Oct. 1, 1935. F. W. CAMP 2,016,250

BLASTING APPARATUS

Filed Feb. 28, 1933

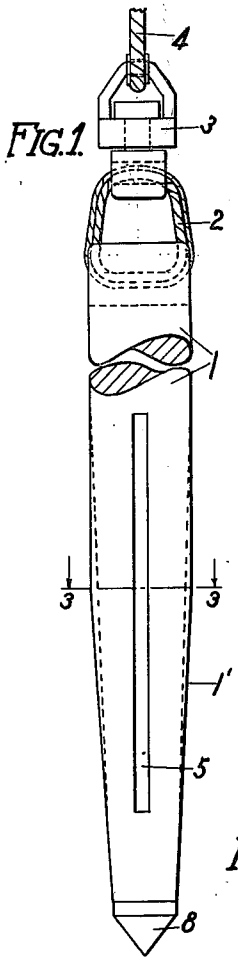


FIG. 1.

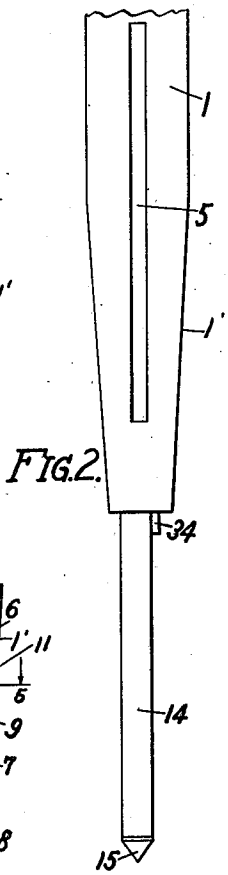


FIG. 2.

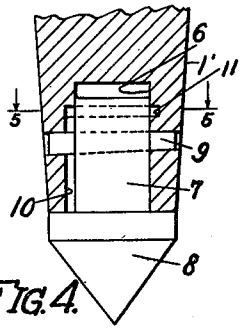


FIG. 4.

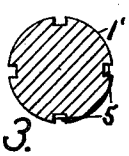


FIG. 3.

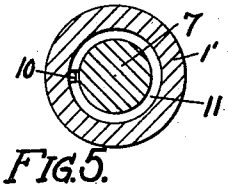


FIG. 5.

FIG. 7.

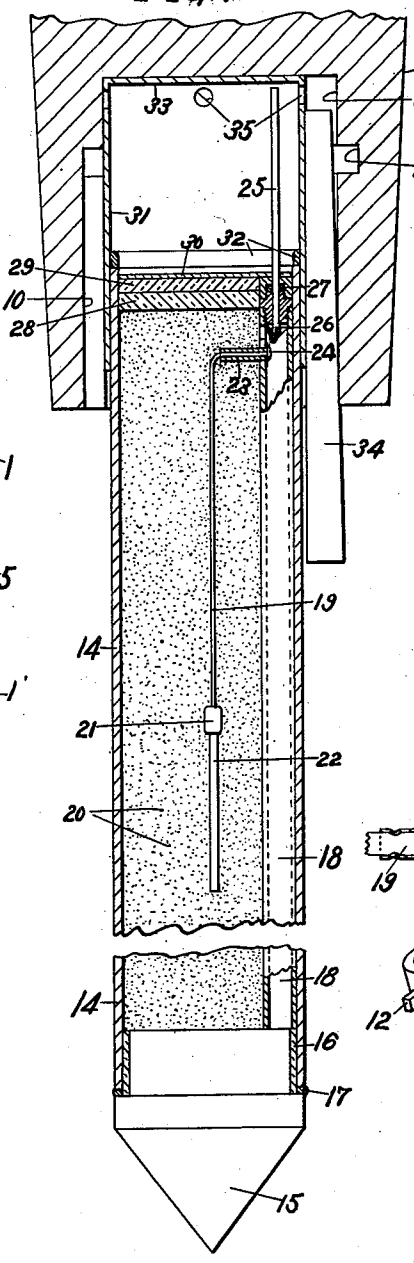


FIG. 8.

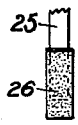


FIG. 9.

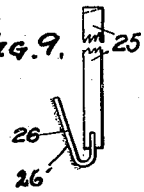


FIG. 10.



FIG. 11.

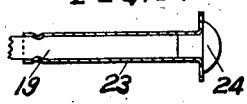
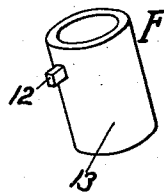


FIG. 6.



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UNITED STATES PATENT OFFICE

2,016,250

BLASTING APPARATUS

Frank W. Camp, San Francisco, Calif., assignor, by direct and mesne assignments, of fifteen per cent to Joseph Liberman, San Francisco, Calif., and ten per cent to Bernard B. Stimmel.

Application February 28, 1933, Serial No. 658,928

7 Claims. (Cl. 102—4)

This invention relates to blasting apparatus of the type shown in my prior Patent No. 1,560,038 of November 3, 1925, and has for its objects improvements over said apparatus whereby the operations of blasting may be more expeditiously carried out. Specific advantages and details of construction will appear in the following specification and accompanying drawing.

Briefly described, the invention consists of a special arrangement of falling weight with a cylindrical rock-penetrating explosive bomb attached at the end of the weight, so as to be driven into the rocky formation upon dropping the weight for blasting a passage for subsequent driving of piles in such formation, the weight being removed before the explosion takes place.

The principal feature of the present invention consists in the special means of attaching the rock-penetrating bomb to the weight, and the automatic means for igniting the charge.

Another feature is the provision for use of different diameter bombs.

In the drawing Fig. 1 is an elevation of the suspended weight without the bomb attached but with a rock-penetrating point in place for making a preliminary entering hole.

Fig. 2 is an elevation of the lower portion of the weight showing the cylindrical pointed bomb in place.

Fig. 3 is a cross section of Fig. 1 as seen from the line 3—3 thereof.

Fig. 4 is an enlarged vertical section of the lower end of the weight of Fig. 1 showing the means of attaching its rock-penetrating point.

Fig. 5 is a cross section of Fig. 4 as seen from the line 5—5 of Fig. 4.

Fig. 6 is a perspective view of a bushing for the lower end of the weight to adapt it for smaller size cylindrical bombs.

Fig. 7 is an enlarged vertical section of the cylindrical bomb secured by a wedge to the lower end of the weight, and showing the firing pin arrangement.

Fig. 8 is an enlarged view of the lower end of the firing pin shown in Fig. 7.

Fig. 9 is a view of Fig. 8 at right angles to the view shown in Fig. 8.

Fig. 10 is an enlarged view of the cap retaining slot for the fuse shown in Fig. 7.

Fig. 11 is an enlarged view of the cap shown in Fig. 7.

In further detail, the weight 1 is an elongated steel shaft of a diameter and length depending on the size holes to be drilled and blasted (one now in use being about 8 inches in diameter, about 25 feet long, and weighing about 6000 pounds), and suspended at its upper end by a loop of steel rope 2 or other suitable connection to a swivel joint 3 in turn suspended from a cable 4 which passes upward over a supporting sheave, not shown, and to a winding drum, not shown, all in a manner so that the weight can be raised and dropped like a pile drived weight.

The lower portion of the weight is tapered as shown at 1' and the sides are longitudinally grooved as at 5 to let water escape upward when the weight is dropped into rocky formation at the bottom of waterways, such as bays, rivers, etc., in making holes for subsequent pile driving.

At the lower end of the weight is a circular recess 6 into which fits the stem 7 of a hard steel rock penetrating point 8, the stem being held in place by a wedge 9 driven transversely through suitable apertures formed in the weight and stem of the point.

In Fig. 4 it will be seen that at one side of the recess 6 is a vertical keyway 10 which joins a circular groove 11 at its upper end. This is to receive a pin 12 of a bushing 13 (Fig. 6) which may be pushed into the recess and turned to bring the pin 12 into the groove 11 to hold it in place and thus effectively change the bore of the weight to a smaller size for small diameter bombs.

In Fig. 7 a rock-penetrating bomb is shown in place in the weight (the preliminary rock penetrating point 8 having been removed). The bomb consists of a strong cylindrical shell 14 (generally about three feet long) fitted with a hard steel point 15 at its lower end, and which point may conveniently be sulphured in place with melted sulphur at 16 and further welded as at 17 around the lower edge of the cylinder 14 and a shoulder formed on the point as indicated. Extending along one side of the space within the cylinder is a pipe 18 to hold air and gases for proper operation of the fuse 19 which extends downward through a mass of explosive 20 to a suitable detonator 21 which in turn fires an exploder cap 22. The upper end of the fuse passes through a horizontally extending pipe nipple 23 into pipe 18 where the fuse end is covered with a friction ignition substance 24, while slidably positioned above the fuse end in pipe 18 is a rod or firing pin 25 carrying at its lower end a flat spring 26 surfaced with friction material 26' on one face such as a sanded surface or otherwise roughened exterior as is found on safety match boxes for striking, so arranged that upon descent the roughened surface will rub across the friction ignition button 24 at the end of the fuse and

ignite the fuse. The firing pin 25 is normally held in raised position by means of a stuffing box 27 fitted in the closed upper end of pipe 18 and through which the pin passes, and it is pushed downwardly by the descent of the weight 1' itself upon the point of the bomb striking the earth. The upper end of the firing pin is grooved as at 25' to indicate the proper position of the spring 26 for engaging the button 24. The upper end of the explosive-containing cylinder 14 is sealed over at 28, 29 as by layers of cement followed by a layer of paraffine 30 poured on after the upper layer of cement has set, while forced snugly over the end of the cylinder is an outer inverted sheet metal cylindrical hood 31 additionally held in place as by a soft metal shearing ring, such as lead, 32, which may be soldered to the inside of outer sheet metal cylinder 31 and rests firmly upon the upper end of cylinder 14 so as to hold the parts in the relation shown with the upper closed end 33 of the hood spaced slightly above the firing pin 25. The bomb assemblage is then held in place within the recess of the weight by means of one or more wooden wedges as at 34 pushed upward into the crescent space between the wall of the recess and the outer surface of the hood as shown in Fig. 7. Hood 31 is perforated at the side as at 35 to permit the contained air to get out when telescoped by the weight upon the bomb reaching the ground.

The diameter of the bombs may be of any size up to the recess in the weight and the wedge can be inserted in the keyway 10, though if very small bombs, say of 2 inches or so in diameter, are used, the bushing 13 is first placed within the recess so as to better centralize the bomb.

The particular explosive used for filling the bombs will depend on the nature of the work being done, but for blasting pile holes in rocky formation I find nitro-starch 60% to be satisfactory.

In using the invention, the weight with point attached is generally first dropped about 50 feet from a pile driving rig into the formation to start the penetration, then hauled up, the point 8 removed, bomb inserted in its place and again dropped. When the point of the bomb strikes the rock hood 31 will be telescoped over cylinder 14, firing pin forced down, fuse ignited, and bomb driven several feet into the rock where it will stick by friction as the weight is at once pulled upward and out of the water covering the buried bomb before the bomb goes off. The length of fuse 19 is arranged to give about four seconds' time for removing the weight although it is obvious that the fuse can be made to give a longer or shorter time as may be desired.

On account of the great weight of the weight 1, it will drop like a plummet, and if the blasting is being done through a great depth of water, it will nevertheless strike the same spot any number of times after a bomb has been placed in it and again dropped. In fact, a high wind or cross currents in the water have no perceptible effect on it.

In forming holes of considerable depth, the operations described may be repeated as often as required as the loose rock seems to burn and to blow out of the hole formed or is spread and what remains is easily penetrated by the relatively small diameter tool under the great pressure induced by the falling mass of metal above it.

Having thus described my improved structure, what I claim is:—

1. A blasting bomb adapted to be forced into the formation to be blasted comprising an elongated cylinder containing an explosive, a hard point on the lower end of the cylinder, a time fuse within the cylinder, a firing pin arranged to slide through the upper end of the cylinder and normally projecting therefrom, means operated by downward sliding of the pin for igniting the fuse, and a telescopic hood over the upper end of the cylinder protecting said firing pin normally held in place by securing means displaceable by downward movement of said hood relative to said cylinder.

2. A blasting bomb adapted to be forced into the formation to be blasted comprising an elongated cylinder containing an explosive, a hard point on the lower end of the cylinder, a time fuse within the cylinder, a firing device for said fuse arranged to operate through the upper end of said cylinder by force applied from above, a tube within the explosive-containing chamber of the bomb holding an air supply for said fuse.

3. Blasting apparatus comprising a heavy metal shaft adapted to be raised and dropped, said shaft arranged to be suspended vertically from the upper end thereof, a cylinder containing an explosive disposed in substantially axial alignment with the shaft and projecting from its opposite end, said bomb being releasably secured to the shaft and means permitting axial movement of the shaft and cylinder relatively upon the cylinder being driven into the formation when the shaft is dropped, and delay firing means for setting off the explosive actuated by the said axial movement of the shaft and cylinder relatively.

4. Blasting apparatus comprising a weight adapted to be raised and dropped, a bomb, means temporarily securing the bomb to the lower end of said weight, said weight being appreciably heavier than the bomb for driving the bomb into the formation to be blasted upon dropping the weight, delay firing means for setting off the bomb operated upon the bomb striking the formation and giving time for removal of the weight before the bomb is exploded, said firing means including a time fuse within the bomb, an ignition device at the end of the fuse, and a cooperating ignition device adapted to be moved through relative movement of the weight and bomb, and means for withdrawing the weight from the bomb after the bomb has been driven into the formation and is held thereby.

5. Blasting apparatus comprising a weight adapted to be raised and dropped, a bomb, means for temporarily securing the bomb to the lower end of said weight, said weight being appreciably heavier than the bomb for driving the bomb into the formation to be blasted upon dropping the weight, delay firing means for setting off the bomb operated upon the bomb striking the formation and giving time for removal of the weight before the bomb is exploded, said firing means including a time fuse within the bomb, an ignition device at the end of the fuse, and a firing pin adapted to be forced downward by the weight and arranged to actuate said ignition device, and means for withdrawing the weight from the bomb after the bomb has been driven into the formation and is held thereby.

6. A blasting bomb adapted to be driven into the formation to be blasted comprising an elongated cylinder provided with a hard driving point at one end and containing an explosive, a time fuse within the cylinder, a firing device for said fuse arranged and adapted to be actuated

by application of a force external of the cylinder and an air chamber within the explosive containing cylinder for holding an air supply for said fuse.

7. A blasting bomb adapted to be driven into the formation to be blasted comprising an elongated cylinder provided with a hard driving point at one end and containing an explosive, a time fuse within the cylinder, a firing device for said fuse arranged and adapted to be actuated by application of a force external of the cylinder and an air container within the explosive containing cylinder provided with an opening communicating with said fuse for supplying air for said fuse.

FRANK W. CAMP.