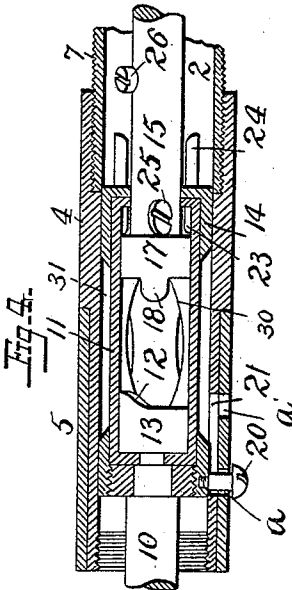
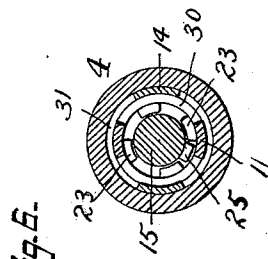
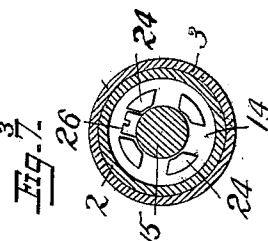
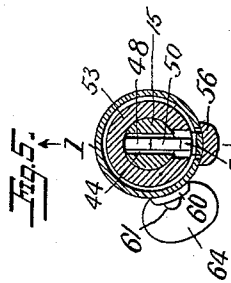
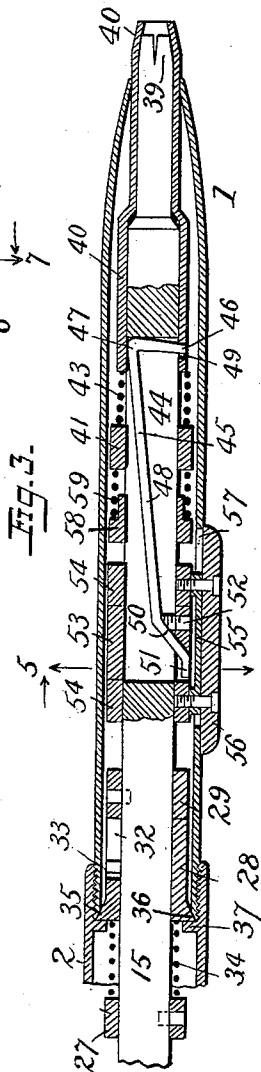
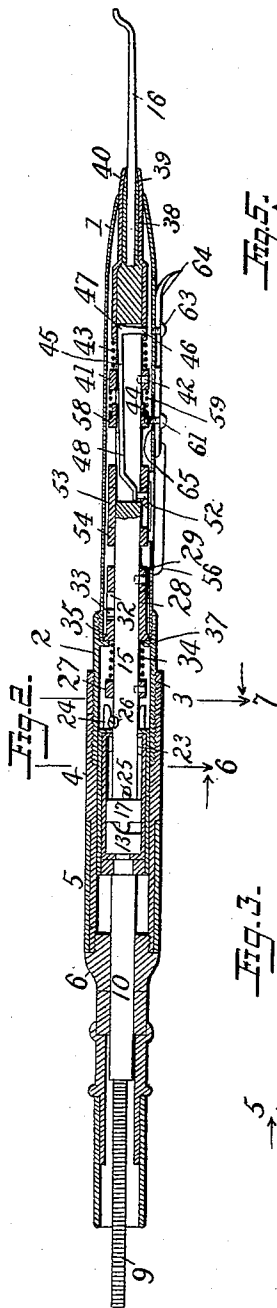
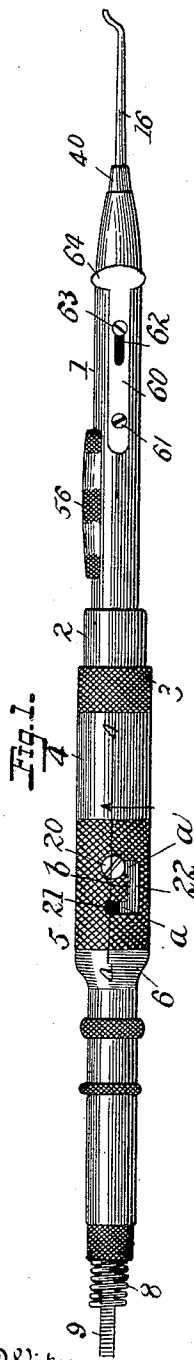


E. HAY.
HAND PIECE FOR DENTAL PURPOSES.

No. 461,754.

Patented Oct. 20, 1891.



Witnesses.
E. H. Hay
H. D. Keefe

Inventor
E. H. Hay
H. D. Keefe
Attorneys

(No Model.)

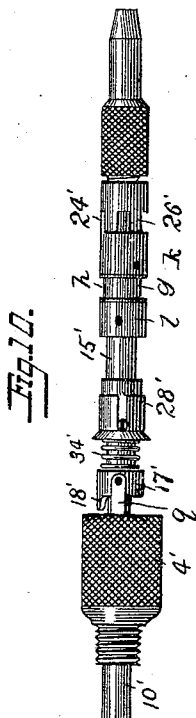
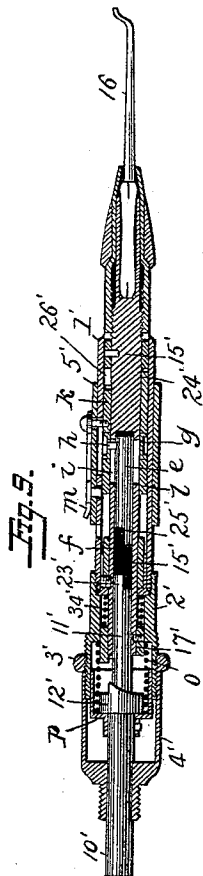
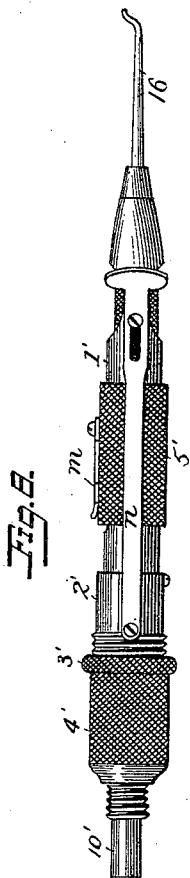
2 Sheets—Sheet 2.

E. HAY.

HAND PIECE FOR DENTAL PURPOSES.

No. 461,754.

Patented Oct. 20, 1891.



Witnesses:

Edw. A. Dick
H. B. Keefer

Inventor

Ellwood Hay
By Marshall Bailey
Attorney

UNITED STATES PATENT OFFICE.

ELLWOOD HAY, OF PHILLIPSBURG, NEW JERSEY.

HAND-PIECE FOR DENTAL PURPOSES.

SPECIFICATION forming part of Letters Patent No. 461,754, dated October 20, 1891.

Application filed June 26, 1891. Serial No. 397,595. (No model.)

To all whom it may concern:

Be it known that I, ELLWOOD HAY, a citizen of the United States, residing at Phillipsburg, in the county of Warren and State of New Jersey, have invented certain new and useful Improvements in Hand-Pieces for Dental and other Purposes; 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 has for its object to produce a tool holding and carrying device which serves to connect it with a motor-shaft and by means of which the tool may be given either rotary or reciprocating movements, it having especially for its object to improve dental hand-pieces; and it consists of mechanism whereby the tool may be either rotated or reciprocated, whereby without the interchange of parts the device may be so adjusted as to cause either of said kinds of motion to be transmitted to the tool from a single motor-shaft, whereby the tool is clamped or released, whereby when the parts are arranged for reciprocating the tool the reciprocations may be stopped without stopping the motion of the motor-shaft, whereby the extent of the reciprocations of the tool may be varied and adjusted, and whereby in the details of construction the machine is improved.

By the application of my invention to a dental hand-piece the latter, without being made more cumbrous than the ordinary drill hand-piece and without requiring any more skill or care for its use, can be adjusted from the outside, so that it may be worked either for plugging or for drilling, and such adjustment can be made as easily and quickly as can one drill be taken from an ordinary drilling hand-piece and another put in its place.

While my invention is particularly adapted for use in connection with dentists' hand-pieces, yet some or all of its features might be applied to other classes of machinery—such, for instance, as stone-working tools—and those parts which relate to the changing of the motion of the tool-carrying parts from that of rotation to that of reciprocation might be applied to machinery of many different kinds where such changes of motion are required. In this specification I use the term

“tool” to apply to any implement which is to be either reciprocated or rotated by the use of my invention, having selected for the purpose of illustration a dental plugging-tool. I employ the term “hand-piece,” meaning to include thereby any form of casing which is used to surround the essential operative parts of the device and remains stationary, so far as the particular motions which are to be imparted to the tool are concerned, and which therefore may be handled to give direction and position to the tool. I employ the term “forward” to indicate direction toward the end of the apparatus carrying the tool, and the term “backward” to indicate the other direction, and I use the term “motor-shaft” in the specification and claims to denote the rotating parts by which power is communicated to the mechanism within the hand-piece, such motor-shaft consisting, as shown in the drawings and as hereinafter described in detail, of a flexible shaft and a spindle secured thereto and mounted in the hand-piece.

In the drawings, Figure 1 is an elevation of a dental hand-piece having my invention applied thereto. Fig. 2 is a central longitudinal section of the device shown in Fig. 1. Fig. 3 is a longitudinal section of the forward part of the device on a larger scale. Fig. 4 is a longitudinal section on the line 4 4 of Fig. 1. Figs. 5, 6, and 7 are transverse sections on the lines 5 5, 6 6, and 7 7, respectively, of Figs. 2 and 3. Fig. 8 is an elevation of a dental hand-piece having another form of my invention applied thereto. Fig. 9 is a central longitudinal section of the device shown in Fig. 8. Fig. 10 is an elevation of the tool-carrying spindle shown in Figs. 8 and 9, with the parts immediately connected therewith and also certain of the parts connected with the motor-shaft.

I will first describe in detail the invention which is embodied in the device shown in Figs. 1 to 7 of the drawings.

The casing which constitutes the hand-piece and serves to cover the operative and essential parts of the device is shown as consisting of several tubular parts designated and assembled as follows:

1 represents the forward tubular portion of the casing, which is of a length about half

that of the entire hand-piece and has a slight taper toward its front end, though its particular outward configuration is not essential. To the rear end of the piece 1 is screwed the short cylindrical intermediate part 2, the rear portion of which is externally screw-threaded, as at 7, and has mounted upon it a lock-nut 3, while the rear tubular portion 4 of the casing, which constitutes the largest part of the hand-piece, is also screwed thereto. Upon this portion 4 is mounted a sleeve 5, for a purpose to be described, and this sleeve is held in place by the cap 6 or rear closing-piece of the casing, such cap being provided with a hollow stem or shank portion to which is secured the flexible tube 8, through which passes the flexible portion 9 of the motor-shaft.

Certain of the parts of the casing have special features of construction, which will be specifically described hereinafter.

The forward end of a spindle 10, which constitutes a part of the motor-shaft, extends into the hand-piece and is provided with one member of a clutch, which unites the motor-shaft and the tool-carrying shaft or spindle 15, and is also provided with a cam or equivalent device, which operates when the tool-spindle is connected therewith to reciprocate the tool-spindle as the motor-shaft revolves. The said clutch member is preferably formed by a series of lugs or ribs 23, arranged parallel with the axis of the spindle 10 and upon the inside of a shell 11, which is secured to the spindle. While the shell may be connected with the spindle in any suitable manner so that it will revolve therewith, I prefer that the connection should be formed by clamping it against a shoulder on the spindle by means of the nut 13, which nut is provided with a cam-shaped end or face 12, which constitutes the cam above referred to. This cam is situated within the shell at its rear end, while the ribs or lugs 23 are situated at the forward end of the shell. The other member of the clutch is carried by the spindle 15, and consists of a pin or projection 25, which is adapted to be moved between two adjacent lugs 23.

The central shaft or spindle 15 passes through the hand-piece or casing and is at its forward end adapted to receive and hold the tool 16. It is preferably formed of a single piece of metal, and its rear end extends into the interior of the shell 11, where it is provided with a head 17, having a projection 18 on its outer face. The head 17 is removably secured to the shaft or spindle 15, being preferably screwed to a reduced end thereof.

14 is a sleeve loosely mounted upon the shell 11, upon which it is free to turn, but not to move longitudinally. The opposite sides of the shell 11 and the sleeve 14 are cut away, forming openings 30 and 31, respectively, through which, when they are brought opposite to each other, access may be had to the interior of the shell, so that the nut 13 and

the head 17 may be put in place. The sleeve 14 is connected with the stationary hand-piece, so that thereby it is held from turning with the spindle 10 and the shell 11, such connection being preferably formed by means of a pin or screw 20, which passes through a straight slot 21, formed in the rear portion 4 of the hand-piece, and through an angular substantially $\square$ -shaped slot 22 in the sleeve 5.

When the tool-carrying spindle is being reciprocated, it is desirable that it should be held or locked against rotation, and for that purpose I employ the following devices: At the front end of the sleeve 14 there are a number of forwardly-projecting fingers 24, and the spindle 15 is provided with a pin or projection 26, arranged outside of and in front of the shell 11 and the sleeve 14 and adapted to be brought between the projecting fingers 24, which, being held by the hand-piece so as not to rotate, serve to lock the spindle against rotation. The shell 11 and the parts connected directly therewith are allowed a certain amount of longitudinal movement within the hand-piece toward and from the spindle 15. When the shell 11 and its connected parts are moved forward—that is, into the position shown in Fig. 2—the exposed faces of the cam 12 and the head 17 are brought into engagement, and the projection 26 on the spindle 15 is brought between the fingers 24 of the sleeve 14, while the projection 25 on the spindle 15 is carried out from between the lugs 23 on the shell 11. This arrangement of parts insures that the spindle 15 shall be held from turning, because of the engagement of the projection 26 and 24, and also that the spindle and the tool carried thereby will be reciprocated longitudinally by reason of the cam 12 acting upon the projection 18 on the head at the end of the spindle, the head and cam being held in engagement by means to be described. When the sleeve 14 and shell 11 and their connected parts are moved backward, as illustrated in Fig. 4, the head 17 and cam 12 are separated, the fingers 24 are thrown back out of engagement with the pin 26, and the lugs or ribs 23 on the shell 11 are brought into engagement with the projection 25, carried by the central shaft or spindle. Now, as the shell 11 turns with the motor-shaft and the lugs 23 and the projection 25 constitute a connection or coupling between the said shell and the shaft 15, it follows that the rotation of the motor-shaft will be imparted to the central shaft 15 and the tool carried thereby, while they will not be reciprocated, because the cam 12 is moved away from the head 17.

The sleeve 5, with the angular slot 22 therein and the pin or screw 20, constitutes a shifting and locking device by which the adjustments just referred to may be made and by which after having been made the parts are held in a locked position. I have designated the central portion of the slot 22, which extends parallel with the length of the hand-

piece *b*, and the two end portions which are arranged at substantially right angles thereto *a a'*, the latter being the part toward the forward end of the casing or hand-piece.

5 When the pin 20 is moved into the portion *a'* of the slot 22, the coupling parts within the casing are in the position indicated in Fig. 2. If now the sleeve 5 be rotated in the direction of the arrow marked in Fig. 1 until the
10 pin 20 is brought into the straight portion *b* of the slot and the pin be then moved backward, carrying with it the parts 10, 11, 12, and 14 within the casing, and afterward the sleeve 5 be rotated in the direction opposite
15 that indicated by the arrow, so as to bring the portion *a* of the slot over the pin, then the coupling parts will be moved into the position shown in Fig. 4 and will be securely locked in this position.

20 27 and 29 are collars formed upon or secured to the shaft or spindle 15 at some distance apart and in front of the projection 26.

28 is a sleeve mounted loosely upon the spindle 15 between the collars 27 and 29, against the latter of which it is normally held by the spring 34. The sleeve 28 is free to have a certain limited amount of longitudinal movement upon the spindle 15, but is held from turning thereon, it being slotted
30 at 32, and a pin 33, projecting from the spindle, extending into the said slot. The rear end of the sleeve 28 is made flaring, as shown at 35, and there is formed an inversely-shaped bearing 36 on the inside of the forward portion 1 of the hand-piece or casing, this bearing being situated at the rear end of such part of the casing. There is also formed a shoulder 37 on the inside of the central or intermediate portion 2 of the casing, which shoulder bears against the outer
40 face of the expanded end of the sleeve 28, when the parts 1 and 2 are tightly screwed together. It will be seen that by forming the sleeve 28 with the expanded end 35 and
45 providing the described bearings therefor upon the parts of the casing there is formed a stationary bearing (relative to the hand-piece) for the spring 34, while the spindle 15 and its connected parts have a limited longitudinal movement within the sleeve 28 and the hand-piece.

50 The function of the spring 34 is to force into and hold in engagement the faces of the head 17 and the cam 12 when the parts are arranged as shown in Fig. 2.

It will now be understood that when the parts are in the position shown in Fig. 2 and the motor-shaft is rotated the spindle 15 will be reciprocated within the hand-piece under
60 the conjoint action of the cam 12 and the spring 34, and a vibrating, hammering, or plugging action will be thus imparted to the tool 16.

I prefer to connect the sleeve 28 with the
65 spindle 15, so that it shall be caused to revolve therewith, in order that the two faces between which the spring 34 is compressed

shall move together and with the spindle, so that when the parts are arranged to cause the spindle 15 to revolve the spring 34, the
70 spindle 15, and the faces between which the spring is confined shall all be caused to move together, thus preventing the friction which would result were the sleeve 28 held by the hand-piece so as not to turn with the shaft or
75 spindle 15.

I will now describe the mechanism whereby the tool may be grasped or released by the tool-holder, such mechanism being operated from the outside of the casing.

80 The shank or stem of the tool enters a socket 38 in the end of the shaft or spindle 15, the socket being surrounded by elastic or spring blades 39, formed with or secured to the spindle, which spring-blades are somewhat tapering on their exterior surfaces.

40 is a shell surrounding the forward end of the spindle and the spring-blades 39 thereof, the interior surface of the said shell being shaped to fit closely the tapering portion of the spring-blades, so that if the shell
90 be drawn backward it will draw together the said spring blades or fingers and thereby contract the size of the socket 38, and if the shank of a tool is situated therein will cause
95 the blades or fingers 39 to tightly clamp it.

41 is a stop, preferably in the form of a collar, which is secured to the spindle 15 by the screws 42, and 43 is a coiled spring surrounding the spindle and situated between
100 the said stop-collar 41 and the rear end of the shell 40 and tending always to throw the shell forward and thus release the tool. Any suitable operative device may be employed for moving backward the sleeve against the
105 action of the spring 43; but I prefer employing the operative devices which I have shown and will now describe.

The spindle 15 is slotted throughout a portion of its length in rear of the shell 40, as at
110 44, and in this slot there is mounted a lever 45 of angular shape. The point 47, where the two arms 46 and 48 of the lever unite, serves as the fulcrum and bears against that wall of the spindle which terminates the slot 44 at its forward end, where it is confined against
115 outward movement by the shell 40. The short arm 46 of the lever extends transversely across the spindle and its end rests in an aperture 49 in the shell 40 diametrically opposite the point where the fulcrum 47 bears.
120 The long arm 48 of the lever extends rearward from the fulcrum 47 and is at its rear end provided with a cam or inclined surface 50 and also a plane surface 51. A projection 52, which may be reciprocated within certain limits, is arranged so that it may be made to engage with the cam-surface 50 of the lever-arm 48 in order to move it inward toward the center of the spindle, the rear end of such
125 arm being normally held outward by the spring 43 forcing forward the shell 40, which in turn moves forward the outer end of the short arm 46 of the lever, thus rocking the

lever on its fulcrum 47. The projection 52 extends into the slot 44 and is carried by a sleeve or collar 53, mounted on the spindle, along which it may be moved to a limited extent.

54 54 are ferrules or loose collars mounted upon the spindle, one on either side of the collar 53. They are connected with each other by a tie-bar 55, and this in turn is connected with a reciprocating finger-piece 56, situated on the outside of the hand-piece by screws which extend through an opening 57 in the forward part 1 of the hand-piece.

It will be seen that by moving the finger-piece either forward or backward the projection 52 is moved so as to either force inward or release the lever 45, and thereby clamp or unlock the tool. By connecting the finger-piece 56 with the two rings 54, which are loose upon the central spindle, the finger-piece may be held stationary and always have an operative connection with the projection 52, which moves with the spindle. When the projection 52 is moved backward so far that it rests upon the plane surface 51 of the lever, it serves to lock the latter in its inner position, and thus locks the tool in its holder.

I will next describe the mechanism whereby when the coupling parts are adjusted to cause the spindle and tool to be reciprocated the reciprocations of these parts may be stopped without stopping the rotation of the motor-shaft.

58 is a collar mounted loosely upon the spindle and preferably arranged between the forward ferrule 54 and the fixed collar 41. Between the fixed collar 41 and the loose collar 58 there is arranged a coiled spring 59, tending to hold them apart.

60 is a sliding bar or plate arranged upon the outside of the part 1 of the hand-piece and connected with the loose collar 58 by a screw or other connection 61, which passes through a slot 65 in the hand-piece. The bar 60 is slotted at 62, and through this slot passes a screw 63, which serves to limit the amount of motion which can be given to the bar. 64 is a projecting portion of the bar adapted to receive the thumb or finger of the operator, and by which the bar and the parts connected therewith may be operated.

If when the parts are in position shown in Figs. 1 and 2 the attendant or operator presses forward the bar 60, the following will result: The collar 58 will be slid forward, compressing the spring 59, which is comparatively weak. After the spring has been compressed to its full extent a further movement of the bar 60 and the collar 58 carries the entire spindle 15 and its connected parts forward until the pin or screw 63 arrests the movement of all the parts. The movement which thus is given to the spindle 15 is comparatively short; but it is enough to carry the head 17 and cam 12 out of engagement with each other, so that the shaft 10 may continue to re-

volve without operating to reciprocate the spindle and tool. It does not, however, move the spindle to such an extent as to cause it to be coupled with the shell 11 and thus made to rotate. As soon as the operator releases the bar 60 the spring 34 throws the spindle 15 and the connected parts backward into the position shown in Fig. 2, and the spring 59 moves backward the loose collar and the outside operating-bar 60.

When the parts are arranged so as to reciprocate the tool, it is desirable that there be an adjustment whereby the extent of reciprocation may be varied. This I accomplish by adjusting the parts which carry, respectively, the cam 12 and the head 17, against which it works. As has been described, the intermediate section 2 of the hand-piece is externally screw-threaded throughout a considerable portion of its length, and the lock-nut 3 and the rear part 4 of the hand-piece are screwed thereon. By screwing backward the part 4 of the hand-piece upon the part 2 the cam 12 is carried backward therewith, and hence is separated to a greater or less degree from the head 17, so that as the elevated portion of the cam passes the projection 18 of the head it actuates the latter and through it the spindle and its tool to a less extent the farther it is moved backward, or to a greater extent as the part 4 is moved forward and the cam and head brought nearer together. The lock-nut is used to hold the part 4 from turning after it has been adjusted to the proper position.

For the purpose of further illustrating my invention and to more clearly point out the fact that it is not limited to the precise construction and arrangement of parts heretofore described, I have illustrated in Figs. 8 to 10 another embodiment thereof. So far as possible I have in these figures used the same reference-marks as are employed on Figs. 1 to 7 for parts analogous to those of the devices therein illustrated, adding, however, a prime (') thereto to prevent confusion. I will describe only those parts which contain the invention sought to be further illustrated.

By the motor shaft or spindle 10' are carried a cam 12' and a member 23' of a clutch, which is adapted to unite the motor-shaft and the tool-carrying spindle 15', so that they shall rotate together. This clutch member is formed by rabbeting or cutting away a portion of the forward end of a spindle 11', connected with the motor-shaft. The clutch member carried by the tool-spindle 15' consists of a rabbeted or cut-away end 25' of a rod *e*, which is mounted in a central longitudinal aperture or socket *f*, extending into the tool-spindle 15' from its rear end, which rod is connected with the spindle, so that it turns therewith. The spindle or rod 11', carried by the motor-spindle, is adapted to extend into this socket *f* when the parts of the device are assembled, so as to be in position

to have its clutch portion 23' engage with the other clutch member 25' when they are brought together.

In the device first described the motor-shaft and the parts carried thereby were moved to bring the clutch members into engagement. In this apparatus I have illustrated a device wherein the other member is the one which is moved.

g is a collar free to slide upon the tool-spindle and connected with the rod *e* by a pin *h*, which extends through a slot *i* in the tool-spindle.

k and *l* are collars or short sleeves loose upon the spindle 15' and arranged one on either side of the collar *g*. These loose collars *k* and *l* are connected by screws or pins with the outside shifting sleeve 5', surrounding the hand-piece. A spring-catch *m*, carried by the shifting piece, serves to lock it in either position to which it may be adjusted. When the sleeve 5' is shifted rearward, it carries backward the collars *k* and *l*, and they cause the collar *g* to move with them, and it in turn carries backward the clutch member 25', so that it engages with the clutch member 23' of the motor-shaft, which will then on being turned rotate the tool. The rear end of the tool-spindle 15' carries a head 17', provided with a projection 18', upon which the cam 12' is adapted to act in order to give reciprocation to the tool.

The locking devices by which the tool-spindle is held against rotation while the tool is being reciprocated are as follows:

26' designates a series of projections carried by the spindle 15' near its forward end and between which a locking-finger 24' is adapted to be slid. This finger 24' is carried by the collar *k* and is moved into one of the recesses between the projections 26' when the collar is slid forward to cause the uncoupling of the clutch members 23' and 25'. The finger 24', being connected with the hand-piece, is held from rotating, so that when it engages with the projections 26' on the tool-spindle the latter is locked against rotation.

28' is a sleeve mounted upon the spindle 15' and corresponding in all particulars with the sleeve 28 of the other apparatus, and therefore I will not here describe it.

34' indicates the spring, which throws backward the spindle 15' toward the cam 12'.

After the shifting sleeve 5' has been moved to uncouple the tool-spindle and the motor-shaft and to lock the former against rotation it is necessary to slide the motor-spindle and the cam 12' forward into engagement with the head 17'. To effect this I mount the motor-spindle 10' in a bearing-piece *p*, situated within the rear part 4' of the hand-piece, and I connect this bearing-piece with a sliding bar *n*, mounted upon the outside of the hand-piece and provided at its forward end with a thumb-piece by which it is moved. A spring *o*, situated between a shoulder on the inside of the intermediate part 2' of the

hand-piece and the bearing-piece *p*, holds the cam 12' back out of engagement with the head 17' until it is thrown into engagement by the sliding bar *n*.

The arrangement just described makes it possible to stop the reciprocation of the tool at any instant without stopping the motor-shaft, it being only necessary to release the bar *n*, when the spring *o* will automatically throw the cam 12' out of engagement with the head 17'. The extent of reciprocation imparted by the cam to the spindle may be regulated in the same manner as in the other device—that is, the part 4' of the hand-piece, in which the spindle 10' and the cam 12' are mounted, together with the bearing-piece *p*, is adjustable relative to the other parts of the hand-piece, having a screw connection with the part 2' of the hand-piece, upon which works the lock-nut 3'.

From this description of my invention it will be evident that it is subject to very considerable modifications and variations of embodiment without departing from its essential principles. Thus the clutch which unites the motor-shaft may be of any operative kind, and either member may be moved to bring the parts into engagement. The reciprocating devices may be varied and arranged to be either locked in working relation or else held in engagement by the act of the operator. The locking devices for holding the tool-spindle against turning and the shifting devices for bringing into operation the tool-spindle, operating devices may be variously constructed and arranged. The means whereby the motion of the tool may be arrested while being reciprocated without stopping the motor-shaft may be operated either automatically or positively by the operator, and many other changes than those shown may be adopted and will suggest themselves to those skilled in the art without departing from my invention.

What I claim is—

1. The combination of a motor-shaft, a spindle adapted to carry a tool, a clutch adapted to unite the motor-shaft and the spindle, the reciprocating devices between the spindle and the motor-shaft, whereby the former may be reciprocated by the latter, the locking device to hold the spindle against rotation while the reciprocating devices are in engagement, and a shifting device which when moved in one position carries into engagement the said clutch part and disengages the said reciprocating devices and when moved into another position reverses the relative positions of these said motion-conveying parts, substantially as described.

2. The combination of a motor-shaft, a spindle adapted to carry a tool, a clutch adapted to unite the motor-shaft and the spindle, the reciprocating devices between the spindle and the motor-shaft, whereby the former is reciprocated, a locking device connected with one member of the clutch so that it shall move

therewith and adapted to hold the spindle against rotation while the reciprocating devices are in engagement, and a shifting device for bringing into engagement either the said clutch or the reciprocating devices, substantially as set forth.

3. In a tool holding and operating device, the following elements, to wit: a motor-shaft, a spindle adapted to carry a tool, a clutch adapted to unite the motor-shaft and the spindle, the reciprocating devices between the spindle and the motor-shaft, whereby the former may be reciprocated by the latter, a locking device to hold the spindle against rotation while the reciprocating devices are in engagement, a shifting device for bringing into engagement either the said clutch parts or the said reciprocating devices, and means other than the said shifting device for arresting the reciprocations of the tool when the reciprocating devices are in operative position without stopping the motion of the motor-shaft, substantially as set forth.

4. The combination of the hand-piece, the motor - shaft, the tool - carrying spindle mounted within the hand-piece and free to rotate therein, the clutch between the motor-shaft and the spindle, one member of which is movable, whereby the clutch members may be engaged and disengaged, the shifting device connected with the movable clutch member and arranged on the outside of the hand-piece, a locking device for the said shifting device, and a lock connected with the movable member of the clutch, whereby when the clutch members are disengaged the rotation of the spindle is positively arrested, substantially as set forth.

5. The combination of a motor-shaft, the tool-carrying spindle provided at its end with a projection 18, a clutch adapted to unite the motor-shaft and the spindle, a cam carried by the motor-shaft and adapted to operate upon the projection 18 of the spindle, and a shifting device for bringing into engagement either the said clutch or the said projection and cam, substantially as set forth.

6. The combination of a motor-shaft, the tool-carrying spindle provided at its end with a projection 18, a clutch adapted to unite the motor-shaft and the spindle, a cam carried by the motor-shaft and adapted to operate upon the projection 18 of the spindle, a shifting device for bringing into engagement either the said clutch or the said projection and cam, and a locking device to hold the spindle against rotation while the cam and projection are in operative engagement, substantially as set forth.

7. The combination of the hand-piece, the motor-shaft carrying a shell at its end, provided with lugs or ribs, a tool-carrying spindle mounted within the hand-piece and free to rotate therein and provided with a projection adapted to enter between the said ribs or projections on the shell, whereby the motor-shaft will be coupled with the spindle,

and means for engaging and disengaging the said coupling parts, substantially as set forth.

8. The combination of a hand-piece, a motor-shaft provided at its forward end with a shell having internal projections or lugs, the cam carried by the motor-shaft and situated within the shell and at the end thereof opposite the projections or lugs, the tool-carrying spindle entering the said shell and provided with a projection adapted to enter between the said projections or lugs and thereby couple together the motor-shaft and the spindle, the projection carried by the spindle and adapted to be acted upon by the said cam, and means for shifting the positions of the motor-shaft and spindle relative to each other, whereby either the clutch parts or the cam and projection may be brought into operative engagement, substantially as set forth.

9. The combination of a hand-piece, a motor-shaft provided at its forward end with a shell having internal projections or lugs, the cam carried by the motor-shaft and situated within the shell and at the end thereof opposite the projections or lugs, the tool-carrying spindle entering the said shell and provided with a projection adapted to enter between the said projections or lugs and thereby couple together the motor-shaft and the spindle, the head carried by the spindle and provided with a projection adapted to be acted upon by the said cam, means for shifting the positions of the motor-shaft and spindle relative to each other, whereby either the clutch parts or the cam and projection may be brought into operative engagement, and a lock for holding the spindle against rotation when the cam and projection are in operative engagement, substantially as set forth.

10. The combination of the motor shaft, the hand-piece, the shell carried by the motor-shaft, the cam 12, also carried by the motor-shaft within the shell, the sleeve surrounding the said shell, about which it is free to turn, but not to move longitudinally relative thereto, the tool-carrying spindle which enters the said shell and is provided at its end with a projection adapted to be brought into engagement with the said cam, the clutch members carried, respectively, by the said shell and the spindle, the projection extending from the said sleeve through the hand-piece, which is slotted to permit it to move and thereby move the motor-shaft and connected parts, and a lock for holding the said projection, substantially as set forth.

11. The combination of the hand-piece, the motor - shaft, the tool - carrying spindle, the shell 11, carried by the motor-shaft and provided at its forward end with the internal projections 23, the cam 12, situated within and at the end of the shell opposite the projections 23, the sleeve 14, free to turn upon the shell 11, but not to move lengthwise thereof, the projections 24, carried by the sleeve, the projections 25 and 26, carried by the tool-spindle and adapted, respectively, to enter

between the said lugs 23 and the said projections 24, means for shifting the said sleeve, shell, and cam, and a lock for holding the last said parts after they are shifted, substantially as set forth.

12. The combination of the hand-piece, the motor-shaft mounted within the hand-piece and free to rotate and to have a limited amount of longitudinal movement therein, a clutch connected to and movable with the motor-shaft and adapted to unite the motor-shaft and the tool-spindle to cause them to rotate together, a cam carried by the motor-shaft and adapted to operate to reciprocate the spindle, a shifting device for bringing into engagement either the said clutch or the said cam, and a spring which holds the spindle and cam in engagement when the parts have been shifted so that the cam will operate, substantially as set forth.

13. The combination of the hand-piece, the motor-shaft mounted within the hand-piece and free to rotate and to have a limited amount of longitudinal movement therein, a clutch adapted to unite the motor-shaft and the tool-spindle to cause them to rotate together, a cam carried by the motor-shaft and adapted to operate to reciprocate the spindle, a shifting device for bringing into operative position either the said clutch or the said cam, a spring which holds the spindle and cam in engagement when the parts have been shifted so that the cam will operate, and a device for moving the spindle against the action of the said spring, whereby the spindle is disengaged from the cam and its rotation is stopped without stopping the rotation of the motor-shaft, substantially as set forth.

14. The combination of the hand-piece, the motor-shaft, the tool-carrying spindle, the cam which is adapted to reciprocate the spindle in the hand-piece, the clutch arranged between the spindle and the motor-shaft, whereby the former may be rotated by the latter, the shifting devices for bringing into operation either the cam or the clutch, the spring which holds the spindle against the said cam, and the finger bar or piece arranged on the outside of the hand-piece and connected with the spindle, whereby the latter may be moved against the action of the spring to disengage the cam and the spindle, substantially as set forth.

15. The combination of the hand-piece, the motor-shaft, the tool-carrying spindle, the cam which is adapted to reciprocate the spindle in the hand-piece, the spring 34, which operates to throw rearward the spindle, the finger-piece 60 on the outside of the hand-piece, the collar 58, loose on the spindle and connected with the said finger-piece and the spring 59, arranged between the collar 58 and a fixed collar or stop carried by the spindle, substantially as set forth.

16. The combination of a motor-shaft, a hand-piece, a tool-carrying spindle, connections between the motor-shaft and spindle for

reciprocating the latter, a sleeve mounted upon the spindle and in which it has a limited amount of longitudinal movement, the sleeve being connected with the hand-piece so as to be held thereby against longitudinal movement, and a spring arranged between said sleeve and a stop or collar on the spindle and adapted to hold in engagement the parts which reciprocate the spindle, substantially as set forth.

17. The combination of the hand-piece, the motor-shaft, a tool-carrying spindle, connections between the motor-shaft and the spindle for reciprocating the spindle, the sleeve 28, provided with an expanded portion 35, which is held by the parts of the hand-piece against longitudinal movement, a pin 33, carried by the spindle and working in a slot in the sleeve 28, whereby the latter is caused to rotate with the spindle, and the spring 34, arranged between the sleeve 28 and a collar carried by the spindle, substantially as set forth.

18. The combination of the hand-piece, and a spindle provided with a contractible tool-socket portion at one end, a tapering shell surrounding the said socket portion of the spindle, means for moving the shell to contract the tool-socket, and a spring which tends to move the shell so as not to contract the socket, substantially as set forth.

19. The combination of the hand-piece, the spindle therein provided at its end with a contractible tool-socket portion, a shell surrounding the socket portion of the spindle, a finger-piece upon the outside of the hand-piece and movable thereon, and connections between the said finger-piece and shell, whereby the latter may be moved to control the size of the socket at the will of the operator, substantially as set forth.

20. The combination of the hand-piece, a spindle provided with a tool-holding-socket portion, a shell with a tapering interior surrounding the socket portion of the spindle, a lever engaging with said shell to move it, a spring bearing against the said shell, and a finger-piece on the outside of the hand-piece connected with the said lever, substantially as set forth.

21. The combination of the hand-piece, the tool-carrying spindle adapted to be revolved, a shell adapted to lock the tool in the spindle, a lever mounted in a recess within the spindle and adapted to move the shell, a finger-piece upon the outside of the hand-piece and held thereby against rotation, and connections between the said lever and finger-piece, whereby the former can be operated to move the shell while the spindle is revolving, substantially as set forth.

22. The combination of the tool-carrying spindle, the shell 40 for locking the tool in the spindle, the spring 43, bearing against the shell, an angular lever situated within a recess in the spindle and having its short arm engaging with the shell and its long arm provided with an inclined face 50 and a plane

face 51, and a projection adapted to bear upon the inclined and plane faces of the lever, substantially as set forth.

23. The combination of the tool-carrying spindle, the shell 40 for locking the tool in the spindle, the spring 43, bearing against the shell, an angular lever situated within a recess in the spindle and having its short arm engaging with the shell and its long arm provided with an inclined face 50 and a plane face 51, a collar 53, surrounding the spindle and having a projection which enters the recess therein and bears upon the parts 50 and 51 of the lever, the loose collars situated one on either side of the collar 53, and the finger-piece situated upon the outside of the shell and connected with the said loose collar, substantially as set forth.

24. The combination of the motor-shaft carrying a cam, a tool-carrying spindle adapted to be reciprocated by the cam, a sleeve surrounding the spindle, in which it has a

limited amount of longitudinal movement, a hand-piece having the portion 4, in which is situated the motor-shaft and the cam, and the portions 1 and 2, in which are mounted the said spindle and sleeve, the said sleeve being held against longitudinal movement between the parts 1 and 2 of the hand-piece and the parts 2 and 4 of the hand-piece being united by screw-threads, whereby they may be adjusted so as to bring the cam and the spindle and sleeve nearer together or carry them farther apart in order to increase or decrease the extent of reciprocations imparted to the spindle by the cam, substantially as set forth.

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

ELLWOOD HAY.

Witnesses:

W. A. CARLING,

J. I. BLAIR REILEY.