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A. U. DAVIS  
BLASTING MACHINE

2,458,687

Filed March 1, 1945

3 Sheets-Sheet 1

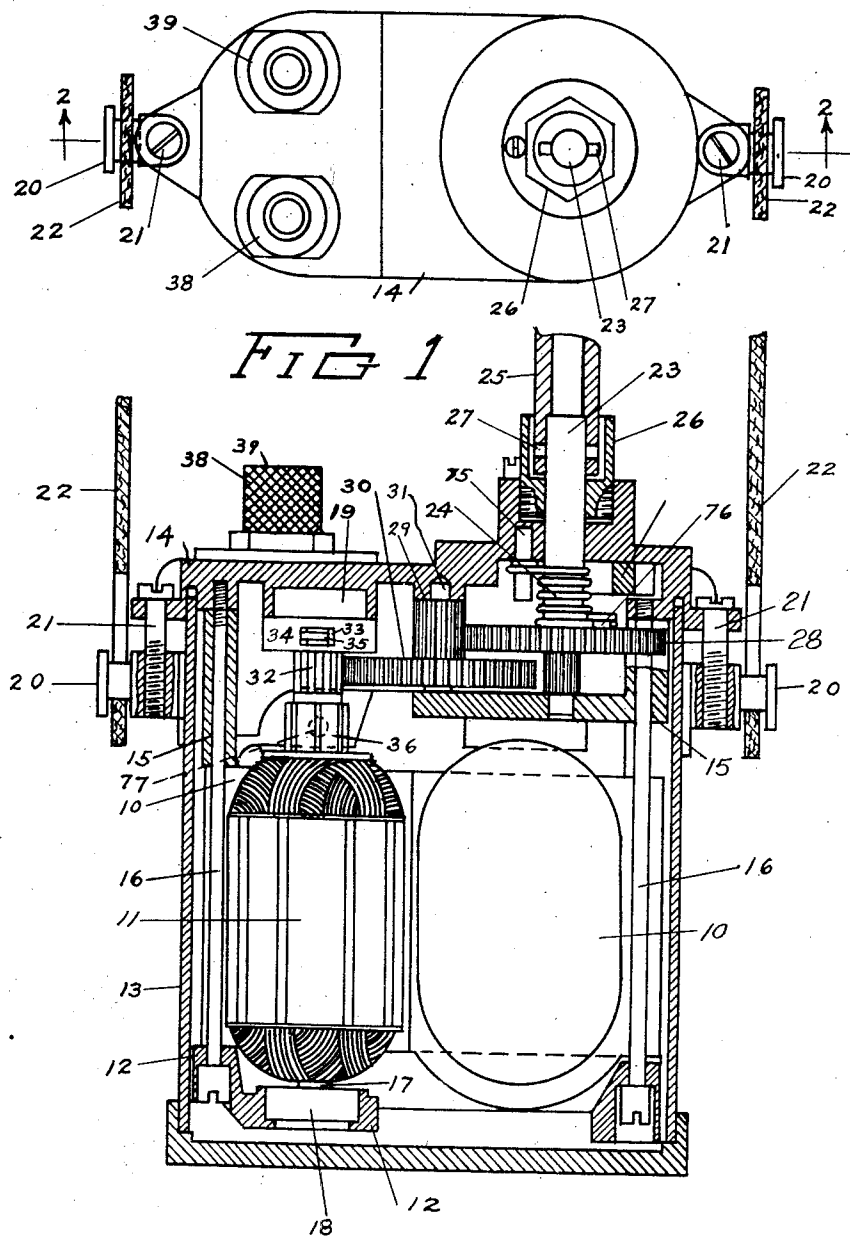


FIG. 2.

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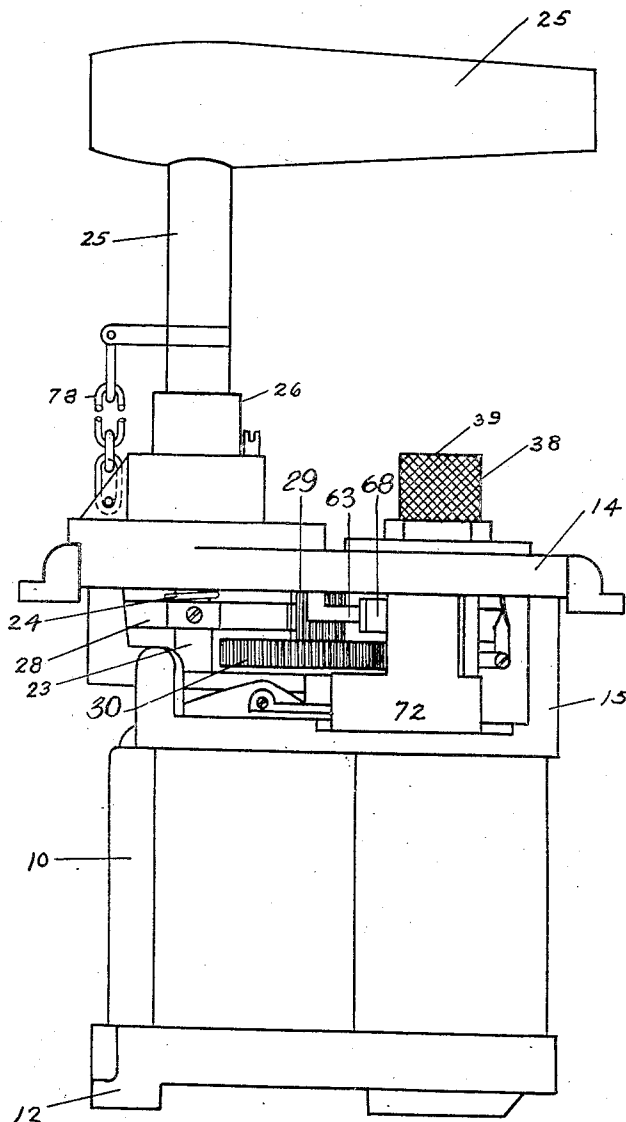


FIG. 3.

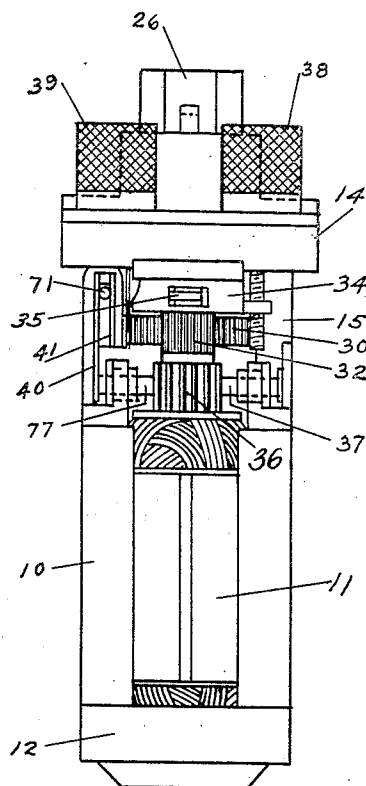


FIG. 4.

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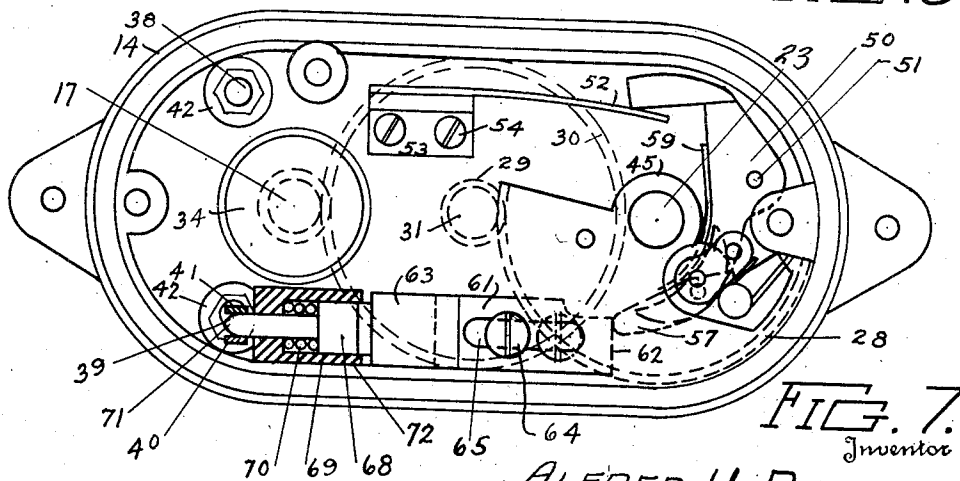
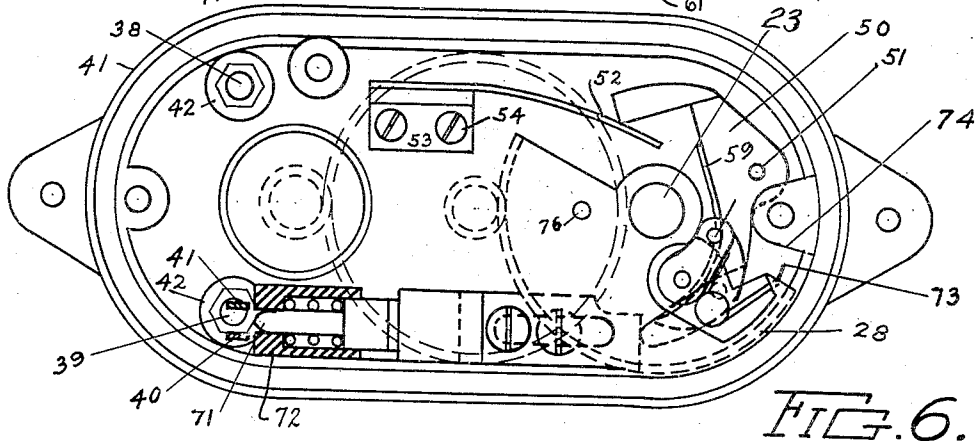
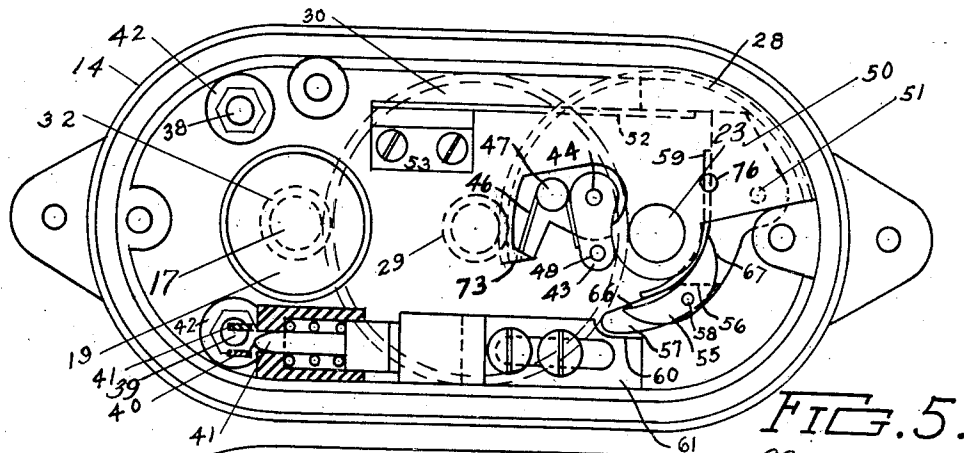
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## UNITED STATES PATENT OFFICE

2,458,687

## BLASTING MACHINE

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4 Claims. (Cl. 171-76)

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This invention refers to blasting machines of the dynamo type and more particularly to the switching mechanism thereof. It has among its objects to provide a new and improved form of blasting machine. An additional object is to provide a blasting machine that will have an automatic instantaneous closing-and-opening action so that the blasting circuit supplied by its electrical energy will avoid a secondary energizing of the circuit tending to induce so-called after explosions. Another object is to have the machine arranged to avoid the production of a counter-electro-motive force created by the return operations of its mechanism as it gets ready for the next blasting charge. A further object of this invention is to render the blasting machine of single pulse type so that it will avoid charging the blasting circuit more than once during the firing period. Still another object is to keep the period of contact for charging the blasting circuit down to a minimum of effective duration, and operable at its maximum value.

A still further object of this invention is to provide a new and improved blasting machine, that will induce a full charge from a contact existing for 5 to 30 thousandths of a second in duration by making the contact and breaking it immediately thereafter within this period and eliminating all possibility of a reverse charge.

Other objects will become apparent as the invention is more fully set forth.

In conventional blasting machines, the probability of plural charging the blasting circuit, plural times, or for too long a period occurs so frequently, as to make their use dangerous and costly in lives and results when explosives are employed. This is due to the fact that the current is kept on the blasting circuit after the main charging contact and discharge of explosives has been made, and tends to make additional ignitions and sparking causing explosions repeatedly afterwards across loose contacts in the circuit, that normally exist after the main explosion has occurred. Such additional ignition effects, results from the rotation of the armature of the dynamo as it continues after the contacts of the switch have been closed. As long as they are kept closed, which is usually until the end of the travel of the blasting machine armature, the circuit is kept alive and ready to recharge any device thereon or in contact therewith or cause a spark to jump. In the case of coal blasting in mines, or other raw products that tend to develop or release explosive gases, the chance of causing incidental

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explosions is considerable, from sparks of this nature. In this invention, the charge generated by the machine is on the blasting circuit for an instant only. After that the line is "dead." The machine through the operation of a ratchet clutch arrangement causes the armature to continue rotating and avoids the development of a counter charge as the mechanism is brought back by its springs to resetting position. The invention provides a safer device; lengthens the life of the parts charged with electricity; acts more effectively; and is handled more conveniently by its user.

In the drawings which illustrate a form of the invention:

Figure 1 is a plan view of a dynamo-generator embodying this invention;

Figure 2 is a side elevation partly in section taken along line 2-2 of Figure 1;

Figure 3 is a side elevation of the device without the casing;

Figure 4 is an end elevation of Figure 3;

Figure 5 is a plan view of the cover showing the hammer and trigger mechanism in their normal position;

Figure 6 is a plan view of Figure 5, with the hammer positioned to start its forward movement to close the circuit, and

Figure 7 is a view similar to Figures 5 and 6, but showing the contacts in closed position.

Similar reference characters refer to similar parts throughout the drawings.

This device consists of a structure having the casing and mechanism of a hand operated blasting machine that has a switch unit mechanism combined with it and adapted for coupling to a blasting circuit. The switch unit mechanism consists of contact means coupled to the machine mechanism and arranged for the closing and opening of a blasting circuit coupled to it. It is coupled to the mechanism of the blasting machine; so as to derive the electrical power therefrom in a conventional manner. It also has means for operating the contact means from the machine when the handle is actuated, at a predetermined instant of its travel. Another means is employed for connecting the previously mentioned means coordinately so that the closing of the circuit will be made only once during the full operative action of the machine and instantly thereafter opened. More particularly the device has a magnet 10 of usual form, between the poles of which the armature 11 is located. The magnet seats edgewise on a base 12, so that the armature is disposed to rotate about a vertical axis, when

in normal position. The casing 13 forms a housing which encloses the magnet and other parts associated therewith. A cover 14 is also fitted to the top of the casing. A shaft 17 of the armature 11 is supported at its lower end by a bearing stud 18 rising from the base 12 and seating in an aperture on said end of the shaft. The upper end portion of the armature shaft is supported by a bearing plate 19 seated in the cover 14. Suspended under the cover is a spider 15 which is clamped between the cover 14, magnet 10, and base 12 by long screws 16. The cover 14 supports the working parts of the unit in a downwardly projecting manner in a complete assembly for insertion within the casing 13. The casing is provided with studs 20 which are attached to its sides and are tapped to receive screws 21 which are used to attach the cover to the casing. The studs also support a sling 22 used to carry the device. The cover 14 supports the upper end of a drive shaft 23, which is provided with a transverse pin 27 for the application of the socket end of the handle 25. A counter-bored nut 26 is screwthreadably attached to the cover and guides the socket end of the handle on to the upper end of the drive shaft 23 and transverse pin 27. The lower end of the drive shaft is supported by the spider 15. A segment gear 28 is mounted on the drive shaft 23 and rotates therewith. A coiled spring 24 is connected to the cover 14 by pin 75 and to segment gear 28 by pin 76 to return the shaft 23 to its original position. The segment gear 28 operates a small pinion gear 29 which forms part of a larger pinion gear 30. The pinion gears 29 and 30 rotate on a pinion shaft 31 which is supported at its ends by the cover 14 and spider 15. The larger pinion gear 30 meshes with an armature pinion gear 32 that is attached to a clutch disc 33 which supports clutch fingers 35. The clutch disc 33 rotates within a clutch shell 34 and is engaged thereto by the clutch fingers 35 when the handle 25 is turned in one direction only. This causes the armature to turn in the proper direction and maintain a constant polarity. When the handle 25 is returning to its normal position the clutch fingers do not engage with the slots in the clutch shell 34 which is attached to the armature shaft 17. This allows the armature to continue turning in its generating direction, instead of reversing its direction when the handle rotation is reversed. The windings of armature 11 connect with a commutator 36 mounted on the shaft 17, and transmit current through brush 37 to terminal 38. The brush 37 connects with contact 40, the other contact 41 connects with the terminal 39. The terminals 38 and 39 are mounted in the cover 14 and insulated therefrom by insulators 42. The binding posts rise from the top of the cover 14 and suitable means are provided for the attachment of the wires conducting the current to the blasting equipment. The machine is particularly intended for energizing and igniting blasting fuses, commonly called "dynamite caps" etc. But it can be used for other operations requiring an electric current. The segment gear 28 has a partial hub 45 which acts as a stop for arm 43. The segment gear carries a trigger mechanism 49, comprising an arm 43 loosely attached to a stud 44 and held in its normal position against the hub 45 by the tension of a spring 46. A post 47 holds the spring 46 in operative position. A trigger 48 is positioned in the outer end of the arm 43 and contacts the crescent shaped cam or portion 55. Towards one of the sides of the machine in the same general

plane of the gears and the trigger mechanism is a hammer device 50 that swings on its pivot 51 and is kept under tension by a spring 52 attached to the part 53 which is attached to the cover 14 by screws 54. The crescent shaped end portion 55 of the hammer has an inner face 66 and outer face 67 and is slotted at 56 to receive a finger 57 which is pivotally connected by a pin 58 to the end cam or portion 55. The finger 57 is tensioned by a spring 59 attached to the side of the hammer device 50. The front end of the finger 57 of the hammer is rounded and arranged to travel along the cut-out end portion 60 of a pusher 61 (as shown in Figure 5) and drops down to align with face 62 and shoot the pusher forward (as shown in Figure 6). The pusher 61 has a slot 65 for attachment to the cover 14 by screws 64 which allow the pusher to reciprocate back and forth in proper alignment. The front end 63 of the pusher contacts a plunger portion 68 which slides in and out of a socket 69 and operates against a spring 70 which returns the contactor 71 to its normal open position after the hammer has completed its strike. The contactor 71 is mounted in an insulated support 72 and attached to the cover 14. The striking action of the hammer device 50 is brought about by the movement of the trigger mechanism 49 and trigger 48, which is moved against the inner face 66 of the crescent shaped portion 55, and forces the crescent shaped cam or portion to move until the finger 57 moves out of the cut-out end portion of pusher 61 and drops down, under tension of spring 59. Before the trigger 48 moves to the end of the inner face 66 of the crescent shaped cam or portion it releases the hammer device 50 and under the action of spring 52, forces the finger 57 forward until it contacts the face 62 of pusher 61 and forces the end 63 against the plunger portion 68 which pushes the contactor 71 in between contacts 40 and 41 and closes the circuit for a short period of about five one thousandth parts of a second (as shown in Figure 7). The trigger then slips over the end of the inner face 66 and returns over the outer face 67 of crescent shaped end portion to its starting point. The finger 57 assumes its former position in cut-out end portion 60, all set for the next movement. The gears then rotate back to their normal position which is about half-a-turn. During this action the handle and drive shaft 23 returns to its starting position. The armature does not rotate backwardly, due to the disengaged clutch arrangement allowing the armature to continue turning in its generating direction when the movement of the gears are reversed. This prevents the armature generating a counter E. M. F. while the machine is returning to its starting position. The clutch mechanism on the armature is shown in Figures 2 and 4. The operator turns the handle 25 during the process until the face 73 of the segment gear 28 contacts the face 74 of the spider 15. The handle then returns to its starting position under tension of spring 24, which is attached to cover pin 75 at one end and to segment pin 76 at the other end. The handle 25 is held to the cover 14 by chain 78. In the operation of the device the handle 25 is turned dle 25 is held to the cover 14 by chain 78. In the operation of the device the handle 25 is turned clockwise about 160 degrees. This action causes the clutch finger 35 attached to the clutch disc 33 to engage the slots in the clutch shell 34 and rotate the armature to which it is attached. The trigger mechanism causes the crescent shaped portion of the hammer to be moved outwardly and

cock the hammer ready for the strike action. As the handle is moved clockwise about 2 more degrees or about 162 degrees, the hammer is released and through action of spring 52 drives the pusher 61 and contactor 71 forward, closing the circuit formed by contacts 40 and 41 for a very short period at the time the armature is turning at about its greatest speed, and under action of spring 70 opens the contacts 40 and 41 almost instantly. The handle is turned in the same direction about 8 degrees further or to about 170 degrees from the starting point where it is stopped through the face 73 of segment gear 28 meeting face 74 of spider 15. The handle is then returned in the opposite direction to its starting position through action of spring 24. During the return of the handle to its starting position the clutch fingers 35 attached to the clutch disc do not engage the clutch shell and allows the armature to continue running in the direction set up in the first movement of the handle in a clockwise direction.

While but one general form of the invention is shown in the drawings and described in the specifications it is not desired to limit this application for patent to this particular form or in any other way otherwise than limited by the scope thereof, as it is appreciated that other forms of construction could be made that would use the same principles and come within the scope of the appended claims:

Having thus described the invention; what is claimed is:

1. In a blasting machine of the class described, the combination of a train of gearing, a clutch incorporated in said gearing, an electrical source of energy actuated by said gearing through said clutch, a segmental element operable extraneously to said machine for actuating said train, a plurality of contacts in said machine, a resiliently biased hammer unit mounted on a pivot in the machine having a limited arcuate travel therein and including a hammer, and a plural faced cam thereon, to which a finger is loosely attached a trigger movable with said element arranged to engage on different faces of said cam during different phases of its travel, said trigger forcing the cam and hammer against their resilient tension to a cocked position from which they are immediately released as the trigger changes its phase of travel, whereby the hammer and finger working cooperatively are suddenly released to deliver a striking blow, and a movable pusher in guides attached to said machine and aligned with said contacts for momentarily bridging the contacts when struck by said finger.

2. In a blasting machine of the class described, the combination of a train of gearing, a clutch incorporated in said gearing, an electrical source of energy actuated by said gearing through said clutch, a segmental element operable extraneously to said machine for actuating said train, a plurality of contacts in said machine, a resiliently biased hammer unit mounted on a pivot in the machine having a limited arcuate travel therein and including a hammer, and a plural faced cam thereon, to which a finger is loosely attached, a trigger movable with said element arranged to engage on different faces of said cam during different phases of its travel, said trigger forcing the cam and hammer against their resilient tension to a cocked position from which they are immediately released as the trigger changes its phase of travel, whereby the hammer and finger

working cooperatively are suddenly released to deliver a striking blow, a movable pusher in guides attached to said machine and aligned with said contacts for momentarily bridging the contacts when struck by said finger, and an insulated bumper operable in a socket on said machine and including a conducting contactor normally spaced away from said contacts, but inserting itself therebetween to produce said momentary bridging.

3. In a blasting machine of the class described, the combination of a train of gearing, a clutch incorporated in said gearing, an electrical source of energy actuated by said gearing through said clutch, a segmental element operable extraneously to said machine for actuating said train, a plurality of contacts in said machine, a resiliently biased hammer unit mounted on a pivot in the machine having a limited arcuate travel therein and including a hammer, and a plural faced cam thereon, to which a finger is loosely attached, a trigger movable with said element arranged to engage on different faces of said cam during different phases of its travel, said trigger forcing the cam and hammer against their resilient tension to a cocked position from which they are immediately released as the trigger changes its phase of travel, whereby the hammer and finger working cooperatively are suddenly released to deliver a striking blow, a movable pusher in guides attached to said machine and aligned with said contacts for momentarily bridging the contacts when struck by said finger, and an insulated bumper operable in a socket on said machine and including a conducting contactor normally spaced away from said contacts, but inserting itself therebetween to produce said momentary bridging, said clutch being adapted to release the gearing in ratchet-like manner and permit the return of the train, element, hammer, finger, pusher, and contactor to normal prefring position, after said bridging.

4. In a blasting machine of the class described, the combination of a train of gearing, a clutch incorporated in said gearing, a generator of electrical energy actuated by said gearing through said clutch, a segmental element operable extraneously to said machine for actuating said train, a plurality of contacts in said machine, a resiliently biased hammer unit mounted on a pivot in the machine having a limited arcuate travel therein and including a hammer, and a plural faced cam thereon, to which a finger is loosely attached, a trigger movable with said element arranged to engage on different faces of said cam during different phases of its travel, said trigger forcing the cam and hammer against their resilient tension to a cocked position from which they are immediately released as the trigger changes its phase of travel, whereby the hammer and finger working cooperatively are suddenly released to deliver a striking blow, a movable pusher in guides attached to said machine and aligned with said contacts for momentarily bridging the contacts when struck by said finger, and an insulated bumper operable in a socket on said machine and including a conducting contactor normally spaced away from said contacts, but inserting itself therebetween to produce said momentary bridging, said clutch being adapted to release the gearing in ratchet like manner and permit the return of the train, element, hammer, finger, pusher, and contactor to normal prefring position, after said bridging, a spring for reversing said train after the latter has been rotated into firing

actuation, said clutch permitting operation of said generator in the same direction during the reverse movement of said train, whereby no counter electromotive energy will be produced in the machine in said movement after said hammer and finger are released.

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