Dec. 6, 1938. K. SEIDL 2,139,608

EXPLOSION ACTUATED PERCUSSION TOOL

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Fig. 1

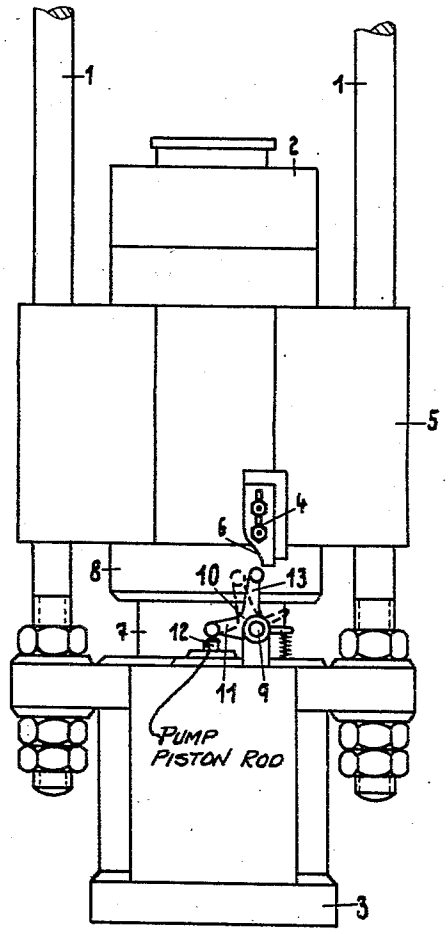

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Fig. 2

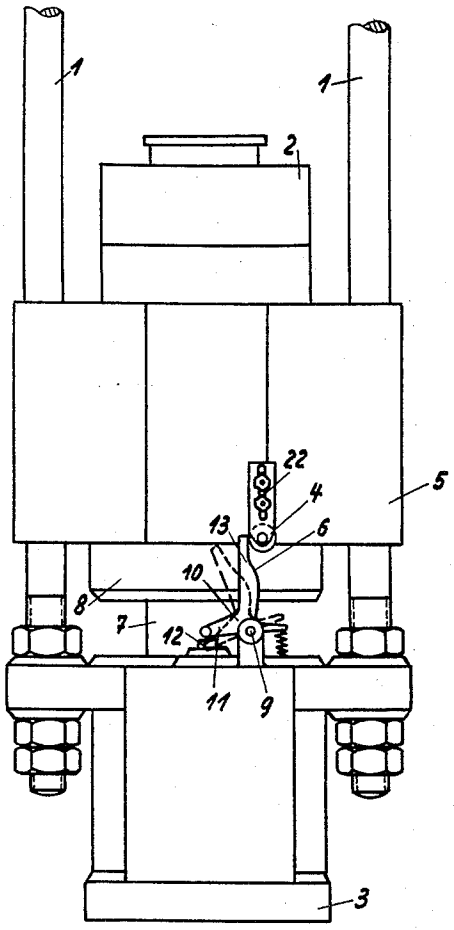

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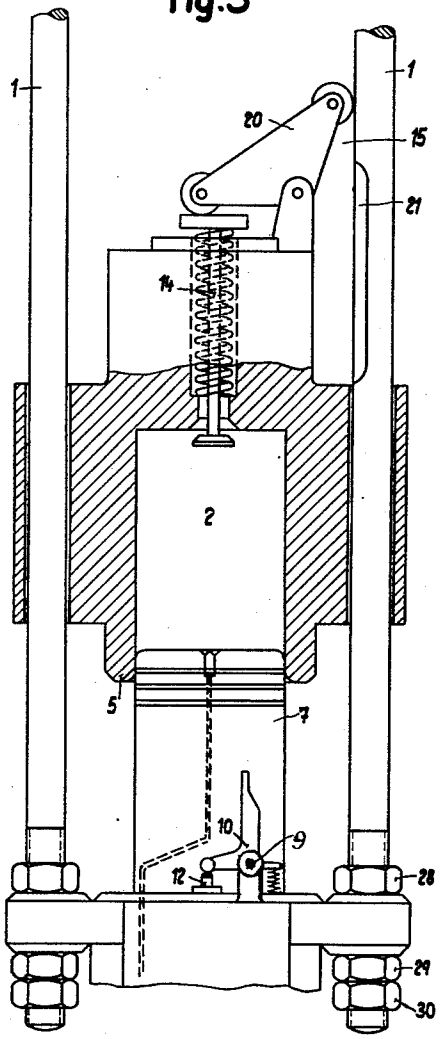
Fig.3



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EXPLOSION ACTUATED PERCUSSION TOOL

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2 Claims. (Cl. 123—7)

Explosion operated percussive tools, such, for example, as pile drivers in which a fuel pump is operated by a cam when the hammer descends and in which, also, means are provided for throwing the pump into and out of operation are known per se but the adjusting device has only been used to shut off the pump and for preliminary pumping. It has been found when pile-driving in loose ground, that the pile to be driven is forced into the ground without the descending hammer actually touching the anvil or cap which the pile carries. This action takes place when the pressure exerted by the air compressed in the working or ram cylinder is greater than the force required to produce yielding of the pile. In other words, the pile, in this case, is driven by the action of the compressed air but, as the hammer no longer reaches the piston of the fuel pump, no subsequent explosion can occur.

The present invention provides means whereby various adjustments of the fuel injection are positively obtained under the various working conditions. The invention also includes means whereby the starting of the hammer is facilitated and cheapened to an extraordinary degree and, as a further feature, permits of introducing into the working cylinder explosives which are capable of being exploded without the admixture of air and without compression and of exploding such substances in the usual way.

Two embodiments of the invention are shown, by way of example, in the accompanying drawings, in which

Fig. 1 shows, in elevation, the lower part of one embodiment,

Fig. 2 is a similar view of a second embodiment, while

Fig. 3 is part sectional elevation of a third embodiment.

Fig. 1 shows a constructional form which is capable of affording an explosion even when the hammer 5, guided by guide rods 1, as usual, fails to reach its anvil.

For this purpose there is arranged at the side of the anvil a bell crank lever 10 which is pivoted at 9 and of which the horizontal arm 11 is adapted to act on the piston 12 of the laterally arranged fuel pump. The other arm 13 of the bell crank lever is substantially vertical and is disposed to be acted upon by an abutment or tappet 4 on the hammer 5. The tappet 4 is provided with a curved inclined surface 6, which when the hammer descends, rocks the arm 13 of the bell crank lever 10 sideways and thereby causes the arm 11 of the lever to exert pressure on the pump piston 12. The result of providing the bell crank lever is that the hammer is by no means compelled to reach its anvil in order to effect the injection of the fuel; consequently the explosions continue to take place in the working cylinder even when the driving of the pile is being effected solely by means of the compressed air cushion. Furthermore, the provision of the inclined surface 6 on the tappet 4 has the advantage that the rocking of the bell crank lever 10 need not, by any means, take place at the same velocity as the descent of the hammer. The lever can, in fact, move much more slowly, thus avoiding such damage to the pump as would be likely to result from a heavy impact at high speed. Preferably the tappet 4 is adjustable vertically on the hammer, so as to enable the instant of operation of the pump to be determined at will. The anvil cap on the head of the pile, for taking the blow of the hammer, is denoted by 3. 8 is the lower portion of the working cylinder and 7 the power piston coacting with said cylinder and carried by said anvil.

In the embodiment shown in Fig. 2 the tappet 4, for regulating the commencement and progress of fuel injection is also mounted on the hammer but in this case its active portion consists of a rotating roller adapted to coact with the arm 13 of the bell crank lever 10, the inclined and curved cam surface 6 being on this arm 13. The other arm 11 of the bell crank lever may act directly on the piston 12 of the fuel pump, as in the foregoing example. For the purpose of varying the quantity of fuel injected, the tappet 4 is made adjustable. The drawing shows means designated generally by the reference 22, for vertically adjusting the axis of rotation of the tappet roller, the means comprising a longitudinal slot and cooperating with bolts and securing nuts. For the rest, the curve of the cam on the lever arm 13 is shaped so as to have the characteristic necessary for correct injection.

In the embodiment shown in Fig. 3 the bell crank lever 20 is pivoted to the hammer 5 of the percussion tool, the working cylinder 2 being incorporated in the hammer. The bell crank lever 20 acts on a spring closed non-return valve 14 opening into the cylinder, the opening of this valve taking place when the vertical arm of the bell crank lever 20 rides on to and along the projecting part 15 of the abutment. When the stationary piston 7, carried in this case, by the pile which is to be driven, has entered the cylinder 2, one arm of the bell crank lever 20 moves on

to the lower recessed part 21 of the abutment, so that the valve 14 is closed.

By adjusting the abutment vertically as by the nuts 28, 29 and 30 it can be ensured that compression in the cylinder 2 commences only when the piston 7 has already moved some distance into the said cylinder. Towards the end of the stroke, that is to say, when the hammer 5 has struck the pile, the compression is so high that ignition follows. Obviously, care must be taken that the abutment is not set too low down, as the compression in the cylinder must attain a value sufficient to bring about auto-ignition.

Thus this arrangement can ensure explosions taking place under all circumstances, even when the ground is soft. However, it also serves to regulate the force of the blow delivered, by varying the compression. Normally, excess compression is employed, that is to say, the compression greatly exceeds the amount necessary for auto-ignition.

Apart from this, however, the arrangement shown in Fig. 3 has the advantage that it provides for the scavenging of the cylinder. Both on the descent and on the ascent of the hammer the valve is open for most of the time, so that the movement of the hammer produces a draught of air which takes care of scavenging. The arrangements shown in Figs. 2 and 3 can obviously be applied both to one and the same hammer.

It will be seen that the arrangement according to this invention is very cheap as to initial cost and that it greatly facilitates the starting of an explosion actuated percussion tool extraordinarily.

What I claim is:

1. In explosion operated percussion tools of the type described, in combination a hammer containing a compression cylinder, a piston adapted to enter said cylinder, a fuel injection pump, a rocking lever for operating said pump, a control member carried by said hammer for actuating said rocking lever on the descent of said hammer, and means mounting said control member on said hammer for adjustment with respect thereto to predetermine the instant of operation of the pump by said control member.

2. The combination as specified in claim 1, including an air-outlet valve provided in said hammer in the top of the compression cylinder therein, means normally closing said valve, a bell-crank lever carried by said hammer, one arm of said bell-crank lever bearing against the protruding stem of said air-outlet valve, and a means controlling the position of said bell-crank lever so as to actuate the same to open said air-outlet valve upon said hammer and said piston becoming separated.

KARL SEIDL.