

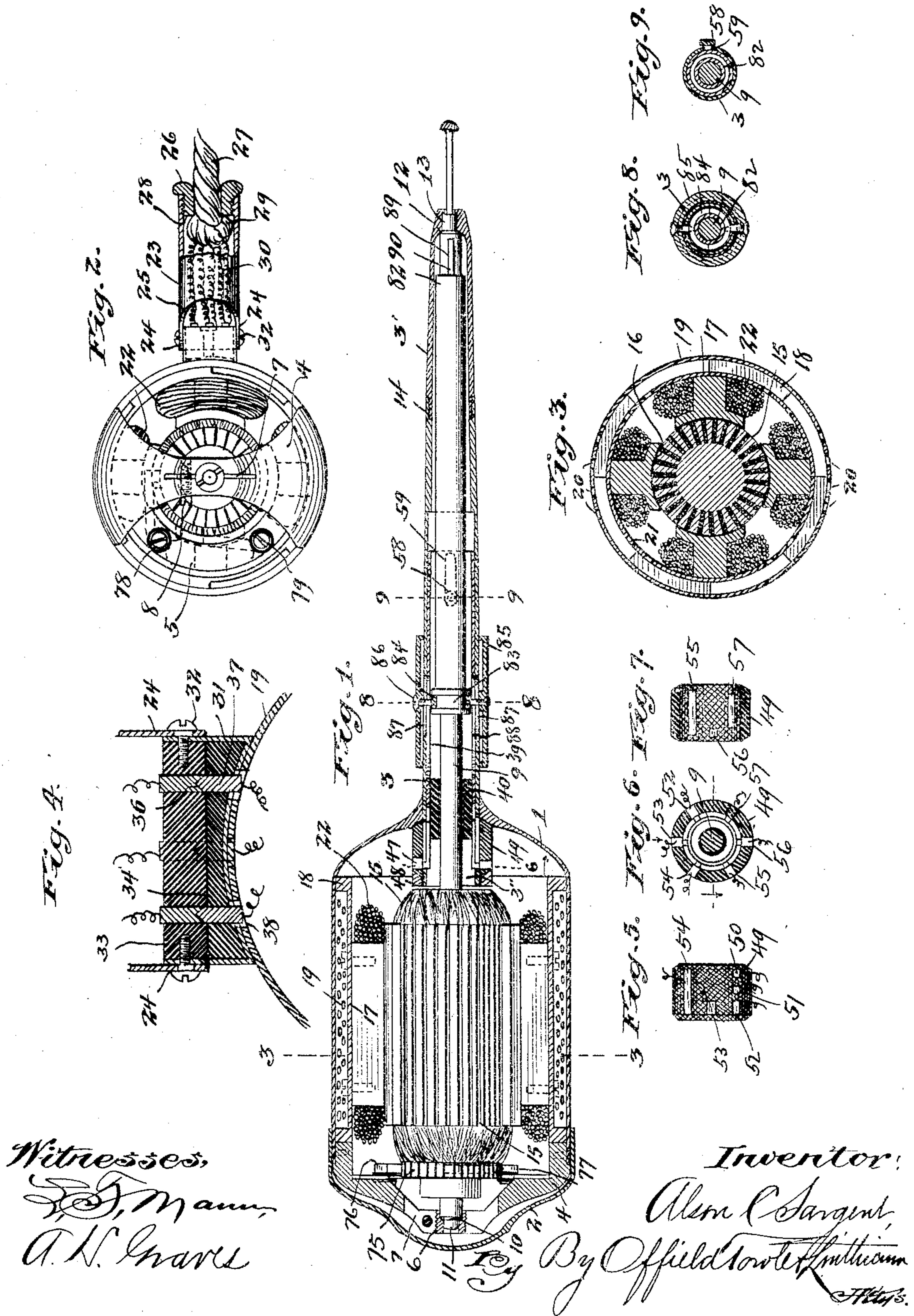
No. 776,204.

PATENTED NOV. 29, 1904.

A. C. SARGENT.  
DENTAL HANDPIECE.  
APPLICATION FILED JULY 13, 1903.

NO MODEL.

3 SHEETS--SHEET 1.



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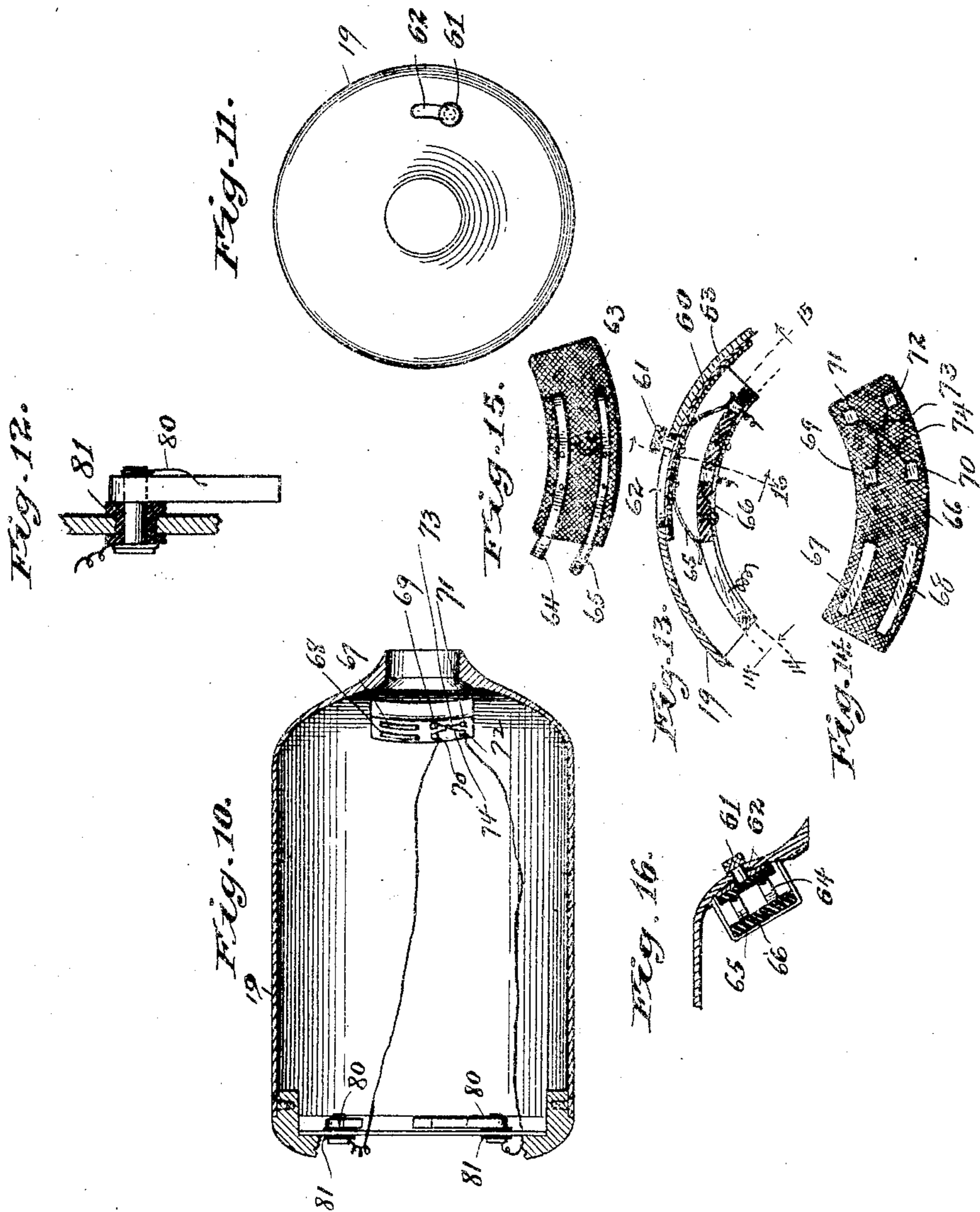
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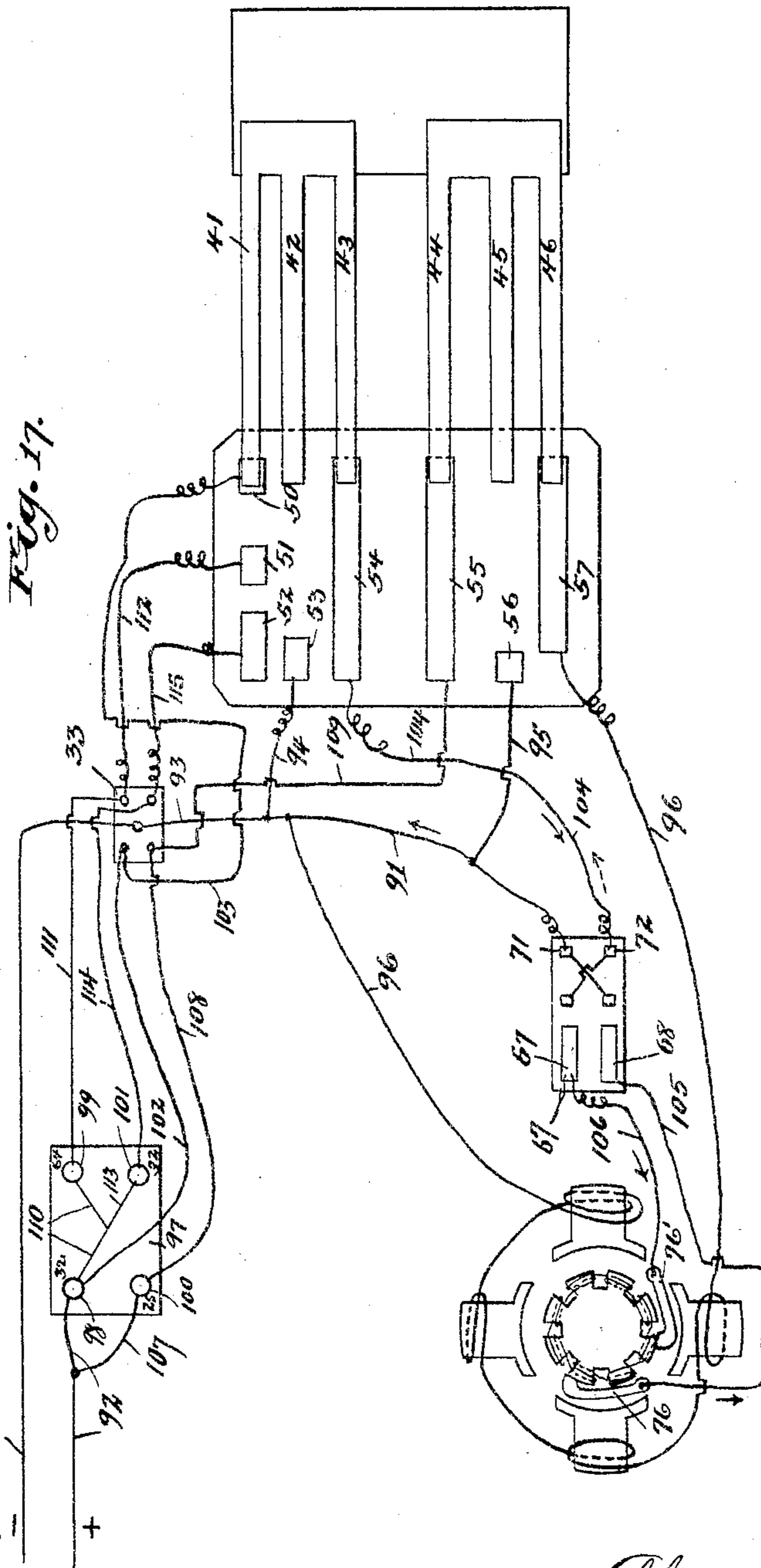
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# UNITED STATES PATENT OFFICE.

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## DENTAL HANDPIECE.

SPECIFICATION forming part of Letters Patent No. 776,204, dated November 29, 1904.

Application filed July 13, 1903. Serial No. 165,296. (No model.)

*To all whom it may concern:*

Be it known that I, ALSON C. SARGENT, a resident of Des Moines, in the county of Polk and State of Iowa, have invented certain new and useful Improvements in Dental Handpieces, of which the following is a specification.

This invention relates to improvements in dental handpieces, and refers more specifically to a self-contained motor-handpiece.

Among the salient objects of the invention are to provide a handpiece in which the driving power is applied directly to the tool-spindle as distinguished from those handpieces in which the spindle is actuated through the medium of a flexible shaft or the like; to provide a self-contained combined motor and handpiece, thereby dispensing with the separate motor mechanism heretofore employed, together with its power-transmission mechanism; to provide a construction in which the driving power is applied directly and positively to the tool-spindle, thereby obtaining a more uniform and positive movement of the tool and at the same time effecting a material saving in units of power; to provide a handpiece in which the controlling devices form a part of the handpiece itself, thereby enabling the instrument to be more conveniently and reliably operated; to provide improved details of construction contributing to the attainment of the general objects hereinbefore stated, and, in general, to provide a simple and improved apparatus of the character referred to.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims; and the invention will be more readily understood from the following description by reference to the accompanying drawings, in which—

Figure 1 is an axial sectional view of a handpiece embodying the invention, certain minor parts being omitted and certain internal parts shown in side elevation. Fig. 2 is a view of the rear end of the handpiece with the end cap removed and showing also the terminal sheath partly in section and partly in elevation. Fig. 3 is a cross-sectional view taken on line

33 of Fig. 1. Fig. 4 is an axial sectional view of the pivoted end of the terminal sheath, showing in detail the connections with the handpiece. Figs. 5, 6, and 7 are details of the controller-sleeve. Fig. 8 is a cross-sectional view taken on line 8 8 of Fig. 1. Fig. 9 is a cross-sectional view taken on line 9 9 of Fig. 1. Fig. 10 is an axial sectional view of the handpiece-shell, showing particularly the mounting of the reversing-switch and commutator-brushes therein. Fig. 11 is a front end view of the shell shown in Fig. 10. Fig. 12 is a sectional detail showing the manner of mounting the common commutator-brushes upon their pivotal supports. Fig. 13 is a sectional view taken through the motor-shell and subjacent switch-plate, showing the details of the reversing-switch. Fig. 14 is a view taken on line 14 15 of Fig. 13 and looking downwardly. Fig. 15 is a view taken on the same line 14 15 of Fig. 13 and looking upwardly. Fig. 16 is a cross-sectional view taken on line 16 16 of Fig. 13. Fig. 17 is a diagrammatic view showing the electrical connections.

Referring to the drawings, 1 designates as a whole an outer motor shell or cover provided at its rear end with a detachable cap 2 and at its opposite end with an axial extension-shell 3, which incloses the principal length of the spindle and other operative parts.

4 designates a yoke arranged to extend diametrically across the rear end of the shell inside of the cap and provided at one side with an integral or rigidly-united arc-shaped member 5.

6 designates a step-bearing adjustably seated in the yoke 4 concentric with the axis of the handpiece said bearing being in the present instance shown as screw-threaded upon its exterior and seated in a correspondingly-threaded aperture in the yoke. In order that the bearing may be adjustably clamped in position, the yoke is longitudinally divided, as indicated at 7, and the clamping-screw 8 inserted transversely therethrough.

9 designates as a whole the spindle, which is provided at its rear end with a step-shoulder 10 and center extension 11, which fit the correspondingly-shaped interior of the bearing 6, while at its opposite end it is provided

with a conical bearing-shoulder 12 and centering extension 13, which fit and engage correspondingly-shaped bearing-surfaces formed in the forward end of the extension 3 of the handpiece-shell. For convenience of access the extension 3 is made separable intermediate its length, as indicated at 14, the tip end 3' being screw-threaded to engage the correspondingly-threaded end of the main portion.

Upon the spindle within the main portion of the shell is rigidly mounted an armature 15, which may be of any suitable or preferred winding, and concentrically therewith and at equal angular distances apart are mounted upon the outer shell a plurality of pole-pieces 16, there being four in the present instance. These pole-pieces are not mounted directly upon the outer shell, but are mounted upon the inner face of an inner shell or annular frame member 17, provided at each end with outturned flange portions or extensions 18, which are secured to the interior of the main outer shell, thereby supporting the inner shell at a distance from the outer shell throughout its main portions and providing an intervening insulating-space 19. The object of this construction is to prevent the direct transmission of the heat generated in the field-pieces to the outer shell, and in order that the insulating-space may act most effectively and in order to provide for a circulation of air between the exterior and interior of the handpiece the outer shell is provided with series of ventilating-apertures 20 and the inner shell with similar series of ventilating-apertures 21. The pole-pieces 16 are provided with the usual windings 22, ordinary series winding being employed in the present instance.

In use the handpiece is connected with a flexible conductor through which current is led into the motor, and in order to provide a connection which will preserve the integrity of the electric connections and will at the same time protect the several conducting-wires against undue torsion and breaking, an improved form of sheath and connections are provided constructed as follows: Referring to Figs. 2 and 4, 23 designates as a whole a tubular sheath which is provided at one end with a pair of pivot-ears 24, between which ears the sheath is cut away, as indicated at 25, to enable the sheath to be flexed into closer relation to the exterior of the handpiece-shell. In its outer end is seated an annular plug 26, through which the main conductor-cord 27 extends, the inner end of said annular plug providing a shoulder 28, which coöperates with a knot or enlargement 29 in the cord to hold the latter in position and prevent tension coming upon the connecting-wires 30 within the sheath. 31 designates a socket-like receptacle permanently secured to the exterior of the shell and to the sides of which the ears 24 of the sheath 23 are pivotally united by means of pivot-screws 32. The

socket 31 is of sufficient depth to receive a pair of insulating-blocks 33 and 34, respectively, arranged in superposed relation. The upper insulating-block 33 has seated therein a plurality of contact studs or plugs 35, there being one stud for each conductor 30, these studs extending entirely through the insulating-block and being provided at their inner ends with conical recesses 36. The lower block 34 is provided with a corresponding set of contact-studs 37, which extend through said block and project through apertures 38 into the interior of the motor-shell, the apertures 38 being made larger than the studs, so as to avoid electrical contact therewith. The upper ends of the studs 37 rise above the insulating-block and are conical to fit and engage the corresponding recesses 36 of the studs 35. The several wires 30 are soldered or otherwise secured to the respective studs 35, and extension-conductors are similarly connected with the inner ends of the studs 37 and extend thence to the controller and reversing-switch, as will hereinafter appear.

Next describing the controller mechanism and referring to Fig. 1, 39 designates an inner sleeve constructed to fit and slide within the extension of the shell 3. The rear end of the sleeve 39 terminates approximately coincident with the juncture of the extension 3 with the main shell of the handpiece, and within this end there is rigidly mounted an insulating block or sleeve 40, one end of which protrudes a considerable distance beyond the end of the sleeve. Upon the projecting end of the insulating-sleeve 40 are mounted a plurality of contact-brushes 41, 42, 43, 44, 45, and 46 and each provided at its free end with an outturned portion 47, adapted to engage corresponding contact-blocks, now to be described.

The outer extension-shell 3 is extended inwardly beyond its point of juncture with the larger outer shell a considerable distance, as indicated at 3'', and upon the extreme inner end thereof is threaded a clamping-ring 48. Upon the exterior of the extension 3'' and between the clamping-ring 48 and the opposing inner surface of the main shell is mounted an insulating-sleeve 49, which, as best shown in Figs. 5, 6, and 7, supports a plurality of contact-plates, designated 50 to 57, inclusive. (See diagrammatic view of Fig. 17.) Each contact-plate extends through the insulating-sleeve, so that its inner surface is exposed to a corresponding brush, while with its outer surface is connected one of the several conductors. The controller-sleeve 39 is shifted endwise by means of a stud 58, connected therewith and extended out through a slot 59 in the upper shell, as best seen in Fig. 1.

A reversing-switch mechanism is also provided in addition to the controller mechanism.

Referring to Fig. 10, &c., 60 designates a plate curved to fit and slide upon the interior

of the outer shell and with which is connected a finger-stud 61, working through a slot 62 in said shell and whereby the plate may be shifted circumferentially of the shell. Upon the plate 60, but insulated therefrom by means of a sheet of insulating material 63, are mounted two bow-shaped spring contact-fingers 64 and 65, the free ends of which bear yieldingly upon an insulating-plate 66, mounted upon the outer surface of the shell 17 and carrying a series of contact plates or blocks, (designated 67 68 69 70 71 72.) The contact-blocks 69 and 72 and 70 and 71 are cross-connected by means of conductors 73 and 74, as best indicated in Figs. 14 and 17. The several contact-blocks are also connected with conductors at their sides remote from the spring contact-fingers 64 and 65, as will hereinafter be explained.

The armature 15 is provided with the usual commutator-segments 75, and upon the yoke 4 are mounted two commutator-brushes 76 and 76', adapted to coöperate therewith. These commutator-brushes are, as usual, arranged at an angular distance of ninety degrees apart, pivotally mounted upon the member 5 of the yoke 4, as indicated at 78 and 79, (see Fig. 2,) and held in yielding engagement with the commutator-segments by means of suitable springs 80. (See Fig. 12.) The commutator-brushes are insulated from their supports by means of insulating-bushings 81.

Next describing the tool-holding mechanism and referring again to Fig. 1, 82 designates a sleeve mounted upon the spindle to reciprocate endwise thereon and provided at one end with an annular groove 83, within which is seated a ring 84. 85 designates a slide taking the form of a sleeve mounted upon the exterior of the extension 3 and operatively connected with the ring 84 by means of a pair of screw-studs 86, working through slots 87, formed in the shell extension 3. In order that the manipulation of the slide 85 may not interfere with the movement of the controller-sleeve, the latter is likewise slotted, as indicated at 88. In the forward end of the spindle are formed a plurality of longitudinally-extending mortises 89, within which are seated chuck-jaws 90, which are externally tapered and are forced into clamping engagement with the shank of the tool by the end of the sleeve 82, which telescopes over said jaws. The mortises 89 extend radially through the spindle to the axial tool bore or socket thereof, and the inner faces of the jaws are suitably shaped to engage and hold the shank of the dental tool. Inasmuch as the features of construction of the tool-holding mechanism form the subject of a separate application filed contemporaneously herewith, Serial No. 165,295, these features need not be more specifically described herein.

Describing now the circuit connections and referring to diagrammatic Fig. 17, 91 and

92 designate two main conductors connected with any suitable source of current-supply—as, for example, a storage battery. The conductor 91 extends directly to and is connected with the central contact-stud 35 of the plate 33. From the connected contact-stud 37 a conductor 93 extends to the contact 71 of the pole-changing switch. A branch conductor 94 leads to the contact-plate 53 of the controller, a second branch conductor 95 leads to contact-plate 56 of the controller, and a third branch conductor 96 constitutes a series winding of the field-pieces and extends thence back to the contact-plate 57 of the controller. In the main line 92 is interposed a series of resistances, which resistances may conveniently take the form of incandescent lamps, a support 97 being to this end shown provided with a series of lamp-sockets 98 99 100 101. In order to provide a greater range of resistance, the lamp-sockets are intended to be occupied by lamps of different resistance—for example, a lamp of thirty-two-candle power being placed in the socket 98, a sixty-four-candle-power lamp in socket 99, a twenty-five-candle-power lamp in socket 100, and a thirty-two-candle-power lamp in socket 101. The contact-brushes of the controller-sleeve are at all times in contact with some of the contact-plates of the stationary controller member, and in the diagram these brushes are shown in that position in which the lowest resistance is interposed, and the motor therefore has the highest speed. Three operative positions or rates of speed are provided for in the present instance, and in addition a further position in which the armature is short-circuited while the field remains in circuit and a final position in which both armature and field are short-circuited, although the circuit is complete through the lamps in sockets 98 and 100. In the position of the parts shown in the diagram the circuit may be traced from the main line 92 through the motor and back to the main line 91, as follows: The main line 92 extends to and through the lamp-socket 98. From thence the conductor 102 extends to contact-plate 33, and from thence a continuation 103 leads to contact-plate 50 of the controller. From plate 50 the circuit is through brushes 41 and 43 of the controller to plate 54, thence by a conductor 104 to contact 72 of the reversing-switch. With the reversing-switch in the position shown in Figs. 13, 14, and 15 the circuit is from contact 72, through the switch-arm 64 to contact 68, and thence by conductor 105 to commutator-brushes 76. The return-circuit is from the other commutator-brush 76', over a conductor 106 to contact 67 of the reversing-switch, thence through the switch-arm 65 to contact 71, and thence back over the main line 91. The circuit through the field is from main line 92 over a branch conductor 107, through the lamp-socket 100, thence by conductor 108

to the contact-plate 33, from the latter over a conductor 109 to contact-strip 55 of the stationary member of the controller, and from the latter through brushes 44 and 46 to contact-strip 57, thence through the windings of the field over conductor 96 and back to main line 91. If now the controller be shifted rearwardly one step, the brush 41 passes out of engagement with contact 50 and into engagement with contact 51, whereupon the circuit from main line 92 is through lamp-socket 98, thence by conductor 110 to and through lamp-socket 99, and thence by conductor 111 to the contact-plate 33, and from there by conductor 112 to the said contact 51. The other circuits remain as in the first position. In the third position the circuit is from main line 92, through sockets 98 and 101, over conductor 113, thence to contact-plate 33, over conductor 114, and thence by conductor 115 to contact-plate 52, the remaining circuits being as before. In the fourth position the armature is short-circuited, but the field remains energized, the object of this arrangement being to take advantage of the counter electromotive force generated by the running of the armature after current has been cut off and opposed by the force of the still-energized field for braking or arresting the armature promptly. In this position of the controller the contact-brush 43 remains in engagement with contact 54, while contact-brush 42 has been brought into engagement with contact-plate 53. The circuit from main line 92 is now entirely interrupted as to the armature, while the circuit through the field remains as before. The circuit through the lamp in socket 98 is, however, maintained, which is from main line 92 to contact-plate 52, as hereinbefore described, from plate 52 to 53, through brushes 41 and 42, and from plate 53 back to 91 over branch conductor 94. At this point the armature-circuit which opposes the counter electromotive force generated by the armature against that flowing from the normal source of current may be traced as follows: from contact-plate, through conductor 94, to conductor 91, thence to the reversing-switch, and from there to the commutator-brush over conductor 106, from the other commutator-brush back over conductor 105 to the reversing-switch, and thence over conductor 104 back to contact 54, and from the latter to 53 through brushes 43 and 42. In the final position of the controller the circuit through the field is interrupted, carrying contact-brush 46 out of engagement with contact-strip 57, and at the same time contact-brush 45 is brought into engagement with contact 56, thereby maintaining the circuit through lamp in socket 100.

The object of maintaining the lamps in circuit when the field and armature pass out of circuit is to prevent arcing between the contacts of the controller.

The change of circuits produced by shift-

ing the reversing-switch will be entirely obvious from the foregoing description and need not, therefore, be detailed, it being borne in mind that the contacts 71 and 70 and 69 and 72 are cross-connected, as hereinbefore described in connection with the description of the construction of the switch.

The operation of the handpiece constructed and arranged as described will be entirely obvious from the foregoing description. It may be briefly noted, however, that in use the handpiece will ordinarily be supported and counterbalanced by extending the conductor-cord over a suitable overhead pulley or pulleys and connecting therewith a suitable counterbalance-weight, thus relieving the operator of the weight of the handpiece, while leaving it entirely free for manipulation.

While I have herein shown and described a practical and preferred embodiment of the invention, yet it will be obvious that the details of construction and arrangement may be modified without departing from the spirit of the invention, and I do not, therefore, limit myself to these details. For example, it will be obvious that by combining a self-contained motor with a handpiece of this character great advantages are secured, and this is true regardless of whether the motor be an electric motor or actuated by other form of power. Accordingly while an electric motor possesses in itself certain features of advantage peculiar to motors of that class and the combination is therefore claimed specifically, yet I also claim the combination of handpiece and self-contained motor broadly.

I claim as my invention—

1. A dental handpiece comprising a hollow-shell casing, a yoke-piece extending across one end of said casing, an adjustable step-bearing mounted in said yoke, a second bearing in the opposite end of said casing, a tool-holding spindle journaled in said bearings, an electric motor, the rotating member of which is mounted directly upon, and concentrically with said spindle within said casing and the stationary member whereof is mounted concentrically with said spindle upon the interior of the casing, and a controller for varying the speed of said motor arranged within said casing and provided with a finger-piece extending through the casing in accessible position.

2. A dental handpiece comprising a hollow shell constituting an outside casing and having a main portion and a reduced tubular extension, a yoke-piece extending across the end of said casing remote from the tubular extension thereof, an adjustable step-bearing mounted in said yoke, a second bearing in the end of said tubular extension remote from the main casing, a tool-holding spindle journaled in said bearings, an electric motor, the rotating member of which is mounted directly upon, and concentrically with said spindle within the main part of the casing and the sta-

tionary member whereof is mounted concentrically with said rotating member upon the interior of the casing, a controller for varying the speed of said motor arranged within  
 5 said casing and provided with a finger-piece extending through the casing in accessible position, a chuck operatively connected with said spindle, and means for operating said chuck likewise provided with a finger-piece extend-  
 10 ing out through the casing in accessible position.

3. A dental handpiece comprising a main shell-like casing of generally cylindric form provided at one end with a tubular extension,  
 15 a tool-holding spindle journaled to extend axially through said casing and extension thereof, an electric motor mounted within the main part of the casing and having driving connection with said spindle, a sliding con-  
 20 troller-sleeve mounted within said shell concentrically with said tubular extension and carrying a plurality of contact-brushes, a stationary controller-sleeve mounted concentrically with said first-mentioned controller-sleeve and provided with a plurality of con-  
 25 tact devices adapted to cooperate with said brushes, a finger-piece connected with the brush-carrying sleeve and extending out through the casing in accessible position, and  
 30 suitable electric connections connecting said motor with a suitable source of current-supply through said controller.

4. In a dental handpiece, the combination of a hollow shell provided with a tubular ex-  
 35 tension, a tool-holding spindle journaled to rotate therein, an armature mounted concentrically upon said spindle, field members mounted upon the interior of the shell concentrically with the armature, a shiftable con-  
 40 troller member mounted within said tubular extension and carrying a plurality of contact-brushes, a fixed controller member mounted in longitudinal alinement with said shiftable controller member and provided with a plu-  
 45 rality of contact devices adapted to cooperate with said brushes, a finger-piece connected with said shiftable controller member and extending out through the tubular extension, and suitable electric connections, substan-  
 50 tially as described.

5. In an electric dental handpiece, the combination with a hollow shell and a motor arranged therein, of a reversing-switch comprising a plate carrying a pair of contact-arms  
 55 and mounted to slide upon the interior of said shell, a finger-stud extending out through the shell in accessible position, a contact-plate arranged parallel with said first-mentioned plate and inside of the latter, a series of contact de-  
 60 vices upon said inner plate adapted to cooperate with said contact-fingers and suitable electric connections.

6. In a hand piece of the general character described, the combination with the outer cas-

ing and an electric motor within said casing, 65  
 of means for flexibly uniting conductors there- with comprising a tubular sheath pivotally mounted at one of its ends upon the exterior of said casing, a plug partially occupying the  
 70 opposite end of said sheath and adapted to confine a knotted or enlarged conductor and stationary contact devices mounted upon the casing approximately coincident with the piv-  
 75 otal axis of the sheath and adapted for connection with the conductors within the latter.

7. In combination with a handpiece of the general character described having an outer shell and an electric motor therein, a socket rigid upon the exterior of said shell, a tubular  
 80 sheath pivotally connected with said socket, an insulated contact-carrying plate provided with contact devices and mounted within said socket exteriorly of the shell, a conductor-  
 85 cord extending through said tubular sheath and having its terminals connected with the contact devices of the plate within the socket, and means for securing said cord against out-  
 90 ward movement through the sheath to prevent tension being brought upon the connected terminals.

8. In a handpiece of the general character described, the combination with the outer cas-  
 ing and electric motor within the casing, of means for detachably and flexibly connecting  
 95 a plurality of conductors therein comprising a socket mounted upon the exterior of the casing, a pair of insulating-blocks arranged within said socket each provided with regis-  
 100 tering contact-studs extending therethrough and resting in electrical connection when the plates are superposed within the socket, a tu-  
 105 bular sheath pivotally and detachably connected with the exterior of the socket, a conductor-cord extending into said sheath and having its terminals connected with the con-  
 110 tact-studs of the outermost contact-block, and means for securing said conductor-cord against outward endwise movement through the sheath.

9. A dental handpiece comprising an outer 110  
 casing, a spindle journaled to rotate therein, an electric motor comprising a fixed member, and a rotating member having driving con-  
 115 nections with said spindle, said fixed motor member being supported upon an inner frame member spaced away from, and principally out of contact with said outer casing, for the purpose set forth.

10. A dental handpiece comprising an outer casing, a spindle journaled to rotate therein, 120  
 an electric motor comprising a fixed member and a rotating member having driving con-  
 125 nections with said spindle, said fixed motor member being supported upon an inner frame member spaced away from, and principally out of contact with said outer casing, and a series of ventilating-apertures formed through said outer casing, for the purpose set forth.

11. In a dental handpiece, the combination  
of a substantially closed shell-like outer cas-  
ing, an inner casing constituting a motor-field  
support, a spindle journaled to rotate within  
5 said casing, an electric motor comprising an  
armature mounted upon the spindle and field  
members mounted upon said inner casing con-  
centric with said armature, and means for  
ventilating the motor comprising a series of  
10 perforations formed through the inner cas-  
ing, and other series of perforations formed  
through the outer casing, substantially as de-  
scribed.

12. In combination with a self-contained  
15 electric-motor handpiece, means for control-  
ling the operation of said handpiece compris-  
ing a controller, a series of resistances, and  
electrical connections whereby said resistances

may be variously interposed in the motor-  
circuits. 20

13. In combination with a self-contained  
electric-motor handpiece, means for control-  
ling the operation of said handpiece compris-  
ing a stationary controller member, a shift-  
able controller member and electric connec- 25  
tions, and coöperating contacts whereby the  
armature may be short-circuited while the  
circuits through the field remain complete,  
whereby the counter electromotive force gen-  
erated by the armature operates to retard its 30  
movement.

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