicating with said porous cylinder wall portion,

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whereby, when the apparatus is cold and said chamber has a volatile fuel having a low ignition temperature located therein, said volatile fuel will pass to the interior of said cylinder between said ramming head means and piston means so that said volatile fuel will be ignited to heat conventional fuel in the ramming apparatus in order to start the same when it is cold.

6. A ramming apparatus comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through the wall thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; a chamber mounted on the outside of said cylinder over said passage means with the interior of said chamber communicating with said passage means, said chamber being formed in part by the wall portion of said cylinder which includes said passage means; and means for closing said chamber on the outside of said cylinder so that the interior of said chamber communicates only with said passage means, whereby, when the apparatus is cold and said chamber has an absorbent material saturated with a volatile fuel having a low ignition temperature located therein, said volatile fuel will pass to the interior of said cylinder between said ramming head means and piston means so that said volatile fuel will be ignited to heat conventional fuel in the ramming apparatus in order to start the same when it is cold.

7. A ramming apparatus, comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through a wall portion thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; and a chamber, having one wall thereof formed by said wall portion of said cylinder, being located about said passage means with the interior of said chamber facing and communicating with said passage means, so that a volatile fuel having a low ignition temperature and located in said chamber will automatically move through said passage means into said cylinder between said ramming head means and piston means so as to become ignited for heating the ramming apparatus during the starting period thereof.

8. A ramming apparatus, comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a bore extending through a wall portion thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; and a chamber, having one wall thereof formed by said wall portion of said cylinder, being located about said bore with the interior of said chamber facing and communicating with said bore, said chamber being open only at said bore so

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that a volatile fuel having a low ignition temperature and located in said chamber will automatically move through said bore into said cylinder between said ramming head means and piston means so as to become ignited for heating the ramming apparatus during the starting period thereof.

9. A ramming apparatus, comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a passage means extending through a wall portion thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; a chamber, having one wall thereof formed by said wall portion of said cylinder, being located about said passage means with the interior of said chamber facing and communicating with said passage means, so that a volatile fuel having a low ignition temperature and located in said chamber will automatically move through said passage means into said cylinder between said ramming head means and piston means so as to become ignited for heating the ramming apparatus during the starting period thereof; and an absorbent material located in said chamber for holding the volatile fluid therein.

10. A ramming apparatus, comprising, in combination, ramming head means; an elongated cylinder mounted about a portion of said ramming head means and being formed with a bore extending through a wall portion thereof adjacent to said ramming head means; piston means slidably mounted in said cylinder; a chamber, having one wall thereof formed by said wall portion of said cylinder, being located about said bore with the interior of said chamber facing and communicating with said bore, said chamber being open only at said bore so that a volatile fuel having a low ignition temperature and located in said chamber will automatically move through said bore into said cylinder between said ramming head means and piston means so as to become ignited for heating the ramming apparatus during the starting period thereof; and an absorbent material located in said chamber for holding the volatile fluid therein.

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