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Stevenson

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[54] **POSITION INDICATING DEVICE FOR DENTAL X-RAY MACHINES**

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[52] **U.S. Cl.** **250/505**

[51] **Int. Cl.** **G21f 5/04**

[58] **Field of Search** 250/379, 505

[56] **References Cited**

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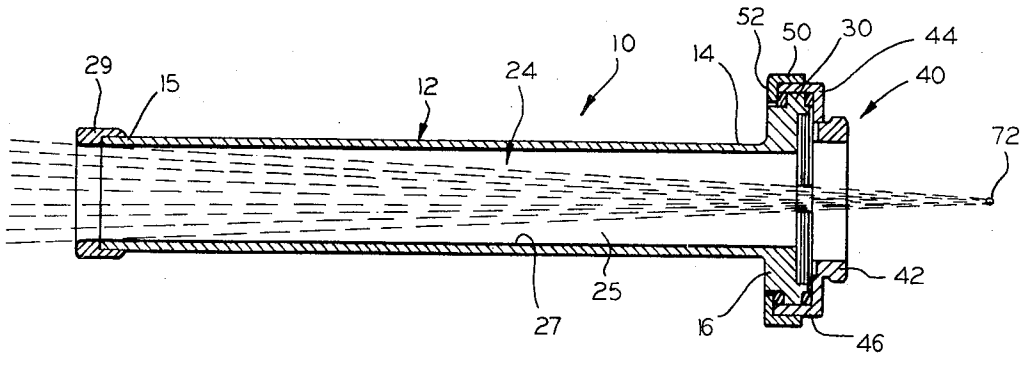
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[57] **ABSTRACT**

A position indicating device for dental X-ray machines comprising a lead lined tubular member having an X-ray receiving end and an X-ray emitting end, with the tubular member at its X-ray receiving end being in the form of a hub portion in which the collimator is mounted, which hub portion is journaled in an adapter member that is formed for securement to the specific X-ray machine to which the positioning indicating device is to be applied. The journaling of the PID relative to the adapter member is such that the PID makes no movement axially thereof, relative to the adapter member, or the X-ray machine, on adjustment of same about the axis of the cone.

4 Claims, 3 Drawing Figures



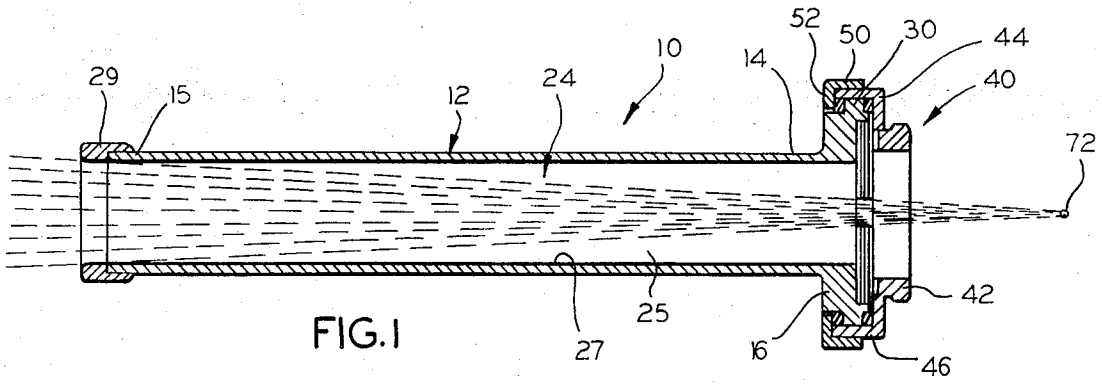


FIG.1

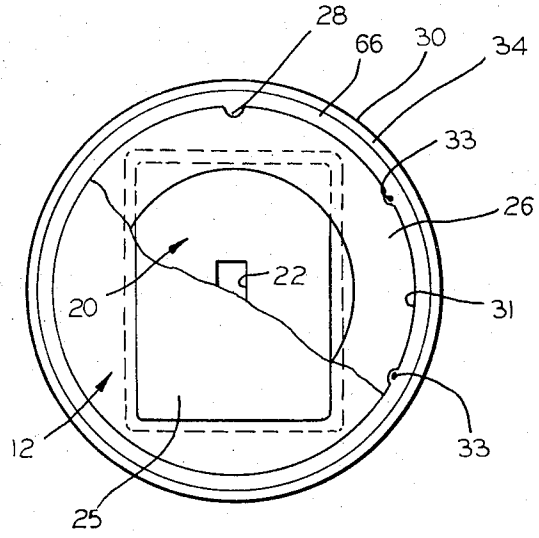


FIG.3

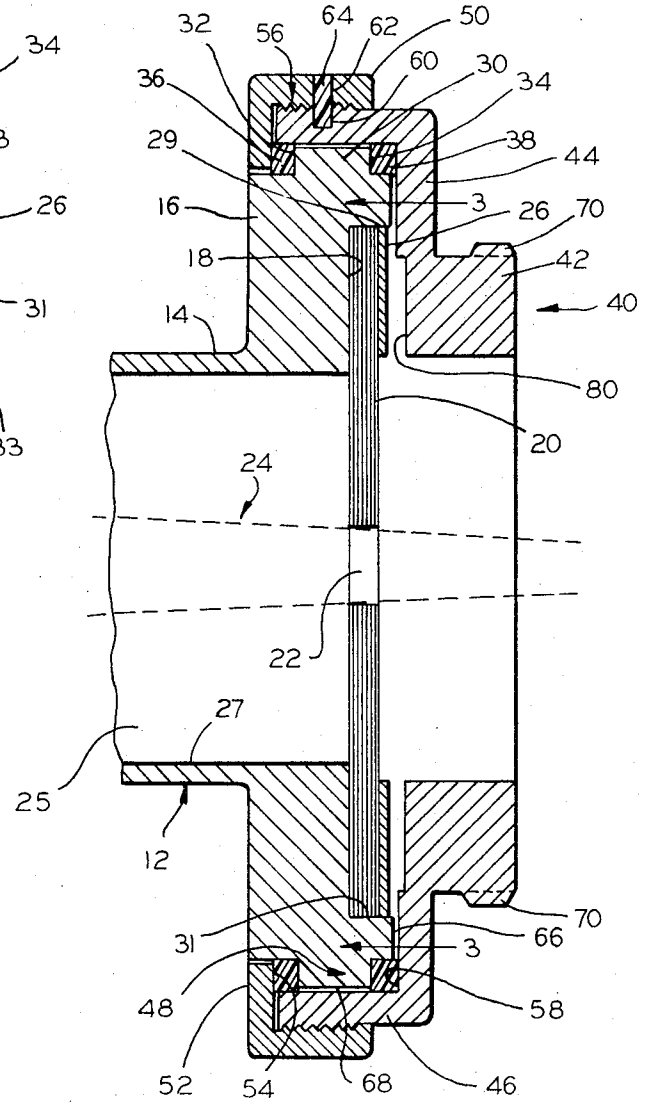


FIG.2

POSITION INDICATING DEVICE FOR DENTAL X-RAY MACHINES

This invention relates to a position indicating device for dental x-ray machines, and more particularly, to a collimating cone arrangement for use in dental radiography.

Dental x-ray machines conventionally are equipped with a position indicating device, (formerly commonly called a cone, or tube, and more recently called a position indicating device or PID) that is used to both limit the size of the useful x-ray beam employed in exposing the x-ray film located within the patient's mouth, and to facilitate the alignment of the beam with the x-ray film. Commercially, such devices are constructed for removable application to the x-ray machine, and at the present time there are approximately 20 different ways to secure the cone to the machine, including variations of the familiar bayonet, snap-in and screw-in type mounting arrangements.

During use of the dental x-ray machine in the practice of dental radiography, it frequently is desirable to adjust the PID about its axis relative to the machine. This has to be done when the PID is of the rectangular type, to accommodate the position of the long dimension of the film within the patient's mouth, due to the fact that it will vary depending on, for instance, whether posterior or anterior film holding instruments are being employed. Where the PID is threadedly mounted to provide this adjustment arrangement, the PID moves axially of the beam, thereby changing the distance between the x-ray generating device (the anode of the x-ray tube) and the opening in the PID collimator, with consequent changing effect on the x-ray beam that emanates from the PID.

A principal object of the invention is to provide a position indicating device (PID) for dental x-ray machines in which the PID is arranged to permit 360° adjustment of same about its axis without varying the distance between the x-ray beam generating device and the beam restricting opening in the PID collimator.

Another object of the invention is to provide a position indicating device for dental x-ray machines in which the collimator is located within the PID but at the x-ray receiving end of same to minimize drift of the x-ray machine head.

Other objects of the invention are to provide a position indicating device for dental x-ray machines that permits full rotational adjustment of the PID, as desired, about its longitudinal axis, while accommodating the various types of PID mounting arrangements in commercial use, to provide a position indicating device for dental x-ray machines that is readily applicable to existing equipment, and to provide a position indicating device that is economical of manufacture, convenient to mount and use, and effective in operation.

In accordance with this invention, a position indicating device or cone for dental x-ray machines is provided comprising a lead lined tubular member having an x-ray receiving end and an x-ray emitting end, in which the tubular member at its x-ray receiving end is in the form of a hub portion in which the collimator is mounted, which hub portion is journaled in an adapter member that is specifically formed for securement to the specific x-ray machine to which the position indicating device is to be applied. The journaling of the PID relative to the adapter member is such that the PID makes no movement axially thereof, relative to the adapter member or the machine, on adjustment of same about the axis of the cone. On such adjustment movement, the adapter remains in its mounted position on the x-ray machine.

Other objects, uses and advantages will be obvious or become apparent from a consideration of the following detailed description and the application drawing:

IN THE DRAWING

FIG. 1 is a longitudinal cross-sectional view through one embodiment of the invention, showing in dashed lines the x-ray beam collimated by the device on operation of the dental x-ray machine to which it is applied (not shown) to expose a dental film within the patient's mouth;

FIG. 2 is a fragmental view of the mounted end of the position indicating device, but on an enlarged scale; and

FIG. 3 is an end view of the tubular member or component of the PID, taken substantially along line 3—3 of FIG. 2 but shown on a somewhat reduced scale.

However, it is to be distinctly understood that the specific drawing illustrations provided are supplied primarily to comply with the requirements of the Patent Laws, and that the invention may have other embodiments that will be obvious to those skilled in the art, and which are intended to be covered by the appended claims.

Reference numeral **10** generally indicates a preferred embodiment of the invention as arranged for application to a dental x-ray machine.

The position indicating device or cone **10** generally comprises a tubular member **12** that defines at its end **14** a round hub portion **16** that is counterbored as at **18** to receive collimating material **20** that conventionally is in the form of lead sheathing or the like. The collimating material **20** is formed to define an aperture **22** through which the x-rays emanating from the x-ray machine (not shown) to which the device **10** is attached pass into the tubular member **12** to form the x-ray beam **24.**

As indicated in FIG. **3,** the tubular member **12** defines a bore **25** that is of rectangular transverse cross-sectional configuration, and accordingly the collimator aperture opening **22** is of corresponding rectangular transverse cross-sectional configuration, such that the x-ray beam **24** at the end **15** of the tubular member **12** substantially conforms to the rectangular cross-sectional configuration of the tube **12** at its end **15.**

The rectangular configuration of the tubular member **12** and its collimating opening **22** are arranged for use in connection with rectangular dental instrumentation. However, for purposes of this invention, the bore **25** of the tubular member **12,** and the collimator aperture **22,** may be circular in configuration for use in connection with circular instrumentation in accordance with standard practices.

The bore **25** of the tubular member **12** is lead lined, as indicated at **27,** to a suitable thickness to confine scatter radiation in normal exposure. The end **15** of tubular member **12** is equipped with a suitable end cap **29** which may be suitably formed for cooperation with positioning frames of the dental instrumentation employed.

The collimating material **20** is held in place by a retainer ring or disc **26** which has a rim **29** that substan-

tially conforms to the diameter of counterbore **18**, and specifically the counterbore side wall **31**. As indicated in FIG. **3**, the ring **26** is staked in place against the material **20**, as at **33**. The side wall **31** of the counterbore **18** is formed with a protrusion or lug **28** that keys the collimating material **20** and retainer ring **26** against rotation relative to tubular member **12**, with the rims of the collimating material and the ring **26** being suitably indented to receive the lug **28**, as indicated in FIG. **3**.

The hub portion **16** of tubular member **12** is formed to define a peripheral rib **30** formed on either side of same with bearing surfaces **32** and **34** against which are applied bearing rings **36** and **38** that are formed from a suitable antifriction material such as nylon or the product sold under the trademark Teflon by E. I. Du-Pont de Nemours and Co.

Operably associated with the tubular member **12** is an adapter member **40** of annular configuration defining a hub portion **42** including a radial flange **44** formed with a rim wall **46** which defines with the flange **44** a socket **48** that receives the tubular member hub portion **16** as well as bearing rings **36** and **38**.

Cooperating with the adapter member rim wall **46** is a collar **50** that is formed with a radial flange **52** defining a bearing surface **54** adapted to engage the bearing ring **36**. The collar **50** and adapter member rim wall **46** are threaded as indicated at **56** whereby the collar **50** may be turned on to the adapter member rim wall **46** to rotatably mount tubular member **12** on the adapter member **40** by clamping the tubular member peripheral rib between the bearing rings **36** and **38**. Bearing ring **38** seats against bearing surface **58** defined by the adapter member radial flange **44**.

The adapter member rim wall **46** and the collar **50** are formed with the respective openings **60** and **62** (see FIG. **2**) that are adapted to be aligned to receive suitable shear pin **64** which holds the collar **50** against threaded movement relative to the adapter member rim wall **46** at the desired degree of compression on rings **36** and **38**.

It is to be noted that the bearing ring **36** is proportioned such that it spaces the collar flange **52** from the adapter member rim wall **46**, and the bearing member **38** is proportioned to space the adapter member flange **44** from the face **66** of the tubular member hub portion **16**. The peripheral surface **68** of the tubular member rib **30** and rings **36** and **38** are proportioned so that surface **68** will be spaced from the adapter member rim wall **46**, for free movement relative thereto. Thus, the tubular member **12**, while having its peripheral rib **30** firmly gripped between the bearing rings **34** and **38**, may be readily turned relative to the adapter member **40**, by virtue of the antifriction characteristics of the bearing rings **36** and **38**.

The hub portion **42** of the adapter member **40** is suitably shaped to accommodate one of the conventional mounting and locking recesses of conventional x-ray machines for dental work. Thus, the hub portion **42** may be lugged as indicated at **70** for providing a familiar form of bayonet type lock arrangement. Alternately, the hub portion **42** may be externally threaded for cooperation with internal threading of the x-ray machine that employs this type of PID connection. Similarly, the hub portion **42** may be equipped for providing one of the snap-in type PID mounting arrangements, or any of the other familiar types of PID mounting arrangements that are conventionally employed.

In other words, the adapter member **40**, in accordance with this invention, is shaped and arranged to accommodate one of the many conventional ways of mounting PIDs on dental x-ray machines that are in use commercially.

In use, the device is applied to a conventional dental x-ray machine by securing the adapter member **40** in place on the machine head, with the adapter member **40** that is used being specifically adapted for mounting on the particular machine in question. The tubular member **12** is aimed at the target area to be x-rayed, it being preferred that the dentist employ film holding instrumentation of the type that is conventionally designed to facilitate such aiming. In this connection, where the rectangular positioning device illustrated is employed, rectangular instrumentation should be employed, and rotation of the tubular member **12** relative to the adapter member **40** is required as the dentist, for instance, changes his instruments for accommodating anterior and posterior positions (which requires a 90° rotation).

In accordance with this invention, the distance between the aperture **22** and the source **72** of the x-ray beam remains the same even though the tubular member **12** may be rotated zero through **360** degrees or more relative to the adapter member **40**. Note, also, that since the collimating material **20** is fixed with respect to tubular member **12**, the distance between the aperture **22** and the end **15** of the tubular member **12** remains fixed.

As important consideration in the present invention is that the relatively heavy collimating material **20** is located at the portion of the tubular member **12** which is closest to the x-ray machine head to which the device **10** is to be applied. This locates the center of gravity of the device **10** as close as reasonably possible to the x-ray machine head to which it is attached.

It is pointed out that the heads of dental x-ray machines are usually mounted on a linkage that is arranged for vertical and horizontal movement. The nature of this linkage is such that the further the center of gravity of the cone is positioned in front of the head, the greater the tendency of the head to drift forwardly, or in the direction of the patient, when released by the dentist after initial positioning. Having the collimating material **20** disposed within the socket **48** of the adapter member **40**, with the adapter member hub portion being received within the head socket that is adapted to receive same, brings the center of gravity of the device **10** sufficiently close to the head to substantially eliminate the drifting problem.

Furthermore, the positioning of the collimating material where shown in the drawings avoids having unwanted radiation within the tubular member itself, and confines radiation, except for the useful beam indicated at **25**, to the machine head. This avoids having to apply additional x-ray absorbative materials to the PID to take care of undesired radiation.

The tubular member **12** and adapter member **40** may be formed from aluminum or the like while the end cap **29** (which may be omitted) is formed from a suitable plastic. Where filtration is required, a disc formed from aluminum is seated in counterbore **80** formed in the adapter member **40**, with the aluminum disc being a solid disc of half value thickness as desirable or necessary.

The foregoing description and the drawings are given merely to explain and illustrate the invention and the invention is not to be limited thereto, except insofar as the appended claims are so limited, since those skilled in the art who have the disclosure before them will be able to make modifications and variations therein without departing from the scope of the invention:

I claim:

1. In a position indicating device for x-ray machines, wherein said device includes a tubular member that is rectilinear axially of same, with said member defining a bore of rectangular transverse cross-sectional configuration that extends the length of same and having its internal surfacing lined for x-ray absorption and defining an x-ray receiving end and an x-ray emitting end, and an adapter member for securing said tubular member to an x-ray machine and secured to said x-ray receiving end of said tubular member,

the improvement wherein:

said tubular member at said x-ray receiving end of same is formed to define a round hub portion having a peripheral rib integral therewith and thereabout defining annular bearing surfaces on either side of same that lie in parallel planes extending normally of said tubular member,

with one of said bearing surfaces facing in the direction of said tubular member x-ray emitting end and the other of said bearing surfaces facing in the direction of said tubular member x-ray receiving end,

said member hub portion being formed with a circular counterbore that faces oppositely of said x-ray emitting end of said member and lies at said x-ray receiving end thereof,

said counterbore defining a side wall that is in circumambient relation about said tubular member bore,

collimating material received in said counterbore and extending from said counterbore side wall across said tubular member bore and being formed to define an x-ray collimating opening centered within said tubular member bore and being of a shape complementing that of said tubular member emitting end,

said member hub portion being formed to define between said counterbore and said other bearing surface an annular face that forms the terminal end surface of said tubular member at said x-ray receiving end of same,

with an annular retaining disc being received in said counterbore about the portion of said collimating material adjacent said counterbore side wall,

means for fixing said retaining disc to said tubular member to secure said collimating material to said tubular member within said counterbore,

said disc extending short of said tubular member end surface axially of said tubular member and being separated from said adapter member,

said adapter member further comprising:

a hub portion including means for securing same to the x-ray machine in the mounted position of said device,

said adapter member hub portion defining a radial flange having a bearing surface and an axially extending rim wall defining a socket in which said tubular member hub portion is received with said peripheral rib being encompassed by said adapter member rim wall and said adapter member flange bearing surface opposing said rib other bearing surface,

a securing collar received over said adapter member rim wall and defining a radial flange directed radially inwardly of said collar and having a bearing surface that opposes said rib one bearing surface,

a first antifriction ring interposed between said one bearing surface of said rib and said collar flange bearing surface in face to face engagement therewith,

a second antifriction ring interposed between said rib other bearing surface and said adapter member flange bearing surface in face to face engagement therewith,

said collar and said adapter member rim wall having threaded engagement for clamping said rings against said tubular member rib under predetermined compression to journal said tubular member in said adapter member,

and means for keying said collar and adapter member rim wall together for maintaining said predetermined compression of said rings,

said first antifriction ring being proportioned axially of said tubular member to space said collar flange from said adapter member rim wall when said first ring is clamped between said rib one bearing surface and said collar flange bearing surface,

said second antifriction ring being proportioned axially of said tubular member to space said adapter member flange from said tubular member end surface when said second ring is clamped between said rib other bearing surface and said adapter member flange bearing surface,

said rib defining a peripheral surface that is spaced from said adapter member rim wall radially inwardly of said adapter member rim wall,

said collar flange defining a bore having an internal diameter proportioned to space said collar flange from said tubular member,

whereby, on rotation of said tubular member relative to said adapter member for adjustment of said tubular member relative to said adapter member, said collimating opening remains stationary axially of said adapter member for **360** degrees of such rotation, and said collar and said adapter member are free of engagement with said tubular member whereby said rotational movement of said tubular member relative to said adapter member is opposed by frictional forces only at said bearing surfaces.

2. The device set forth in claim **1** wherein:

said collimating material and said retaining disc are keyed to said tubular member hub portion against rotation with respect thereto about the axis thereof.

3. The device set forth in claim **1** wherein:

said antifriction rings are formed from a nonmetallic antifriction material.

4. The device set forth in claim **3** wherein:

said bearing surfaces are planar in configuration and extend normally of said axis of said tubular member,

said antifriction rings each defining planar end surfaces against which the respective bearing surfaces engage.

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