

[54] DENTAL ILLUMINATION DEVICE

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[58] Field of Search 32/7, 27, 69

[56] References Cited

UNITED STATES PATENTS

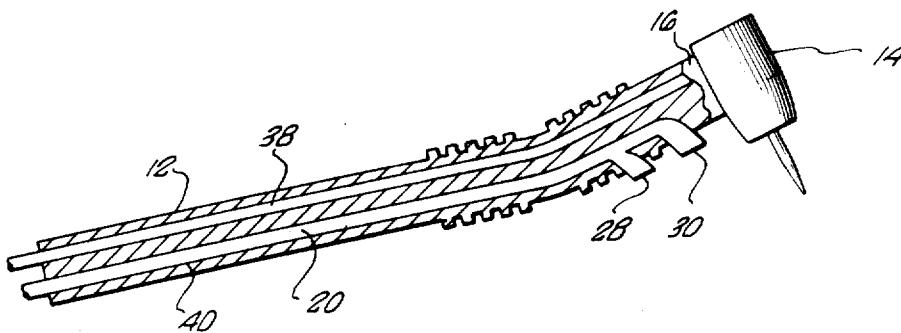
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[57] ABSTRACT

A handpiece for holding dental tools which contains an illuminating system is disclosed. The illuminating system consists of a fiber optic bundle which passes through the handpiece. The fiber optic bundle is connected to a remote light source on one end, with the other end illuminating the region in which the dental tool is to be operated.

2 Claims, 3 Drawing Figures



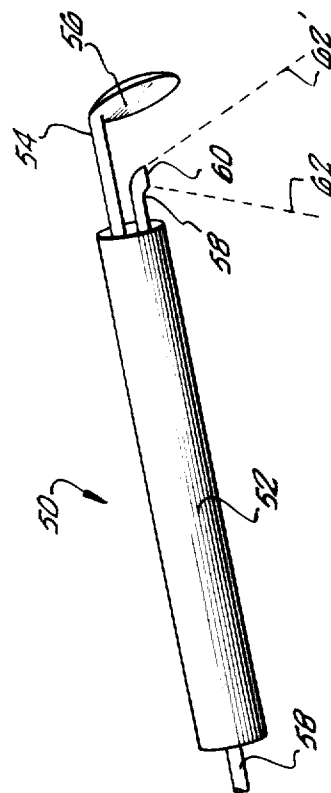
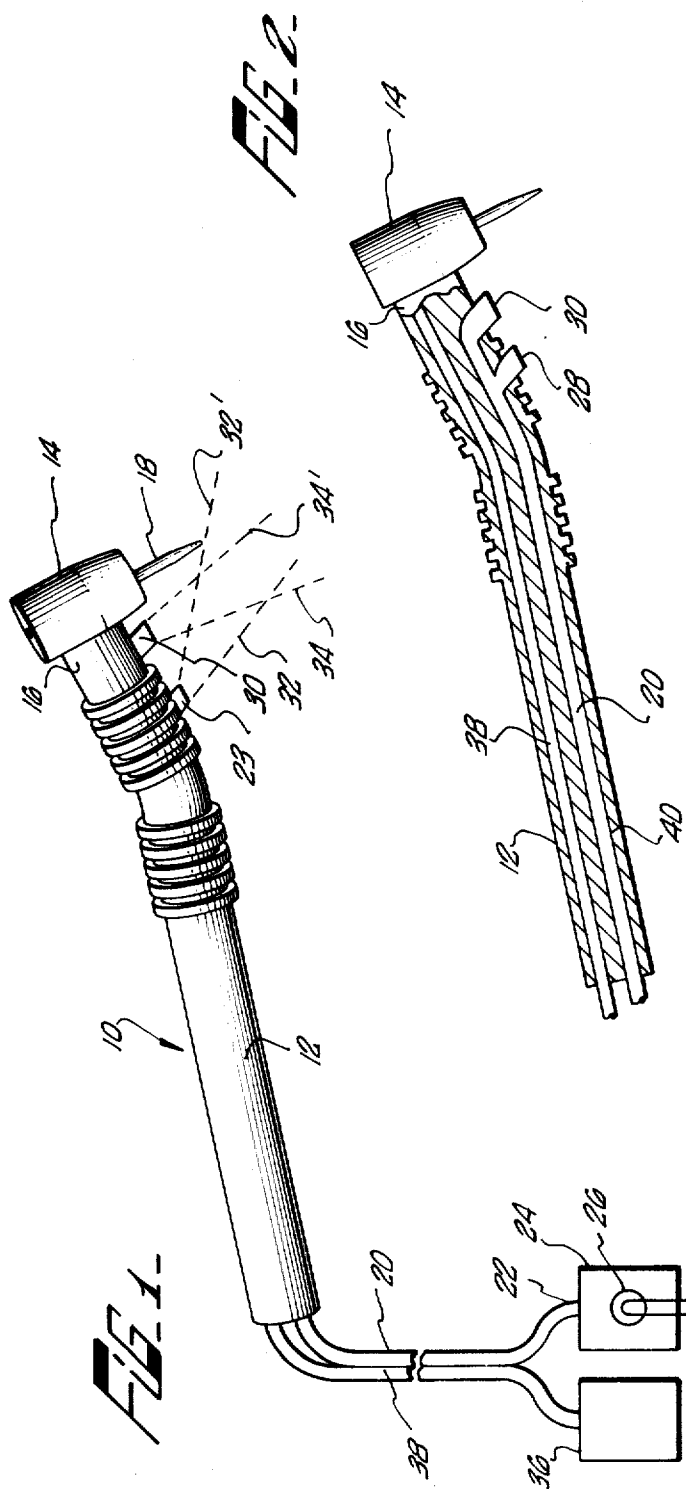


FIG. 3-

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DENTAL ILLUMINATION DEVICE

This invention relates to devices which illuminate the area in which a tool is to be used, and particularly relates to illumination of areas in which dental tools are to be used.

Dental work is made difficult by the fact that a high degree of precision is required and because the operation takes place in a confined space. One of the methods of alleviating this difficulty is to provide proper illumination of the area in which work is to be done. By the nature of dental work, the dentist's hand normally blocks the entrance of most external light to the working area, and hence it is desirable to provide an internal source of illumination.

Various devices have been invented in which a source of illumination is provided on the dental tools themselves, whereby an internal source of illumination is provided. These inventions are described in patents to A. Stutz et al., U.S. Pat. No. 2,038,911, H. Freedman, U.S. Pat. No. 2,720,702, and G. A. La Fitte, U.S. Pat. No. 3,032,879. However, all of these devices have certain deficiencies which are avoided by the present invention.

All of the above inventions provide a source of light within the dental instrument itself, whereas the present invention relies on an external remote source of light. The use of an internal source of light as taught in the prior art, has several basic deficiencies.

The above inventions all have a bulb within or attached to the dental instrument itself. The bulb will radiate heat, and since the instrument must be held by the dentist in close proximity to that bulb, the heat will cause extreme discomfort to the dentist or the patient. This problem is especially acute, for example, in a device where the light bulb is contained in the handle of the instrument, which is where the device will be held by the dentist. Since light originates in an incandescent source, the brighter the light, the more heat will be generated.

The problem of heat is avoided somewhat in the Stutz and Freedman devices in which the light source is external to the handle of the instrument. However, in these devices, the heat is convected into the air in the mouth of the patient, and causes discomfort to the patient. These devices have the added disadvantage that the light source is exposed to breakage by accidental contact with a tooth, in which case the patient could be injured.

In the present device, the source of light is external to the dental instrument itself and is located at a remote location, such as the dental console. The light is conducted to the mouth of the patient by means of a fiber optic bundle internal to the dental instrument. This bundle is not heated by the conducted light and is not breakable. Hence, the problems of past devices are avoided.

Another problem which is associated with many prior art devices is that electricity must be conducted to the dental instrument itself to energize the light source. In many dental devices, water is also carried to the dental instrument. Either through seepage of the water or fraying of the insulation around the electric cord, a short can be caused in the electric circuit.

This short might cause the patient or the dentist to receive an electric shock even if low voltages were em-

ployed. Obviously, high voltage could not be used since the hazard is a potentially lethal one.

The use of a fiber optic bundle prevents this possibility, since no electricity conducted to the dental instrument itself. The term "bundle" as used herein is intended to include single fibers as well as multiple fibers. Only the light is conducted which cannot result in any adverse results. The light source is remote from the dentist and the patient.

Probably the most annoying problem, and one which is common to all previous devices is that really high intensity light is not obtainable. Any light source which is intended to be contained within the handle of a dental instrument or attached to the instrument itself must be quite small. Such a small source is not capable of providing the intensity of light which is desired without generating unacceptable levels of heat. In the present invention, the size or intensity of the light source is not limited in any way. A very high power source can be used to provide the desired level of illumination since cooling of the source can be conveniently accomplished. In addition, the fiber optic bundle can concentrate the light to a relatively small area, enables a more efficient utilization of the light source, including, if desired, reflection and condensing lens systems.

While in the Stutz and Freedman devices, the light source is external to the dental instrument, and can be easily replaced, in other devices, the source is contained inside the handle of the instrument which makes replacement of the source difficult since the entire instrument must be taken apart. In the present invention, the source is remote to the tool and can be easily replaced.

In dental work, a limited area is of interest at any time. For example, only one tooth is being worked on at one time, and hence only a small area must be illuminated. The prior art flood lights attempt to illuminate the work area from the exterior. Frequently the dentist is required to use a dental mirror to reflect incident light to the area as well as to observe the work areas. Such devices do not focus the light on this small area, and most of the light energy is wasted. In the present invention, the fiber optic bundle is formed so as to concentrate the light output on the area of interest, and the light gathering end can be formed to gather more of the available light resulting in less waste and more intensity of light in the area of interest.

A tooth is an irregularly shaped body, and if a tooth is illuminated by a single source, much of the tooth will be shadowed. Since most dental work is done around the base of the tooth, this problem is especially acute. In the present invention, specific embodiments employ a plurality of light beams. A fiber optic bundle is adapted to be split at the output end to provide several light beams, whereas a separate source would be required for each light beam in a device which uses conventional light bulbs as the light source. The elimination of shadows is highly desirable in dental work, and the direct means for obtaining this capability inherent in the present device is a significant advance over any prior dental illumination devices.

If desired, the plurality of light beams can be used to accomplish another objective. The diffusion levels of the various light beams can be made dissimilar to achieve a desirable result. A highly intense beam may

be used to illuminate the immediate area in which the instrument is operated, while more diffuse beams can be used to light the surrounding area. The use of more diffuse beams will serve to further eliminate shadows which are caused by the more intense beam, while maintaining the illumination level of the intense beam in the work area. These capabilities inherent in the present invention are not present in any prior devices, and serve to increase the utility of internal illumination devices.

In a preferred embodiment, the invention is employed in a handpiece having one end adapted to connect to a tool. A fiber optic of single or multiple fiber is adapted to be wholly internal to the handpiece. The fiber optic bundle has a proximal end adapted to be coupled to a remote external light source, and a distal end adjacent the tool holding end of the handpiece. The distal end is formed such that light conducted through the fiber optic bundle from the proximal end illuminates the area of operation of the tool.

The novel features which are believed to be characteristic of the invention, both as to organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which preferred embodiments of the invention are illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention.

FIG. 1 is a frontal view of an embodiment of the invention as applied to a dental handpiece used as a drill;

FIG. 2 is a section view of the embodiment of the invention used in a dental handpiece;

FIG. 3 is a frontal view of an alternative embodiment of the invention as applied to a dental mirror;

In FIG. 1, a preferred embodiment of the invention is employed as part of a dental drill apparatus 10. The drill apparatus has a handpiece 12, to which is attached a drill head 14 at the attachment end 16 of the handpiece 12. The drill head 14 contains a drill bit 18. A fiber optic bundle 20 has a proximal end 22 attached to a light source 24 containing a lamp 26 and appropriate cooling apparatus.

The fiber optic bundle 20 passes through the interior of the handpiece 12 and, in the illustrated embodiment, emerges and terminates in two separate distal end sections 28 and 30 adjacent the drill head 14. Light is transmitted by the fiber optic bundle 20 from the light source 24 through the handpiece 12 and emerges at the distal end sections 28 and 30. This light is focused on the area of operation of the drill bit 16 as indicated by the dashed lines 32, 32', 34, and 34'.

In FIG. 1, the drill head 14 is supplied with compressed air from a source 36 through a feed line 38. The feed line 38 also passes through the handpiece 12 to the drill head 14. In FIG. 1, the fiber optic bundle 20 is shown attached to the feed line 38. However, the fiber optic bundle 20 could also be contained within the feed line 38 to form a single line (not shown) carrying light through the feed line 38 along with water or air.

FIG. 1 specifically shows the invention applied to use with a dental handpiece used with a drill. However, it

must be recognized that the invention applies to a variety of dental tools. Other dental tools, such as a water emitter, an air emitter, a pick and so forth, could be attached to the attachment end 16 of the handpiece 12. Items such as a water emitter or an air emitter require a feed line 38, but items such as a pick would not require such a feed line, and such a line would not be used.

FIG. 2 shows a section view of the handpiece 12 of FIG. 1. Dental tools such as a drill, water emitter, air emitter or pick can be attached to the attachment end 16 of the handpiece 12. The handpiece has an opening 40 through which is passed the fiber optic bundle 20. The fiber optic bundle 20 is split into two sections 28 and 30 at its distal end. The two sections 28 and 30 can be formed dissimilar so as to provide light beams of different diffusion. Although two distal end sections 28 and 30 are shown, the invention applies to one or several distal end sections. The feed line 38 is also shown to pass through the handpiece 12.

FIG. 3 shows the invention as applied to a dental mirror 50. The mirror 50 is made up of a mirror handpiece 52, a mirror support 54 and a mirror face 56. A fiber optic bundle 58 passes through the mirror handpiece 52, and terminates at its distal end 60. Light is conducted through the fiber optic bundle 58 from a source (not shown) through the distal end 60, and is emitted as shown by the dashed lines 62 and 62'.

The present invention is concerned primarily with the handpiece which are indicated in the figures together with the method of illumination built into that handpiece. The type of handpiece shown can be used with a variety of dental tools, and its utility is not limited to the particular tools illustrated.

What is claimed is:

1. For use in conjunction with a dental console adapted to supply fluid to a remote handpiece, in combination:

a handpiece having one end adapted to connect to a tool; work area illuminating means including a fiber optic bundle integrally contained within said handpiece, said fiber optic bundle having a proximal end adapted to connect to a remote external light source at the console and a distal end, said distal end of the fiber optic bundle being split into a plurality of sections, said first section of the distal end of the fiber optic bundle being canted relative to a second section of the distal end of the fiber optic bundle whereby the area of operation of the tool is illuminated from different angles, by light being conducted from said proximal end of said fiber optic bundle through each section of said distal end.

2. For use in conjunction with a dental console adapted to supply fluid to a remote handpiece, in combination:

a handpiece having one end adapted to connect to a tool; work area illuminating means including a fiber optic bundle integrally contained within said handpiece, said fiber optic bundle having a proximal end adapted to connect to a remote external light source at the console and a distal end, said distal end of the fiber optic bundle being split into a plurality of sections including a first and a second section of said distal end, said first and second sec-

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tions of the fiber optic bundle being formed such that the diffusion of light conducted through said first section of said distal end of said fiber optic bundle is greater than the diffusion of light conducted through said second section of said distal 5

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end of said fiber optic bundle, such that light conducted from said proximal end of said fiber optic bundle through each section of said distal end illuminates the area of operation of the tool.

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