

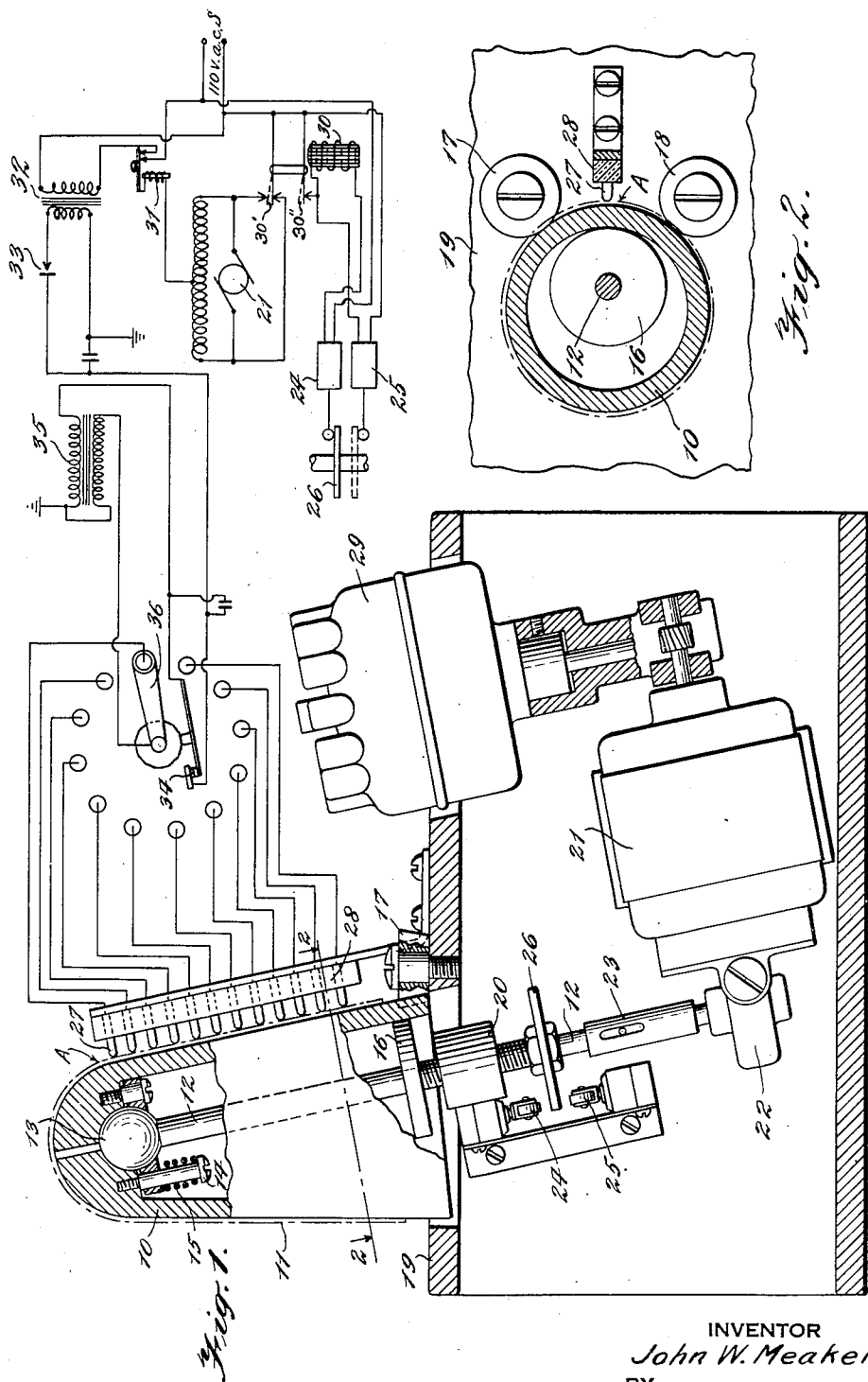
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ELECTRICAL PERFORATING APPARATUS

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## ELECTRICAL PERFORATING APPARATUS

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My invention relates to a novel and improved apparatus for perforating felt or other material by means of an electrical discharge.

An object of the invention is to provide an apparatus capable of perforating a material such as the felt used in hats in a manner that will not injure the appearance of the material. Another object is to provide an apparatus for perforating material by means of an electrical discharge that eliminates any possible fire hazard or danger to the operator. Other objects and advantages of my invention will be best understood from the following description and accompanying drawings, in which I have shown a selected embodiment of the invention and in which:

Fig. 1 is a side view in partial section of an apparatus having the invention embodied therein with the appropriate electrical circuits shown diagrammatically in conjunction therewith; and Fig. 2 is a plan view in section along the line 2—2 of Fig. 1 of a part of the apparatus illustrated in Fig. 1.

Referring to the drawings in detail there is an electrical discharge circuit having a common electrode shown in the illustrated embodiment of my invention as a dome-shaped hat block 10. This electrode may be utilized to support the material to be perforated, in this case a hat felt 11 which is placed over the hat block in the customary manner.

The hat block 10 is supported on a shaft 12 and is rotatable therewith being secured to the shaft by a ball and socket joint 13. This arrangement permits the hat block 10 to be tilted angularly in relation to the shaft while being rotated. The ball and socket joint 13 may be appropriately adjusted by means of an adjusting screw 14 engaging with a spring 15 which bears against a clamping member of the ball and socket joint.

A circular guide 16 carried by the shaft 12 contacts the inner wall of the hat block at a point near the bottom of the hat block. Acting in conjunction with the guide 16, there are a pair of rollers 17 and 18 mounted on a base 19 which contact the outer surface of the hat block 10 on opposite sides of its point of contact with the guide 16. In the apparatus illustrated, the shaft 12 is not concentric with the axis of the hat block so that when the hat block is rotated, the slope of side wall along the line indicated by the letter A, will be maintained constant by alignment of the hat block between the guide 16 and the rollers 17 and 18.

A bracket 20 secured to the base 19 threadably

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engages with the shaft 12 and provides a support for the shaft. Due to this threaded engagement of the shaft with the bracket 20, the shaft, when it is rotated, will move upwardly or downwardly depending upon its direction of rotation. A reversible motor 21 drives the shaft 12 through reduction gearing indicated generally at 22 and a sliding coupling 23 which permits vertical movement of the shaft during rotation.

The bracket 20 also carries a pair of limit switches 24 and 25 positioned so that one of them will be operated by a plate 26 carried by the shaft 12 when the shaft has traveled upward or downward an appropriate distance. Operation of either of the limit switches 24 and 25 causes the connections to the motor 21 to be reversed so that the motor will rotate in the opposite direction when operation is resumed.

The electrical discharge circuit also includes a series of electrodes 27 mounted in a column adjacent the hat block 10 on a frame 28 secured to the base 19. These electrodes are spaced from the common electrode or hat block 10 to form a gap across which an electrical discharge may pass. The size of this gap will depend on the electrical characteristics of the electrical discharge circuit. The details for such spacing are well known to those skilled in the art and need not be discussed here. In the illustrated form of the invention the column of electrodes 27 is inclined to correspond with the slope of the side wall of the hat block 10 in order to provide a uniform gap between each of the electrodes and the sloping wall of the hat block.

The electrodes 27 are alternately connected in the electrical discharge circuit by a switching device 29 that is operated by the motor 21 which drives the shaft 12. The switching device 29 utilized in the embodiment of the invention illustrated, is a well known form of automotive distributor and it need not be described in detail. Since only one of the several electrodes 27 is connected in discharge circuit at a time, the tendency for the discharge current to short or spark between these electrodes is eliminated.

The feature of having the movement of the material 11 between the electrodes coordinated with the operation of the switching device 29 by means of a common drive insures that the frequency of the perforations in the material will remain constant regardless of the speed at which the material moves between the electrodes. In addition, when movement of the material ceases, the electrical discharges also cease eliminating any possible fire hazard that might exist if the

discharge were permitted to continue at such time.

In order to operate the apparatus, it may be connected to any suitable source of electrical energy S; in the embodiment illustrated the customary 110-120 volt alternating current has been utilized for both the motor 21 and the electrical discharge circuit.

The motor 21 is connected to the source of electrical energy by the contacts of a motor reversing relay 30 whose operation is controlled by the limit switches 24 and 25. The limit switch 24 is normally closed and the limit switch 25 is normally open. When the plate 26 strikes the switch 25, the switch 25 is closed completing a circuit through the normally closed limit switch 24 connecting the relay 30 to the source of electrical energy. This energizes the relay 30 causing the relay to operate a switch 30' to connect the motor 21 to the source of electrical energy so that the motor will rotate in a direction to move the shaft 12 upwardly in the bracket 20. After the plate 26 releases the switch 25, the switch 25 returns to its open position, but the connection of the relay to the source of electrical energy is maintained by a relay operated switch 30'' and the switch 24 in a holding circuit. The normally closed limit switch 24 is in this holding circuit and when the plate 26 strikes this limit switch 24 the holding circuit to the relay 30 is broken. This causes the relay 30 to operate the switch 30 to reverse the connections to the motor 21 so that the motor will now rotate in the opposite direction.

The contacts of a manually operable reset relay 31 connect both the motor 21 and the electrical discharge circuit to the source of electrical energy. When the motor is connected to the source of electrical energy by closing the contacts of the relay 31, this relay is energized and its contacts are held closed. However, when the motor circuit is interrupted during operation of the motor reversing relay 30, the reset relay is momentarily disconnected from the source of electrical energy causing it to open its contacts thereby interrupting both the circuit to the motor and the electrical discharge circuit. This brings the apparatus to a halt so that the hat felt operated on may be removed and a fresh felt placed on the hat block. It will be noted that during this operation the electrical discharge circuit is disconnected from the source of electrical energy so that there is no danger to the operator. After a fresh hat felt has been placed on the hat block, the apparatus is placed in operation by manually closing the contacts of the reset relay 31.

In addition to the electrodes and the switching means previously mentioned, the electrical discharge circuit includes a transformer 32 having a primary connected to the source of electrical energy and a low voltage secondary. One side of the low voltage secondary is connected to the common electrode or hat block 10, and the other side of the secondary is connected through a rectifier 33, breaker points 34 and an ignition coil 35 to the rotor arm 36 of the switching device 29. When the rotor arm 36 is rotated it sequentially completes the circuit to each of the electrodes 27 while in appropriately timed relation a high voltage current is induced in the circuit by each opening of the breaker points 34 to interrupt the circuit to the ignition coil.

The discharge between the electrodes 27 and the hat block 10 produced by the discharge cir-

cuit just described does not increase in intensity after it has been initiated but decays at a relatively rapid rate. Also, in this circuit the common electrode 10 is the discharge receiving electrode and any carbonization will be on the inside of the material. Under these conditions, the rupture produced in the material being perforated is barely visible. This feature is extremely important where carbonization or large perforations would injure the appearance of the finished material. However where such requirements are not critical, an electric discharge produced in any of the well known ways may be utilized.

As previously mentioned, the frequency of the perforations produced will remain constant for any given apparatus since the speed with which the motor 21 rotates the hat block 10 to move the material between the electrodes is directly related to the speed at which the switching means rotates. The relative rotation speed of these two parts may be coordinated so as to give any desired number of perforations for a given area.

While I have shown the invention as embodied in a specific form, it is to be understood that various changes in details may be made by those skilled in the art without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In an apparatus for perforating felt hats by means of electrical discharges; the combination of a column of spark-discharging electrodes; a felt-supporting electrode adjacent said column of electrodes and separated therefrom by a gap of substantially uniform thickness; power-driven means for rotating said felt-supporting electrode; means for moving said felt-supporting electrode longitudinally relative to said column of electrodes, means for maintaining said gap of substantially uniform thickness; switch means actuated by said power-driven means for connecting each of a column of electrodes to said source of high voltage current; a second switch means for shutting off power to said power-driven means; said second switch means being actuated by said second-mentioned means.

2. In an apparatus for perforating felt material by means of electrical discharges, the combination of a form for receiving said felt material; a series of electrodes arranged adjacent said form and separated therefrom by a gap of substantially uniform thickness; power-driven switch means for sequentially connecting each of said electrodes to a source of high voltage current power-driven means for moving said form upwardly and downwardly with respect to said electrodes and coincidently rotating the same; switch means connected to said source of high voltage current and actuated by said last-mentioned means for shutting off power thereto at predetermined positions in the upward and downward travel of said form; said switch means being adapted to interrupt the flow of high voltage current to said electrodes; and manually operable switch means for restoring the flow of high voltage current to said electrodes and coincidently resuming the application of power to said power-driven means.

3. In an apparatus for perforating preformed articles by means of an electrical discharge, the combination of a rotatable electrode shaped to fit inside of the article to be perforated, a series of fixed electrodes opposed to and spaced from said rotatable electrode, a rotatable shaft sup-

porting the rotatable electrode reversible driving means connected to said shaft for rotating said shaft and the rotatable electrode supported thereon, means for moving said shaft and the rotatable electrode supported thereon longitudinally relative to the series of fixed electrodes upon rotation of the shaft, switching means connecting the reversible driving means for rotation in one direction, a second switching means connecting the reversible driving means for rotation in the opposite direction, and switch operating means carried by the shaft, said switch operating means engaging with one of said switching means upon longitudinal movement of the shaft in one direction and with the other of said switching means upon longitudinal movement of the shaft in the opposite direction.

4. In an apparatus for perforating preformed articles by means of an electrical discharge, the combination of a rotatable electrode shaped to fit inside of the article to be perforated, a series of fixed electrodes opposed to and spaced from said rotatable electrode, a rotatable shaft supporting the rotatable electrode, reversible driving means connected to said shaft for rotating the shaft and the rotatable electrode, circuits connecting each of the fixed electrodes and the rotatable electrode to a source of high voltage current, switching means in the circuits connecting the fixed electrodes to the source of high voltage current, said switching means connecting each of the fixed electrodes to the source of high voltage current at a different time, means for moving said shaft and the rotatable electrode longitudinally with respect to said fixed electrodes upon rotation of the shaft, a switch connecting the reversible driving means for rotation in one direction, a second switch connecting the reversible driving means for rotation in the

opposite direction and switch operating means carried by the shaft, said switch operating means engaging with one of said switches upon longitudinal movement in one direction and engaging with the other of said switches upon longitudinal movement in the opposite direction.

5. In an apparatus for perforating preformed articles by an electrical discharge, the combination as defined in claim 4 wherein the switching means connecting the series of fixed electrodes to the source of high voltage current is driven by the reversible driving means.

6. In an apparatus for perforating preformed articles by an electrical discharge, the combination as defined in claim 4 which includes an angularly adjustable connection between the shaft and the rotatable electrode supported thereon and guide means engaging with and holding the fixed electrode with the portion adjacent the fixed electrodes in uniform spaced relation to said fixed electrodes.

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