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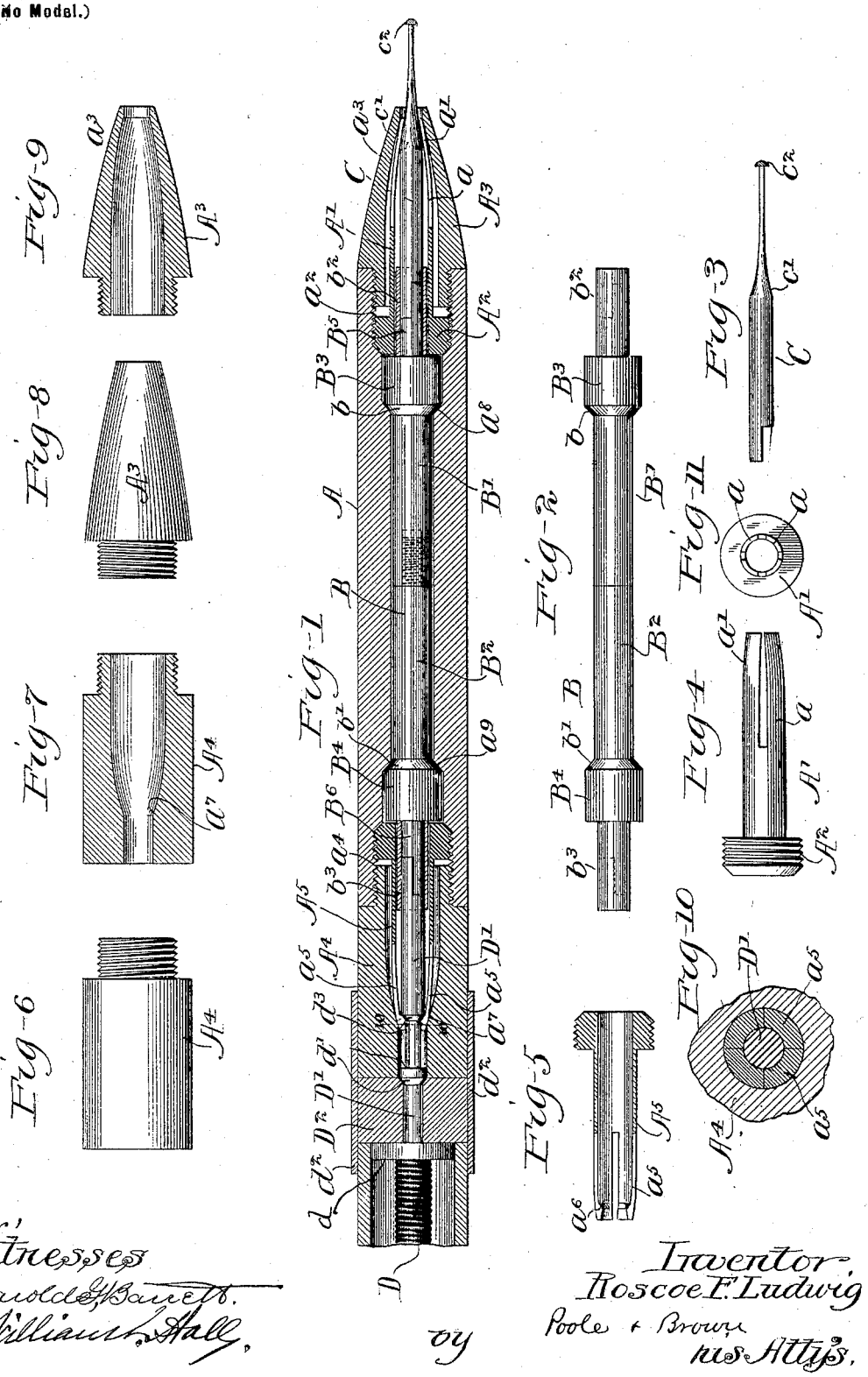
R. F. LUDWIG.

SHAFT COUPLING FOR DENTAL ENGINE HANDPIECES.

(Application filed June 27, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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SHAFT-COUPLING FOR DENTAL-ENGINE HANDPIECES.

SPECIFICATION forming part of Letters Patent No. 649,642, dated May 15, 1900.

Application filed June 27, 1898. Serial No. 684,577. (No model.)

To all whom it may concern:

Be it known that I, ROSCOE F. LUDWIG, of Chicago, in the county of Cook and State of Illinois, have invented certain nw and useful Improvements in Shaft-Couplings for Dental-Engine Handpieces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The invention embraces as a main feature an improved means for coupling the spindle to the driving-shaft and the tool or bur to the spindle of a dental-engine handpiece, this feature of the invention being applicable to devices of other kinds where it is desired to detachably join a driving shaft or spindle to a tool or spindle end to end.

The invention also includes other features of construction which are especially applicable to handpieces for dental engines.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal sectional view of a handpiece constructed in accordance with my invention. Fig. 2 shows the revolving spindle thereof removed from the casing. Fig. 3 shows the operating bur or point removed from the casing. Fig. 4 is a side elevation of the split sleeve which holds the bur in place. Fig. 5 is a longitudinal section of the split sleeve employed in the connection between the spindle of the handpiece and shaft of the engine. Figs. 6 and 7 are side elevation and longitudinal sectional views of the clamping and connecting sleeve employed in the joint between the engine-shaft and the handpieces and spindle thereof. Figs. 8 and 9 are side elevation and longitudinal sectional views of the screw-threaded tip which engages the split sleeve to clamp the same upon the bur or point. Fig. 10 is a section taken on line 10 10 of Fig. 1. Fig. 11 is an end elevation of the sleeve illustrated in Fig. 4.

As shown in said drawings, A designates the tubular non-rotative casing or handle of my improved handpiece; B, a spindle which is mounted and rotates within the casing A; C, an operating bur, point, or tool which is removably inserted into the handpiece and has detachable connection with the spindle B, and D the shaft of the dental engine, which has driving connection with and rotates the spindle B. The shank of the tool C and spindle have interlocking projections or surfaces, affording non-rotative connection between them—as, for example, by having the inner end of its shank flattened on one side to overlap a corresponding flattened surface on the spindle B, said shank and spindle being arranged end to end or in axial alinement with each other. The spindle B of the handpiece is similarly joined by interlocking parts to the shaft D of the engine, by which rotary movement is transmitted from one to the other.

The tool C is provided with an outwardly-facing conical shoulder c' at the base of its tapered outer end, on which is formed the drill, cutter, or bur c^2. The casing A is provided with a tubular prolongation or sleeve A′, which is split inwardly from its outer end to form spring-arms a, having inwardly-inclined extremities a', which when the tool is inserted into the handpiece are located opposite the shoulder c' thereof and are adapted to engage the same, so as to form, in effect, a split annular bearing adapted for engagement with said shoulder. The shank of the tool is made of such external diameter as to have no contact with the sleeve A′ except at the shoulder c', and the overlapping parts of the spindle and tool-shank are held from lateral displacement by means of a sleeve or tube b^2, which surrounds and is attached to the reduced end B^5 of the spindle. As herein shown, said split sleeve is provided on its inner end with an enlargement A^2, which is exteriorly screw-threaded to engage interior screw-threads in an axial socket or recess a^2 in the adjacent end of the casing A. This construction affords a convenient means of securing the sleeve to the body of the handpiece.

A^3 designates a tubular removable clamping member or tip which has a conical interior surface a^3 fitting over and engaging the spring-arms a of the sleeve A′. Said tip has screw-threaded engagement with the casing, and the dimensions of the interior of the tip and the exterior of the spring-arms are such

that when the tip is moved upon the casing it presses said spring-arms inwardly, and thereby contracts the bearing projections about the conical shoulder of the tool, so as to bring the said bearing projections, which together form a split box or journal-bearing, into bearing contact with said shoulder, but without any clamping action. Preferably the inner end of the tip is reduced and provided with exterior screw-threads, which engage the interior screw-threads in the socket or recess a^2.

As a result of the construction described the tool-shank or tool is securely retained in the handpiece, the oblique projection a^3 of the spring-arms acting upon the conical shoulder of the tool to hold the same from outward movement away from the spindle B and permanently hold the tool in operative position. The tool is, furthermore, supported laterally at a point near its operating extremity, where the strain comes upon it in the use of the device. The tool is released by unscrewing the clamping member or tip a sufficient distance to permit the spring-arms (or parts of the bearing formed thereby) to separate to allow the shank of the tool to pass between the same.

Referring now to the means for connecting the handpiece to the shaft of the dental engine, these parts are constructed as follows: The shaft D is made flexible in its parts between the engine and handpiece and is provided with a rigid prolongation at its outer end having the form of a shaft D′, which extends axially through a short sleeve-section D^2, in which the shaft is confined from endwise movement by means of shoulders d d', immovably fixed to the shaft. Said sleeve-section D^2 is attached rigidly to and in axial prolongation of a connecting-sleeve A^4 (which latter is detachably connected with the casing or handle A of the handpiece) by a slip-joint consisting of a tubular section d^2, which overlaps the adjacent ends of said parts. Said connecting-sleeve A^4 is reduced at its inner end and provided with exterior screw-threads, which engage interior screw-threads in an axial recess or socket a^4 in the rear or adjacent end of the casing A. The shoulder d' of the shaft is of conical form and engages a conical recess in one end of the sleeve-section D^2, and the shoulder d consists in the present instance of a flat disk, which engages the opposite end of said sleeve-section. The internal diameter of the sleeve-section D^2 is greater than the external diameter of the shaft, and the conical shoulder serves to center the shaft therein and hold it out of contact therewith, except at the shoulder d'. The joint between said shaft and spindle is like that by which the spindle is connected with the shank of the tool, said shaft being flattened on one side and having overlapping engagement with a corresponding flattened surface on the spindle. A sleeve b^3 on the reduced part B^6 of the spindle holds the overlapping parts from lateral displacement. The shaft is provided between said joint and the conical shoulder d' with a second conical shoulder d^3, and the casing A is provided with a rearwardly-extending exteriorly-reduced tubular portion A^5. Said tubular portion A^5 surrounds the adjacent ends of the shaft and spindle, extending between the same and the inner surface of the connecting-sleeve A^4, and is split to form at its outer ends spring-arms a^5, which extend beyond the shoulder d^3 of the shaft when said parts are assembled. Said arms are provided adjacent to their free ends with interior oblique shoulders or projections a^6, which when the shaft is in its operative position stand opposite the shoulder d^3 thereof and form the parts of a separable or split bearing. The connecting-sleeve A^4 is provided with a conical interior surface a^7, which engages the outer tapered surface of the tubular extension or sleeve A^5 and which when the sleeve is moved toward the casing serves to contract the spring-arms about the shaft, with the shoulders a^6 thereof in bearing engagement with the shoulder d^3 of the shaft. This arrangement serves to hold the shaft from endwise movement with respect to the spindle and prevents the disconnection of said parts. The shaft may be disconnected from the spindle by unscrewing the connecting-sleeve A^4 such distance as will permit the spring-arm a^5 to spread sufficiently to allow the enlarged portion of the shaft inside of said shoulder to pass between the same. In disconnecting the handpiece from the engine it will not be necessary to disengage the connecting-sleeve A^4 from the handpiece, said sleeve being withdrawn from the sleeve d^2 when it has been moved a sufficient distance to release the part D′ of the shaft from the spring-arms a^5 and the extended portion D′ of said shaft being afterward withdrawn from said sleeve.

As a further and separate improvement the spindle B and the bearing between the same and the casing are of novel construction, said parts being made as follows: The spindle is provided adjacent its outer ends with enlargements B^3 B^4, which fit in enlarged portions of the bore of the casing A, said enlargements B^3 B^4 being provided with inwardly-facing conical shoulders b b', which engage outwardly-facing shoulders a^8 a^9 in the tubular interior of the casing, which shoulders when the spindle is in its operative position within the casing, as shown in Fig. 1, limit the longitudinal movement of said spindle in both directions. The external diameter of the rotating spindle is such with respect to the diameter of the bore of the casing that it has no frictional contact with the casing excepting at the conical shoulders b b' and a^8 a^9. Said spindle will conveniently be made of two parts or sections B′ B^2, which are joined between the shoulders B^3 B^4, so that the two parts of the spindle may be inserted into the casing from

the opposite ends thereof when assembling the device. As herein shown, the part B^2 is provided with a reduced screw-threaded portion, which engages a screw-threaded recess in the part B'.

From the foregoing description and from an inspection of Fig. 1 of the drawings it will be seen that the spindle is connected rigidly with the tool at one end and with the engine-shaft at its opposite end and that the rotative frictional bearing between said parts and the surrounding tubular parts is confined to the conical bearing-surfaces, thereby reducing friction between said parts to a minimum. The inwardly-facing conical shoulders between the spindle and the casing serve to take up the end thrust thereon in both directions and to hold said spindle from endwise movement within the casing and the conical shoulders of the tool, and the shaft serves to hold said parts in rigid endwise relation to the spindle.

A main feature of my invention is embraced in the construction by which a bearing for taking the end thrust of the removable part of a shaft-coupling is a split bearing, the parts of which are attached to spring-arms and which are held in proper bearing relation to a shoulder on the removable part by a surrounding sleeve and which may be sprung apart to allow the disconnection of the removable part by the removal of said sleeve. In the case of the device for holding the bur or rotating tool C the split bearing referred to is formed by the inwardly-inclined ends or extremities a^3 of the split tube A', which extremities when forced toward the bearing-shoulder c' by the tubular tip A^3 constitute, in effect, a journal-bearing to hold the tool both from outward and lateral movement. It is to be noted in this connection that the said spring-arms and the surrounding sleeve or tip are not constructed to clamp the spring-arms against the conical surfaces of the tool, as in the case of clamping devices used for lead-pencil holders and the like; but the parts are so arranged that when the ends of the spring-arms are contracted to the inward limit of their movement they form a bearing-surface of practically the same diameter as that of the shoulder on the tool, so as to give a tightness of fit or bearing contact like that ordinarily present in journals or bearing-boxes. This result of avoiding any clamping action may be produced by constructing the extremities of the arms of the tube so that they will meet at their side edges when drawn together around the bearing-shoulder, as shown in Fig. 10, or by so arranging the parts that when the tip A^3 is screwed inwardly to the greatest possible extent it will bring the arms or ends of the split sleeve in proper bearing relation to the said shoulder. It will of course be understood that the tool, which may be a drill, reamer, or other rotative tool, is engaged with the spindle by overlapping or interlocking projections which prevent relative rotation, but which are not constructed to hold the tool from outward endwise movement, so that, considering the entire device as a shaft-coupling, (which it is, in fact,) any relative rotation of the driving-spindle with the rotative driven part is prevented by the interlocking parts thereon, while disconnection of the tool from the spindle by outward endwise movement is prevented through the action of the split bearing, which latter is so constructed as not only to confine the tool from endwise and lateral movement, but also to permit the ready and convenient removal of the tool from its engagement with the spindle. The same general features of construction are illustrated in connection with the coupling by which the spindle of the handpiece is joined to the flexible shaft D, said spindle in this instance being the part which is driven by or from the shaft D, and which is detachably coupled thereto by a device embracing the general features of construction heretofore referred to—that is to say, the spindle D' is engaged at its end with the projecting part B^6 of the spindle B^2 by a joint which is adapted to hold said part from relative rotation, but which in itself is not adapted to hold the part from relative endwise movement. Said spindle D' is, however, held or confined from movement in a direction away from the part B^6 by a bearing which is, in effect, a split bearing and consists of the spring-arms on the sleeve A^5, which spring-arms have the inwardly-inclined shoulders adapted to engage the bearing-shoulder d^3 on said spindle D'. In this instance the parts are so arranged that when the sleeve A^4 is screwed to the fullest possible extent into the casing A the spring-arms, which carry the parts of the bearing, are brought into bearing contact with the shoulder d^3, but are not and cannot be clamped against said shoulder, the spring-arms in connecting with the external sleeve forming, in effect, a journal-bearing which when the parts are assembled or joined operates in all respects like an ordinary or solid annular journal-bearing. In this instance also the action of the said spring-arms is unlike that of a clamping device or chuck, the function of said spring-arms being to permit movement of the parts of the bearing when the external sleeve is removed, and to thereby permit the outward passage between them of the shoulder on the spindle. In both of these instances illustrated, namely, in the device for coupling the spindle B' to the tool C and in the device for coupling said spindle to the shaft D, said spring-arms and external tapered sleeve constitute together a bearing which serves to rigidly hold the tool from sidewise as well as endwise movement at the point where said bearing engages the same. So far as the holding of the bur or similar tool in a dental handpiece is concerned the presence of this bearing at the extremity of the handpiece is of great benefit and impor-

tance, for the reason that it supports the outer end of the bur from sidewise movement under the lateral pressure coming therein in the use of the bur.

I claim as my invention—

1. The combination with a rotative part and a shaft which drives the same, of a coupling therefor comprising a non-rotative part affording bearing for such shaft, means for holding said shaft from endwise movement therein, said rotative part and shaft being engaged end to end by interlocking connections, and one of said parts being provided with an annular shoulder, spring-arms connected with said non-rotative part which are provided with inwardly-extending projections adapted to engage said annular shoulder to form a split bearing therefor, and an external sleeve which is detachably secured to the non-rotative part and is constructed to confine the free ends of said spring-arms in bearing engagement with the shoulder; said spring-arms having a limited inward movement to avoid clamping pressure of the parts of the split bearing upon said shoulder.

2. The combination with a rotative part and a shaft which drives the same, of a coupling therefor comprising a non-rotative part affording bearing for said shaft, means for holding said shaft from endwise movement therein, said rotative part and shaft being engaged end to end by interlocking connections, and one of said parts being provided with a conical annular shoulder, spring-arms connected with the non-rotative part which are provided with inwardly-extending tapered projections adapted to engage said annular shoulder to form a split bearing therefor, said spring-arms having a limited inward movement, and a tubular clamping member which is detachably secured to the stationary part and which is provided with an inner conical surface which bears upon the extremities of the spring-arms and has screw-threaded engagement with said non-rotative part.

3. The combination with a tool provided with an outwardly-facing shoulder, of a tubular casing, a rotative spindle therein, said spindle and the shank of the tool having interlocking non-rotative but endwise-movable engagement, spring-arms connected with the casing and having inwardly-projecting parts at their free ends which, when contracted, form a split bearing to engage the bearing-shoulder on the tool, and a clamping-tip connected with the casing and acting upon the free ends of the spring-arms to hold said projecting parts in bearing engagement with the bearing-shoulder of the tool, said arms having a limited inward movement to avoid clamping pressure on the bearing-shoulder of the tool.

4. The combination with a dental tool provided with an outwardly-facing shoulder, of a tubular casing, a spindle rotatively secured therein, said spindle and the shank of the tool having interlocking projections on their adjacent ends, spring-arms connected with the casing and having inwardly-projecting oblique parts at their free ends, which when contracted form a split bearing for the tool and a clamping-tip connected with the casing and acting upon the free ends of the spring-arms to contract said oblique projections into bearing engagement with the shoulder of the tool, the said spring-arms having a limited inward movement to avoid clamping pressure on the bearing-shoulder of the tool.

5. The combination with a tool, provided with an outwardly-facing shoulder, of a tubular casing, a rotative spindle therein, said spindle and shank of the tool having interlocking non-rotative, but endwise-movable engagement, a split sleeve surrounding the shank of the tool and detachably connected with the casing, said sleeve being provided with outwardly-extending arms having inwardly-projecting oblique parts at their free ends, and a clamping-tip connected with the casing and acting upon the arms of the sleeve to move the oblique parts into bearing engagement with the shoulder of the tool.

6. The combination with a rotative shaft, of a dental engine provided with an outwardly-facing shoulder, a handpiece comprising a tubular casing, a rotative spindle therein connected with said shaft by means of interlocking projections on the spindle and shaft, spring-arms connected with said casing and having inwardly-extending projections at their free ends, and means connecting said shaft and tubular casing and acting to contract said projections of the spring-arms into bearing engagement with the shoulder of the shaft.

7. The combination with the rotative shaft of a dental engine provided with an outwardly-facing shoulder, of a handpiece comprising a tubular casing, a rotative spindle therein connected with said shaft by means of interlocking projections on the shaft and spindle, spring-arms connected with said casing and having oblique projections at their free ends, and a sleeve connected at one end with the casing and at its other end with the shaft and provided with an interior conical surface which acts upon the spring-arms to hold said oblique projections in bearing engagement with the shoulder of the shaft.

8. The combination with the rotative shaft of a dental engine provided with an outwardly-facing shoulder, of a handpiece comprising a tubular casing, a rotative spindle therein connected with said shaft, said shaft and spindle having interlocking projections on their adjacent ends, spring-arms on the casing which have oblique projections at their free ends and a sleeve which has screw-threaded engagement with the casing and which has a slip-joint connection with the shaft, said sleeve having a conical inner surface which acts upon the spring-arms to hold said projections in bearing engagement with the shoulder of the shaft.

9. The combination with a tubular casing, provided with interior outwardly-facing oblique shoulders, of a rotative spindle therein provided with inwardly-facing conical shoulders adapted to engage the oblique shoulders of the casing, the parts of said spindle between said shoulders being of less external diameter than the internal diameter of the bore of the casing, a driving-shaft, a tool, and separable coupling devices for joining the ends of said spindle to the driving-shaft and tool.

10. The combination with a tubular casing, provided with interior outwardly-facing oblique shoulders, of a rotative shaft therein provided with inwardly-facing conical shoulders engaging the oblique shoulders of the casing, said shaft being made of two parts, and joined between the shoulders, and the parts thereof between said shoulders being made of less external diameter than the internal diameter of the bore of the casing.

11. A dental handpiece comprising a tubular casing provided with interior outwardly-facing oblique shoulders, a rotative spindle therein provided with inwardly-facing conical shoulders, engaging the oblique shoulders of the casing, a tool having detachable and rotary connection with said spindle and provided with an outwardly-facing shoulder, a split or separable bearing connected with the casing and engaging said shoulder, the parts of said spindle and tool aside from the conical bearing being of less external diameter than the bore of said casing.

12. A dental handpiece comprising a tubular casing provided with interior outwardly-facing oblique shoulders, a rotative spindle therein provided with inwardly-facing conical shoulders, a tool having detachable and rotary connection with said spindle and provided with a conically outwardly facing shoulder, spring-arms connected with said casing and having oblique projections at their free ends and clamping means engaging said spring-arms to hold said projections in bearing engagement with the shoulder of said tool and in rigid axial alinement with the casing, said spindle and tool being out of contact with the casing excepting at said conical bearing-surfaces.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 10th day of June, A. D. 1898.

ROSCOE F. LUDWIG.

Witnesses:
WILLIAM L. HALL,
CHARLES W. HILLS.