No. 701,627. Patented June 3, 1902.

E. SCHREIER & H. DÜMLER.

SWITCH FOR ELECTROMOTORS FOR DRIVING DENTAL APPARATUS.

(Application filed Jan. 10, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

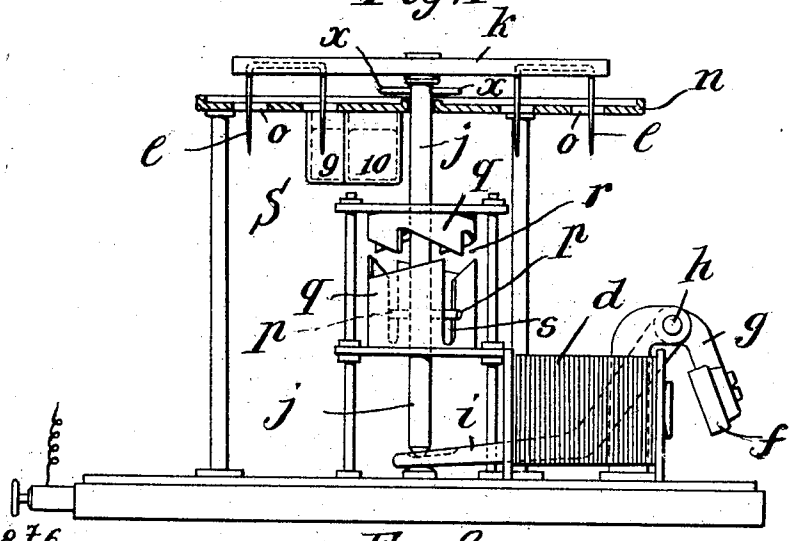
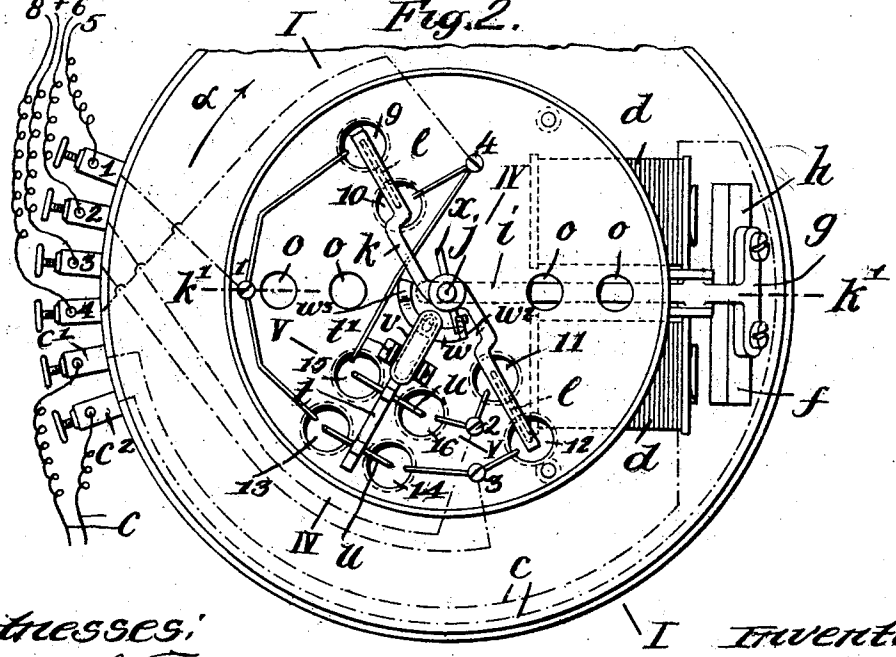


Fig. 2.



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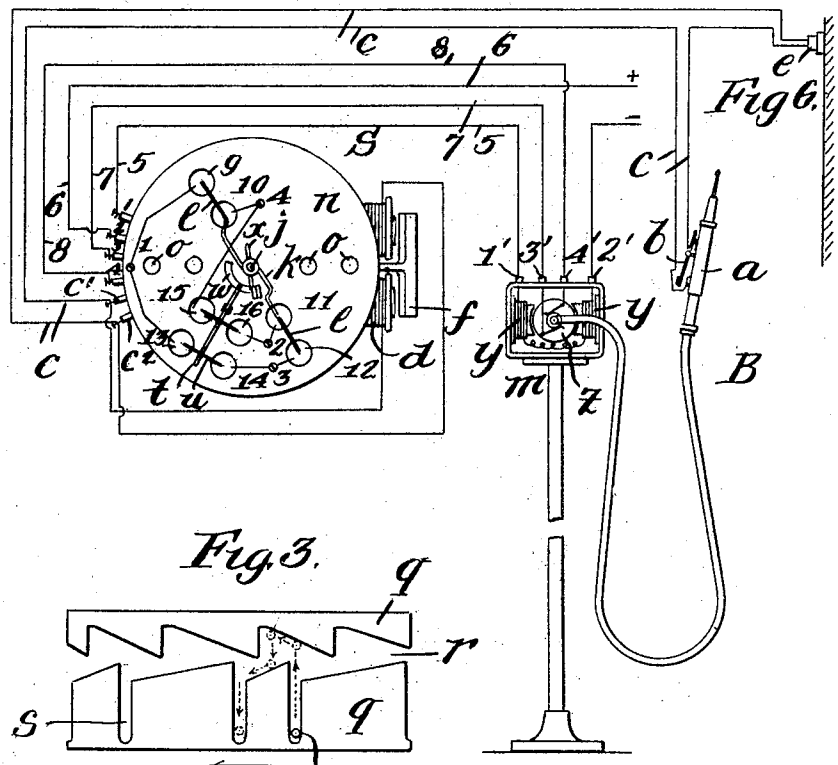
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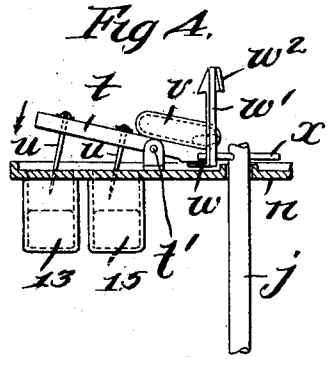
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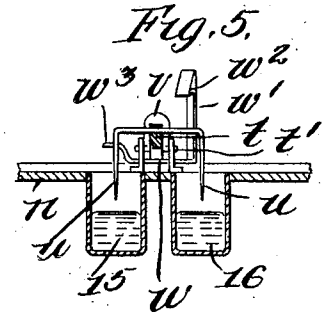
SWITCH FOR ELECTROMOTORS FOR DRIVING DENTAL APPARATUS.

(Application filed Jan. 10, 1902.)

(No Model.) 2 Sheets—Sheet 2.







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UNITED STATES PATENT OFFICE.

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SWITCH FOR ELECTROMOTORS FOR DRIVING DENTAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 701,627, dated June 3, 1902.

Application filed January 10, 1902. Serial No. 89,221. (No model.)

To all whom it may concern:

Be it known that we, EMIL SCHREIER and HERMANN DÜMLER, subjects of the Emperor of Austria-Hungary, residing at Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Switches for Electromotors for Driving Dental Apparatus; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

Our invention relates to those kinds of switches that are operated at a distance by a push-button or contact-switch affixed to a portable apparatus, such as the handle of a dental drill.

This invention includes an electrical connection made on the handle of a portable tool operated by an electric motor, a switch actuated by said connection in such a manner that said motor may be started, stopped, or reversed, as the operator may desire.

The invention also includes the novel combination, in such a mechanism, of a solenoid connected in series with a suitable push-switch and an electric circuit, an armature fastened to one arm of a pivoted lever, the other arm engaging one end of a vertical shaft, and a cross-arm provided with switch-blades fastened to the other end of said shaft, cams with slots surrounding said shaft and adapted to guide a cross-pin forming part of the aforementioned shaft in such a manner that it may rotate.

The invention furthermore includes the novel application of an auxiliary switch acted upon by the aforementioned shaft, a tube fastened to the lever of this switch and containing mercury, also a novel combination of electrical connections, all of which will hereinafter be more fully described, and pointed out in the claims.

The objects of our invention are to provide an apparatus in which a portable tool driven by an electric motor is started or stopped by a push-switch suitably affixed to the handle of said tool, to provide means by which the electrical connections in a switch may be changed at will by opening or closing an auxiliary circuit, to provide an electrical-driven tool in which said tool may be stopped or reversed instantly without mechanical brake and without any movement of the operator except by the hand holding the tool, thus providing a portable tool by means of which better and more difficult work may be accomplished in less time and in a safer and more efficient way. We attain these objects by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section on line I I of Fig. 2. Fig. 2 is a plan view of switch. Fig. 3 shows the development of a cylindrical cam. Fig. 4 and Fig. 5 are vertical sections on lines IV IV and V V of Fig. 2. Fig. 6 illustrates the general arrangement of our invention, showing a motor driving a dental drill; also, the electrical connections between the motor and switch and connections between the portable tool and switch.

Referring to Fig. 6, B indicates a portable apparatus, the handle *a* containing a mandrel connected to a flexible shaft in one end and provided with means to receive a suitable tool—such as a drill or emery-wheel, &c.—in the other end. The handle *a* is also provided with a push-button or spring-contact switch, by means of which the electric circuit *c* may be opened or closed, thus operating a switch hereinafter described. The electric circuit *c* is either connected to a separate source of current or to the main line that operates the motor by means of a plug cut-out *e*, as shown in Fig. 6.

The electric motor may be of any type and has terminal connections 1′, 2′, 3′, and 4′ to the armature *z* and fields *y*. The shaft of armature *z* is provided with means to connect with the flexible-shaft-driving mandrel heretofore referred to.

In the switch mechanism, Fig. 1 and Fig. 2, *d d* are solenoids connected in circuit *c*, heretofore referred to, and act upon armature *f*. Lever *i g* is pivoted at *h*. The shorter arm *g* is fastened to armature *f*, and the other arm *i* is adjusted to engage a vertical shaft *j*. The arm *i* is provided with a slot in which the pointed end of shaft *j* rests and the object of which will hereinafter be explained. The

vertical shaft j is on its upper end provided with a cross-arm k, which in turn holds the V-shaped switch-knives or contact-points $l\,l$ insulated from each other. Under said cross-arm k a cross-pin x is fixed and the object of which is to engage an auxiliary switch mechanism, hereinafter described. At a desired distance under the pin x shaft j slides through top plate n, which forms a guide. A second cross-pin p and a part of shaft j act on a stationary cam g. Cam q is built up of two cylindrical pieces surrounding shaft j, bolted at a suitable distance from each other and to the frame of switch. Both parts of cam q have in this case four teeth. The lower part has, furthermore, four slots for cross-pin p to rest in. It will be observed that as cross-pin p engages the cam on both sides of shaft those parts opposite each other must be symmetrical. When a pin on one side only of the shaft is used, this is not necessary.

The auxiliary switch heretofore referred to consists, mainly, of two U-shaped contact-points u, mounted on a lever t, pivoted at t'. Said lever t is provided with a closed tube containing some mercury and the object of which is to retain by the shifting weight of the mercury a given position. Plate w is fixed to lever t, as shown in Figs 4 and 5, and is bent up to form a projection w^3 in one end and a projection w', with hook w^2, in the other end. This plate forms a cam-surface for either end of cross-pin x to act upon. The base of the switch on which this mechanism is mounted contains six binding-posts 1, 2, 3, and 4, corresponding and connected to the terminals of the motor, and c' c^2, connecting circuit c with solenoid d. Top plate n, heretofore referred to, is practically a switchboard. Cups are secured to top plate n in pairs, as shown in Fig. 5, and contain mercury. Each pair may be connected electrically by lowering U-shaped contact-points into the same. To use this apparatus, the operator closes circuit c, which may be done by depressing a push-switch b with the thumb or one of the fingers of the hand holding portable tool B. When the push-switch b is released, the circuit is opened again, and, as will be seen, at each opening and closing of said circuit c an operation is automatically performed in switch S.

To make clear the operation of switch S, let us assume cross-arm k placed in an "off" position, (denoted by line k', Fig. 2, and the section of Fig. 1.) Contact-points l make no electrical connection here, holes o c in top plate n having for an object to give points l clearance, to permit shaft j to bear into slot of arm i, cross-pin x to bear upon plate w, and cross-pin p into slot of cam g. When the operator closes the circuit at b, the solenoid d attracts armature f, giving arm i a radial motion about pivot h and raising shaft j. The object of slot in arm i is here evident. In transforming the radial motion into the straight-line motion the end of shaft j slides along the slot. Shaft j when raised allows cross-pin p to engage the upper tooth of cam g, thus twisting the shaft in the direction indicated by arrow, and when the operator now opens the circuit at b solenoid d releases armature f, and shaft j by virtue of its weight falls back. This permits cross-pin p to engage the tooth of lower part of cam g, which imparts another twist to shaft j. As stated, shaft j falls back by gravity. It is evident, however, that a spring or other means may be employed to impart this motion. In Fig. 3 the dotted lines indicate the evolution of pin p. It will here be seen that two teeth are twice as wide as the other two, showing that the angle through which cross-arm K moves depends on the distance between the slots, in this case sixty degrees and one hundred and twenty degrees. Cross-arm k has therefore moved through an angle of sixty degrees and is now in the position as shown in Fig. 2 and Fig. 6. Pin X in its downward motion with shaft j bends aside hook w^2, which by virtue of its shape allows pin X to pass down without disturbing the switch, but not up. The auxiliary circuit is now open, but the main circuit is closed. Wire 6 connects electric current to binding-post 2 and mercury-cup 11. The current traverses contact-point l into mercury-cup 12, then to binding-post 3, along the wire 7 to binding-post 3′ on motor, then into the armature and back to switch S through binding-post 4′, wire 8, and binding-post 4, connected to mercury-cup 10. Here the current again passes a contact-point l, connecting with mercury-cup 9 and returning to fields of motor through binding-post 1, wire 5, and binding-post 1′, and as binding-post 2′ is connected to the other pole of fields main electric line the circuit is complete and the motor is driven.

To instantly stop or reverse the motor, circuit is closed and the mechanism goes through the same motion as previously explained, with this exception: Pin X engages hook w^2, which closes the auxiliary switch. This reverses the current in the armature, but not in the fields. The current now passes from wire 6 to binding-post 2, then to mercury-cup 16, over contact-point u into cup 15, then to binding-post 4, along wire 8 to binding-post 4′, into armature z, through binding-post 3′, wire 7, back to switch S, and to binding-post 3, connected to mercury-cup 14. Here again it passes contact-point u into mercury-cup 13, back through fields into main line, as heretofore described. This all takes place while circuit c is closed the second time, and if kept closed the motor will run in the reverse direction. If only closed for an instant, the centrifugal force of armature is checked, and before reversing the motion of the armature z circuit c is opened again, allowing cross-arm k to swing to the off position and permitting cross-pin x to act on w^3, thus opening auxiliary switch, which has for a short time reversed the direction of the current through the armature z, thus acting as an electric

brake. The parts of the mechanisms may be altered. Additional contact-points may be used with rheostat connections. The auxiliary-switch contact-points may be put on a cross-arm *k*, all of which we include in the scope of our invention.

Having described our invention, what we claim is—

1. The combination with a tool and an electric motor for operating it, of an electric switch controlling the direction of the current in the motor-circuit, an auxiliary electric circuit and one or more solenoids connected therewith for operating said switch, and a push-button on the handle of the tool for opening and closing the auxiliary circuit, substantially as and for the purpose specified.

2. The combination with a tool and an electric motor for operating it, of an electric switch for controlling the motor-circuit, an auxiliary circuit including one or more solenoids for operating said switch, and a spring-contact carried by the handle of the tool for opening and closing said auxiliary circuit, substantially as and for the purpose specified.

3. The combination with a tool and an electric motor for operating it, of an electric switch for controlling the motor-circuit, an auxiliary circuit including one or more solenoids for operating the switch, a spring-contact carried by handle of the tool, and means actuated by the switch for stopping starting and reversing the motor, substantially as and for the purpose specified.

4. The combination with a tool and an electric motor for actuating it of a switch S comprising cams *q* surrounding switch-shaft and adapted to guide the cross-pin forming part of said shaft in such a manner that it may rotate and otherwise control its movements, substantially as described.

5. The combination with a tool and an electric motor for actuating it of switch S with solenoids *d* adapted to impart a pivot motion to arm *i* and the means to transform this into a vertical as well as revolving motion of shaft *j*.

6. The combination with a tool and an electric motor for actuating it of solenoids to impart the operating movements in a switch S and a cam surrounding a shaft with a cross-pin to control and guide such movements, substantially as described.

7. The combination with a tool and an electric motor for actuating it, of solenoids to impart a part of the operating movement and a spring or the action of gravity to impart the other part of the operating movement in a switch S, a cam surrounding a shaft with a cross-pin to control and guide such movements, substantially as described.

8. The combination with a tool and an electric motor for actuating it of solenoids to impart the operating movements in a switch S, a pivot-lever with a slot or notch in which the point or end of a shaft rests one or a number of cross-pins or pins a part of said shaft one or a number of cams surrounding, guiding and controlling the movements of said shaft.

9. The combination with a tool and an electric motor for actuating it of solenoids to impart the operating movements in a switch S, a pivot-lever with a slot or notch in which the point or end of a shaft rests, a number of cross-pins or pins a part of said shaft and arranged so as to guide and control the movement of shaft by means of a cam and to control the opening and closing of an auxiliary switch, substantially as described.

10. The combination with a tool and an electric motor for actuating it of solenoids to impart the operating movements in a switch S an auxiliary switch comprising a switch-lever, a tube fastened to the lever and containing mercury, a plate *w* on this lever with projecting arms adapted to engage with a cross-pin or pin a part of main switch-shaft, substantially as described.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

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HERMANN DÜMLER.

Witnesses:
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