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Flatland

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[54] **DENTAL HANDPIECE**

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[52] **U.S. Cl.** **32/27**

[51] **Int. Cl.** **A61c 1/10**

[58] **Field of Search** 32/27, 26

[56] **References Cited**

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[57] **ABSTRACT**

A dental handpiece has a head with a spherical portion and a cylindrical extension made of two pieces removably held together on a meeting plane. The head is hollow and has cushion mounts for spaced bearings carrying a shaft supporting a turbine wheel thereon between the bearings. The shaft receives a dental burr. The turbine wheel is supplied with air through a channel in both halves of the cylindrical extension and spherical portion. A hollow handle engages the cylindrical extension and may include a swivel provided with an air supply conduit joined to the supply channel by a flexible tube.

3 Claims, 8 Drawing Figures

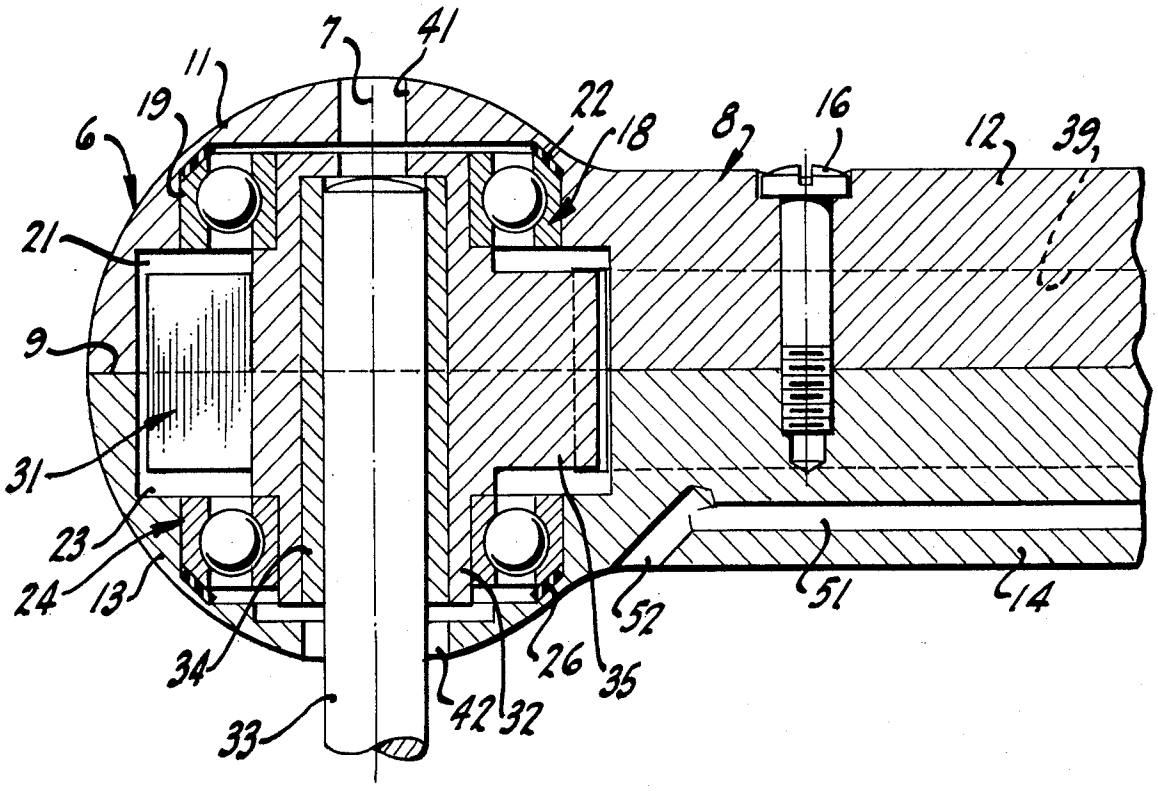


FIG-1

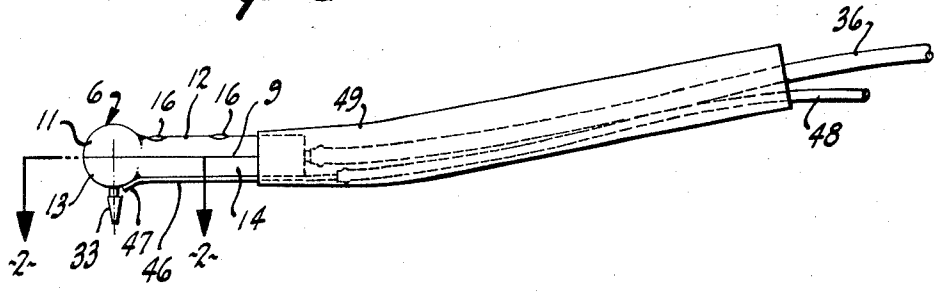
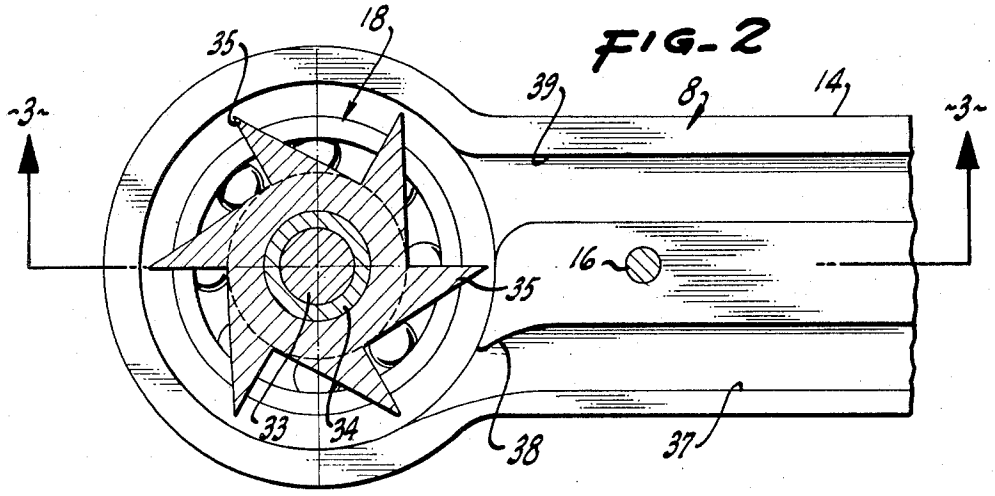


FIG-2



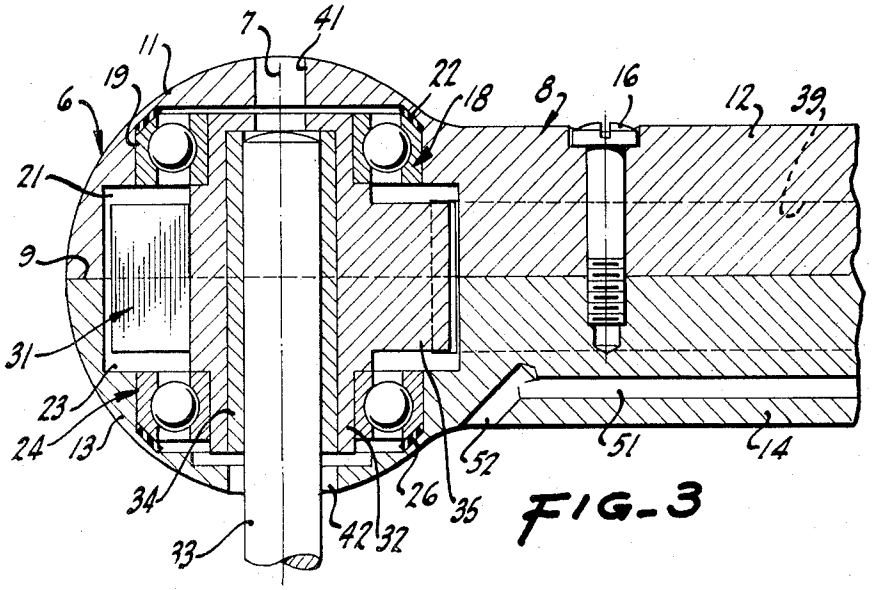


FIG-3

FIG. 4

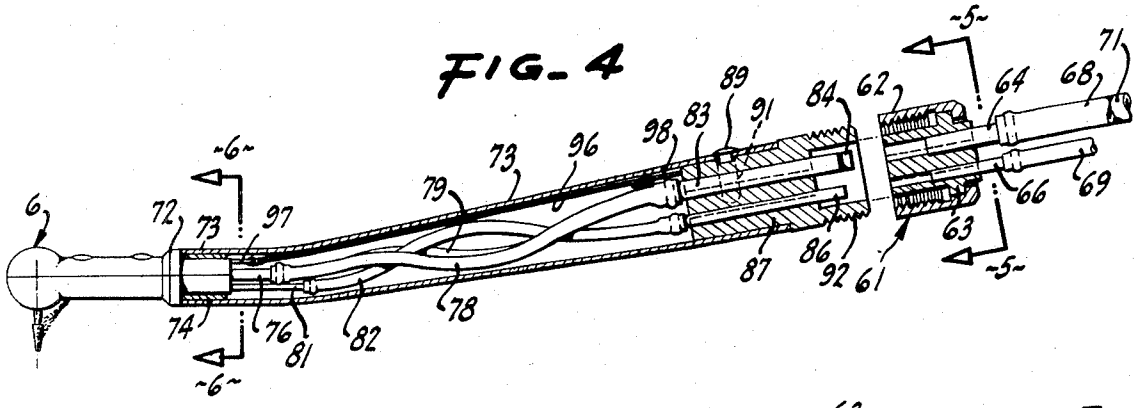
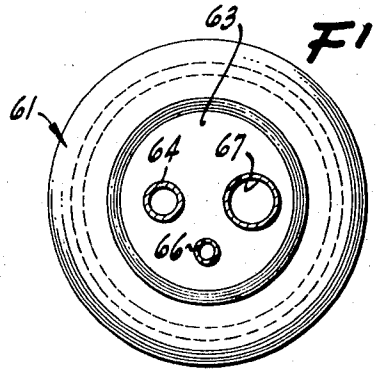


FIG. 5



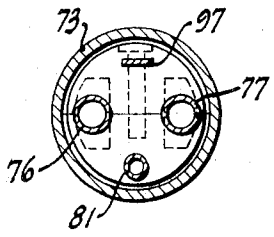


FIG. 6

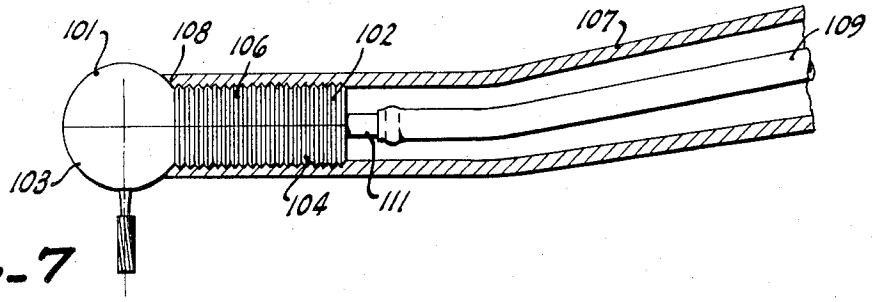


FIG. 7

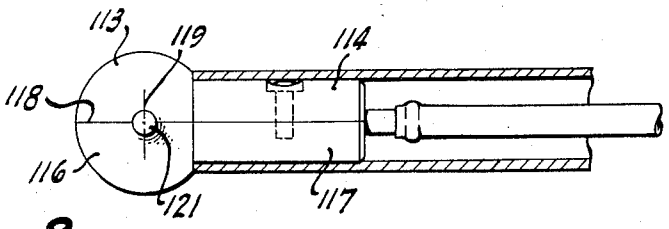


FIG. 8

DENTAL HANDPIECE

For use in dentistry there is a continuing need for a handpiece that will operate and support the various dental tools but with only a small amount of bulk and weight. The arrangement of the handpiece should be such that it can be held, manipulated and adjusted with ease. There is always a need for a compact, light instrument so that the manipulation thereof in the patient's mouth can be accomplished with no discomfort to the patient and with efficiency. There is also a continuing need for a smooth running, quiet driving means and one that can be inexpensively fabricated.

It is therefore an object of the invention to provide a dental handpiece that is compact, light and readily manipulated.

Another object of the invention is to provide a dental handpiece that is quite easily manufactured so that it is relatively inexpensive initially and can be maintained and repaired economically and easily.

A further object of the invention is to provide a dental handpiece employing an air turbine in which the turbine is so disposed as to impart little or no sound or other vibration to the structure.

An additional object of the invention is to provide a dental handpiece that is compatible with equipment already available in most dentists' offices.

A further object of the invention is to provide a dental handpiece that is in general an improvement over dental handpieces heretofore available.

Other objects, together with the foregoing, are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. **1** is a side elevation of a dental handpiece constructed in accordance with the invention;

FIG. **2** is a cross-section, the plane of which is indicated by the line **2—2** of FIG. **1**;

FIG. **3** is a cross-section, the plane of which is indicated by the line **3—3** of FIG. **2**, but with a modification in the water supply;

FIG. **4** is a side elevation of a modified form of dental handpiece, some portions being in cross-section on a vertical longitudinal plane;

FIG. **5** is a cross-section, the plane of which is indicated by the line **5—5** of FIG. **4**;

FIG. **6** is a cross-section, the plane of which is indicated by the line **6—6** of FIG. **4**;

FIG. **7** is a partial elevation and partial cross-section on a vertical longitudinal plane through a further modified form of handpiece pursuant to the invention; and

FIG. **8** is a plan with portions in cross-section of a still further modified form of dental handpiece.

In one form of the invention, as particularly illustrated in FIGS. **1, 2** and **3**, the handpiece has a head portion **6** symmetrical about a central axis **7** (FIG. **3**) and externally is substantially entirely spherical except for a smooth merger with an extension **8** that is of circular-cylindrical configuration exteriorly. Particularly in accordance with the invention, the extension and head are integral except that they are divided on a meeting or common plane **9**, preferably normal to the axis **7**. The head and the extension have two major portions, one portion including a first head housing **11** integral with a first shank extension **12** and the other portion including a second head housing **13** integral with a second shank extension **14**. The divided portions are detachably secured together in any convenient way,

preferably by one or more fasteners **16** in the shape of threaded screws, which hold the parts together with the common plane **9** in a central position. Since the exterior envelope is either spherical or circular-cylindrical and the merger between them is smooth, the outside of the head **6** is easily manipulated and unlikely to cause any difficulty in the patient's mouth.

Disposed within each of the head housings **11** and **13** are appropriate bearings. For example, the first head housing **11** carries a specially configured ball bearing assembly **18.** This is substantially standard except that the outer race **19** of the bearing is beveled so that the bearing fits easily into a first cavity **21** in the spherical first head housing. Instead of seating directly against the adjacent surfaces of the housing, the outer race is made smaller in diameter than its surroundings and is axially seated firmly against a conical, resilient, elastomeric cushion **22.** The bearing has a limited amount of radial and axial float about its designed location, nominally concentric with the axis **7.**

In an entirely similar fashion a second cavity **23** in the second head housing **13** carries a comparable, second shaft bearing **24** mounted against a second resilient, conical cushion **26** in a position nominally concentric with the axis **7** but allowing for a limited amount of radial and axial bearing motion. In this fashion the bearings are separated at a substantial distance from the common plane but are practically aligned and vibrationally isolated from the remainder of the head **6.**

Since it is desired to operate the tools with an air turbine, a turbine wheel **31** is mounted in the bearings and so is disposed symmetrically about the axis **7** for rotation therearound. The turbine wheel includes a hollow shaft **32** received in the respective bearings and effective to receive a dental burr **33** or comparable tool, usually with an intervening holder **34** or chuck. The turbine wheel is formed with a plurality of peripheral vanes **35** occupying much of the volume of the first and second cavities **21** and **23.** The turbine wheel **31** is substantially larger in diameter than the bearings **18** and **24** but is arranged and dimensioned so that an imaginary envelope of spherical contour centered on the intersection of the axis **7** and the common plane **9** substantially contains the bearings and turbine wheel.

In order that the turbine may have an appropriate supply of operating air or comparable fluid, a tube **36** from an appropriate source is connected to the end of a duct **37** conveniently formed partly in the lower half of the extension and partly in the upper half of the extension. The duct **37,** because it opens to the common plane, can readily be made of any desired cross-sectional shape, such as rectangular, in order to have a relatively large capacity. Near its merger with the interior cavities **21** and **23,** the duct **37** is especially contoured to provide at least a partial nozzle **38** directed in a tangential direction against the vanes **35** of the turbine wheel.

To relieve the turbine housing of spent air there is a principal discharge duct **39** formed in the head and in the extension in a fashion similar to the supply duct **37** and either discharging into a tube like the tube **36** or into the atmosphere. There are other possible places for discharge of some portions of the air, which can flow through the bearings. For example, the first head housing **11** has an axial opening **41** and there is a comparable opening **42** around the dental burr **33.** These

communicate with the central cavities through the openings in the adjacent bearing.

In the use of this device a supply of pressure air entering through the duct **37** causes the turbine wheel **31** to spin about the axis **7**, thus rotating the comparable portions of the bearings and also rotating the burr **33.** Because the turbine may operate at quite a high speed and since the rotating parts may not be precisely in balance, the bearings **18** and **24** float slightly so that any resulting vibration or noise is confined generally to the rotating mass and is not transmitted to the housings and extensions and so is kept away from the dentist and patient.

Frequently, it is desired to supply water or comparable cooling and flushing liquid to the site of operation. For that reason there is joined to the exterior of the head a water tube **46,** as particularly shown in FIG. **1.** This tube has one end **47** directed toward the dental burr **33** and has its other end going to a tube **48** extending to any appropriate water supply. Conveniently, the extensions **12** and **14** are surrounded by a hollow tubular handle **49** which also encloses the tube **46.** This affords the dentist an appropriate and comfortable grasp of the handpiece.

Since the handle extends over the tubes and the conjoined extensions, it is advisable, in order to dismantle the handpiece, to detach the tubes **36** and **48** and remove the handle **49.** Alternatively, the handle can be slipped back over the tubes. The fasteners **16** can be removed and the interior of the handpiece can then be immediately exposed. The parts can be individually detached and the air supply and the exhaust channels can be cleaned. The parts can then be replaced and the head housings and extensions can be put into abutment on the common plane **9** and the fasteners **16** restored. Upon connection of the tubes **36** and **48** and restoration of the handle **49** the unit is again available for use.

A variation on the water supply, as shown in FIG. **1,** may be provided, as particularly shown in FIG. **3.** A suitably supplied integral duct **51** in the second shank extension leads to an angled outlet **52** directed toward the dental burr **33.** The water duct is formed within the compass of the extension so that the fitting of the handle is somewhat easier.

In many instances it is desired to connect the handpiece as shown in FIG. **4.** In this case there is already available in the dentist's office a connecting sleeve **61** having a threaded, rotatable collar **62** encompassing a core **63** into which an air pipe **64** leads. There may also be a water supply pipe **66** and in some instances an air exhaust pipe **67.** Each pipe is provided with its respective one of a number of hoses **68, 69** and **71.** In this instance, the head housings and extensions are generally as shown in FIGS. **2** and **3,** for example, but also include a collar **72** against which abuts a tubular handle **73.** There may be an intervening sleeve **74.** Usually, the fit is relatively tight although permitting an axial connection and disconnection of the parts. The shank extensions carry tubes **76** and **77** joined with the channels **37** and **39,** respectively, and in turn receiving one end of a pair of flexible tubes **78** and **79.** Similarly, the water passage **51** merges with a pipe **81** in turn joined to one end of a flexible tube **82.**

The tubes **78, 79** and **82** are long and easily bendable and are easily disposed within the hollow handle **73.** At their other ends they are joined to corresponding tubes **83, 84** and **86** secured in a plug **87** rotatably disposed within the otherwise open end of the tubular handle **73.** The plug and handle are held against axial separation and for limited rotation by a pin **89** secured in the tubular handle and extending into an arcuate, shallow channel **91** in the plug. The plug **87** can be rotated through, for example, 180 degrees only in the tubular handle, the rotation being accompanied by a twist of the various flexible tubes **78, 79** and **82.** The plug at its end is provided with standard external threads **92** adapted to be engaged by the internal threads on the sleeve **61.** The plug is assembled so that the various tubes interengage with each other and the swivel connector is then screwed tightly home. With this arrangement the handle **73** can be turned at any time with respect to the supply tubes to afford an appropriate operation of the handpiece and without twisting the external tubes such as **68, 69** and **71.**

In order that the parts can easily be assembled and disassembled, especially if it is necessary to replace the tubes **78, 79** and **82,** the head **6** is retained on the handle **73** preferably by a tension band **96.** This can be a small coil spring or can even be a rubber band which is hooked or tied to eye fasteners **97** and **98** in the first shank extension **12** and in the plug **87.** The parts are assembled by being brought close together, the tension band is hooked or tied in place and then the parts are released and guided together and maintained in assembled condition under the band tension. For disassembly it is merely necessary to pull the head out of the handle and then release or unhook the tension band.

In some instances a considerably simplified version of the device is acceptable. It is convenient to make the first head housing **101** and its first shank extension **102** internally very much as before and likewise to make the second head housing **103** and the second shank extension **104** very much as before except that the fastenings **16** are omitted and the abutted parts are provided with external screw threads **106.** A tubular handle **107** is provided. In this instance the handle has internal screw threads fitting the screw threads **106.** For the assembly of this device the head portions are brought together and as a unit are threaded into the handle end with the various threads in interengagement. The head is advanced into the handle until the spherical portion is substantially in abutment with a spherical counterbore **108** therein. In this way the head portions and the handle are all rigidly united. The handle houses at least an air supply hose **109** connected to an air supply pipe **111** clamped between the extensions **102** and **104.**

In most instances and for most manufacturing purposes it is desired to split the portions of the head so that the common plane **9** is normal to the axis **7.** But there are other possibilities. As shown in FIG. **8,** a quite comparable device has the first head housing **113** and the first shank extension **114** related to the second head housing **116** and the second shank extension **117** by abutment on a common plane **118** that is not normal to the axis **119** of the rotary parts but rather is coincident therewith. That is, the axis **119** of rotation of the burr **121** is within the common plane **118.**

In either form of the invention the manufacture is greatly expedited, since by having a common plane such as **9** or **118** it is simple to form the individual housing and extension parts. The various cavities or ducts and interior surfaces are well exposed to a tooling operation and do not necessitate boring and comparable blind operations. The two portions of the head and ex-

tensions can be made in various ways such as by die casting or stamping.

What is claimed is:

1. In a dental handpiece having a head formed of two housing halves having abutting planar surfaces defining a central plane and means removably securing said housing halves together, the improvement comprising:

each housing half having a generally cylindrical cavity, opening to said central plane and opposed to the cavity in the other housing half to define therewith a cylindrical chamber;

each of said cavities having a cylindrical recess in the bottom thereof, of less diameter than said cavities, the outermost portions of said cavities and recesses lying in the surface of an imaginary sphere and the outer surfaces of said housing halves being configured to define a sphere concentric to said imaginary sphere and of only slightly larger diameter;

an antifriction bearing seated in each recess;

a generally cylindrical turbine rotor in said cylindrical chamber and journalled in said bearings; and

duct means for directing operating fluid into said chamber and onto said rotor, said duct means being provided by a groove extending along at least one of said planar surfaces to said chamber.

2. A dental handpiece comprising a first head housing terminating in a plane and having a first cavity therein, a second head housing terminating in a plane and having a second cavity therein, means for securing said first and second head housings together with said plane terminations together and said cavities in communication, a first shaft bearing in said first head housing, a second shaft bearing in said second head housing, a shaft mounted in said bearings for rotation about an axis and extending through said first and second cavities, a turbine wheel mounted on said shaft between said bearings, means for supplying said turbine wheel with operating air including a duct with one half formed in said first head housing and open to said plane and the other half formed in said second head housing and terminating in said plane, and means on said shaft for receiving a dental burr, shank extensions on said head housings, a tubular handle at one end fixed onto said shank extensions, and a swivel connector mounted in the other end of said tubular handle and rotatable with respect to said handle.

3. A dental handpiece as in claim **2** including means forming an air supplying conduit in said swivel connector, and a flexible tube within said tubular handle connecting said air supply conduit to said means for supplying said turbine wheel with operating air and adapted to be flexed when said swivel connector is rotated with respect to said handle.

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