

Sept. 21, 1937.

H. CORDES

2,093,634

DIESEL POWER HAMMER

Filed May 9, 1936

2 Sheets-Sheet 1

Fig. 1

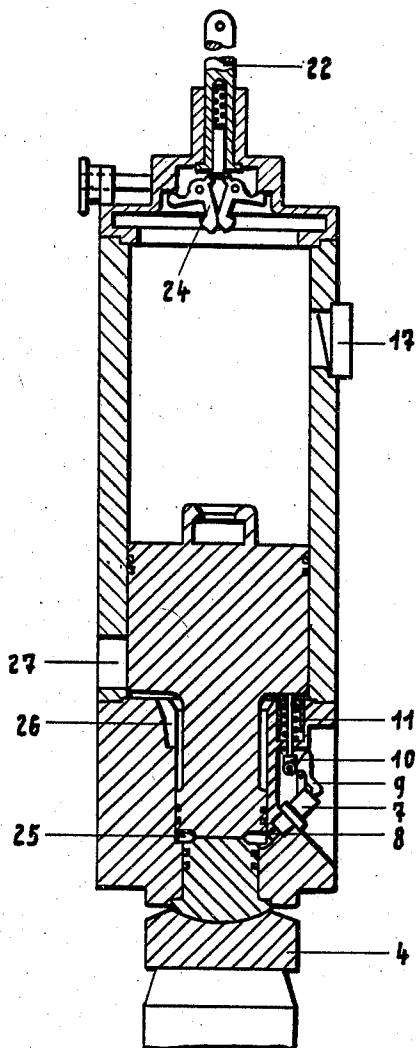
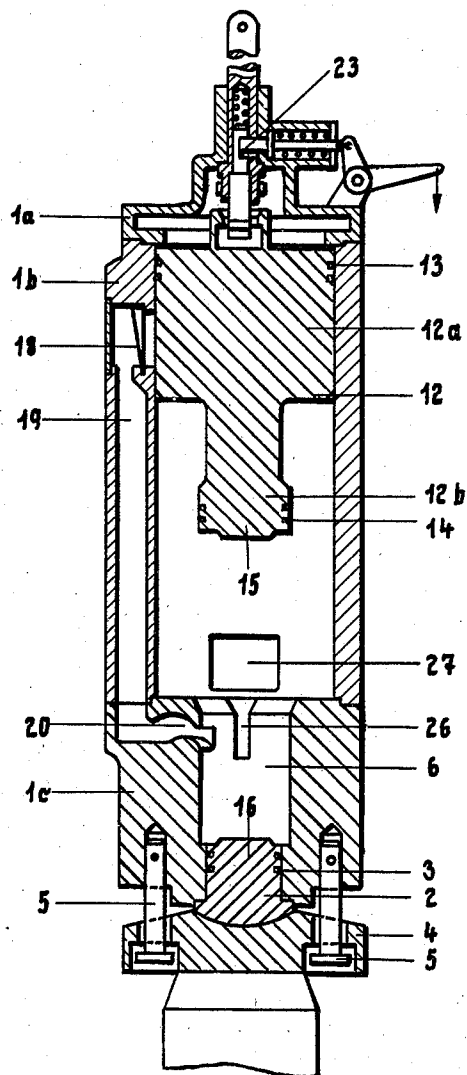


Fig. 2



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Fig. 3

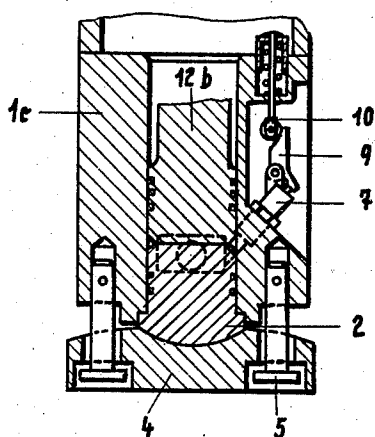


Fig. 4

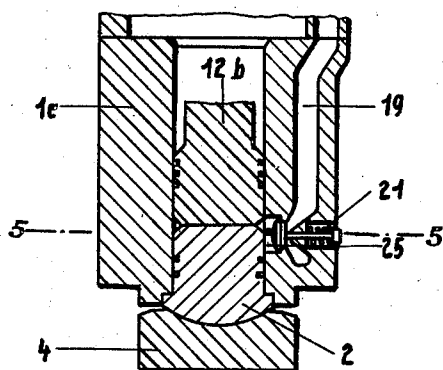
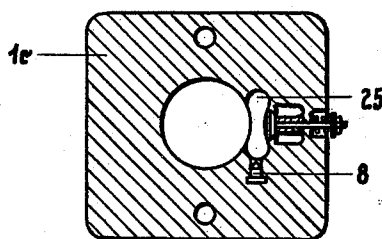


Fig. 5



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UNITED STATES PATENT OFFICE

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DIESEL POWER HAMMER

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4 Claims. (Cl. 123-7)

Among the so-called Diesel power hammers one form of apparatus (U. S. Patent 929,696) is known in which a cylinder rests on the impact plate, while a piston is acting as a ram, and in which, further, the cylinder bottom contains a bore in which a particular hammer block moves. This known form of apparatus contains a differential ram the upper part of which may act as an impact body, the combustion space being arranged at the end of its lower part with its comparatively small diameter. However, this known form of apparatus does not allow of injecting the fuel from outwards into pure air, as the impact face is of annular form and obturates the injecting chamber formed by recesses in the striking parts.

The present invention equally concerns a device of this kind, which, however, differs fundamentally from the known form in that the useful impact surface is arranged in the central part of the hammer block and of the ram, and that the injecting chamber is arranged outside of the impact surface.

The injecting chamber could for example be obtained in such a way that the piston and the hammer block each are designed with a projection of comparatively small diameter. Of course, the hammer block only may be equipped with a projection of this sort, as it is only fundamentally important that between the impact body moving as a ram within the cylinder and the hammer block reposing on the impact plate an injection chamber be left free while the ram strikes the hammer block. The injection chamber may, for example, be provided in the form of pockets contained in the cylinder wall, or it may be arranged symmetrically or asymmetrically relative to the hammer block, without a modification of the principle of the invention.

Further, it is preferable to have the piston go entirely clear of the combustion chamber, by which means a better scavenging effect with fresh air and better cooling are obtained.

In the accompanying drawings two forms of the new apparatus are shown, viz:

Fig. 1 shows one form of apparatus in a substantially central longitudinal section, the piston being raised,

Fig. 2 shows a central longitudinal section at right angles to that of Fig. 1 with the piston in the striking position,

Fig. 3 is another form of apparatus with a combustion chamber arranged laterally, the lower part of the entire device being shown only, Fig. 3 being a central longitudinal section,

Fig. 4 shows the same design in a central longitudinal section, at right angles to that of Fig. 3.

Fig. 5 is a section along line 5-5 in Figure 4.

The hammer body comprises an upper part 1a, a middle part 1b and a lower part 1c. The lower part contains a hammer block 2; it is obturated against the part 1c by means of piston rings 3. The hammer block 2 rests, by means of a spherical surface, upon the impact plate 4 which is connected with the hammer body by means of pins 5, thus permitting a certain longitudinal displacement as well as a certain inclination relative to the centre line of the hammer body at a certain angle in every direction. The hammer block 2 is, further, equipped with a shoulder against which the hammer body rests. It can freely move in the longitudinal direction of the hammer body, and its upper face bears a central abutment. The lower part 1c of the hammer body contains a cavity forming a combustion chamber 6 and carries a fuel pump 7 with an injecting nozzle 8 which is actuated by means of a curved lever 9 and a push rod 10. The push rod 10 is moved downwards by the impact body 12, and it is actuated in an upward direction by spring 11 when the shoulder 12 moves upwards.

Within the hammer body the said impact body 12 having the shape of a differential piston is arranged. Its upper part 12a is a cylindrical body the diameter of which is larger than that of the lower part 12b. Both parts of the impact body are provided with piston rings 13 and 14. The central part of the lower section of the impact body 12 is provided with an abutment 15 which may deliver an impact blow to the abutment 16 of the hammer block 2.

The central part 1b of the hammer body is equipped with an air filter and inlet valve 17 through which air may enter but which will prevent air from escaping. This valve 17 is arranged at substantially the same height as an overflow valve 18 permitting air to leave the cylindrical space of the overflow duct 19, but the action of which cannot be reversed. The duct 19 ends within the combustion chamber 6 in the form of an open tuyere 20 or, as shown in Figures 3 to 5, in a check valve 21 located near the lower end of the combustion chamber and which allows the air to escape from the duct 19, but prevents it from entering therein. According to the design in Figures 3 to 5, the overflow valve 18 may be omitted.

In the head 1a of the hammer body, a sliding rod 22 is arranged so as to be movable longitudinally; it can be arrested in its upper position by means of a locking pawl 23. At the same time

the rod is tightened in its seat in the head 1a so as to prevent air from escaping. Rod 22 carries hooks 24 which fit into a corresponding recess at the upper part of impact body 12.

The apparatus operates as follows:

To start the hammer, the winch rope of the pile driver is connected to the sliding rod 22. When the winch rope is released, rod 22 carrying the hooks 24 will drop, and the hooks 24 will engage the impact body 12 which thus can be lifted by means of the winch. Upon the impact body 12 having reached its upper position, the hooks 24 are released. As soon as the hooks 24 have been released, the impact body 12 will drop freely, thus producing within the combustion chamber 6 a compression of the air contained therein; at the same time air is drawn into the space provided above the impact body through inlet valve 17. After the air has been compressed, the impact body will strike the hammer block 2. In this way, the air will be driven from the central part to the circumference and will be caught in the space 25. This space, of annular form, surrounds the abutment 16 in the embodiment shown in Figures 1 and 2. In the modification shown in Figures 3 to 5, the annular space is of very restricted dimensions, and space 25 has been provided as a cavity in the wall of the combustion chamber. These two conceptions differ in that space 25 always maintains a constant volume as shown in Figures 3 to 5, without being influenced by the relative positions of the hammer block 2 and the hammer body. However, with a design as shown in Figures 1 and 2 the space 25 is reduced in volume in accordance with the difference in diameter. In this way the compression of the air will reach a higher degree, and by the action of the surplus surface, the hammer body is given an additional tendency to descend. In this way, the hammer body will follow the hammer block at a faster rate than it would without the effect of the compressed air. This feature is important whenever the soil yields quickly so that hammer block 2 descends at a very fast rate and that in the embodiment of Figures 3 to 5 the connection between space 25 and the contact face between parts 12 and 2 could be impaired. It is true that in this way a portion of the impact energy would be lost and transformed into compression work. The fuel jet will enter space 25 through the nozzle contained in its lower part, as shown in Figure 2; thus the impact body 12 when descending cannot interfere with the fuel jet. Further, in order to obtain for the atomization of the fuel a space of greater height, the cylinder bottom can be recessed in the proximity of the fuel nozzle. Of course, the design shown in Figures 1 and 2 would also allow of transposing the space in question into the cylinder walls, e. g. by arranging pockets or an annular space therein. This will be found particularly useful whenever the impact surface must be so large as to leave only little space for the space above mentioned. The space within the cylinder bore can, then, be completed by means of a cast-in or machined cavity of the cylinder body. The design shown in Figures 3 to 5 shows the last stage in this direction in which the aforementioned space has been nearly completely transposed into the cylinder wall.

The injection of the fuel into the compressed air is effected by means of a shoulder of the differential impact body 12 which pushes the pin 10 downwards against the tension of spring 11. Pin 10 may bear a roller which slides along the

lever 9. The rolling curve of lever 9 can be designed in such a way that the lever is accelerated without impact and that it will actuate the piston of the fuel pump with a practically constant velocity in spite of the variation of the speed of the impact body 12. After the fuel pump has reached its full stroke, the roller may proceed a bit further, thus allowing the impact body to enter the cylinder for some further distance. By this time the injection of fuel has practically ceased, and the ignition is caused by a correspondingly intense compression of the air. As a consequence of the combustion, the impact body is thrown upwards, and after the exhaust slots 26 have been opened, the hot gases will escape. A short time afterwards the canal 19 shown in Figures 1 and 2 opens and the air in the space above which has also been compressed by the rising impact body, can enter the combustion space through valve 18 and nozzle 20. As the cold gases are heavier than the combustion products, they will penetrate into the combustion chamber which process is favored by the circumstance that nozzle 20 is directed downwards. The impact body will entirely get out of the combustion cylinder, by which way the scavenging process of the combustion chamber is completed. Below the portion 12a of the impact body the exhaust gases and the surplus cold air escape through opening 27 in the cylinder casing. As soon as the impact body has reached a sufficient height to obturate overflow valve 18, the air contained in the space above impact body 12 will be compressed. This compressed air causes a back pressure acting on the impact body and delays its ascent, while at the same time it tends to lift the hammer body. Thus, an acceleration of the rate of working is obtained, because the impact body will rise for an amount which is smaller than that which would correspond to its natural rising height. As the weight of the hammer body must be considerable to obtain an appreciable acceleration of impact body 12, the air cushion which, of course, could also be replaced with some other elastic means, as for example a spring or a rubber bumper, could be omitted in those cases where a rapid succession of blows is not desired. It must still be pointed out that the technical details of the catching device for the impact body may be designed in any suitable way and that this catching device might even be omitted, for example, if starting were effected by compressed air.

I claim:

1. In a Diesel power hammer, in combination a housing containing a combustion chamber, a hammer block formed with an abutment extending through the bottom of said housing, an impact body movably mounted in said housing and formed with a reduced piston to fit said combustion chamber and adapted to strike said hammer block, said impact body and hammer block having centrally disposed impact faces, said housing having a fuel receiving space laterally of the impact face of said hammer block, a means for injecting fuel into said space, means for admitting air to said combustion chamber, and means for raising said impact body in said housing for starting purposes.

2. In a Diesel power hammer, in combination a housing containing a combustion chamber, a hammer block formed with an abutment extending through the bottom of said housing, an impact body movably mounted in said housing and formed with a reduced piston to fit said combustion chamber and adapted to strike said hammer

block, said housing having a fuel receiving space, means for injecting fuel into said space, means for raising said impact body in said housing for starting purposes, means for securely guiding said impact body in the upper part of said housing, the latter being so dimensioned as to permit the piston part of said impact body to completely leave said combustion chamber after each impact thereby admitting scavenging air to said combustion chamber.

3. In a Diesel power hammer, in combination a housing containing a combustion chamber, a hammer block formed with a shoulder for supporting said housing and with an abutment extending through the bottom of said housing, an impact body movably mounted in said housing and formed with a reduced piston to fit said combustion chamber and adapted to strike said hammer block, said housing having a fuel receiving space laterally of the impact face of said hammer block, means for injecting fuel into said space, means for admitting air to said combustion chamber, means for raising said impact body

in said housing for starting purposes, an impact plate formed with a spherical seat for said hammer block, and means connecting said impact plate to said housing so as to permit slight angular and longitudinal adjustment of said impact plate on said housing.

4. In a Diesel power hammer, in combination a housing containing a combustion chamber, a hammer block formed with a shoulder for supporting said housing and with an abutment extending through the bottom of said housing, an impact body movably mounted in said housing and formed with a reduced piston to fit said combustion chamber and adapted to strike said hammer block, said housing having a fuel receiving space laterally of the impact face of said hammer block, means for injecting fuel into said space, means for admitting air to said combustion chamber, means for raising said impact body in said housing for starting purposes, means in the upper part of said housing for cushioning the upward stroke of said impact body.

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