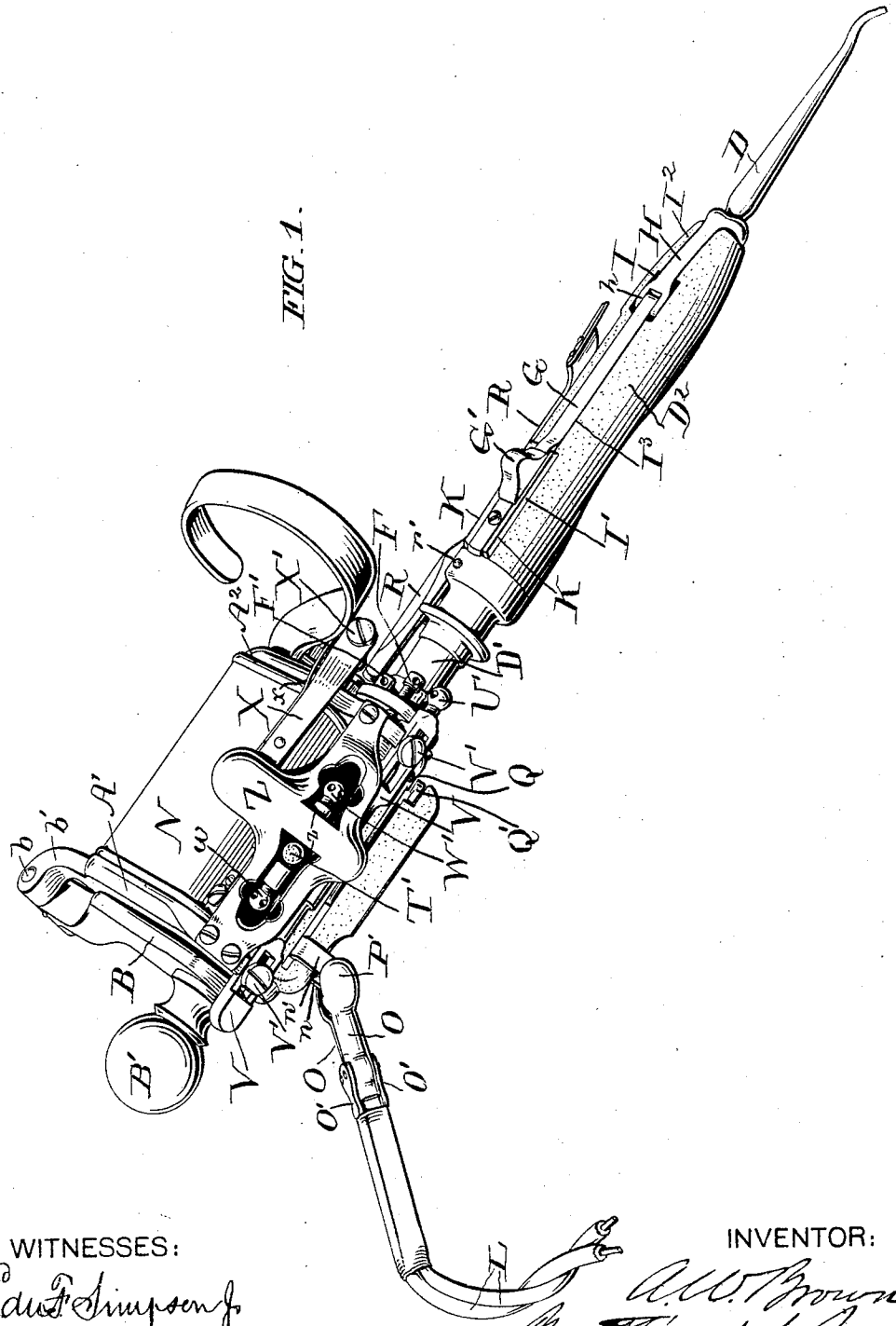
(No Model.) 5 Sheets—Sheet 1.

A. W. BROWNE.

ELECTRICALLY ACTUATED DENTAL PLUGGER.

No. 558,153. Patented Apr. 14, 1896.

FIG. 1.



WITNESSES:

Edwin F. Simpson Jr.

Robt. E. Gordon

INVENTOR:

A. W. Browne

By attys J. D. Peyton.

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A. W. BROWNE.

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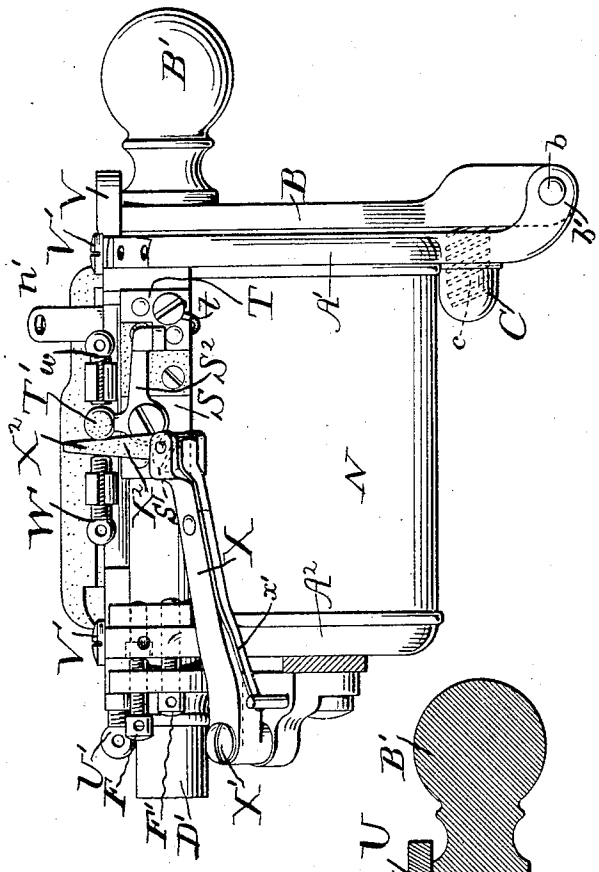

FIG. 2.

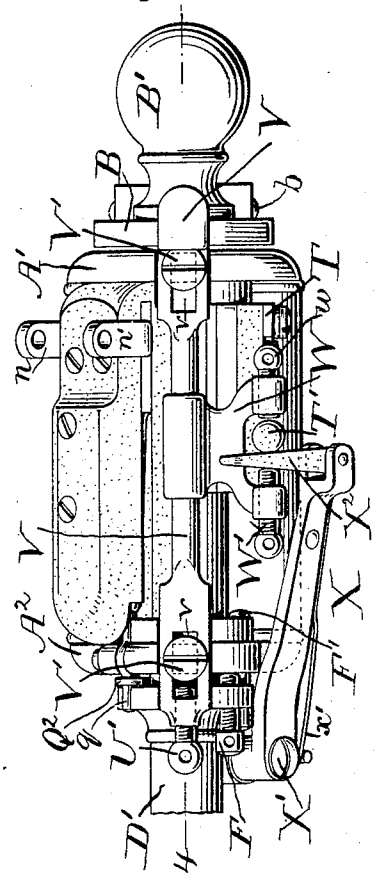

FIG. 3.

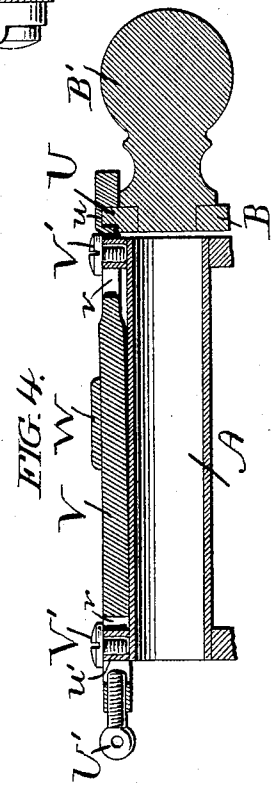

FIG. 4.

WITNESSES:

Edw. F. Simpson, Jr.

Robt. E. Gordon

INVENTOR:

A. W. Browne

By Atty J. S. Peyton.

(No Model.) 5 Sheets—Sheet 3.

A. W. BROWNE.

ELECTRICALLY ACTUATED DENTAL PLUGGER.

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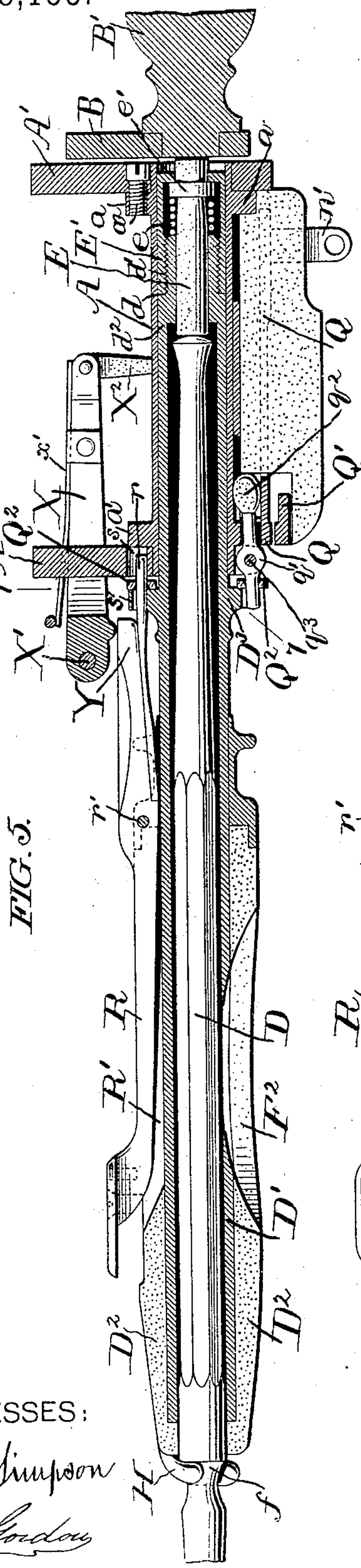

FIG. 5.

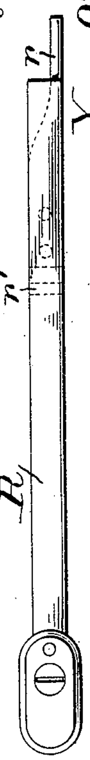

FIG. 6.

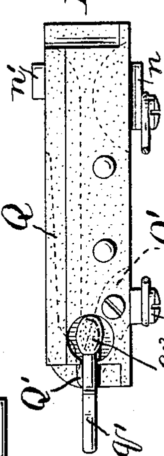

FIG. 8.

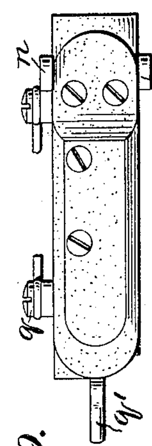

FIG. 9.

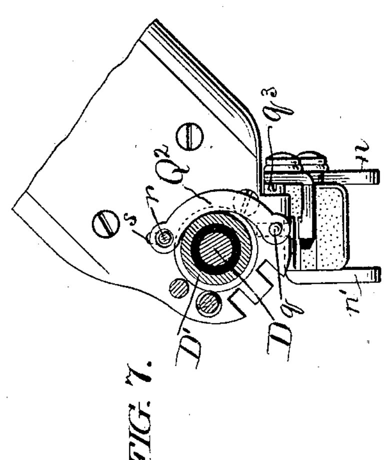

FIG. 7.

WITNESSES:

INVENTOR:

ANDREW B. GRAHAM. PHOTO-LITHO. WASHINGTON, D.C.

(No Model.)

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A. W. BROWNE.

ELECTRICALLY ACTUATED DENTAL PLUGGER.

No. 558,153.

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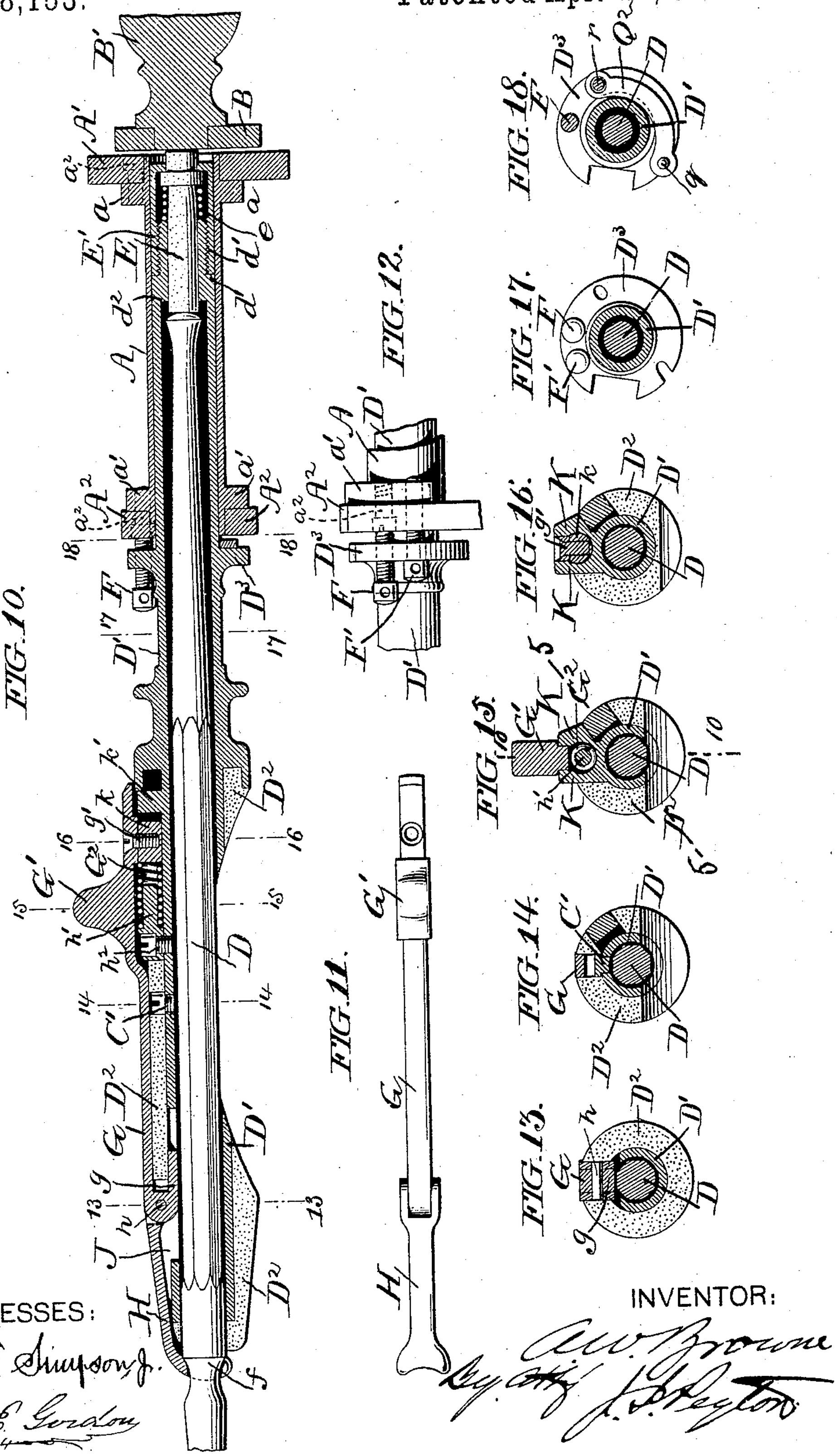


WITNESSES:

INVENTOR:

(No Model.) 5 Sheets—Sheet 5.

A. W. BROWNE.

ELECTRICALLY ACTUATED DENTAL PLUGGER.

No. 558,153. Patented Apr. 14, 1896.

FIG. 19.

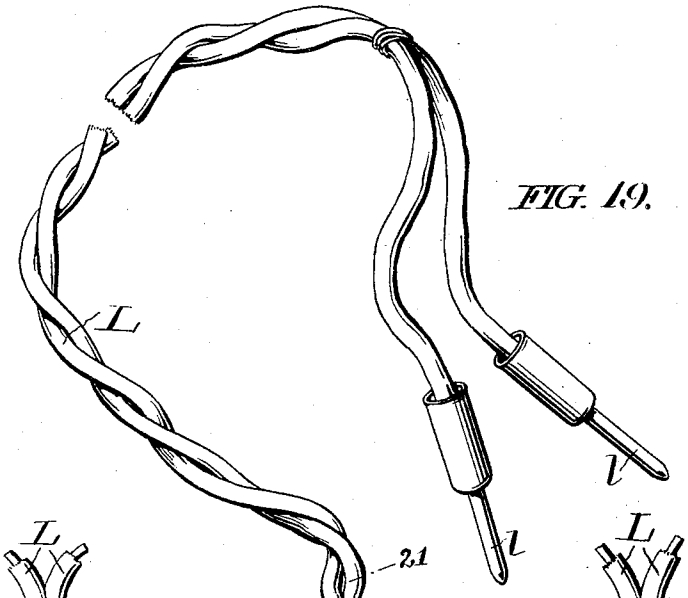


FIG. 20.

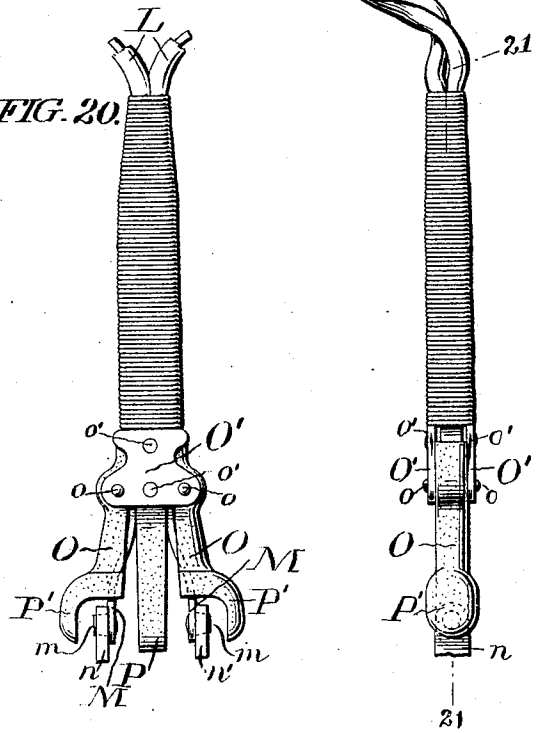
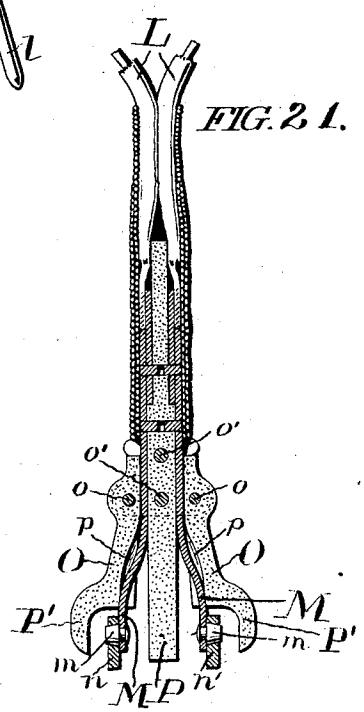


FIG. 21.



WITNESSES:

Edw. F. Simpson, Jr.

Robt. E. Gordon

INVENTOR:

A. W. Browne

By Atty J. D. Peyton.

UNITED STATES PATENT OFFICE.

ARTHUR W. BROWNE, OF PRINCE'S BAY, NEW YORK, ASSIGNOR TO THE S. S. WHITE DENTAL MANUFACTURING COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRICALLY-ACTUATED DENTAL PLUGGER.

SPECIFICATION forming part of Letters Patent No. 558,153, dated April 14, 1896.

Application filed November 6, 1895. Serial No. 568,087. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR W. BROWNE, a citizen of the United States, residing at Prince's Bay, in the county of Richmond and State of New York, have invented certain new and useful Improvements in Electrically-Actuated Dental Pluggers; and I 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.

My invention relates to certain improvements, as hereinafter claimed, including features of the plugger-frame, the plugger-handle, the connection of the plugger-handle with the frame, the plugger-retaining devices, the hammer-actuating devices, the circuit-interrupting devices and their controlling devices, and the conducting-cord and its connection with the plugging apparatus.

In the accompanying drawings, Figure 1 is a view in perspective of the improved mechanism with the conducting-cord partly broken away. Figs. 2 and 3 are views at right angles with each other, showing the frame of the instrument and various parts carried thereby with parts of the apparatus detached. Fig. 4 is a view showing parts in section on the line 4 of Fig. 3. Fig. 5 is a view, partly in side elevation and partly in longitudinal central section, on the line 5 of Fig. 15. Fig. 6 is a view showing, detached, the lever by way of which the circuit-interrupting devices are controlled to open and close the circuit. Fig. 7 is a view, partly in end elevation and partly in transverse section, on the line 7 of Fig. 5, showing details of construction. Figs. 8 and 9 show, respectively, an inside and an outside view of the plate-carrying contacts for making coupling connection with the conducting-cord and also showing the coöperating contact actuating-lever. Fig. 10 is a view, mainly in longitudinal section, on the line 10 of Fig. 15, designed particularly to show the manner of securing the plugger in operative position. Fig. 11 is a longitudinal view of the plugger-retainer detached. Fig. 12 is a detail view showing the means for securing the plugger-handle to the frame. Figs. 13 to 18, inclusive, are views in transverse sections through Fig. 10, showing details of construction, Fig. 13 being a section on line 13 of Fig. 10, Fig. 14 a section on line 14, Fig. 15 a section on line 15, Fig. 16 a section on line 16, and Figs. 17 and 18 sections on lines 17 and 18, respectively, with parts in elevation. Fig. 19 is a view in perspective showing the cord by which electrical connection is made between the apparatus and a battery or switchboard; Fig. 20, a view of a portion of such conducting-cord and its connecting-forks or coupling contacts for connection with contacts of the apparatus, and Fig. 21 a sectional view on the line 21 of Fig. 19.

A suitable frame serving to support the plugger and the field-coils and their soft-iron cores constituting the electromagnets usually employed in this class of devices is shown as composed of a metal tube A, having annular shoulders or collars a a' near its ends and end pieces or plates A' A^2 embracing the ends of the tube and secured in place by screws a^2 passing through the plates and engaging the tube-collars. The parts may readily be separated by removing their connecting-screws.

An armature B, constituting the mallet or hammer for actuating a plugger, is weighted by a knob B', is jointed to the frame by a pivot b passing through one end of the armature, and through lugs b' b' at the extremity of the frame end piece A'. A spring c, serving to retract the armature or restore it to its normal position after being attracted by the electromagnets, is inclosed and protected by a housing C, formed with the end piece A' of the frame.

A tubular handle for the plugger D is adapted to be readily secured to and detached from the frame. This handle is shown as composed of a main or inner section D', of metal, and an outer or enveloping section D^2, preferably of hard rubber, shorter than the main section and surrounding the inner section of a portion only of its length beyond or in advance of the frame. A screw C' detachably connects the two sections of the handle. The handle at its inner or rear portion, which is constituted by the inner or main section alone, enters the tubular portion A of the frame and is provided with an annular shoulder or fixed

collar D^3 which, when the handle is in place, is slightly in advance of the outer end or plate A^2 of the frame. At its inner or rear end the handle is reduced in diameter from the shoulder *d* and externally screw-threaded from this shoulder to its rear extremity, as shown at *d'*, Figs. 5 and 10. The handle is also internally shouldered at d^2 near its rear end, and is of reduced internal diameter from this shoulder to its rear extremity. A plunger E is mounted to reciprocate in the reduced rear end of the handle, and a short tubular section or cap E' screw-attached to the rear end of the handle surrounds the plunger and provides a chamber in which is a coiled spring *e*, bearing at one end against the rear end of the handle and at the other against a shoulder or collar *e'* of the plunger near its rear end, which projects through and extends a short distance rearwardly from the cap, so as to be struck by the armature-hammer B. The plunger-spring exerts a constant pressure upon the plunger in a direction to project it rearwardly to the slight extent of the movement allowed it after having been forced forward by a blow of the hammer. The shoulder *e'* of the plunger limits its rearward movement by coming in contact with the end of the handle-cap E'. In order to locate the head or rear end of the plunger properly relatively to the hammer and so as to compensate for wear of the head of the plunger, provision is made for slightly adjusting the handle lengthwise in the frame. This adjustment is shown as attained by means of two screws F F', one of which, F, engages a female screw in the collar D^3 of the handle and bears against the frame-plate A^2, and the other, F', passes through a hole in this collar and engages a female screw in the frame-plate A^2, and also engages this frame-plate with the collar *a'* of the tubular portion of the frame. These screws, it will be seen, are adapted to act in opposition to each other, so that by their manipulation the handle, and consequently the plunger, may be adjusted lengthwise inward or outward in the frame and securely locked as adjusted.

The inner and outer sections of the handle are cut away at F^2 to expose the plugger-shank and permit of its being engaged by the operator's thumb to turn the plugger, so as to properly present its point to the work being done, as is well understood.

In electromagnetic mallet-actuated pluggers as usually constructed plugger-retaining devices are employed which are adapted to engage inclined or conical shoulders on the plugger-shanks, and to insure proper working each plugger must be provided with such a shoulder at a certain point that is at an exact distance from the end of the plugger-shank which is operated upon by the mallet-actuated plunger. Such a shoulder *f* is shown plainly in Figs. 5 and 10 located on the plugger-shank in advance of the handle in which it reciprocates. In accordance with my improvements the nice work required to locate the shoulder at exactly a given point is rendered unnecessary, and the location of these shoulders may be varied slightly without affecting the perfect operation of the plugger.

Instead of the spring retaining jaws or fingers usually employed I provide plugger-retaining devices such as now to be described.

The plugger-handle is provided with a slide G, having a finger knob or projection G', by which to move it outward against the force exerted by a spring G^2, the tendency of the spring being to maintain the slide in its retracted or inward position and restore it to such position after being moved outward.

A plugger-retainer H is forked at its outer end to engage the plugger at its shoulder *f* and is jointed at its inner end to the outer end of the retainer-slide by the pivot *h*, so that the retainer may be swung away from the plugger or into engagement therewith. The retainer-slide has suitable guideway connection with the plugger-handle, the connection shown being as follows: The outer section D^2 of the handle is suitably cut away at I I' and longitudinally grooved at I^2 I^3, and the inner section D' of the handle is cut away at J. A lip or flange *g* of the retainer-slide works inside the handle-section D^2 at the cut-away portion J of the handle-section D'. Near its inner or rear end the retainer-slide is detachably connected by a screw *g'* with a slide-piece *k*, adapted by dovetailed connection to reciprocate in a guideway formed between two flanges or ribs K K of the inner handle-section. Inward movement of the slide-piece is limited by its contact with a lug or shoulder *k'* of the handle-section D'. The spring G^2 bears at one end against the slide-piece and at its opposite end against a shoulder or lug *h'*, detachably secured by a screw h^2 to the inner handle-section and provided with the stem surrounded by the spring.

From the above description it will be seen that the use of the plunger-spring *e* is not necessary, as its action is supplemented by the spring of the plugger-retaining devices, which might be wholly relied upon for performing the work of projecting the plunger by way of the plugger. It will also be seen that as the spring of the retaining devices exerts a direct pull or retracting strain upon the plugger an abrupt or square shoulder might be substituted for the inclined shoulder *f*, which latter form is necessarily used with the old style of retainers, consisting of spring-jaws pressing laterally from opposite sides upon the inclined shoulder, and so by a wedging action yieldingly pressing the plugger inward.

By my improvements the plugger may readily be inserted into and withdrawn from the handle by movement of the slide and swing the pivoted retainer out of the way, while the accidental forcing of the plugger from the handle in operation is rendered impossible, which is not the case when spring-

fingers pressing laterally on the plunger-shoulder are used. Further, it should be noticed that a much greater range of movement is given the pivoted retainer having the slide movable lengthwise of the handle than is possessed by the old flexing retaining-fingers, and consequently the forked end of the retainer may be advanced by the yielding of the spring G^2 as far as is ever likely to become necessary to enable it to properly engage and act upon the shoulder of the plugger should this shoulder be located somewhat farther from the rear end of the plugger than usual or intended.

By properly proportioning the parts (see Figs. 5 and 10) it is obvious that as the plunger is shortened as the result of wear the plugger is permitted to be moved farther inward in its handle by the action of the retaining devices, thus compensating for wear and preventing lost motion.

The two branches of the conducting-cord L, adapted to have connection by points *l l* with the source of electricity, are provided with the spring-contact arms M M, having the lugs *m m* for electrical connection with the magnet-coils N N by way of the coupling-lugs *n n'*. To prevent shocks to the operator by contact of the hand with the coupling devices and facilitate the coupling up of the conducting-cord, I provide guards O O, of suitable non-conducting material, preferably hard rubber, for the spring-contact arms M of the coupler. These guards are jointed near their inner ends by pivots *o o* to metallic plates O' O', which are secured by rivets *o' o'* to a strip of insulating material P, which is suitably secured between the spring-contact arms and serves to limit their movement toward each other when pressed between the fingers. The pivoted guards O O are recessed on their inner surfaces, and the spring-contact arms at opposite sides of the separating-strip P project into these recesses *p p* of the guards and by their pressure outward tend to hold the guards with their outer ends as far away from the separating-strip as permitted by their rocking movement on their pivots *o o*. At their outer ends each of the pivoted guards is extended laterally and terminates in the protector P' for the coupling-lugs *m m* of the spring-contact arms.

It will be seen that as the non-conducting guards secured to the insulated plates prevent the hand of the operator from touching the contact-arms of the coupler shocks are rendered impossible. It will further be seen that the outer ends coupling-lug protectors of the guards serve, when pressed toward each other by the fingers, to force the coupling-lugs *m m* toward each other and against the opposite sides of the separating-strip, thus enabling them to be inserted between the lugs *n n'* so as to snap into engagement with them when the finger-pressure is released.

Electrical connection between the magnets and the contact-lugs *n* and *n'* and the manner of making and breaking the circuit are as next to be described. The lug *n'* is at one end of a spring-contact plate Q, Fig. 5, which is adapted to make and break connection with a contact-piece Q', which is directly electrically connected by the binding-screw *q*, Fig. 8, with one end of the field-coils. Normally, the contact-plate Q is held disconnected from the contact Q' by its own resiliency. By the operation of a lever *q'* the contact between the parts Q Q' is made to complete the circuit which is shown as broken in Fig. 5. The contact-actuating lever *q'* is insulated at q^2 to prevent the passage of the current into the frame to which the lever is jointed by the pivot q^3. This lever has jointed connection with one end of a link Q^2, the opposite end of which is engaged by an attachment *r* of a finger-actuated controller shown as consisting of a lever R, which is pivoted at *r'* to the plugger-handle. The attachment *r* is made of spring metal, is riveted at its front end to the under side of the controller R, and terminates at its rear in the pin-like or rounded portion, as clearly shown in Figs. 5 and 6, projecting from the lever. The controller occupies a groove R', extending longitudinally of the handle of the plugger, and is provided with a finger-rest by way of which to rock it on its pivot, so as to press inward the finger-rest end and move outward the opposite end, the attachment *r* of which engages a hole in the link Q^2 and also projects into a larger hole *s* in the frame and through a hole *s'* in the collar D^3, Fig. 5, in which it is allowed slight play as the finger-rest of the lever moves toward and away from the handle of the instrument.

It will be seen that slight pressure upon the finger-rest of the controller-lever R will actuate the lever *q'* by way of the connecting-link Q^2 to make connection between contacts Q and Q', and that when the controller is relieved from pressure of the finger the action of the spring-contact Q breaks connection between it and the contact Q'.

Included in the plugger-circuit between the coupling-contacts *n* and *n'* are the automatic circuit-interrupting devices as follows: A contact-plate S, Fig. 2, is directly electrically connected by a binding-screw S', dotted lines, Fig. 2, with the end of the field-coils opposite that connected with the contact Q, and a rocking-lever contact S^2 is pivoted on the contact S, with which it has electrical connection. This rocking lever is of bell-crank form, and one of its arms (the longer one) is adapted to make electric contact with a plate T, and through wire *t* this plate is electrically connected with the coupling-contact lug *n*. The short arm of the bell-crank contact is provided with the insulated knob or end T', by the actuation of which the circuit is made and broken by controlling means as follows:

A slide-rod V is mounted to move endwise on the frame of the implement, the end pieces

of the frame being provided with grooves in which the rod moves. The slide-rod is provided with slots *v v* adjacent to its opposite ends, and screws V′ V′, overlapping the rod, passing through its slots, and engaging the frame, secure the rod in place while permitting of its movement to the extent desired. The armature-hammer is provided with a lug U, Fig. 4, which engages a notch or recess *u* in the under side of the slide-rod V, so that the slide-rod is moved as the hammer is actuated.

An adjusting-screw U′ serves to limit the retracting movement allowed to be imparted to the hammer by its spring, this adjusting-screw being adapted to strike against the lug *w′* of the frame which is embraced by the slot at one end of the slide-rod. A forked arm or yoke W, rigidly connected with the slide-rod, carries two adjusting-screws W′ *w* in alinement with the knob or short arm of the contact-lever S^2. The adjusting-screw *w*, when once properly set, remains unaltered except when adjusted to compensate for wear, while the screw W′ requires to be adjusted to correspond with the adjustment of the slide-rod adjusting-screw U′, for a purpose farther on to be made apparent.

From the above description, assuming the hammer to be retracted by its spring, thus causing the adjusting-screw W′ to act on the bell-crank contact S^2 and the controller-lever R to be properly pressed upon, it will be seen that the circuit will be completed and the magnets charged, so that the hammer is attracted to actuate the plugger and also cause the adjusting-screw *w* to operate the bell-crank contact-lever to break the circuit, thus leaving the hammer-spring free to act to retract the hammer and cause a repetition of the operations described. By adjustments of the regulating-screws U′ and W′ the length of stroke of the hammer is regulated and the force of its blows correspondingly controlled.

To enable the length and force of the blows of the hammer to be controlled by the pressure of the finger upon the controller R, circuit-interrupting devices intermediate the controller and the slide-rod and its forked arm are employed as follows: A lever X, jointed at one end to the frame by the pivoting-screw X′, carries at its opposite end a pivoted wedge-shaped arm X^2 of insulated material, which is adapted to reciprocate between the short arm T′ of the contact-lever S^2 and the adjusting-screw W′ when properly set. A spring *x′* acts upon the lever X with a tendency to force its wedge-like arm between the knob of the bell-crank contact-lever and the adjusting-screw W′, while the controller at its inner end Y acts, when the finger-rest of this controller is properly pressed inward upon the lever X, to move outward its wedge-like arm and thus leave the hammer free to strike its blow and interrupt the circuit by way of the bell-crank contact-lever, as has before been explained.

By the spring action of the attachment *r*, as well as by the action of the spring *x′*, the controller R is returned to its normal or inoperative position when relieved from the pressure of the finger and the circuit is broken. The adjustment of the screws U′ and W′ required for varying the length and force of the blows of the hammer, when the intermediate controlling devices are employed, will readily be understood from the description before given.

A guard Z suitably secured to the frame of the instrument protects from contact with the hand and accidental derangement those portions of the circuit controlling and interrupting mechanism which are most liable to be interfered with in operating the instrument, while not interfering with the ready manipulation of the adjusting-screws W′ and *w*, which are easily accessible through slots *z z* in the guard.

When it is not desired to use the intermediate devices of the controlling and circuit-interrupting mechanism, they may readily be detached by removal of the pivoting-screw X′ by which the lever X is secured in position.

I claim as my invention—

1. In an electrically-actuated dental plugger, the supporting-frame consisting of the tubular portion to receive the plugger-handle, and the end pieces detachably secured to the tubular portion to receive the magnets between them, substantially as set forth.

2. In an electrically-actuated dental plugger, the combination of the magnet-supporting frame provided with the tubular portion, of the plugger-handle detachably secured in the tubular portion of the frame, substantially as set forth.

3. In an electrically-actuated dental plugger, the combination of the magnet-supporting frame provided with the tubular portion, of the plugger-handle entering the tubular portion of the frame, and means by which said handle is detachably and adjustably secured in position, substantially as set forth.

4. The combination of the magnet-supporting frame, provided with the tubular portion, the pivoted armature-hammer, the tubular handle entering the tubular portion of the frame and in which the plugger is reciprocated, the plunger for operating on the plugger, and the adjusting-screws connecting said handle and frame to detachably and adjustably secure the handle in position, substantially as and for the purpose set forth.

5. The combination of the plugger-handle, the plugger provided with the shoulder, the pivoted retainer adapted to engage the shouldered portion of the plugger, the slide acted upon by a spring and to which the retainer is pivoted, and means for supporting the slide to admit of its movement against the pressure of its spring, substantially as and for the purpose set forth.

6. The combination of the supporting-frame, the plugger-handle carried thereby,

the plunger carried by the handle, the plugger provided with the shoulder, the plugger-retainer adapted to engage the shouldered portion of the plugger, the slide provided with the finger-knob and having guideway connection with the plugger-handle and to which the plugger-retainer is pivoted, and the spring acting on the retainer-slide, substantially as and for the purpose set forth.

7. In an electrically-actuated dental plugger, the combination of the conducting-cord, its spring-contact arms, and the non-conducting guards having pivotal connection with the conducting-cord outside the contact-arms, substantially as and for the purpose set forth.

8. In an electrically-actuated dental plugger, the combination of the conducting-cord, its spring-contact arms the insulating-strip between these arms, the non-conducting guards having pivotal connection with the conducting-cord and arranged outside the contact-arms, substantially as and for the purpose set forth.

9. The combination of the supporting-frame, the electromagnets, the pivoted armature-hammer, its spring, the plugger-handle, the plugger actuated by said hammer, the terminal contacts *n n'* of the plugger-circuit, the finger-actuated controller on the plugger-handle, means to complete the plugger-circuit controlled by said controller, and means to vary the force of the blows of the armature-hammer, also controlled by said controller, substantially as set forth.

I testimony whereof I affix my signature in presence of two witnesses.

ARTHUR W. BROWNE.

Witnesses:

SEYMOUR CASE,

M. A. COLE.