A. WENDELBURG.

ELECTRIC TOOL.

APPLICATION FILED SEPT. 4, 1913. RENEWED FEB. 27, 1918.

1,262,148.

Patented Apr. 9, 1918.

3 SHEETS—SHEET 1.

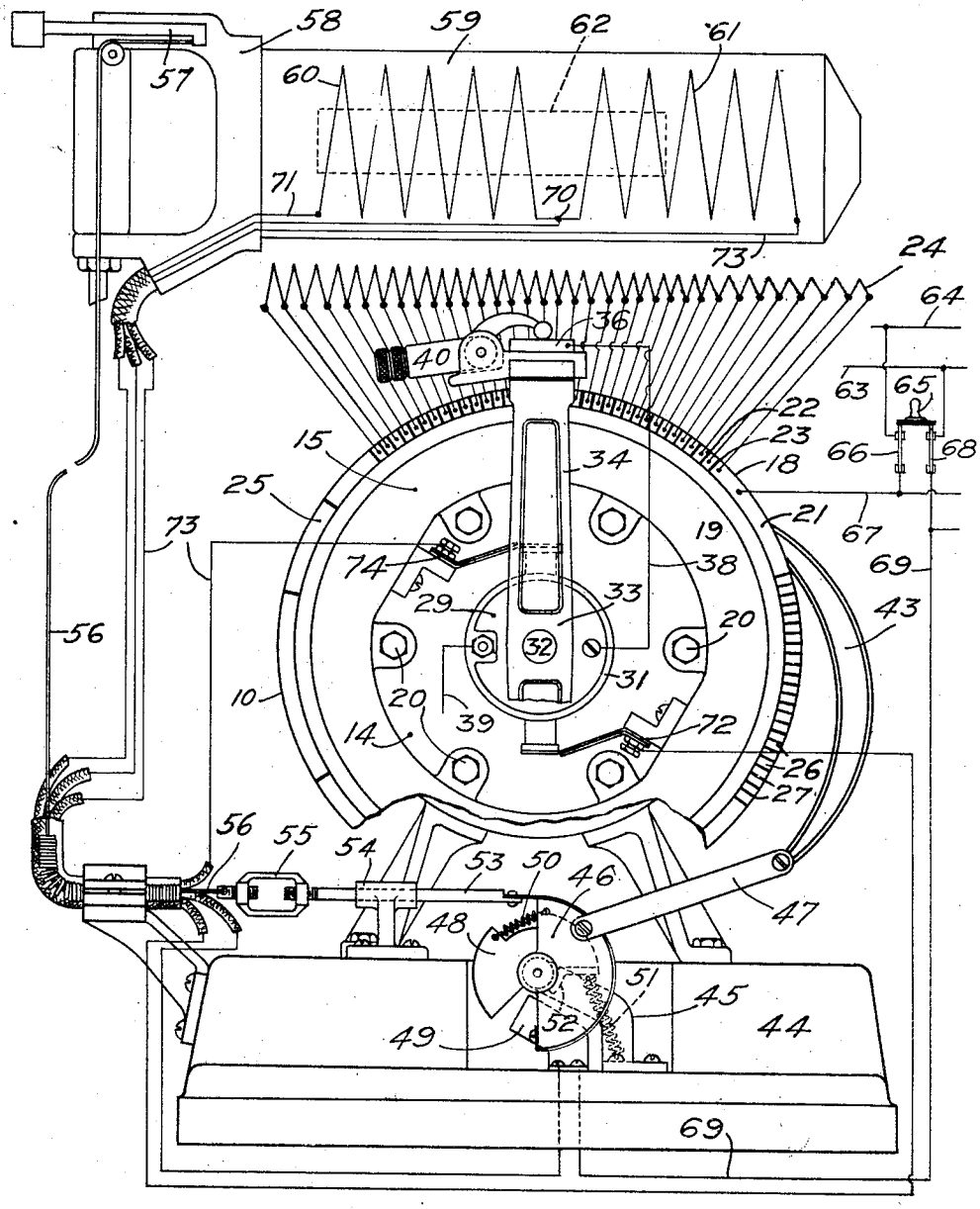


Fig. 1.

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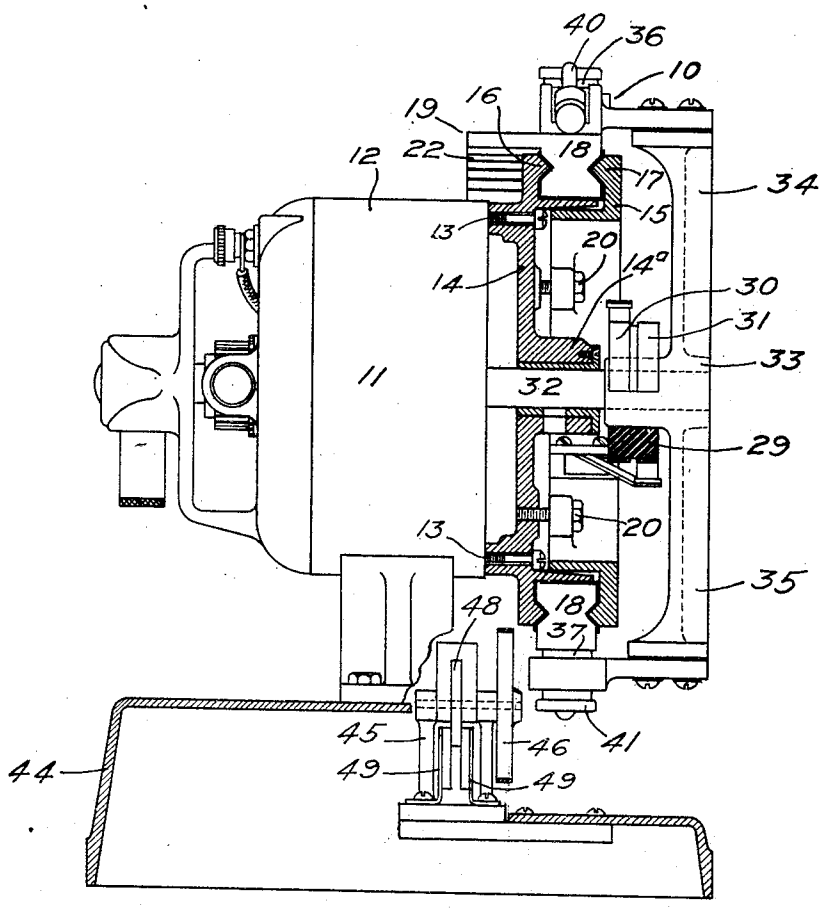


Fig. 2.

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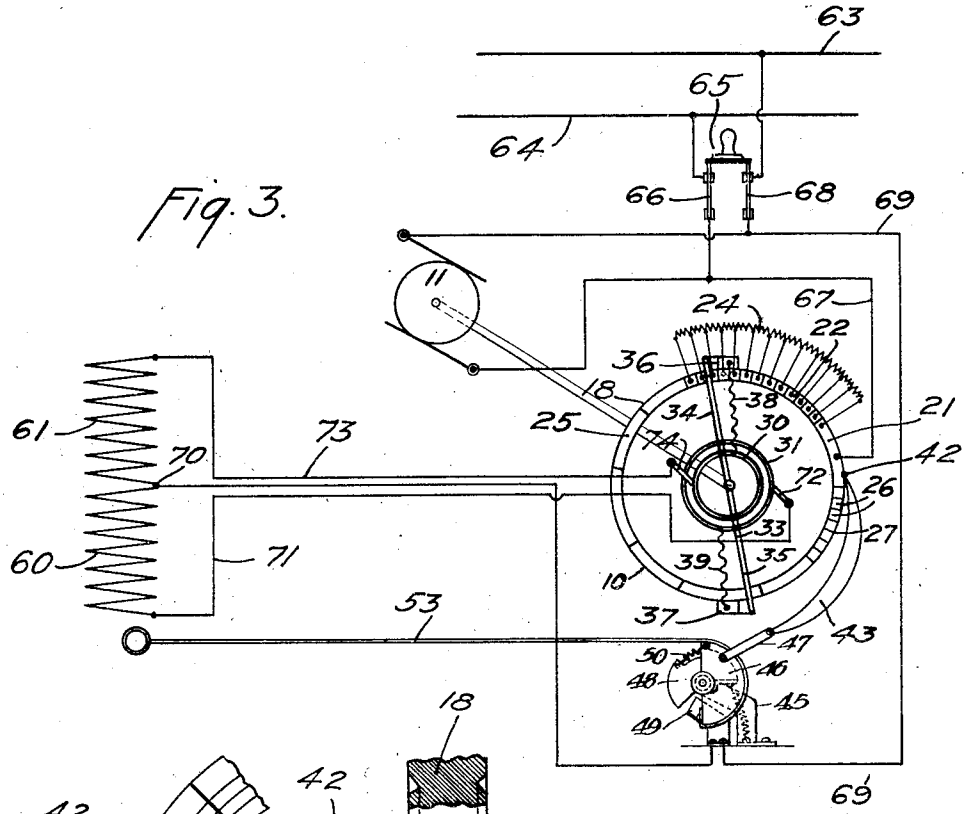
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3 SHEETS—SHEET 3.

Fig. 3.



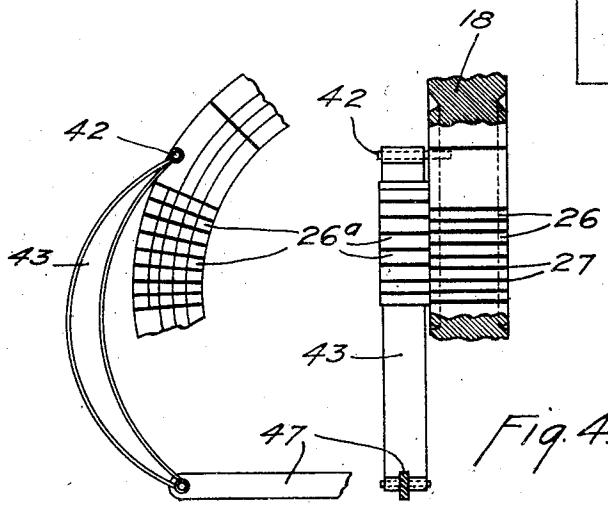


Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

ALEX WENDELBURG, OF NEW YORK, N. Y., ASSIGNOR TO PITTSBURGH ELECTRIC TOOL COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRIC TOOL.

1,262,148. Specification of Letters Patent. Patented Apr. 9, 1918.

Application filed September 4, 1913, Serial No. 788,121. Renewed February 27, 1918. Serial No. 219,540.

To all whom it may concern:

Be it known that I, ALEX WENDELBURG, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have made a new and useful Invention in Electric Tools, of which the following is a specification.

This invention relates to electric tool drivers and more particularly to an electric tool driver in which a reciprocating hammer is caused to deliver blows in rapid succession on a tool holder by the energizing and de-energizing of electro-magnet coils.

One of the objects of the invention is to provide an operating means for the tool driving motor whereby the strength of the blow may be dependent upon the will of the operator.

Another object of the invention is to provide a circuit breaker or commutator in the line between the source of current supply and the coils of the tool driver, of such construction that the current supplied to the coils may be gradually cut down.

Another object of the invention is to provide a digitally operated means whereby the effective surface of the energized contact on the circuit breaker or commutator may be lengthened or shortened, depending upon the amount of magnetic saturation desired in the armature element of the tool driving motor.

Other objects and advantages of this invention will be specifically referred to hereinafter, it being understood that changes in form, proportion and minor details of construction may be resorted to without departing from the spirit of my invention or sacrificing any of the advantages thereof.

In the drawings:

Figure 1 is a broken elevational view of my invention, the wiring being shown in diagram;

Fig. 2 is a view partly in elevation and partly in section of the commutator or circuit breaker, together with the motor which drives it;

Fig. 3 is a diagram of the wiring of a mechanism embodying my invention; and

Figs. 4 and 5 are fragmentary detail views of the commutator ring and the contact controller.

Referring now to the drawings by numerals of reference:

10 designates a circuit breaker shown as a commutator with movable brushes which are driven by a motor 11 receiving its power from a suitable source of supply, as for example, an electric generator. The commutator is fastened to the motor casing 12 by means of suitable fastening devices 13 which pass through the commutator frame and into the motor casing.

The commutator frame is shown as comprising a ring 14 having a hub 14ª and a ring 15, one ring being adapted to telescope within the other, said rings being provided with clamping jaws 16 and 17 to hold the segments 18 of the commutator ring 19. Fastening devices 20 are shown for holding the rings 14 and 15 in their clamping positions.

The commutator ring 19 includes an elongated segmental contact 21, a series of short auxiliary segments 22 insulated from each other by insulation 23; each segment 22 is connected to a stage of the resistance 24 and each succeeding stage of the resistance is of increasing strength so that the current in the line containing the tool motor may gradually be cut down. 25 is a long blank or insulated segment made up of a plurality of sections of insulating material, or metal insulated from the line. The sections of the segment are separated from each other by insulation so that in the event that current should happen to jump across the gap between the last segment of the series 22 and the adjacent section of the segment 25, the current would not then be carried around to a point on the ring opposite the series 22 so as to complete the circuit for the brushes rotated by the motor 11.

By reference to Figs. 1 and 3, it will be observed that the segment 25 extends around in the ring to the series of short supplementary segments 26 spaced apart and insulated from each other by insulations 27.

The segments 26 are provided with longitudinally extending contact extensions 26ª, the purpose of which will be apparent hereinafter.

Secured to the shaft 32 of the motor 11 is a metal hub 33 with oppositely projecting arms 34 and 35 carrying brushes 36 and 37. On the inner portion of hub 33 is fastened a fiber disk 29 which carries two metal collector rings 30 and 31. The brushes 36 and 37 and the collector rings 30 and 31 are electrically connected by the conductors 38 and 39. The brushes 36 and 37 are insulated

from the arm 34 but movable with relation thereto, and they are responsive in their movement to the weighted brake arms 40 and 41. These arms 40 and 41 not only serve to exert pressure upon the brushes 36 and 37, but as a brake or governor to maintain the rotative speed of the arm 33 within maximum limits, because, should the motor 11 tend to overspeed, centrifugal force will cause the free ends of the arms 40 and 41 to move out so as to exert pressure upon the brushes and cause them to bear with more force upon the commutator ring and thereby prevent the overspeeding of the motor.

On the live segment 21 is a swivel pin 42 in electrical connection with the segment 21 and to which is secured a movable conductor or contact 43 in the form of a spring bow which is adapted to swing around into contact with one or more of the extensions 26^a of segments 26, thereby in effect widening segment 21 and increasing the time during which current can flow to the brushes at each rotation thereof. The number of segments 26 in the series which will become energized from segment 21 through the movable conductor 43 will depend upon how many of the extensions 26^a are in contact with the conductor 43. The movement of the contact or conductor 43 will be responsive to the digitally operated part carried by the tool, and the construction of the mechanism for operating the element 43 is best shown in Fig. 1.

On the base 44 of the motor 10 is a make and break device illustrated as a switch. This switch consists of the bracket 45 upon which is a semi-circular disk 46 having connection with the contact 43 by means of a link 47. The disk 46 carries a metal blade 48 of suitable conductivity which is adapted to move between the two blades 49 secured to and insulated from the base 44. The blade 48 is adapted to have a rotative movement independent of the movement of the disk 46 and moves about the same axis as the said disk, as will be presently explained. The blade 48 is connected to the disk 46 by a spring 50, and the disk 46 is connected to the base 44 by a spring 51, the spring 51 being of greater strength than the spring 50. 52 is a finger carried by the disk 46 for the purpose of moving the blade 48 out of contact with the knives 49 at the proper time. To the disk 46 is connected an actuator rod 53 guided in a guide 54 and which has a turnbuckle connection 55 with a cord or cable 56 connected to the digitally operated actuator 57, shown in Fig. 1 as being connected to the handle 58 of the tool casing 59.

60 and 61 are the coils of the motor for the hammer, these coils being adapted to be alternately energized and deënergized, as is common in these devices, for the purpose of reciprocating the solenoid armature 62. The current is supplied from a suitable source, for example, from the generator, through the wires 63 and 64 to switch 65 from the leg 66 of the switch 65 to the segmental contact 21 through wire 67; 67 also leading to the motor 11. From the leg 68 of the switch 65 current passes through the wire 69 to one of the knives 49 and when the blade 48 is between said knives, through the other knife 49 to the neutral point 70 for the series coils 60 and 61. The return circuit for the series coil 60 is through wire 71 back to the brush 72 for the collector ring 31; and the return circuit for the coil 61 is through the wire 73 back to the brush 74 for the collector ring 30.

When the operator desires to start the hammer, it is only necessary to actuate the switch by the element 57 conveniently situated at the handle end of the tool so that the blade 48 will pass between the knives 49. The farther the blade 48 is inserted between the blades 49 the greater number of segments 26 will be connected with segment 21 by the contact 43, so that if the operator wishes to increase the active length of the segment 21, he may do so by adding as many segments 26 as he deems necessary simply by establishing contact between these segments and the contact 43. The greater the number of contacts 26 covered, the greater the active contact face between the blades 48 and 49. As more current is used, more contact area is employed. The reason for increasing the active length of the segment 21 is to increase the impact of the motor plunger which is reciprocated by the solenoid coils 60 and 61, and this is brought about by increasing the time during which current is allowed to build up in the coils as follows:

In a rapidly acting solenoid, such as is employed in operating motors for tools, as for example, an electric hammer, some time is consumed in magnetically saturating the solenoid armature, and at the high rate of speed at which the coils are energized and deënergized the amount of current which can be passed through the coils is governed by the length of time the coil is allowed to remain in the electric circuit; for example, if the length of segment 21 is fixed, the contact of the solenoid will be only for the length of time either brush takes to pass over it, so that at the high rate of speed at which it is traveling, the current will only be in the coil for a relatively short period. Therefore, the plunger's impact will be fixed. There can be no variation of the blow given by the plunger or solenoid armature unless there is provided a variable energized contact.

I am enabled by the construction shown to provide either a light blow, a very heavy blow, or a blow of any degree between two extremes. For example, if a light blow is desired, the contact 43 will not include the segments 26, so the blow will be propor-

tionate to the length of the segment 21. If a very heavy blow is required, the contact 43 may include all of the segments 26 in the period of saturation of the solenoid armature, and, of course, the coils will be materially strengthened. If a blow between these two extremes is desired, a proportionate number of the segments 26 in addition to the segment 21 will be caused to be energized.

It will be seen from the above that the pull of the magnet which is rapidly acting can be increased as the length of time current is allowed to flow through the same is increased, and that the blow of the hammer can be changed without introducing resistance to cut down the amount of current allowed to pass through the tool motor coils.

Besides acting as a circuit-closer, the blade 48 passing between the knives 49 will serve to keep the knife contacts 49 clean. During the operation of the switch when the pull on the cord or cable 56 is released, the blade 48 does not immediately move out from between the knives 49, but it is held there by the friction of said blades, and as the disk 46 is being brought back to its original position by the spring 51, the small light spring 50 is brought into play; the finger 52 passing to the under side of the disk 46 will pass between the knives 49 so as to force the blade 48 out of contact with the two knives 49. Inasmuch as the spring 50 is of relatively less strength than that of the spring 51, it is possible to have a considerable movement of the disk without a corresponding movement of the blade 48. The spring 50, however, will be effective in quickly breaking the circuit at the proper period so as to cause practically an instantaneous break, thus preventing any serious arcing or burning should the switch be released at a point when the current is running through the tool motor.

By reference to Fig. 1 it will be observed that as the brush leaves the energized segment 21 and passes on to the segments 22 the current will not be broken sharply so as to cause an arc, but the current will be shunted from the brush through the first segment of the series 22 through resistance then through the energized segment 21. By so doing, the first unit of resistance is introduced into the circuit without breaking it, and in this manner the current is decreased somewhat. The brush in the path of its rotation now moves to the second segment of the series 22, and as the current has been somewhat weakened by the introduction of the first unit of resistance, a greater amount of resistance may be introduced in the second unit between the second unit of the series than was introduced between the energized segment 21 and the first unit or segment of the series 22 without causing an arc to jump across the gap between the said segments. This increasing of a resistance for each successive unit or segment of the series 22 may be continued throughout the series so that by the time the brush will have traveled to the last segment of the series, the current will have been reduced to practically zero. The circuit at this point is then broken entirely without causing arcing. In practice I prefer to have the resistance units just a trifle below the resistance of the gap between each of the segments of the series 22. This I find desirable so that current will flow through the resistance wire rather than to have it arc across the gaps between the segments in the series 22. In the form shown, the segments 22 are of equal size and the gaps between the same are of equal size, but the current is cut down in stages by resistance of successively increasing strength. By this means the current decreases as the resistance of each stage increases. Instead of having the gaps between the segments in the series 22 uniform and the resistance of increasing strength, I may construct this part of the commutator by employing uniform periods of resistance and increasing the size of the gaps.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention together with the device which I now consider to represent the best embodiment thereof, but I desire to have it understood that the device shown is only illustrative and that the invention can be carried out in other ways.

Having thus described my invention, what I claim is:

1. Apparatus of the character described, comprising in combination, a reciprocating electric tool, a commutator for controlling the supply of energy to said tool, means associated with said commutator for varying the time during which energy is supplied to said tool and means associated with said tool for controlling said first-named means from said tool.

2. Apparatus of the character described having in combination, a circuit breaker comprising a commutator having a live segment and a dead segment, brushes adapted to move over said commutator, an electric tool, means for energizing said tool from said brushes, means for varying the effective length of said live segment to vary the time during which said tool is energized from said brushes, and means associated with said tool for controlling said varying means from said tool.

3. Apparatus of the character described having in combination, an electric tool, a circuit breaker comprising a commutator having a live contact portion, means for supplying energy from said contact portion to said tool, a spring conducting element for

varying the length of said contact portion, and means associated with said tool for controlling the operation of said element from said tool.

4. The combination with an electrical hammer of a controller therefor remote from said hammer, a digitally operated member near the hammer handle, an actuating bar controlled thereby, and a switch located adjacent said controller for controlling the supply of current to said hammer and operatively connected to said bar, said switch comprising contact blades, a rotatable spring-retarded disk, a blade movable between said contact blades, and a spring connecting said disk to said movable blade.

5. The combination with an electric hammer of a controller therefor remote from said hammer, a digitally operated member near the hammer handle, a rod connected for operation thereby, and a switch located adjacent said controller for controlling the supply of current to said hammer and controlled by said rod, said switch comprising yielding contact blades, a segmental metal blade movable between said contact blades to establish electrical connection therebetween, a rotatable disk for moving said segmental blade forward, a spring connected to retard the forward movement of said disk, and a second spring connecting said segmental blade to said disk to effect a quick break when the electrical connection is to be interrupted.

6. An apparatus of the character described, comprising in combination, an electric hammer, a digitally operated member near the hammer handle, a circuit for said hammer, a commutator connected to said circuit for controlling the supply of current to said hammer and comprising a live segment and a dead segment, means for varying the effective length of said live segment, a switch for controlling the hammer circuit comprising a movable actuating member and a plurality of contact members, a connection between said actuating member and said varying means, and means connecting said digitally operated member with said actuating member whereby said switch and said varying means may be controlled from said hammer.

In testimony whereof, I have hereunto subscribed my name this 26th day of August, 1913.

ALEX WENDELBURG.

Witnesses:
B. F. FUNK,
MARK ALEXANDER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."