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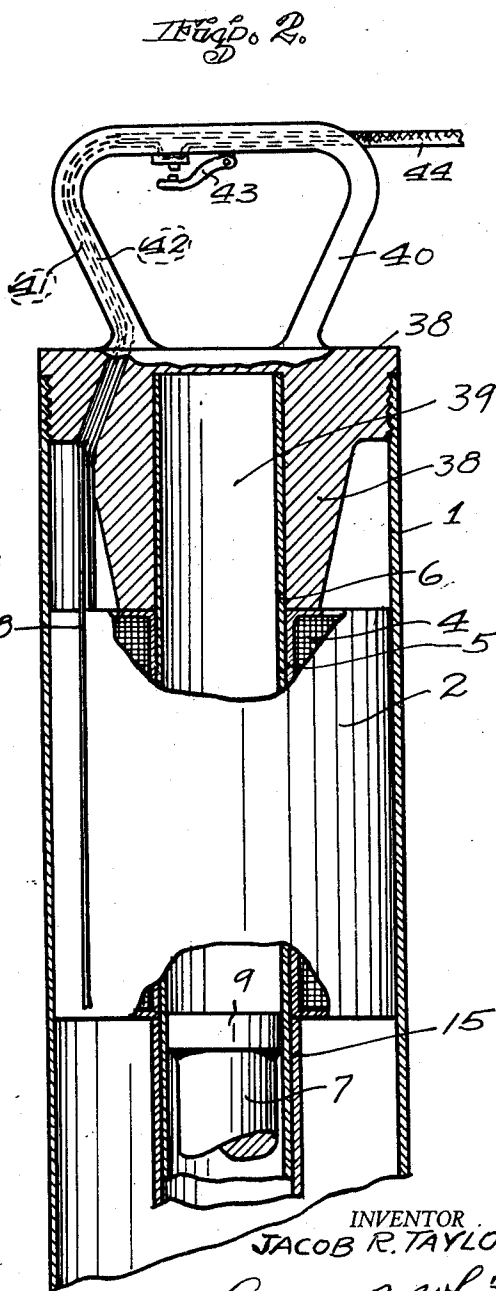
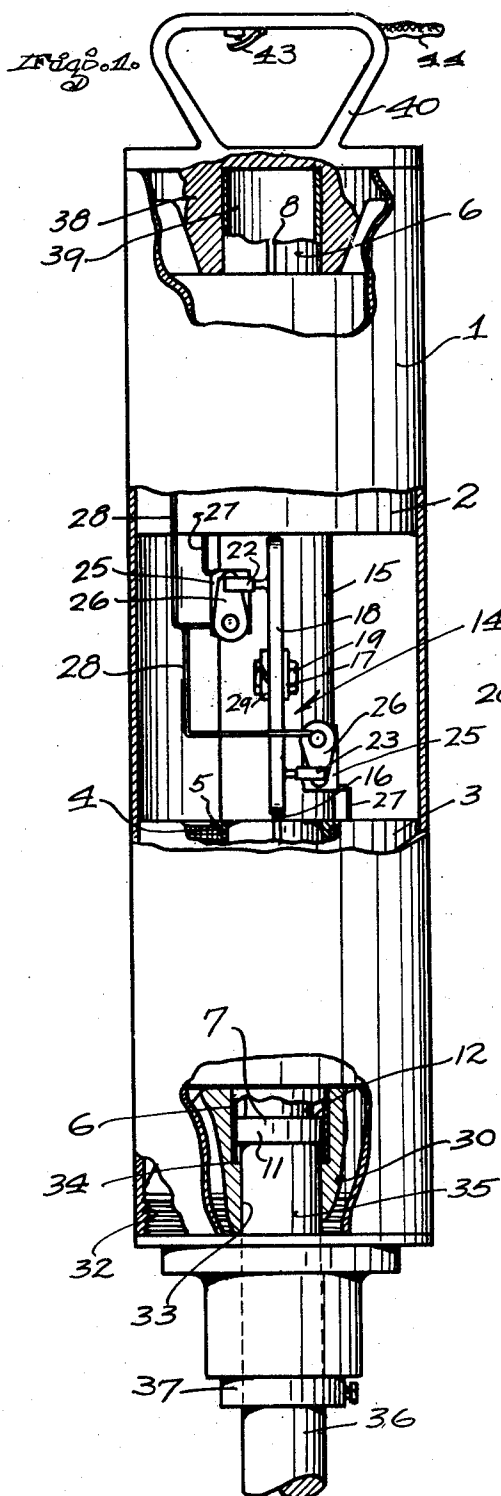
J. R. TAYLOR

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ELECTRIC PERCUSSION TOOL

Filed April 14, 1933

2 Sheets-Sheet 1



INVENTOR
JACOB R. TAYLOR
BY *George B. White*

ATTORNEYS.

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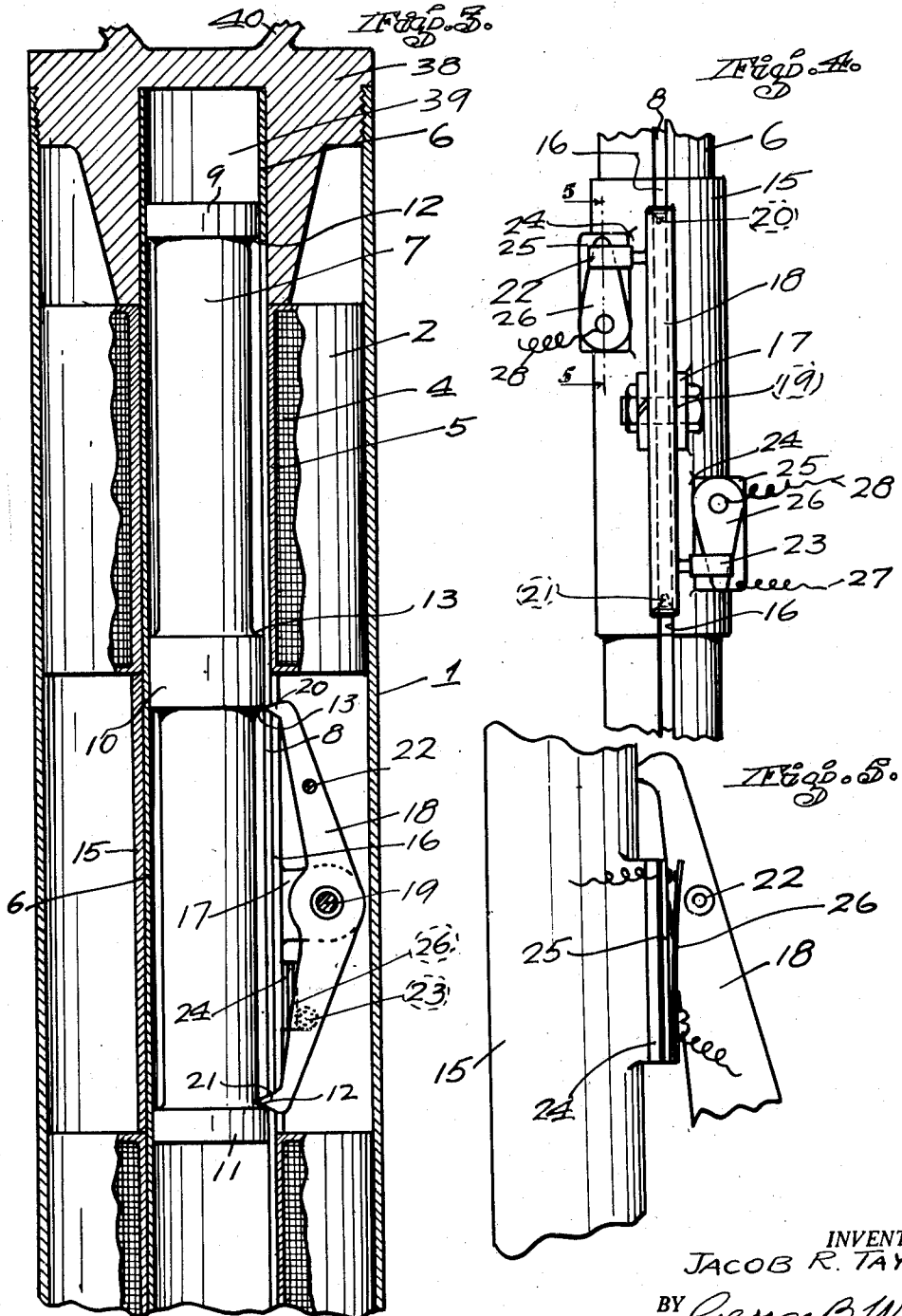
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JACOB R. TAYLOR
BY *George B. White*
ATTORNEYS.

UNITED STATES PATENT OFFICE

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ELECTRIC PERCUSSION TOOL

Jacob R. Taylor, San Francisco, Calif.

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13 Claims. (Cl. 172-126)

This invention relates to reciprocating motors and particularly to electric percussion tools.

An object of the invention is to provide an efficient driving mechanism for percussion tools and the like, wherein a reciprocating element is employed for the production of work, the working element being reciprocated by the alternative setting up of electromagnetic fields in spaced solenoids.

10 A further object of the invention is to provide a non-magnetic guide through spaced solenoids, yet to provide means whereby the respective magnetic fields can act on a plunger core for reciprocating the latter in said guide; a circuit breaker being provided adjacent the guide for actuation by the plunger core, whereby the spaced solenoids are alternately energized.

15 Another object of the invention is to provide a circuit breaker in an electric percussion tool for alternately energizing spaced solenoids thereby to reciprocate a core, means being provided on the core and the circuit breaker for positively operating the circuit breaker at each stroke of the core and to hold the circuit breaker in position throughout each stroke of the core.

20 A still further object of the invention is to provide an energy absorption structure for percussion tools whereby an air cushion is utilized to absorb the energy of each idle stroke of the plunger core.

25 Other objects and advantages are to provide an electric reciprocating motor and electric percussion tool that will be superior in point of simplicity, inexpensiveness of construction, positiveness of operation and facility and convenience in use and general efficiency.

30 In this specification and the annexed drawings, the invention is illustrated in the form considered to be the best, but it is to be understood that the invention is not limited to such form, because it may be embodied in other forms; and it is also to be understood that in and by the claims following the description, it is desired to cover the invention in whatsoever form it may be embodied.

35 This invention is clearly illustrated in the accompanying drawings wherein,

40 Figure 1 is a side view of an electric percussion tool constructed in accordance with my invention and being shown partly in section.

Figure 2 is a fragmental sectional view of my electric percussion tool.

45 Figure 3 is a fragmental sectional view of my electric percussion tool showing the plunger at the end of its back stroke.

Figure 4 is a detailed view of a circuit breaker mechanism, and

Figure 5 is a fragmental view on an enlarged scale of the contacts and actuator of the circuit breaker mechanism on the guide.

60 In carrying out my invention, I make use of a housing 1, which may be made of either magnetic or non-magnetic material in my device. The housing 1 is substantially cylindrical. In the housing 1 is removably placed an electro-magnetic field producing structure and a reciprocating core system.

65 The electro-magnetic field producing structure comprises two solenoids 2 and 3 spaced from each other endwisely. Each of the solenoids 2 and 3 is preferably made of a winding of coils 4 around a bushing 5 of magnetic material, but it may be formed in another suitable manner.

70 The reciprocating core system includes a tubular member 6, preferably made of non-magnetic material. The member 6 extends through the bushings 5 of both solenoids, and also beyond the solenoids 2 and 3 at both ends thereof. The tubular member 6 forms a guide within which a plunger core 7 reciprocates. The length of the core 7 is slightly larger than twice the height of one of said solenoids, and the spacing between the solenoids 2 and 3 is slightly larger than the height of one of said solenoids. The tubular member 6 has a slit 8 substantially along its entire length to allow for the action of the magnetic fields of the solenoids 2 and 3 on the core 7. The core 7 is preferably made of magnetic material, because the usual non-magnetic materials do not stand up under the blows on the tool as well as certain magnetic materials. The outer diameter of the core 7 is smaller than the inner diameter of the tubular member 6 and is spaced from said member. The core 7 is guided in the member 6 by means of collars 9, 10, and 11 thereon which slidably fit within the tubular member 6. The collars 9 and 11 are at the opposite ends of the plunger core 7, while the collar 10 is intermediate between the ends of said core 7. The shoulders 12 of the collars 9 and 11 and the shoulders 13 of the collar 10 are in definite, spaced relation for the operation of a circuit breaker mechanism 14 mounted on the outside of the tubular member 6.

105 There is a spacer sleeve or bushing 15 on the outside portion of the tubular member 6 between the opposed ends of the solenoids 2 and 3, to positively space the solenoids 2 and 3 apart and prevent the sliding of the solenoids toward each other. The sleeve 15 has a slit 16 on one side

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thereof along its entire length, in registry with the slit 8 of the tubular member 6. The sleeve 15 is made of non-magnetic material.

The circuit breaker mechanism 14 is mounted on the sleeve 15, although, in the absence of such sleeve it may be mounted directly on the tubular member 6. A bracket 17 extends from the sleeve 15 alongside a portion of the slit 16. A lever 18 is pivotally mounted intermediate its ends on a pivot 19 on the bracket 17. The lever 18 is opposite to and aligned with the slits 8 and 16.

On the opposite end of the lever 18 are flat substantially V shaped points 20 and 21 which slidably fit into the slits 8 and 16, and extend through said slits to protrude into the interior of the tubular member 6 and in the path of the collars 9, 10, and 11 of the core 7. The spacing of the points 20 and 21 from each other corresponds to the spacing between one of the shoulders 12 and the adjacent shoulder 13, so that the two points 20 and 21 are between two adjacent shoulders 12 and 13 at the end of each stroke of the plunger core 7. As the plunger core 7 reciprocates it oscillates the lever 18 at each stroke by reason of the successive engagements of the points 20 and 21 by the respective shoulders 12 and 13 of the collars 9, 10, and 11.

From the lever 18 extend lateral abutment prongs 22 and 23 in opposite directions. The prong 22 is located between the point 20 and the pivot 19, and the prong 23 is between the point 21 and said pivot 19. Opposite to and below each prong 22 and 23 is a lug 24 extended from the sleeve 15. On the lug 24 is a stationary contact 25, and a spring contact 26. When the lever 18 is tilted the prong 22 or 23, as the case may be, is pressed against the adjacent spring contact 26 and closes the same against the stationary contact 25 therebelow, thereby closing an electric circuit.

A wire or conductor 27 connects each stationary contact 25 to the nearest solenoid 2 or 3. The wires 28 lead from the spring contacts 26 to the top of the housing to connect to a terminal of a source of electricity.

Each solenoid 2 and 3 is also connected to a wire 29 and to another terminal of the source of electricity not shown. When one of the spring contacts 26 is depressed by reason of the tilting of the lever 18 the solenoid nearest to said contact 26 is energized and the core 7 is drawn thereinto. At the end of the stroke of the core 7 one of the end collars of the core 7 again tilts the lever 18 and causes the pressing of the other spring contact 26 into circuit closing position, thereby the other solenoid is energized and the core 7 is again reciprocated.

In order to prevent the lever 18 from tilting, by reason of the tension of the closed spring contact 26, a spring washer 29 is provided on the pivot 19 and is suitably pressed against the lever 18 at the pivot to resist any accidental tilting of said lever 18. It requires a positive exertion of force on the ends of the lever 18 to tilt it.

The aforescribed field producing structure, core system, and circuit breaker are assembled as a unit, the entire unit being readily removable from the housing 1. This unit is held in place in the housing 1 by a tool holder 30 at one end and by a cover 38 at the other end of the housing 1.

The tool holder 30 is threadedly secured in place as at 32, and it has an axial bore 33 there-through. The inner end of the bore 33 is counterbored or recessed at 34 to accommodate the end of the tubular member 6 therein. It is to

be noted that the lower end of the tubular member 6 abuts against the bottom of the counterbore or recess 34, and the said recess 34 is substantially of the same depth as the length of the portion of the tubular member 6 extended beyond the solenoid 3, so that the solenoid 3 rests upon the inner end of the holder 30. The shank 35 of a tool 36 slidably fits into the bore 33 of the holder 30. The shank 35 has a stop or collar 37 adjustably fixed thereon to determine the length of the shank 35 extended into the holder. The top of the shank 35 extends above the bottom of the recess and into the end of the tubular member 6 in the path of the lower end 11 of the core 7. The tool 36 may be made either of steel, or of soft iron with a steel head on the inner end of the shank 35.

A cover 38 is threadedly secured in the other end of the housing 1. The cover 38 has a recess or pocket 39 formed therein into which the upper end of the tubular member 6 extends. The depth of the pocket 39 is such as to accommodate the part of the tubular member 6 extended beyond the solenoid 2 so that the inner end of the cover 38 bears against the solenoid 2. In this manner the solenoids 2 and 3, and the tubular member 6 are positively held within the housing 1. It is to be noted that the pocket 39 is not provided with any air escape, hence on the backward or idle stroke of the plunger core 7 air is compressed into the pocket 39 forming an air cushion, and energy absorbing means.

On the cover 38 is secured a handle 40 of the usual type. The handle 40 is preferably provided with a cavity therein through which extend wires 41 and 42. Wire 41 is connected to wires 28, and the wire 42 is connected to the solenoids. A hand switch 43 of the usual trigger type is connected in series with wire 41 to control the supply of current to the field producing system.

A flexible cord 44 is provided to conduct electricity to the said wires.

In operation the housing 1 and the handle 40 are gripped by the operator in the usual manner, so that the tool 36 is held against the work. Then the operator closes the trigger switch 43. The plunger core 7 by reason of its own gravity assumes a position shown in Fig. 1, when not in operation, hence the lever 18 is so tilted that the point 20 and the prong 22 are held in circuit closing position. Consequently the solenoid 2 is energized first and attracts the plunger core 7 upwardly against the air cushion in the pocket 39. The energy of this stroke is thus absorbed. The solenoid 2 remains energized throughout the entire backward stroke of the plunger core 7. As the middle collar 10 of the core 7 passes the point 20 it pushes the same outwardly of the tubular member 6, thereby it tilts the lever 18 and moves the other point 21 into the tubular member 6 and in the path of the other end collar 11. The shoulder 12 of the end collar 11 holds the point 21 in place, the point 20 being at the same time in an out of way position. Thus the prong 22 is raised to allow the spring contacts therebelow to break the electric circuit of the solenoid 2, and the prong 23 is pressed against the other spring contact to close the electric circuit of the solenoid 3 and cause the energization of the latter. Thereupon the solenoid 3 draws the plunger core 7, with great force, against the inner end of the tool shank 35, exerting a full stroke driving force on the tool 36. As the middle collar 10 passes the point 21 it moves the same outwardly of the tubular member 6, thereby again tilting the lever 18 to press the other

prong 22 upon the spring contact therebelow to energize solenoid 2. In this manner the solenoids 2 and 3 are alternately energized, and remain energized for the respective full strokes of the core 7, because the circuit breaker 14 is positively actuated by the core 7 at the completion of each stroke. The electrical driving mechanism herein described operates with equal efficiency on direct current as well as on alternating current; its operation is positive, and powerful, yet the construction is simple, and it readily adaptes itself for use by labor ordinarily available.

Having thus described this invention, what I claim and desire to secure by Letters Patent is:

1. In a reciprocating electric motor a housing, field producing means, a reciprocating core system, and a guide of non-magnetic material to guide said core extended along the entire length of the stroke of said core system, said guide having a longitudinal slit along a side thereof communicating with the air in the housing to prevent suction and compression in the path of the reciprocating core system.

2. In a reciprocating electric motor a housing, a pair of spaced solenoids, a reciprocating core system, and a guide of non-magnetic material to guide said core extended through both solenoids, said guide having a longitudinal slit along a side thereof, an oscillating circuit breaker disposed between the spaced solenoids to cause alternate energization of said field producing means, and means related to said circuit breaker to coact through said slit with the reciprocating core to actuate the circuit breaker at the completion of each stroke of the core.

3. In a reciprocating electric motor a pair of spaced solenoids, a reciprocating core, a guide extended through the solenoids to guide said reciprocating core; an element tiltably supported on the guide, a normally open circuit breaker connected in series with each solenoid, means on said element to alternately close the circuit breakers as the element is tilted in opposite directions; said guide having a longitudinal slit on a side thereof, abutments on said element being slidably extended through said slit, and means on the reciprocating core to coact with said abutments to tilt the element at each stroke of the reciprocating core.

4. In a reciprocating electric motor the combination with a pair of spaced solenoids, a reciprocating core, a guide extended through the solenoids to guide said reciprocating core; of an element tiltably supported on the guide intermediate its ends, normally open circuit breakers one for each solenoid, means on said element to alternately engage and close the respective circuit breakers as the element is tilted in opposite directions; said guide having a longitudinal slit on a side thereof, abutments on said element being slidably extended through said slit, and means on the reciprocating core to coact with said abutments to tilt the element at each stroke of the reciprocating core; said coacting means on the core being adapted to maintain the element tilted until the completion of the respective strokes of the core.

5. In a reciprocating electric motor the combination with a pair of spaced solenoids, connected to a source of electricity, a reciprocating core, and a guide for the core extended through the solenoids; of a circuit breaker mechanism comprising a rocking element on the guide; said guide having a longitudinal slit along its side, spaced abutments extended from said element

through said slit, normally open circuit breakers one for each solenoid, means on the rocking element to alternately close the respective circuit breakers when rocked in opposite directions, and means on the core to coact with said abutments to rock said element once at each stroke of the reciprocating core.

6. In a reciprocating electric motor the combination with a pair of spaced solenoids, connected to a source of electricity, a reciprocating core, and a guide for the core extended through the solenoids; of a circuit breaker mechanism comprising a rocking element on the guide; said guide having a longitudinal slit along its side, spaced abutments extended from said element through said slit, a normally open circuit breaker operatively connected to each solenoid, means on the rocking element to alternately close the circuit breakers when rocked in opposite directions; and a plurality of abutment members on the core spaced from each other, the spacing between said abutment members being substantially equal to the length of one stroke of the reciprocating core, said abutment members being adapted to engage the respective abutments of the rocking element to rock said element at the completion of each stroke of the reciprocating core.

7. In a reciprocating electric motor, the combination with a pair of spaced solenoids, a guide extended through the solenoids, a core reciprocated in said guide; of a circuit breaker mechanism between the spaced solenoids, comprising a rockable element fulcrumed on the guide to extend longitudinally with respect to the guide, said guide having a longitudinal slit along a side thereof in operative position relatively to said rockable element, a normally open circuit breaker on each side of the fulcrum connected to each solenoid and being in operative relation to said rockable element, a pair of spaced abutments extended from the rockable element and through the slits, said abutments being on opposite sides of the fulcrum of the rockable element, means on said element to alternately close the respective circuit breakers when rocked in opposite directions; a plurality of spaced members on the core adapted to coact with said abutments in opposite directions as the core reciprocates.

8. In an electric percussion tool, the combination with a pair of spaced solenoids on a guide in a housing having a core in the guide reciprocated by said solenoids and means to alternately energize the solenoids, a head at one end of the housing, a holder at the other end of the housing, of opposed, aligned recesses in the head and tool holder, the ends of the guide being extended into said recesses, the end of the guide in said head being adapted to cooperate with said recess in the head to confine an air pocket therein completely closed by the end of the core at the end of a stroke thereof, the remaining portion of the guide being open to allow the passage of air into and out of the interior of the guide.

9. In an electric percussion tool, the combination with a pair of spaced solenoids on a guide in a housing having a core in the guide reciprocated by said solenoids and means to alternately energize the solenoids, a head at one end of the housing, a tool holder at the other end of the housing, of opposed, aligned recesses in the head and tool holder the ends of the guide being extended into said recesses, said guide having a longitudinal slit through a side thereof extending from the end of the tool holder recess to a point in the recess in the head spaced from the

bottom of the recess to confine an air pocket in the head at an end of the stroke of said core.

10. In a reciprocating electric motor the combination with electromagnetic field producing means, a reciprocating core, means to guide the core through said field producing means, and means to cause the energization of said field producing means so as to reciprocate the core, of means to form a compression chamber at an end of said guiding means, and means to conduct air into and out of said guide means as the core is reciprocated, said conducting means being inoperative relatively to said compression chamber.

11. In a reciprocating electric motor the combination with field producing means, a guide extended through said means, and a core reciprocated in said guide by the alternate energization of said field producing means, of means to form a cushioning chamber at an end of said guide, and means to communicate the portions of the guide that extend into the field producing means with the surrounding space in the motor so as to allow circulation of air into and from said guide as the core is reciprocated.

12. The combination with a percussion tool

including a core reciprocated by electromagnetic means in a guide, and a tool opposite the end of one stroke of the core, of a compression chamber formed at the end of the guide adjacent the end of the other stroke of the core being adapted to receive air urged into said chamber by the core, said guide having a passage formed on its side to conduct air into and from the interior of the guide as the core is reciprocated, said passage being closed relatively to said compression chamber by the action of said core near the end of the second stroke of the core.

13. The combination with a percussion tool including a core reciprocated by electromagnetic means in a guide, and a tool opposite the end of one stroke of the core, of a compression chamber formed at the end of the guide adjacent the end of the other stroke of the core being adapted to receive air urged into said chamber by the core, the side of said guide being slotted at points below said compression chamber to allow passage of air into and out of the path of the reciprocated core when the end of the core is outside of said compression chamber.

JACOB R. TAYLOR.

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