

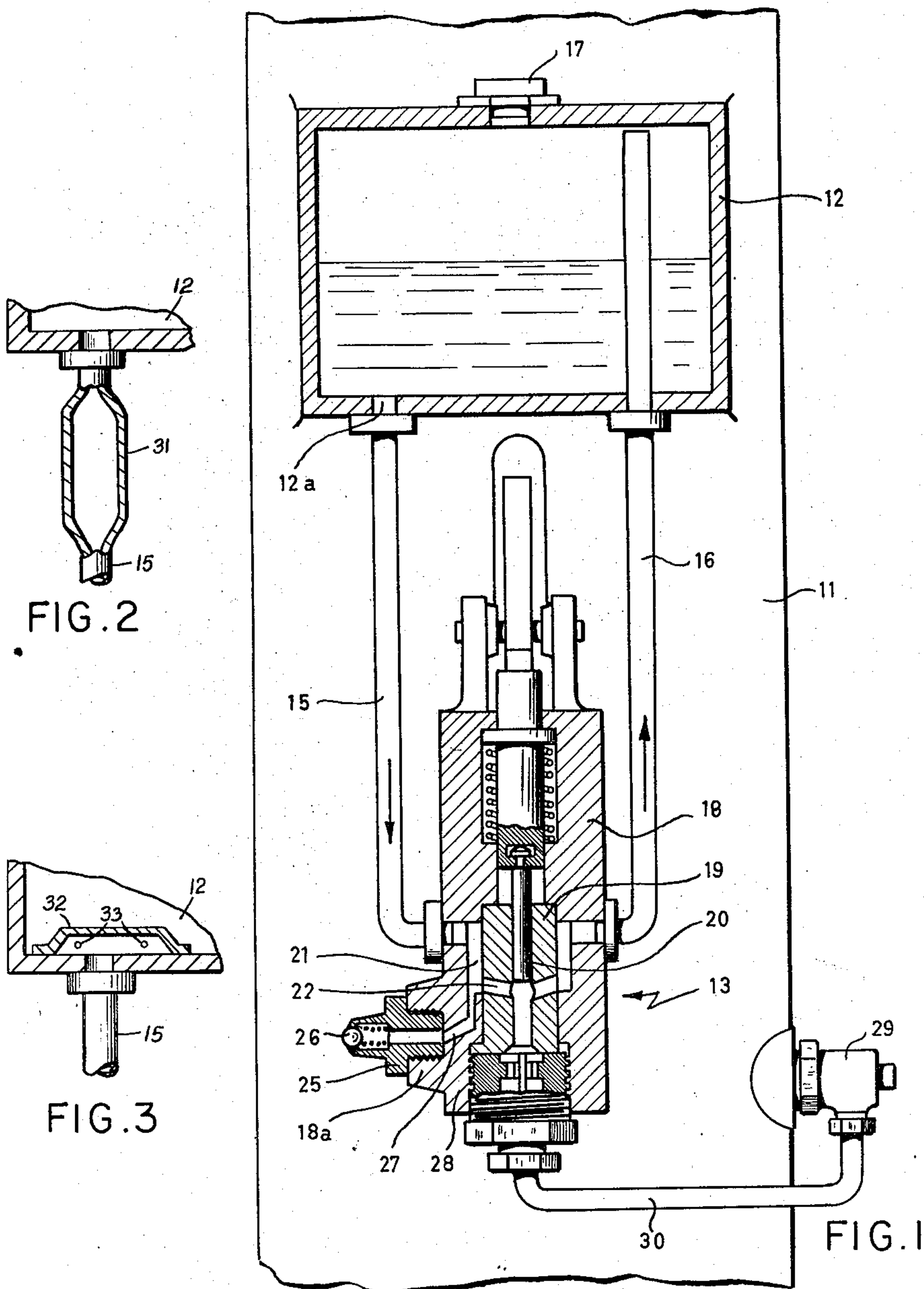
Sept. 20, 1960

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2,953,615

DIESEL HAMMER FOR PILE DRIVERS AND OTHER DRIVING DEVICES

Filed March 6, 1959



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2,953,615

## DIESEL HAMMER FOR PILE DRIVERS AND OTHER DRIVING DEVICES

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Filed Mar. 6, 1959, Ser. No. 797,735

Claims priority, application Germany Mar. 8, 1958

4 Claims. (Cl. 123—187.5)

The present invention relates to a diesel hammer for pile drivers and other driving devices which work in conformity with the internal combustion principle and are equipped with a fuel injection pump and a device for facilitating the starting of the driver by means of a special starting fuel.

Such diesel hammers, i.e. hammers which are operated as diesel engines, frequently do not start or start only under great difficulties in wet cold weather. A pre-heating of the engine cylinder is rather cumbersome, time-consuming and frequently, in stormy weather, can hardly be carried out. Therefore, in an effort to overcome these difficulties, it has been suggested to connect the compression chamber to an auxiliary chamber into which a volatile fuel of low ignition temperature is filled as for instance ether, such fuel in this connection being termed "starting fuel." During the cycle of the working piston, due to the pressure change in the cylinder, a small portion of the starting fuel will enter the cylinder and during the compression in said cylinder will, due to its low ignition point, initiate the ignition. Arrangements of this type have the drawback that the auxiliary chamber increases the compression chamber and thereby decreases the compression. Such auxiliary chamber has, therefore, to have only very small dimensions with regard to the compression chamber, which means that the auxiliary chamber can hold only a rather small quantity of starting fuel so that, in particular in cold weather, it is required to fill the auxiliary chamber quite a number of times before the hammer is in proper operation.

Therefore, so-called two-fuel hammers have been designed according to which the starting fuel is injected by an additional second fuel pump. While such hammers avoid the drawbacks of auxiliary chambers referred to above, they require an additional expensive and usually complicated injection pump and an additional second fuel container. Furthermore, after a certain time, namely when the hammer has become sufficiently heated up, the operation of the hammer has to be shifted from operation by starting fuel to operation by ordinary fuel.

It is, therefore, an object of the present invention to provide a diesel hammer for pile drivers and other driving means, which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a diesel hammer for pile drivers and other driving means, which will make it possible, without affecting the compression chamber and without the necessity of installing an additional injection pump and an additional fuel tank in the hammer, satisfactorily to start the diesel hammer in cold weather.

It is still another object of this invention to provide a diesel hammer of the type set forth in the preceding paragraphs, in which the shift-over operation of the diesel hammer from operation with starting fuel to operation with ordinary fuel will be brought about automatically.

These and other objects and advantages of the invention will appear more clearly from the following specification

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in connection with the accompanying drawing, in which Fig. 1 illustrates a diagrammatic section through a portion only of the cylinder of a diesel hammer according to the invention.

Figs. 2 and 3 respectively illustrate some modifications of the supply line from the fuel tank to the fuel injection pump, and of the fuel tank portion adjacent said supply line.

### General arrangement

The diesel hammer according to the present invention is characterized primarily in that the starting fuel is fed to the pump chamber through an inlet adapted to be closed by a shut-off member, and through a supply passage which leads into the lower portion of the pump chamber. The starting fuel pressed in this manner into the lower portion of the pump chamber displaces the ordinary fuel in said pump chamber and in the upper portion of the feeding line feeding the ordinary fuel into the pump chamber, at least partially and in the direction toward the tank for the ordinary fuel. The normal fuel injection pump which forms a standard part of the diesel hammer will then during the first cycles inject a pure starting fuel or a mixture of ordinary fuel greatly enriched with starting fuel into the compression chamber so that the diesel hammer will start with pure or almost pure starting fuel. To the extent to which the diesel hammer is being heated up by its operation, the mixture of starting fuel and ordinary diesel fuel decreases more and more as to the starting fuel so that after a relatively short while of the operation of the diesel hammer, the latter will be operated by pure ordinary diesel fuel only. In this way, a safe and instantaneous starting of the diesel hammer will also be assured in cold weather.

If more starting fuel is pressed into the pump chamber than would correspond to the volume of the pump chamber, the excessive starting fuel will mix with the ordinary diesel fuel in the tank for the latter. If the diesel hammer has only a rather short and narrow supply line for the ordinary fuel, according to the present invention, the said supply line is enlarged or widened by a corresponding enlargement. When the starting fuel is then pressed into the pump chamber and the supply line for the ordinary fuel leading into said pump chamber, the ordinary fuel will be displaced from the said enlargement so that sufficient starting fuel is stored in front of the pump chamber for a satisfactory starting operation of the hammer.

According to a modification of the present invention, instead of or in addition to the enlargement referred to above and provided in the supply line, the discharge opening at the bottom of the tank for the ordinary fuel may be covered by a chamber within said tank which chamber communicates through at least one bore with the interior of said tank.

According to the invention, the inlet for the starting fuel may be designed as a connecting nipple equipped with a check valve.

### Structural arrangement

Referring now to the drawing in detail showing a portion 11 only of the cylinder of the diesel hammer, said cylinder has connected thereto a fuel tank 12 for ordinary diesel fuel and a fuel injection pump 13. Pump 13 is adapted to communicate with tank 12 through a supply or feeding line 15 and through a venting line 16. The discharge opening 12a for feeding line 15 is provided at the bottom of tank 12, whereas the venting line 16 extends almost to the top of tank 12 which latter is provided with a removable closure 17. In customary manner, the fuel injection pump 13 comprises a pump cylinder 19 mounted in a housing block 18. Reciprocally mounted in the cylinder chamber of cylinder 19 is a piston 20 which is actuated in standard manner. Inasmuch as such actuat-



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ing means are well known and do not form a part of the present invention, these actuating means have not been shown in the drawing. Pump cylinder 19 with its pressure chamber communicates through a connecting member 28 and conduit 30 with an injection nozzle 29 connected to cylinder 11 of the diesel hammer. The feeding line 15 communicates through pump chamber 21 and a transverse passage 22 in pump cylinder 19 with the pressure chamber of pump cylinder 19. The lower portion of the housing block 18 of pump 13 is provided with a connection 18a having laterally connected thereto a filling nipple 25 for forming the inlet for the starting fuel. The filling nipple 25 includes a check valve, for instance in form of a spring-loaded ball 26, and communicates through a feeding passage 27 with the pump chamber 21 within the range of the mouth of the above mentioned transverse passage 22 of pump cylinder 19.

When the diesel hammer is to be started in cold weather, the filling nipple 25 is connected with any suitable starter fuel supply source or supplying device, as for instance a starter fuel tank under pressure or a manually operable press, by means of which starter fuel will be pressed through filling nipple 25 and feeding passage 27 into the pump chamber 21, 22. If a sufficient quantity of starting fuel is pressed into the diesel hammer, this starting fuel will displace or push back the ordinary fuel in the pump chamber and, as the case may be, also in the feeding line 15 and sometimes even up to the connection of the feeding line 15 with the tank 12, so that a considerable quantity of starting fuel in pump chamber 21, 22 and feeding line 15 will be available to the pump during the first cycle thereof so that a quick and proper start of the diesel hammer will be assured.

If desired, in conformity with a further development of the present invention, the feeding line 15 may have an enlargement or chamber 31 as indicated in Fig. 2. It will be appreciated that the said chamber 31 increases the capacity of feeding line 15 whereby it will be possible to press an increased quantity of starting fuel into and temporarily to store the same in said feeding line 15 without any material mixing with the ordinary fuel from tank 12, so that a larger quantity of pure starting fuel will be available for the starting of the diesel hammer.

Instead of the said enlargement 31, or in addition thereto, there may be provided in tank 12 a cap-like chamber 32 which is arranged above the outlet 12a and communicates with the interior of tank 12 through at least one bore 33. Said chamber 32 which is shown in Fig. 3 likewise increases the capacity of feeding line 15 in a manner similar to that described above and for the purpose mentioned in connection with chamber 31.

It is, of course, to be understood that the present invention is, by no means, limited to the particular construction shown in the drawing but also comprises any modifications within the scope of the appended claims. It is also to be understood that the present invention is not limited to diesel hammers for pile drivers but can also be used with other driving devices employing the fuel injection principle.

What I claim is:

1. In a pile driving device and other driving devices employing the internal combustion principle: a cylinder, a fuel injection pump having a pump chamber receiving the fuel to be injected into said cylinder, first conduit means leading into the lower portion of said pump chamber and adapted to be connected with an outside source of starting fuel, shut-off valve means mounted in said first conduit means for closing the latter toward the outside of said driving device, a fluid reservoir carried by said driving device for receiving and storing normal fuel

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for normal operation of said driving device, and second conduit means leading from said reservoir into the upper portion of said pump chamber, said shut-off valve means being adapted to be opened to admit starting fuel from an outside source into said first conduit means and through the latter into said pump chamber whereby the normal fuel in said pump chamber will at least to a certain extent be displaced from said pump chamber into said second conduit means in the direction toward said reservoir.

2. A device according to claim 1, in which a portion of said second conduit means is provided with an enlargement.

3. In a pile driving device and other driving devices employing the internal combustion principle: a cylinder, a fuel injection pump having a pump chamber receiving the fuel to be injected into said cylinder, first conduit means leading into the lower portion of said pump chamber and adapted to be connected with an outside source of starting fuel, shut-off valve means mounted in said first conduit means for closing the latter toward the outside of said driving device, a fluid reservoir carried by said driving device for receiving and storing normal fuel for normal operation of said driving device, the bottom portion of said reservoir being provided with a fuel outlet, housing means located in spaced arrangement to and over said fuel outlet so as to confine a chamber with the adjacent bottom portion of said reservoir, said chamber having at least one opening establishing communication between the interior of said chamber and the adjacent portion of said reservoir, and second conduit means leading from said reservoir into the upper portion of said pump chamber, said shut-off valve means being adapted to be opened to admit starting fuel from an outside source into said first conduit means and through the latter into said pump chamber whereby the normal fuel in said pump chamber will at least to a certain extent be displaced from said pump chamber into said second conduit means in the direction toward said reservoir.

4. In a pile driving device and other driving devices employing the internal combustion principle: a cylinder, a fuel injection pump having a pump chamber receiving the fuel to be injected into said cylinder, first conduit means leading into the lower portion of said pump chamber, a connecting nipple connected to said first conduit means and adapted to be connected with an outside source of starting fuel, a check valve associated with said connecting nipple and normally closing said first conduit means toward the outside of said driving device, a fluid reservoir carried by said driving device for receiving and storing normal fuel for normal operation of said driving device, and second conduit means leading from said reservoir into the upper portion of said pump chamber, said shut-off valve means being adapted to be opened to admit starting fuel from an outside source into said first conduit means and through the latter into said pump chamber whereby the normal fuel in said pump chamber will at least to a certain extent be displaced from said pump chamber into said second conduit means in the direction toward said reservoir.

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