(Model.)

W. A. JOHNSTON, A. W. BROWNE, E. T. STARR, & J. W. GILBERT.

DENTAL ENGINE HAND PIECE.

No. 287,683. Patented Oct. 30, 1883.

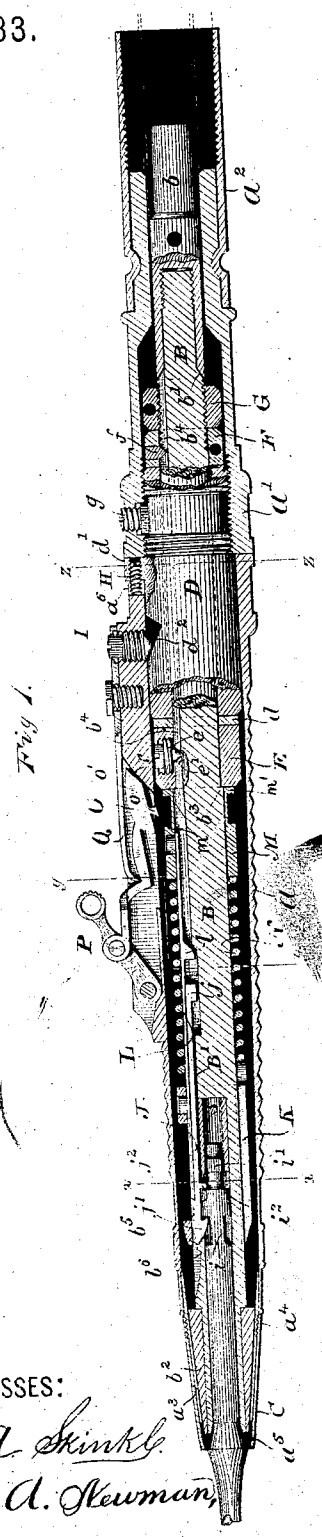


Fig. 1.

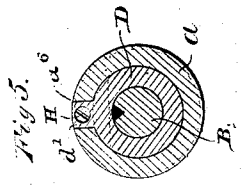


Fig. 5.

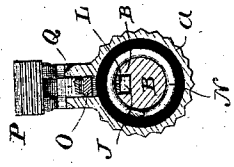


Fig. 4.

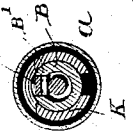


Fig. 3.

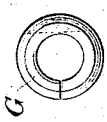


Fig. 7.

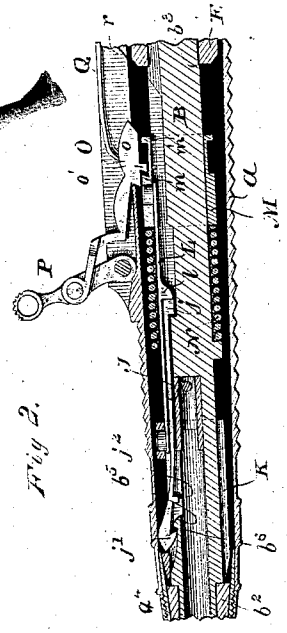


Fig. 2.

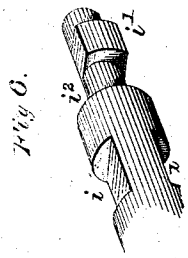


Fig. 6.

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DENTAL-ENGINE HAND-PIECE.

SPECIFICATION forming part of Letters Patent No. 287,683, dated October 30, 1883.

Application filed February 12, 1883. (Model.)

To all whom it may concern:

Be it known that we, WILLIAM A. JOHNSTON, of the village of Clifton, county of Richmond, and State of New York, ARTHUR W. BROWNE, of the village of Westfield, in said county and State, and ELI T. STARR and JOHN W. GILBERT, both of the city and county of Philadelphia, in the State of Pennsylvania, have jointly invented certain new and useful Improvements in Hand-Pieces or Tool-Carriers, more especially adapted for use with dental and surgical engines and electromotors, of which the following is a specification.

Our invention relates more especially to the hand-pieces or tool-carriers of the power-driven engines used by dentists and surgeons in their operations; and it constitutes more particularly an improvement upon the hand-pieces shown in the patents of Johnston and Browne, No. 213,662, of March 25, 1879, and in the patents of E. T. Starr, Nos. 233,707, 233,708, and 233,709, of October 26, 1880.

The prime objects of our invention are, first, to provide an absolutely secure and true tool-fastening, whereby the tool shall at all times be firmly seated in the socket of its rotary spindle without liability to either lateral or end play therein; second, to provide for readily exposing the working parts of the hand-piece for oiling, cleaning, or inspection without disturbing the adjustment of the bearings of the rotary spindle of the hand-piece; third, to permit the bit to be changed while the engine is in motion, and enable the rotary spindle to run as freely with the tool-fastening released as when a tool is clamped in the socket of the rotary spindle; fourth, to facilitate the substitution of one bit or tool for another without changing the position of the hand-piece in the hand; fifth, to provide a nose-cap covering the end of the spindle, the ready removal of which facilitates the oiling and cleaning of the front end of the spindle; sixth, to retain the feature of drawing the shank of the tool firmly into place in the spindle-socket when inserted therein, as shown in the Johnston and Browne patent above mentioned, while providing against the accidental removal of the bit or tool when a "pull" cut is being made; seventh, to prevent the liability of the lubricating-oil used about the hand-piece from soiling the fingers of the operator or the face of the patient; eighth, to prevent the several screws used in the construction of the hand-piece from being lost or mislaid in taking apart the hand-piece; ninth, to so construct the various parts that any of them can be renewed without sacrificing the other parts of the organization; tenth, to improve the arrangement of the journals and bearings of the hand-piece; eleventh, to provide an improved connection between the rotary power-driven shaft of the engine and the rear or butt end of the rotary spindle; and, twelfth, to improve the construction of the front or socket end of the spindle, so that its tapered journal may be readily removed, when worn, and replaced without sacrificing the rest of the spindle.

The subject-matter claimed herein as of our invention is particularly pointed out at the close of the specification.

In the accompanying drawings we have shown all our improvements as embodied in the best way now known to us.

It is to be understood that some of these improvements may be used without the others, and in hand-pieces differing in their details of construction from that particularly shown.

In said drawings, Figure 1 is a longitudinal section through a hand-piece embodying our improvements; and Fig. 2, a similar view through a portion thereof, the tool-locking mechanism of the hand-piece and its operating devices being shown in a position different from that shown in Fig. 1. Figs. 3, 4, and 5 are transverse sectional views on the lines $x\,x$, $y\,y$, and $z\,z$, respectively. Fig. 6 is a perspective view of the rear or driving end of an operating-tool adapted to the socket of the rotary spindle of the hand-piece, and Fig. 7 is a view of the split or squeeze nut which locks the pull-collar of the spindle in place.

The hand-piece casing in the example shown consists of a handle-section, *a*, a second sec-

tion, a', united to the handle-section by means of a union sleeve or coupling, and a third section, a^2, which constitutes the shank-section of the casing, said shank-section being connected with the section a' by means of a swivel-joint, as in the well-known hand-piece of the S. S. White dental engine, whereby the handle-section may turn freely to conform to the movements of the hand of the operator relatively to the shank-section. Said shank-section is permanently connected with the outer or free end of the flexible sheath of the engine which envelopes the flexible driving-shaft, as usual. Neither said sheath nor said shaft is shown in the drawings, as to depict them therein would be unnecessary. The outer or free end of the flexible driving-shaft is connected to the rear or butt end of the rotary spindle B of the hand-piece in this organization by means of a socket-connection, b. This socket piece or connection is connected at its rear end, preferably by soldering, as usual, with the front end of the flexible shaft, so as to form a permanent connection therewith. The front end of the connection b is also socketed, and the socket is provided with a female thread at its inner termination, so as to permit the connection to be firmly screwed upon the male-threaded end of the spindle B, so as to form a firm but detachable connection therewith. The spindle B has a tapering shoulder, b', formed thereon, corresponding with the tapering or conical mouth of the socket of the connection b, whereby upon firmly screwing up said connection a firm driving-connection is formed, even as against back rotation of the engine. The enlarged frictional surfaces afforded by the cone-shoulder and the cone-socket very materially aid in making the connection a secure driving one, in whichever direction the driving-shaft may turn. The spindle B has its bearings in the hand-piece casing. The front end of the spindle is socketed for the reception of the tool-shanks, as usual, and has a taper or cone journal which fits a corresponding bearing formed by the front end of the handle-section of the casing. The advantages of a cone-journal for the rotary spindle at the front or nose end of a hand-piece are well established, and need not be reiterated here by us.

The handle-section a of the casing is usually made of brass. In order to afford a durable bearing for the tapered end of the spindle, we preferably construct the bearing therefor at the nose of the hand-piece of a hardened-steel thimble, a^3, soldered or otherwise suitably connected to the front end of the handle-section proper. By this means, when the said thimble is worn too much for the successful operation of the hand-piece, it may readily be removed and a new one substituted for it. In order, likewise, to provide for the renewal of the cone-journal of the spindle when worn, so as not to sacrifice the entire spindle, we construct the cone of the spindle of an externally-tapering tube, b^2, of hardened steel, so connected to the reduced end of the spindle as to be removed by a machinist when worn and a new one placed thereon. The preferred construction is to reduce the front end of the spindle B, as clearly shown in Fig. 1. The hardened cone-journal b^2 is then forced on the reduced socketed end of the spindle and firmly soldered in place. It is then centered by the socket in the end of the spindle, and the cone ground to shape and trued exactly with the center of the socket. The socket in the front end of the spindle B for the reception of the tool-shank has a tapered mouth, as in the Johnston and Browne patent before mentioned, for the reception of the cone-shoulder formed on the shank of the operating-tool. It will be noticed that the end of the spindle B projects a little beyond the end of the hard-metal thimble-piece a^3, before described. This projecture of the front end of the spindle beyond the casing proper is more especially for the purpose of exposing the end of the spindle for the purpose of cleaning and lubricating the front journal thereof. If this spindle, however, was not inclosed, saliva, grit from the teeth, and other impurities would find ready access to the front bearing of the hand-piece, while the lubricating-oil would also escape and soil the fingers of the operator and face of the patient. To avoid these objections we provide the front or nose of the hand-piece with a tapered cap, C, internally threaded at its inner end, so as to fit the threads a^4, formed on the exterior hard-metal thimble-piece, a^3. The cap C, when screwed in place, as shown in Fig. 1, fully covers the protruding end of the spindle and overlaps the cone-shoulder formed on the tool-shank, whereby there is formed, as clearly shown in said figure, a space, a^5, which most effectually prevents the entrance of saliva and other deleterious matter to the front bearing of the hand-piece, while the exudation or escape of the lubricant is also prevented. This screw-cap C is readily screwed on or taken off from the front end of the hand-piece as occasion requires.

The rear axial bearing of the spindle B is provided in the union-piece or collet D. The spindle B is prevented from inward endwise movement in the hand-piece casing by means of a thrust-bearing formed by a collar, E, fitted upon the spindle, and held thereon by means of a set-screw, e. This thrust-collar is readily removable from the spindle by loosening the set-screw e. When in place upon the spindle, however, its position is determined by means of the shoulder b^3, formed on the spindle, the collar being forced up against said shoulder. The set-screw e, which has a tapered end fitting a longitudinal groove, b^4, of the spindle, is then tightened up, causing its pointed or cone end to bear against an inclined shoulder formed by a slot, e', in the spindle, whereby the collar E will be forced firmly up against its shoulder b^3 on the spindle, and be securely locked, so as to rotate therewith.

The rear face of the thrust-collar E is smooth or flat, and interposed between said end and the front end of the union-piece or collet D is a hard-metal anti-friction ring, *d*, such as is shown in the Johnston and Browne patent. This ring takes the wear of the thrust of the spindle and effectually protects the front end of the union-piece or collet D from wear. Both the thrust-collar E and the anti-friction ring *d* are preferably of hardened steel for durability, and when too much worn they may be replaced by new ones. The pull-bearing of the spindle is formed by a hard-metal collar, F, which is fitted to the spindle, and locked thereon from turning by means of the cone end of a screw or pin, *f*, which fits in the longitudinal groove b^4 of the spindle before mentioned. The said pull-bearing is forced firmly up against the rear end of the union-piece or collet D by means of a squeeze-nut, G, which is screwed upon the threaded end of the spindle B, as clearly shown in Fig. 1. From this description it will be seen that, while the spindle B is capable of freely rotating axially in the union-piece or collet D, still the spindle cannot move endwise in either direction, while all wear of the thrust and pull collars may be taken up by the adjustment and the parts readily renewed when desired. The union-piece or collet D at its rear end is screw-threaded for the reception of the internally-threaded front end of the casing-section *a'*. Said casing-section, when screwed in place upon the union-sleeve or collet, is firmly fastened in place by means of a set-screw, *g*. Projecting upward from the union-piece D is a lug, *d'*, having an opening therethrough extending longitudinally of the hand-piece, and screw-threaded for the reception of an adjusting-screw, H. The front portion of said union-piece is smooth, so as to enable the rear end of the handle-section *a* of the casing to be readily slipped thereon. Said handle-section *a* of the casing is provided with a longitudinal slot, a^6, which permits the rear end of said section to be slipped on the front end of the union-piece, past the setting device H, and be brought up against the end of the casing-sections *a'*, so as to form a nice joint. The extent, however, to which the handle-section of the casing is slipped upon the union-piece D is determined by the set-screw H, before mentioned, inasmuch as when the said handle-section is slipped upon the union-piece its inward movement is limited by the shoulder formed at the end of the slot a^6 coming against the front end of said screw H. When the handle-section has been slipped upon the union-piece to its fullest extent as determined by the adjusting device H, it is held in such position by means of the set-screw I, having a tapering inner end, which bears against an inclined or wedge surface, d^2, formed in the periphery of the union-piece, as clearly shown in Fig. 1. As the said screw is tightened up, it will be obvious that the handle-section of the casing is wedged backward to its greatest extent as allowed by the set-screw H, before mentioned. This provision of screws H and I with the inclined surface d^2 of the union-piece is for the purpose of enabling the handle-section to be adjusted so as to compensate for any wear of the journal or bearing at the front end of the hand-piece, and is a simple and very desirable method of compensating for wear and securing the proper action of the spindle in the casing.

It will be noticed that the screws *e*, *g*, and I are constructed with reduced upper or driving ends, and that the openings in which they move terminate in reduced diameters, whereby while the screws may be readily turned to perform their functions, still they cannot be entirely removed, so as to be mislaid or lost. This is also a very desirable feature.

It will be noticed, also, that the thrust and pull collars E and F are locked to the grooved spindle B by means of pins or pointed screws, whereby they are locked to the spindle and compelled to rotate therewith, while movable endwise thereon for purposes of adjustment, removal, or replacement. This is also a desirable feature, because the circumferential positions of the collars when placed on the spindle must always be the same, the collars having the same positions circumferentially when taken off and replaced as before existed. Inasmuch as wear takes place between the collars and the faces against which they abut, there would not be accurate fitting when the collars are removed and replaced unless their positions were the same as they were before their removal. This accurate fitting cannot be had with collars adjustable upon threads upon the spindle, for instance, which construction has heretofore existed.

In the Johnston and Browne patent before alluded to, the tool-shank, when inserted in the socket of the rotary spindle, is not only locked therein against endwise movement, but the cone-shoulder on the shank is also drawn or forced by the action of a spring firmly in its corresponding seat in the mouth of the tool-socket. This avoids endwise movement of the tool in the socket and prevents any wabbling or rattling movement of the tool. Under some circumstances, however, when a pull cut is being made with a hand-piece like that of Johnston and Browne's, the pull upon the tool wedges the tool-fastening outward, and the tool pulls out of the socket. To avoid this difficulty, and to improve the class of tool-locks shown in the Johnston and Browne and Starr patents, we have devised the locking mechanism which we will now describe.

A longitudinal groove or recess, B', is made in the spindle, and fitted in the front end thereof is a spring-latch, J. The rear end of this latch is provided with a depending lug, *j*, sliding in its groove, and the latch at its front end is provided with a tapering or arrow-shaped head, *j'*, the lower portion of which forms a hook to engage a shoulder on the tool-shank to lock the tool in the tool-socket, the front end of the groove B' opening into or communicating

with said socket. The tool-shank is preferably provided with two transverse locking-grooves, *i i*, and with a reduced end having a driving-lug, *i'*, as usual. Back of the hook end of the locking-latch is a depending lug, j^2, the function of which will presently be described.

Surrounding the spindle and overlapping the locking end of the latch J is an endwise-movable sleeeve, K, the upper portion of which is slotted or cut away, as clearly shown in Figs. 1, 2, and 3. The rear end of this sliding sleeve is connected by a link, L, with a ring, M, also fitted upon the spindle so as to move endwise thereon.

Interposed between the front end of the ring M and a rigid pin or shoulder on the spindle is a coiled spring, N, the tension or stress of which acts to throw and keep the ring M back against the front end of the thrust-collar E. This action of the spring consequently, by means of the link L, normally retains the slotted sleeve K in the position shown in Fig. 1, with its front end over the front end of the locking-latch, whereby said locking-latch cannot rise under any pulling-strain upon the tool.

When it is desired to release the locking-latch from the tool-shank, so as to permit the tool to be removed, or a new tool to be inserted in its place, the ring M is forced forward, carrying with it the link L, which has depending lug *l*. The first portion of this movement carries the front end of the sleeve K forward, and brings its slot above the end of the locking-latch J. As soon as the front end of the sleeve K has passed from above the head of the locking-latch, the lug *l* of the link L comes against the end of the locking-latch and forces it forward, causing its inclined or beveled end to ride up the inclined surface b^5, formed upon the spindle B, and spring down into a cross-notch, b^6, in advance of the incline b^5, above mentioned. The tool-locking latch is then in the position shown in Fig. 2, and the tool-shank is released and may be removed.

In order to lock the tool-shank in the socket, the ring M is moved backward upon the spindle, carrying the sleeve K with it, and as this sleeve comes in contact with the locking end of the spring-latch it trips or forces it over the inclined wedging-shoulder b^5, and permits it to spring down into engagement with one of the cross-notches *i* of the tool-shank, the head of the locking-latch in its descending movements drawing the tool firmly into the tool-socket, with its cone-shoulder firmly centered in the cone-mouth of said socket of the spindle. As the head or locking end of the spring-latch springs down into engagement with the tool-shank, to lock it in the socket, the front end of the sleeve K again rides over the upper surface of said head, and prevents it from rising until the said sleeve K is again forced forward. During the unlocking operation the shoulder j^2 of the locking-latch J comes against an annular shoulder, i^2, on the tool, formed by reducing the end of the tool-shank, and forces the said tool outward, so as to loosen it in its socket and enable it to be readily removed. This feature is to overcome the difficulty of withdrawing the tools by reason of their tendency to stick in the socket.

In order to cause the movements of the tool-lock which have been described, we preferably employ a gripping pawl or hook, O, acting through a slot in the handle-section of the casing, and pivoted at its forward end to a rocking lever, P, pivoted externally upon the casing at one end, and affording at its other a handle or surface by which to rock the lever backward and forward longitudinally of the casing. The upper surface of the hook or pawl at the point *o* is rounded or inclined, and the front end of the plate-spring Q bears upon said surface of the latch, so as to keep the rear end of the latch pressed downward, with a tendency, during the rocking movements of the lever, to enter the opening in the casing and engage the ring M by means of a projecting point or tooth, *o'*. The extreme rear end of the pawl is provided with an inclined surface, which, when the lever is in the position shown in Fig. 1, rides up the incline *r*, so as to carry the pawl out of the recess in the casing. When the lever P is rocked in the forward direction, it carries the pawl with it, and this pawl, being acted upon by the spring before mentioned, is forced down through the slot in the casing, while its tooth *o'* engages the annular shoulder *m* of the ring M, carrying that ring forward, to manipulate the tool-lock and release the tool, as before described.

By reason of the engagement of the end of the locking-latch with the cross-notch b^6, before described, the tool-locking devices are held in their unlocked position without frictional contact between the ring M and the pawl O. This avoidance of friction is a desirable feature, especially when the hand-piece is used with motors which it might not be desirable to stop while changing the bits or tools. When the lever is rocked from front to rear, the tooth *o'* comes in contact with the rear annular shoulder, *m'*, of the ring M, and carries the ring backward to lock the tool in the socket, as before described, the pawl at the end of the movement of the lever P riding up out of the slot in the casing, as before described, thus leaving the spindle free and unretarded in its rotation.

Any suitable means may be employed to afford a driving-connection between the tool-shank and the spindle. In this present instance we provide the inner end of the tool-socket with a driving-surface formed by means of a tube having its wall at one or more sides slotted for the passage of the driving-lug *i'* of the tool-shank, as is clearly shown in Figs. 1 and 2.

Without elaborating the advantages of a hand-piece constructed according to our invention, and the facilities it affords for accurate adjustment, durability, and efficiency of work, nor of its adaptability for repairs and cleaning of its parts, we state our claim as fol-

lows, first premising that any and all matter not specifically claimed herein is reserved for a future application or applications, and that this reservation of the right to claim any patentable matter disclosed herein, but not now claimed, is not affected or lessened by the making and cancellation of any claim or claims in the prosecution of this present application.

We claim herein—

1. The combination, with the handle-section of a hand-piece casing, of an external detachable screw-threaded cap fitted to external threads on the nose of said handle-section, substantially as described.

2. A tubular sectional hand-piece casing, the sections of which are united by a union-piece carrying an adjustable screw or device which determines the approach of one section relatively to the other, substantially as described.

3. A hand-piece casing the handle-section of which is united to another section by a union-piece the front end of which is fitted to receive said handle-section and enable it to be slipped freely endwise thereon, said casing carrying a wedging device to force said handle-section backward upon said union-piece, substantially as described.

4. The tubular sections of a hand-piece casing, detachably and adjustably united by a union-piece the rear end of which is screw-threaded for the reception of the front end of one of said sections, and the front end of which is fitted for the reception of the rear end of the other of said sections, and said union-piece being provided with an inclined surface to be acted upon by a laterally-operating wedging device carried by said last-mentioned section, substantially as described.

5. In a hand-piece, a tubular section of the casing fitted to slide upon the smooth front end of a union-piece or collet, substantially as described.

6. The combination, with the hand-piece casing and union-piece thereof, of a spindle fitted to turn in said union-piece, and be locked from endwise movement therein by a thrust-collar on said spindle at the front of the union-piece, a pull-collar on said spindle at the rear of said union-piece, and a locking device to hold said pull-collar against the rear face of said union-piece, said thrust and pull collars having projecting portions fitting a longitudinal groove in the spindle, so as to be incapable of turning on the spindle, while movable endwise thereon, substantially as described.

7. The combination of the longitudinally-grooved spindle, the pull-collar fitted to move endwise on said spindle, and provided with a projection fitting the groove thereof, and a locking device to retain said collar in position.

8. The combination, with the longitudinally-grooved spindle having a shoulder thereon, of the thrust-collar fitted to said spindle, and having a projection fitting its groove, whereby the collar may be moved endwise to abut against said shoulder, but cannot turn upon said spindle.

9. The combination, with the longitudinally-grooved spindle having a shoulder thereon and an incline or wedge surface therein, of the thrust-collar fitted to said spindle, and provided with a set-screw the wedge end of which fits the groove of said spindle, and when tightened acts upon the incline thereof, whereby the collar is firmly forced against the shoulder on the spindle and locked securely thereto.

10. The spindle provided at its forward socketed end with a rigid but detachable tubular journal, so as to be replaced when worn, substantially as described.

11. The socketed spindle reduced at its forward end, and having rigidly soldered thereto a hardened tubular journal having a tapered or coned periphery to fit a correspondingly-shaped bearing, substantially as described.

12. The internally-threaded and conically-socketed driving-shaft connection, substantially as described.

13. The endwise-movable tool-locking latch, in combination with the spindle, and the slotted sleeve movable endwise on said spindle over the locking end of said latch.

14. The combination, substantially as hereinbefore set forth, of the spindle, the endwise-movable tool-locking latch, a ring mounted on said spindle and fitted to slide thereon to operate said latch, and a link-connection between the latch and ring.

15. The combination of the spindle, the locking-latch, the slotted sleeve movable on the spindle over the locking end of said latch, a ring fitted on the spindle to control the movements of said latch, a link-connection between said ring and said sleeve, whereby the two move together, a projection on said link which, at the end of its forward movement, forces the latch forward to release the tool, and a spring to retract said ring and sleeve to bring the parts of the tool-lock to their locking position, substantially as described.

16. The combination, substantially as hereinbefore set forth, of a spindle, a spring-operated tool-locking latch carried thereby, and a shoulder or equivalent detent to retain the latch in its unlocked position, when moved to release the tool, until positively tripped to move the tool-lock to its locking position.

17. The combination, substantially as hereinbefore set forth, of a spindle fitted to turn in a hand-piece casing, a spring-operated tool-lock carried by said spindle, a shoulder or equivalent detent to retain the tool-lock in its unlocked position when moved to release the tool, and a device mounted on the casing and operating therethrough to manipulate said tool-lock, whereby the tool-lock may be operated, while the spindle is in motion, to release a tool, and be held open as long as desired without frictional contact with the external operating device.

18. The combination, substantially as here-

inbefore set forth, with the tool-locking mechanism of a dental-engine hand-piece, of a pivoted device carrying an independently-pivoted pawl or hook to operate said tool-locking mechanism from the outside of the casing.

19. The combination, substantially as hereinbefore set forth, of the hand-piece casing, the spindle fitted to turn therein, the ring M, fitted to move on the spindle, and the lever carrying a pivoted pawl or hook to move said ring in operating a tool-locking mechanism.

20. A tool-lock-operating apparatus for hand-pieces, consisting of a lever, a pawl or hook connected therewith, and a spring acting upon said pawl, substantially as described.

21. The combination of the hand-piece casing, the spindle fitted to turn therein, the tool-locking mechanism, the ring fitted to move endwise in said spindle to operate said mechanism, the lever pivoted externally on the casing, the pawl pivoted to said lever and adapted to engage said ring as the lever is rocked back and forth, the spring acting on said pawl, and the incline on the casing, up which the end of the pawl slides at the completion of its backward movement.

In testimony whereof we have hereunto subscribed our names this 3d day of February, A. D. 1883.

WM. A. JOHNSTON.
A. W. BROWNE.
ELI T. STARR.
JOHN W. GILBERT.

Witnesses:
E. M. WHITE,
WM. J. PEYTON.