4 Sheets—Sheet 1.

E. T. STARR.

Dental-Engine.

No. 222,093. Patented Nov. 25, 1879.

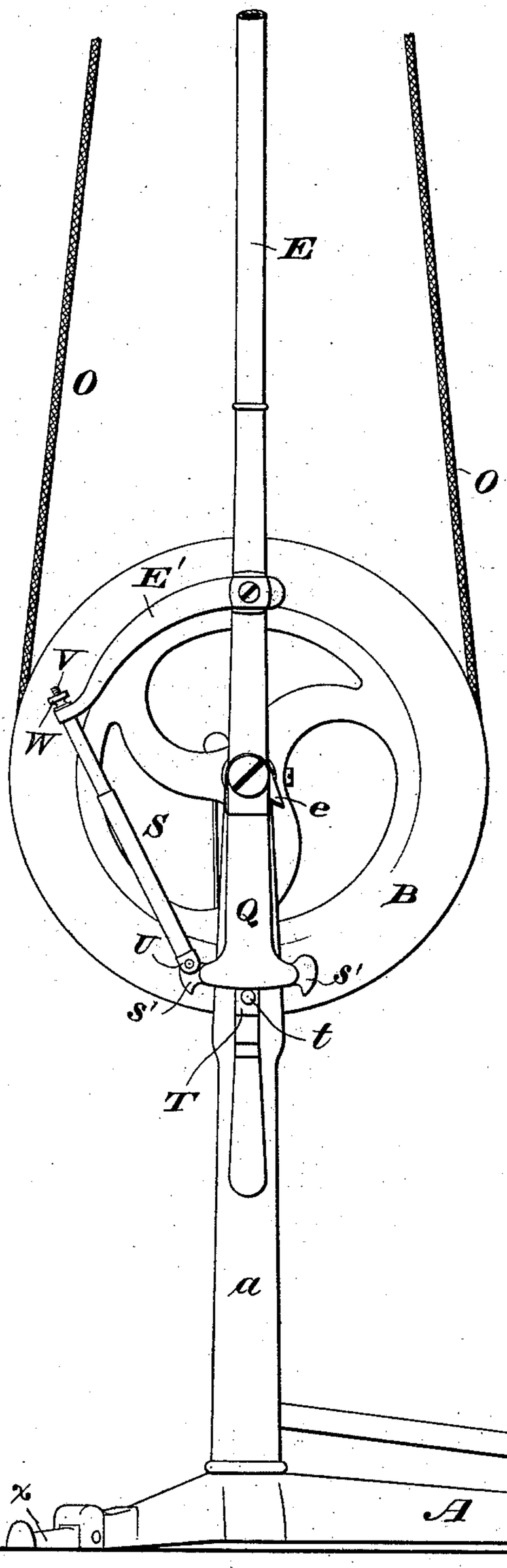
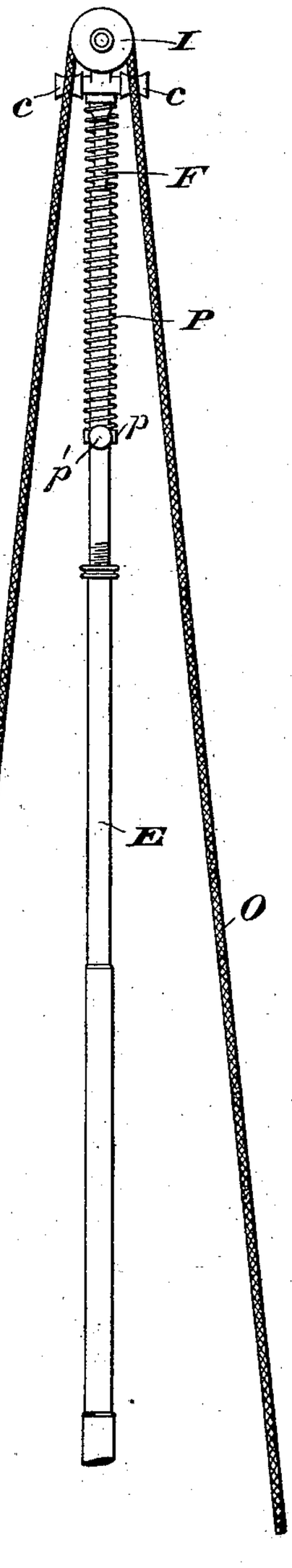


Fig. 1.



WITNESSES

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4 Sheets—Sheet 2.

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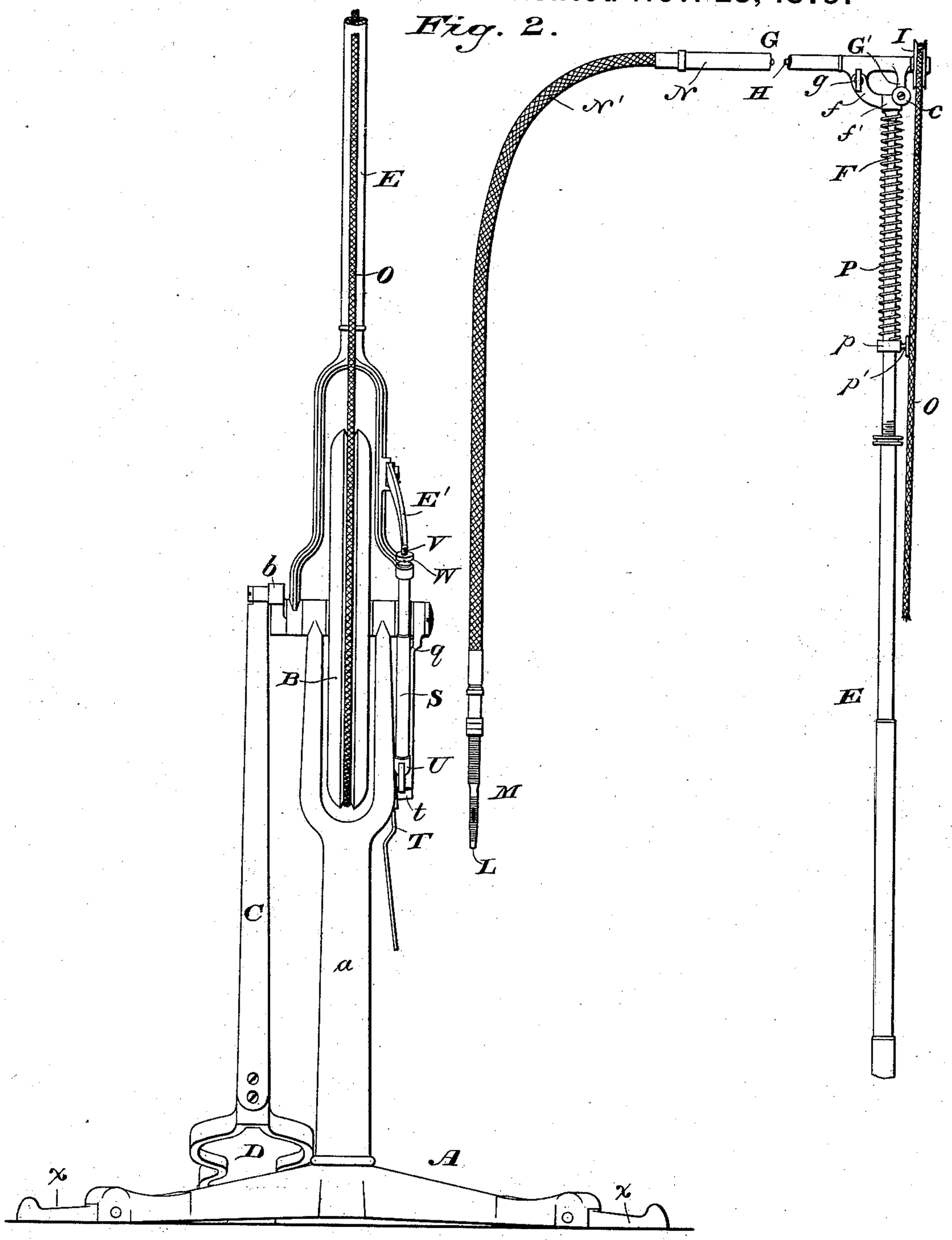
Fig. 2.



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4 Sheets—Sheet 3.

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Fig. 3.

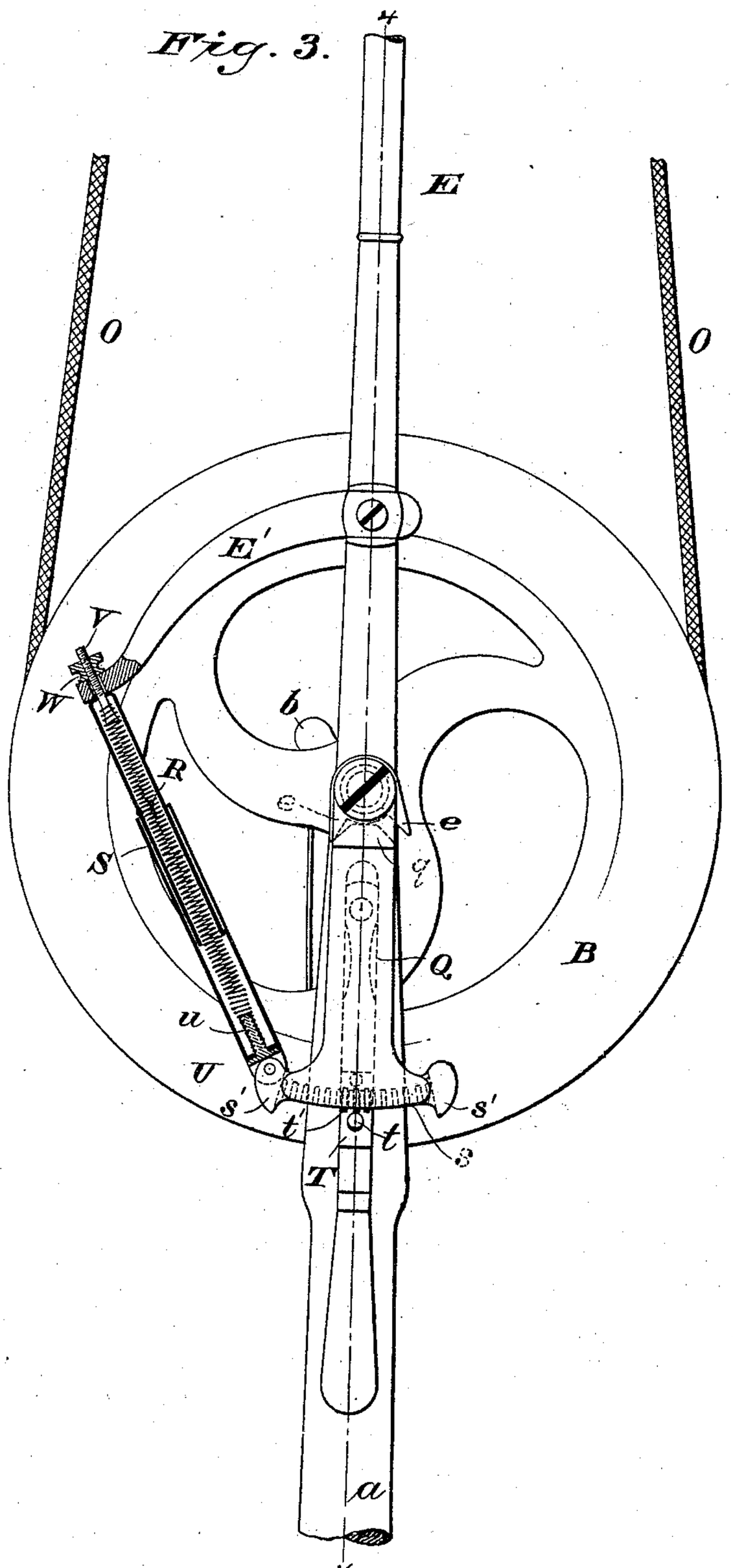

Fig. 4.

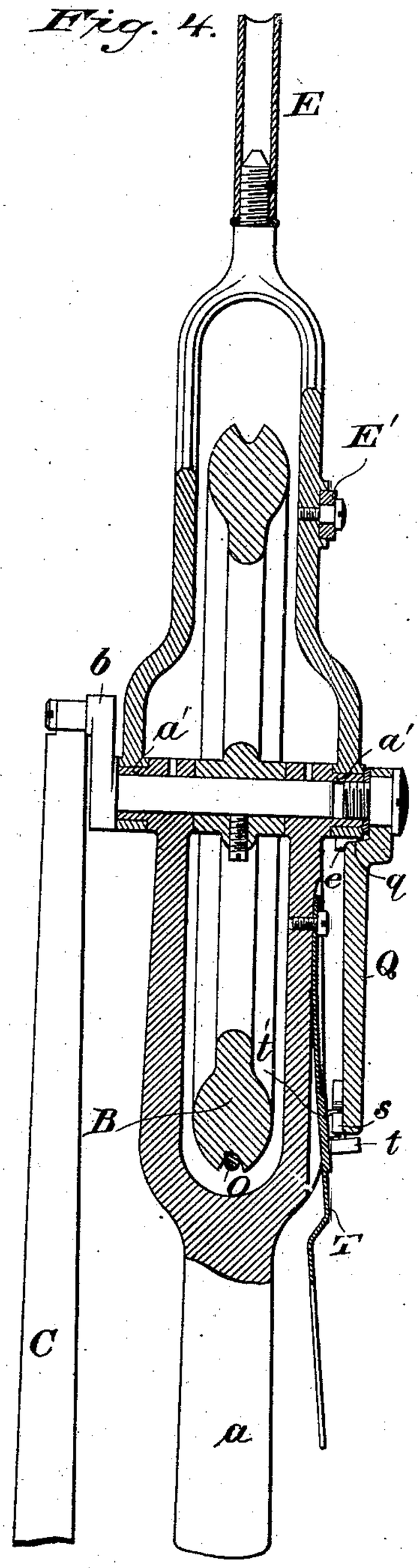

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Fig. 9.

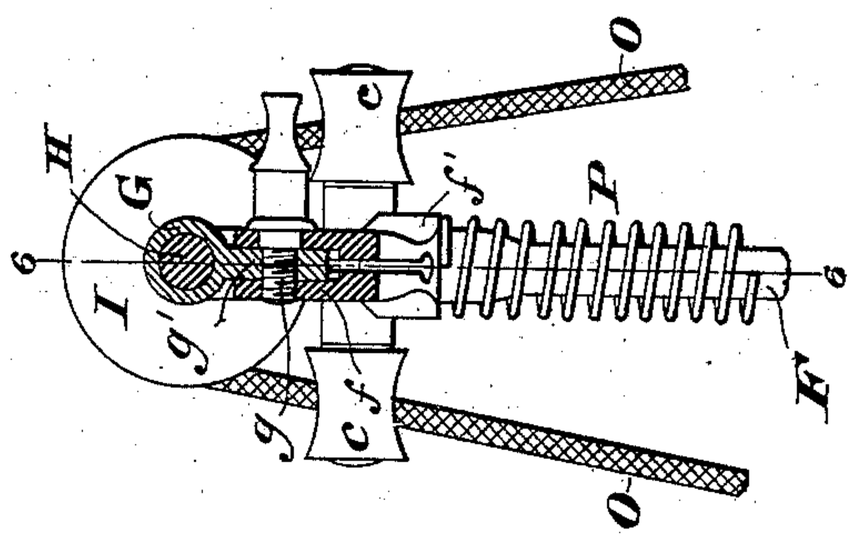

Fig. 6.

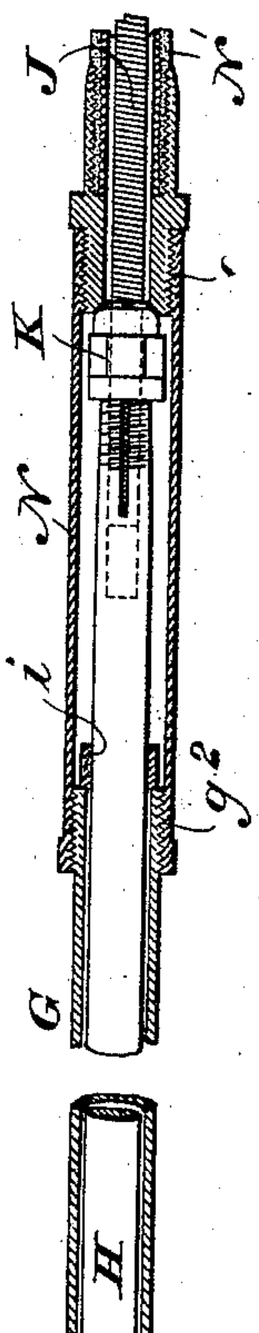

Fig. 8.

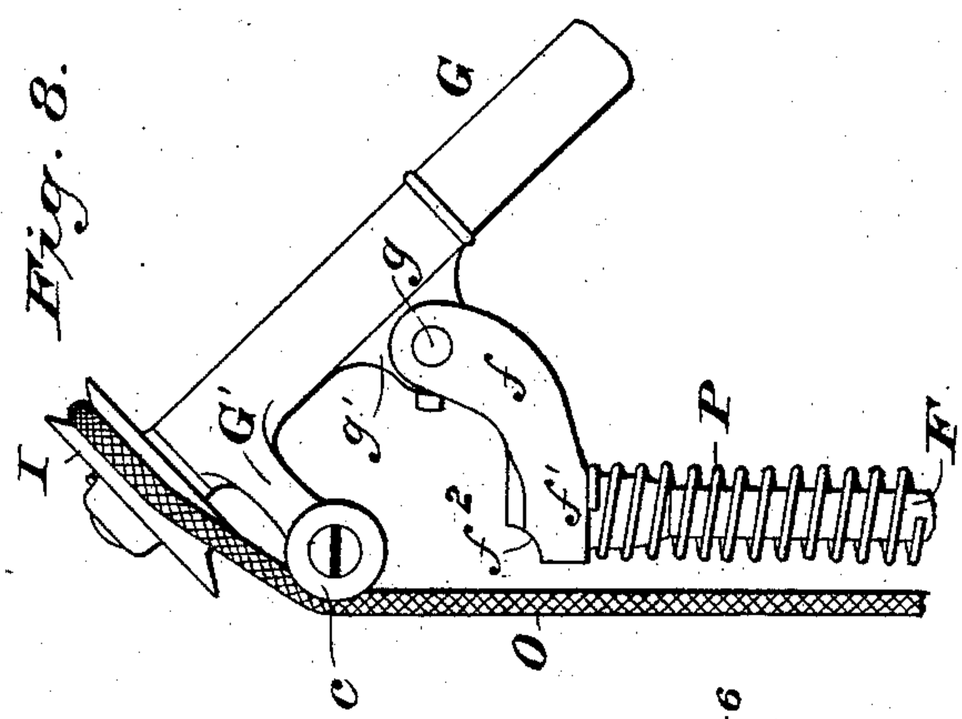

Fig. 5

Fig. 7.

WITNESSES

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UNITED STATES PATENT OFFICE.

ELI T. STARR, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO SAMUEL S. WHITE, OF SAME PLACE.

IMPROVEMENT IN DENTAL ENGINES.

Specification forming part of Letters Patent No. **222,093**, dated November 25, 1879; application filed August 22, 1879.

To all whom it may concern:

Be it known that I, ELI T. STARR, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Dental Engines, of which the following is a specification.

My invention relates more especially to dental engines of the class comprising in their structure a base or stand carrying a foot-treadle and driving-pulley, an arm or frame rising from the base, a driven pulley connected with the upper end of the engine-arm, a belt-connection between the driving and driven pulleys, and a flexible power-conveyer receiving motion from the driven pulley and imparting motion to the operating-tool mounted in a handle or hand-piece, the hand-piece being free to be moved about in various directions to operate at different points in the patient's mouth.

My invention constitutes an improvement upon the well-known S. S. White dental engine, and more especially upon the improved forms thereof shown in my applications for Letters Patent filed, respectively, February 1, June 17, and June 27, 1879.

The objects of my present invention are to improve the construction and organization of the mechanism for giving great freedom of movement to the hand-piece and operating-tool carried thereby, as well as to the flexible power conveyer or shaft relatively to the engine-arm without interrupting the transmission of the driving-power, and also to improve the devices which enable the normal position of the engine-arm relatively to the base to be changed at pleasure without destroying the rocking capacity of the arm upon the base, which ends I attain by means of certain new constructions and combinations of devices, which will hereinafter be specifically designated, and then pointed out at the close of the specification.

In the accompanying drawings, which show all my improvements as embodied in the best way now known to me, Figure 1 is a side elevation of the improved engine with the top portion or upper works thereof broken off and brought down to one side to show the whole apparatus. Fig. 2 is a view thereof from the back of the engine. Fig. 3 is a side view, partly in section, the upper portion of the engine-arm and the base being broken away. Fig. 4 is a longitudinal central section thereof on the line 4 4 of Fig. 3. Fig. 5 is a side elevation of the upper works of the engine, including a portion of the flexible power-conveyer and its enveloping and protecting sheath. Fig. 6 is a longitudinal central section on the line 6 6 of Figs. 7 and 9 through the engine-head or lateral arm, showing, among other things, the manner of connecting the flexible power-conveyer to the driven spindle of the engine. Fig. 7 is an inverted sectional plan of a portion of the engine-head or lateral arm on the line 7 7 of Fig. 5. Fig. 8 is a side view thereof, the lateral arm being shown as rocked to a different position from that shown in Fig. 5; and Fig. 9 is a transverse section through the lateral arm on the line 9 9 of Figs. 5 and 6, showing the rocking pivotal connection of the arm or head.

The base or tripod A is provided with the usual fixed upright or standard *a*, the upper end of which is forked or divided for the reception of the driving-pulley or fly-wheel B, the journal or trunnions of which turn in suitable bearings or boxes in said standard in the usual manner. A driving-crank, *b*, is secured to one end of the pulley journal or axle, or is formed therewith, in this instance, and is connected, preferably, by means of a plate-spring pitman, C, with the treadle, pedal, or foot-board D, which is pivoted or journaled upon one arm of the tripod in the usual manner. The forked or divided end of the standard is also provided, outside the driving-pulley, and in this instance concentrically with the axis of said pulley, with trunnions or pivots *a' a'* for the reception of the forked lower end of the engine-arm E, which is of well-known construction, and is given, by means of its pivots, a capacity of rocking or vibrating on the standard of the base, as usual. The upper end of the engine-arm is shown as tubular, for the reception of the pivotal shank, journal, or spindle F of the engine-head or lateral arm, so that said head may turn or swivel freely horizontally around or upon the engine-arm, as usual. The upper end of said pivotal shank F is provided in this instance with a bent or

lateral split portion or extension, *f*, as clearly shown, the outer or upper end of which receives the pivotal bolt or pivots *g* of the crosswise pivotal connection, which connects the lateral arm or engine-head G with the engine-arm E with the capacity of rocking or vibrating freely relatively to the engine-arm and to the shank, as hereinafter described.

In the form of engine shown in this instance the engine-head or lateral arm has the form of a tube, G, fitted near its butt or rear end with a depending ear or flattened lug, *g'*, forming a part of the rocking pivotal connection with the engine-arm E, although it will, of course, be understood that the members of the pivotal connection, which are connected by the pivot or pivots need not necessarily be of the form shown, as they may be of yoke or other suitable form, as shown in my application of June 27, 1879, above referred to. This tubular lateral arm or engine-head G forms a bearing for the journal, shaft, or spindle H, on which is mounted a pulley, I, constituting the driven pulley of the engine, said pulley imparting the required rotary motion to the said spindle, when driven by the belt-connection, hereinafter fully described.

The driven spindle H is locked from endwise movement in the bearing G by means of the pulley I at the butt of the spindle, and by the adjustable collar *i*, which bears against the annular shoulder formed by the front end of the tubular bearing, as clearly shown in Fig. 6.

The outer end of this driven spindle or shaft H is preferably socketed for the reception of the inner end of the flexible power conveyer or shaft J, said inner end of the conveyer being inserted in the socket and secured therein. The driven spindle and flexible shaft are shown as secured together by a clamp, the walls of the socket being split so as to form spring clamping-jaws, which are compressed upon the flexible shaft, or an inner stiff section thereof, by means of a screw-nut, K, which works upon suitable threads formed upon the inclined or tapering circumference of the walls of said socket, as clearly illustrated in the drawings.

The flexible power-conveyer, which preferably consists of a coiled-wire shaft, such as are in common use, is connected at its outer or free end with a chuck, mandrel, or tool-holder, L, of any suitable construction, so as to turn it, said tool-holder being mounted in suitable bearings in a hand-piece casing, M, and being also adapted for the ready interchange of the operating-tools used with this class of engines in performing dental operations.

The tubular lateral arm G, at its outer end, is provided with screw-threads g^2 for the reception of a correspondingly internally-threaded sleeve, ferrule, or portion, N, secured or connected by screw-threads, preferably, to the inner end of a flexible sheath or cover, N', such as those in common use, which envelops and protects the flexible power-conveyer. At the outer or free end of the flexible sheath is secured the hand-piece casing M, as clearly shown in Fig. 2, while the enveloped power-conveyer is connected with the butt-end of the tool-holder, mounted in said hand-piece casing, to turn it, as before stated.

In some instances I contemplate dispensing with the flexible sheath or cover for the flexible power-conveyer, in order to give more flexibility or freedom of movement to said conveyer.

By means of the threaded sleeve N, with which the flexible sheath is connected, I am enabled to vary the relation of the said sheath to the flexible driving-shaft, this result being accomplished by turning said sleeve N so as to screw it either toward or from the butt of the tubular engine-head or lateral arm G, the movement of the sleeve N toward the butt of the arm G drawing the flexible sheath endwise toward the driven spindle H, whose clamp-nut K limits the movement, in this instance, in this direction, as clearly shown in Fig. 6, while the movement of the sleeve N in an outward direction forces said flexible sheath away from said spindle, the range of movement being limited in this direction, in this instance, by a suitable annular shoulder on the tool-chuck, against which a similar internal shoulder on the hand-piece casing abuts.

The driving-belt O passes from the driving-pulley at the lower end of the engine-arm around the driven pulley I, which pulley, it will be observed, is mounted upon the spindle, journal, or shaft H, carried by the engine-head or lateral arm in such manner as to swing, vibrate, or rock around the pivots or pivot-bolt *g* as a center.

Upon a suitable cross-arm or depending portion, G'—in this instance at the butt of the lateral arm or engine-head G—are mounted small guide-pulleys *c c* for the driving-belt when the engine-head is rocked to a position requiring their aid, as in Fig. 8, for instance.

In order that the tension of the driving-belt may not be materially changed by the variation of position of the engine-head or lateral arm and pulley carried thereby, when that head is rocked or turned, I preferably secure upon the upper end of the engine-arm E a collar or annular shoulder, *p*, fastened by a set-screw, *p'*, and interpose between said collar and the annular shoulder or portion *f'* near the upper end of the turning-shank F, a spiral spring, P, which tends to cause the shank F of the engine-head to slide endwise in the engine-arm. This shank-spring, it will be obvious, operates upon the engine-head and the driven pulley carried by it with a yielding pressure, and preserves the requisite tension of the driving-belt connection in all the movements of said head.

It will be noticed that the driven pulley I is arranged to overhang the pivot *g* of the rocking pivotal connection of the engine-head or lateral arm G, the said pulley being at the side of said pivot opposite that at which the arm

extends; and the belt-connection O, when in place, practically prevents the said pulley from rising, while the spring P, operating through the pivot *g*, tends to force the lateral arm upward. As this upward pressure is exerted between the driven pulley and the larger portion of the lateral arm, the shank-spring exerting it counterbalances in whole or in part the downward pressure due to the weight of the lateral arm and its appurtenances, and causes it to stand out laterally from the engine-arm.

The upward movement of the lateral arm is limited, in this instance, by the depending portion G′, which comes in contact with and rests in the concave seat f^2, formed on the turning-shank F, as clearly shown in Figs. 6 and 8.

It will be obvious that the collar *p* may be reversed—that is, the said collar may be secured upon the upper end of the turning sliding-shank F and the spring P interposed between said collar and the top of the engine-arm in which the shank works; or the shank F may be tubular, and the spring may be inserted within it; or the spring may be inserted in a tubular cavity in the engine-arm, and it may operate against the end of the shank F.

From the foregoing description it will be obvious that the hand-piece is given great freedom of movement, not only by the flexure of the flexible power-conveyer and rocking of the engine-arm upon the base, but by the universal engine-head or lateral arm, which possesses the capacity of turning or swiveling horizontally and of rocking vertically, while at the same time the proper tension of the belt is maintained, and the weight of the rocking head is counterbalanced by the action of the shank-spring.

The rocking lateral arm or engine-head and its appurtenances, when not in use, may also be rocked downward, so that the flexible power-conveyer will hang vertically and straight at one side of the engine-arm, which position tends to prevent it from taking a set in a curved direction.

It will be noticed that the pivot-bolt which passes through the split extension or lateral portion *f* of the shank F, and through the ear or lug *g′* of the lateral arm or engine-head G, is in the form of a thumb-screw, whereby I am enabled to rock the lateral arm or engine-head to any position desired upon its crosswise pivotal connection, and lock it firmly in such position against the returning action of the shank-spring by tightening the thumb-screw pivot, which will compress the members of the split portion *f′* together upon the ear *g′*, and securely clamp the parts together.

I am aware that rocking and turning or universal engine-heads are very common, and do not, broadly, claim such a device; nor do I intend to claim herein, broadly, the combination of the lateral arm, the pivot crosswise of said arm upon which the arm rocks, and the driven pulley overhanging said pivot at the side thereof opposite that at which said lateral arm extends; nor such a combination with the flexible power-conveyer, as that forms part of the subject-matter of my application of June 27, 1879, hereinbefore referred to.

To control the rocking movement of the engine-arm E, or to return it automatically to and maintain it in a normal position, I employ a counter-balance or spring, as usual; and in order to enable the normal position of said engine-arm, relatively to the base, to be varied at pleasure, and to permit this variation in normal position without destroying the rocking capacity of the arm, I employ an adjustable plate, Q, pivoted at its upper end to the standard *a* concentrically with the rocking arm, as clearly shown in Figs. 1, 2, 3, and 4, and connect the lower end of said plate with one end of the counterbalancing and returning spring, the opposite end of the spring being connected with the engine-arm.

The upper end of the pivoted plate Q is bent outward and upward, or is formed with a shoulder, *q*, so as to limit the range of rocking movement of the engine-arm, the branch or member of said arm next the plate Q being provided with depending ears or lugs *e e*, one of which passes down upon each side of the shoulder *q*, as clearly shown by the dotted lines in Fig. 3, said lines also showing the formation of the shoulder *q* and the extent of movement allowed the engine-arm by its ears or lugs, which abut against said shoulder when the engine-arm is rocked to its limit.

The plate Q, at its lower and larger end next the standard *a*, is provided with a series of teeth or notches, *s*, the corners of said plate being also provided with lugs or projections *s′ s′*, which limit the range of movement of the plate Q around its pivot by coming in contact with a pin or stud, *t*, projecting from a plate-spring, T, in this instance, which spring lies in a recess in the standard *a*, with its upper end firmly secured thereto, and is provided with one or more projections or teeth, *t*, which engage the teeth or notches of the pivoted plate Q to lock it firmly to the standard *a* in any desired position in its range of movement.

The tension or force of this plate-spring-locking device is exerted at all times to throw its locking tooth or teeth into engagement with the plate Q, and is operated or retracted when the said plate Q is to be adjusted to a different position by pressing it inward, it being preferably provided with an arm or extension to be acted upon by the foot, in order to avoid the necessity of stooping.

The construction of this spring-locking device obviously may be varied in well-known ways, and need not of necessity be a plate-spring.

It will be obvious that by adjusting the plate Q the normal position of the engine-arm relatively to the base may be varied without destroying the rocking capacity of the arm, the counterbalancing-spring, when the deflecting-strain is removed, returning the

arm to its usual position with one of its lugs *e* abutting against the shoulder *q* of the adjusting-plate Q, as shown in Fig. 3, the rocking movement of the arm being then permitted in the opposite direction against the tension of the spring. This capacity, however, of changing the normal position of the arm without destroying its rocking capability is not broadly claimed herein, as it forms part of the subject-matter of my aforesaid application of February 1, 1879.

The counterbalancing-spring R, in the present instance, is a coiled spring surrounded by a sectional telescoping tube or cover, S, so as to protect the spring and present a handsome appearance, one end of said spring being connected with a threaded shank, *u*, of a forked plate or clevis, U, pivoted to one of the lugs *s'* of the plate Q, said pivot being crosswise of the path in which the engine-arm rocks or vibrates, so as to permit the tubular sectional covering of the spring to rock or yield during the vibration of the engine-arm.

The upper end of the counterbalancing-spring is connected, in this instance, with a curved arm or extension, E', of the engine-arm, by means, preferably, of a screw-shank, V, which passes through the arm E' and receives a thumb or set-nut, W, as clearly shown in Fig. 3, whereby the tension of the spring may be adjusted or varied at pleasure.

The two arms of the tripod or base opposite the one on which the treadle is mounted are preferably provided with pivoted toes *x*, as fully described in my application of February 1, 1879, in order to give the tripod or base the capacity of being tilted or inclined at pleasure in different directions, so as to throw or bring the head or upper end of the engine-arm in front of or toward the patient, or out of the perpendicular, independently and irrespectively of its rocking movement upon the base, and without, at the same time, necessitating bringing the base or treadle inconveniently close to the patient or operating-chair. The pedal or treadle being mounted on the base is also inclined therewith, whereby the treadle may be operated, when the foot is thrown out, with ease and comfort. I do not claim herein this feature of tilting a dental-engine base, as that forms part of the subject-matter of my application of February 1, 1879, aforesaid.

I also disclaim, generally, in favor of my aforesaid applications of February 1, June 17, and June 27, 1879, all patentable subject-matter common to said applications and this present one, except as set out in the following claims, my said applications of February and June being prior to and taking precedence of this one.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of the lateral arm, the rocking pivot thereof, the shank of said arm, the shank-spring, the engine-arm, and the overhanging driven pulley carried by said lateral arm.

2. The combination, substantially as hereinbefore set forth, of the lateral arm, the rocking pivot thereof, the pivotal shank of said arm, the shank-spring, the engine-arm, the overhanging driven pulley carried by said lateral arm, and the flexible power-conveyer driven by said pulley.

3. The combination, substantially as hereinbefore set forth, of the lateral arm, the rocking pivot thereof, the adjusting device to lock the arm, when desired, in the position to which it is rocked, and the driven pulley overhanging said pivot at the side thereof opposite that at which the lateral arm extends.

4. The combination, substantially as hereinbefore set forth, of the lateral arm, the rocking pivot thereof, the adjusting device to rock the arm, when desired, in the position to which it is rocked, the driven pulley overhanging said pivot at the side thereof opposite that at which the lateral arm extends, the flexible power-conveyer driven by said pulley, and the hand-piece.

5. The combination, substantially as hereinbefore set forth, of the lateral arm, the locking pivot thereof, the shank of said arm, the shank-spring, the engine-arm, the overhanging pulley carried by said lateral arm, and the device to lock the arm against its rocking movement, when desired.

6. The combination, substantially as hereinbefore set forth, of the pivoted plate to change the normal position of the arm, with a spring-locking device.

7. The combination, substantially as hereinbefore set forth, of the pivoted plate to change the normal position of the arm provided with teeth or notches, with a spring-locking device to engage said plate and lock it to the engine-standard.

8. The combination, substantially as hereinbefore set forth, of the pivoted plate having lugs thereon to limit its range of movement, with the spring-locking device.

9. The combination, substantially as hereinbefore set forth, of the engine base, the engine-arm rocking thereon, the mechanism for changing the normal position of the engine-arm, the counterbalancing-spring, and the yielding sectional telescoping cover or envelope for said spring.

10. The combination, substantially as hereinbefore set forth, of the engine-head or lateral arm, the flexible shaft, the flexible sheath or cover of said shaft, and the adjustable connection to vary the relation of the shaft and sheath.

In testimony whereof I have hereunto subscribed my name.

ELI T. STARR.

Witnesses:

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WM. F. GILLESPIE.