

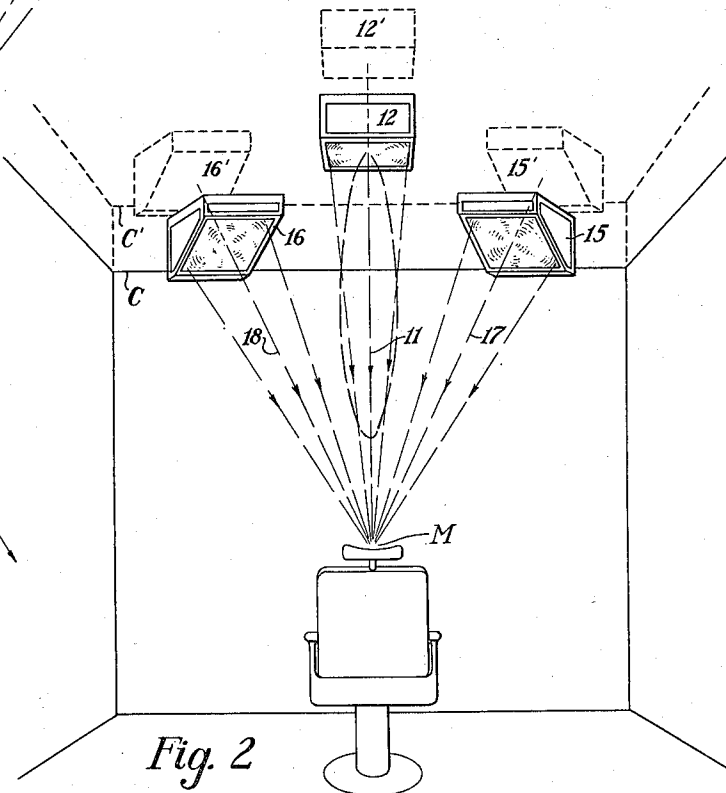
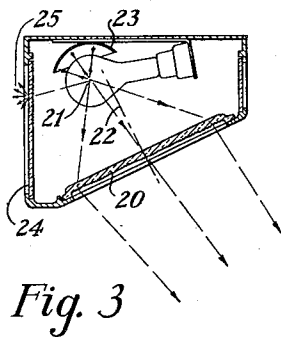
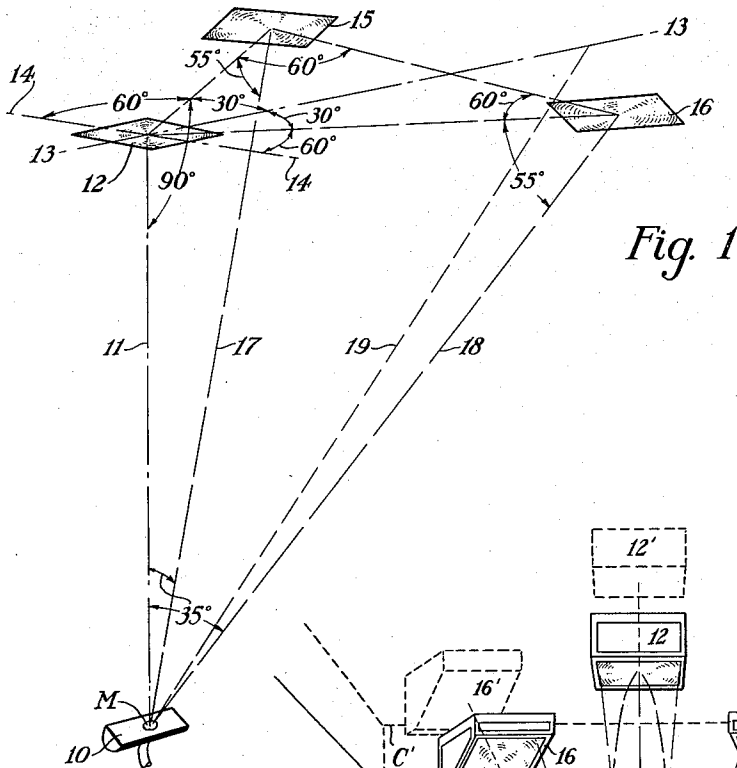
Jan. 8, 1935.

H. L. LOGAN
DENTAL LIGHTING SYSTEM

1,987,019

Filed Nov. 10, 1932

2 Sheets-Sheet 1



INVENTOR.
Henry L. Logan.
BY *Joseph Shiberman*
ATTORNEY.

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Fig. 4

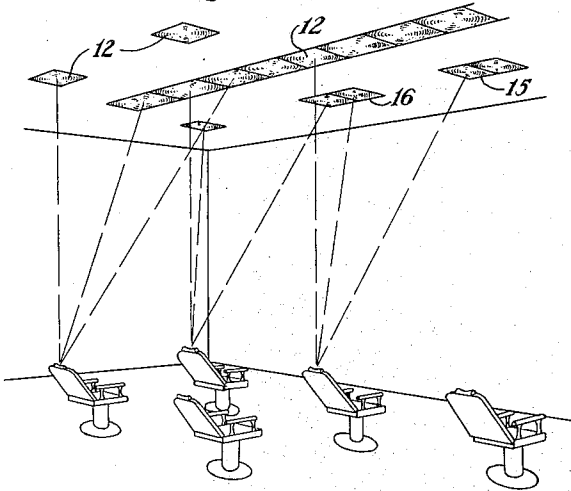


Fig. 5

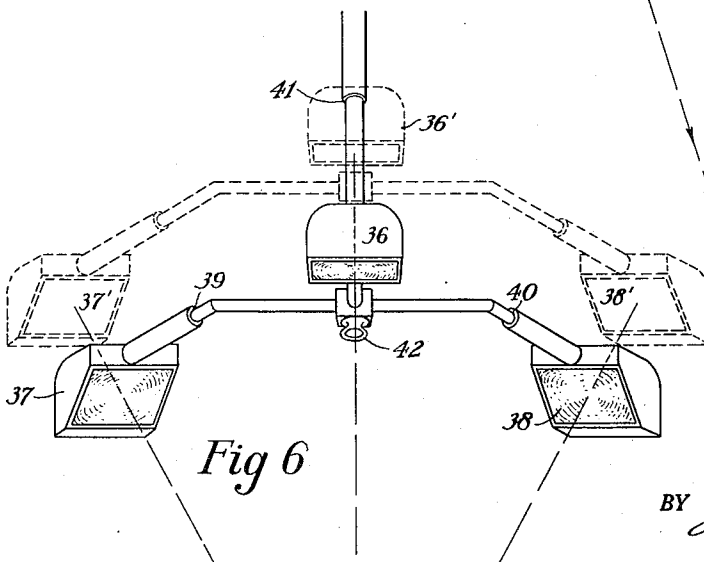
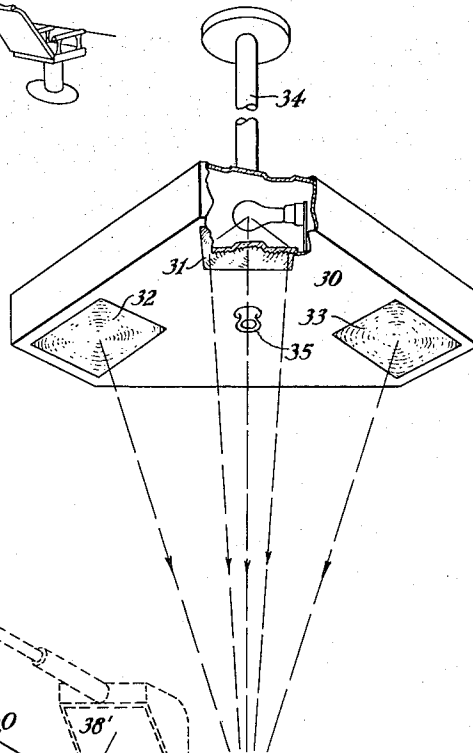


Fig 6

INVENTOR.
Henry L. Logan.
BY *Jacob S. Sherman*
ATTORNEY.

UNITED STATES PATENT OFFICE

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DENTAL LIGHTING SYSTEM

Henry L. Logan, New Rochelle, N. Y., assignor to
Heloophane Company, Inc., New York, N. Y., a
corporation of Delaware

Application November 10, 1932, Serial No. 641,969

3 Claims. (Cl. 240—1)

The present invention relates to dental lighting systems and is more particularly directed toward the provision of lighting apparatus more suitable for use in carrying out dental operations than those in common use.

The use of a fixed system of lighting for dental work has heretofore been considered impossible as a general proposition. Owing to the variation in height of dentists, the height of the working plane above the floor has to be varied, and, owing to the variation in height of the patient, there is a considerable range in the positions of the mouth, both as to its elevation above the floor and its position relative to the center or support of the dental chair. It is also desirable to swing the chair to some extent about this pivot. The net result of these conditions is that the mouth may be placed in an operating region which varies about one foot in height and has a horizontal dimension of a foot or more.

The lighting of the mouth during dental operations requires a high intensity of illumination with the light directed onto the surfaces on which the dentist is working, so that he can carry out the operations with adequate lighting, all of which must be received through the comparatively small opening of the mouth. The dentist must be close to the patient and the operations must be carried out in various places in the mouth by instruments which the dentist holds in his hand, so that avoiding the creation of shadows in the mouth cavity is important. These conditions have made it the almost universal practice for the dentist to employ movable light sources comparatively close to the patient. Such movable lighting apparatus clutters up the space about the patient and dental chair and requires adjustment by the dentist each time he or the patient moves. Such adjustments take the attention of the dentist away from the more important work in hand, are unsanitary, and annoying to the patient.

The present invention contemplates a lighting system for dental use which consists essentially of a plurality of simultaneously operated light sources placed in fixed positions. They are far above the operating chair so as not to interfere with the movements of the dentist and require no attention by the dentist. They are constructed to provide very intense beams of light projected toward the center of the region occupied by the mouth cavity. While the crossing of the beams is at this center, there is a region of considerable depth and width in horizontal directions which these fixed light sources illuminate to a very high

intensity, of the order of 250 foot candles. This is obtained from three such sources with proper lenses and reflectors for projecting the light toward this theoretical center. The lights are so located as to provide not only horizontal illumination of the mouth cavity, but also a crossing of the light rays inside the mouth cavity for the illumination of vertical surfaces and to bring about diffusion to illuminate back surfaces. This arrangement also minimizes the casting of objectionable shadows by the dentist or the tools which he uses.

The preferred location for these light sources is in or near the ceiling of the room, but where the room has too high a ceiling, the light sources can be supported on a chandelier-like structure at the desired elevation above the operating plane. Once this chandelier is installed, it requires no adjustment so long as the operating center is retained.

In order that the patient will not be unnecessarily annoyed by the lighting, the system is also designed so that the light sources are not within the normal field of vision of the patient when in the operating position.

Other and further objects and advantages of the invention will be apparent as the description proceeds.

The accompanying drawings show, for purposes of illustrating the present invention several of the many embodiments in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same. In these drawings:

Fig. 1 is a diagrammatic view illustrating an angular layout for the lighting units of the system in connection with an operating chair;

Fig. 2 shows a triple spot lighting system viewed from the rear of the operating chair with the three beams of light directed toward the operating point on the dentist's chair.

Fig. 3 is a cross-section of one of the lens units used for this system;

Fig. 4 shows a recessed lighting system with a number of dental chairs and triple spot directed toward each operating point but with lenses grouped together mechanically wherever possible;

Fig. 5 is an adjustable triple spot lighting unit; and

Fig. 6 is another form of adjustable triple spot unit.

Fig. 1 shows the head rest of a dental chair at 10. It is tilted at the usual angle to permit the dentist to work in the mouth (M). The line 11 is projected vertically upward from the mean

position occupied by the mouth during the dental operations. A lighting unit diagrammatically indicated at 12 is placed along the vertical line 11 at a desired elevation above the operating plane. It is designed to project a beam of light vertically downward or toward the mouth.

Lines 13—13 and 14—14 intersecting at the center of the unit 12, indicate a horizontal plane through the lighting unit 12, the line 13—13 extending from the rear of the chair toward the front of the chair while the line 14—14 is at right angles to the line 13—13.

Two other lighting units are indicated at 15 and 16. The preferred spacing of the lighting units 15 and 16 is at the apices of an equilateral triangle, the line between the units 15 and 16 being parallel with the line 14—14 thereby locating these units on opposite sides of the patient's mouth. The units 15 and 16 may be alike and are designed to project slanting light beams whose axes are indicated at 17 and 18. These slanting axes intersect the vertical beam axis 11 at a predetermined point which is at the center of the region in which operating work is performed.

The line 19 indicates the normal line of vision from the head rest. As the head rest is usually tilted from 30° to 45°, this line of normal vision varies from 60° to 45° to the vertical. It has been found by experiment that the units 15 and 16 should be placed at such a distance from the unit 12 that the beam axes 17 and 18 are at angles of approximately 35° with the vertical as indicated in the drawings. The line of vision is then from 20° to 30° from the axes of the beams. With such an arrangement, the light comes at an angle sufficiently near the vertical to be free from annoying glare, except when the patient looks up to see the lighting units, and yet affords a satisfactory amount of vertical illumination inside the mouth. It will thus be seen that there are three beams of light, one vertical from unit 12, the other two being oblique at angles at 35° to the vertical and at angles of about 33° to one another, all directed into the oral cavity. It will, therefore, be apparent that the light from these three sources crosses in the oral cavity and is capable of illuminating vertical and horizontal surfaces and of producing excellent diffusion around the mouth for illuminating surfaces which cannot be directly reached.

This beam arrangement is one in which the dentist is not annoyed by shadows cast into the mouth by his body or the instruments he is using.

In Fig. 2 the lighting unit 12 is placed directly over the patient's mouth in the dentist chair. The additional units 15 and 16 are placed respectively on each side of the central unit and forward. Unit 12 has a lens unit directing a beam straight downward. Units 15 and 16 direct slanting beams at an angle to converge at the same point, viz., the patient's mouth M. The lens units 12, 15, and 16 are placed on a ceiling, the height of which is indicated at line C. If the ceiling is higher, as shown by the dotted line C', the units are placed farther apart, but in the same angular relation to one another and so that the beams still converge at exactly the same point. Unit 12 is raised to the position 12'. Unit 15 is carried back along the line 17 to the position 15'. Unit 16 is carried back along the line 18 to the position 16'. By moving these units back along the axes 17 and 18 of the slanting beams, they are placed at a new location on the higher ceiling such that the beams are still directed exactly to the same point as before. It

will be evident, therefore, that the relation between the boxes varies with the ceiling height.

Fig. 3 shows a cross-section of the units 15 and 16. A lens 20 is held in a tipped position to direct the light at the proper angle downward. However, a part of this angular direction downward is obtained by offsetting the light center 21 somewhat from the axis 22 of the lens 20. This permits a somewhat lesser degree of tip to the lens than would be necessary if all of the tip of the light beam were obtained by tipping the lens. When beams or other obstructions on the ceiling interfere with the location of a unit at exactly the proper point, the unit may be moved to one side or the other. Then the proper angle of beam may be obtained by a change in the position of the light center 21 to one side or the other of the position shown in Fig. 3. In the unit shown in Fig. 3 efficiency is increased by the use of a spherical reflector 23 placed above the light source. Diffusing glass sides of opal or other glass may be used in these units as indicated at 24. This gives a spread or diffusion to the transmitted light as shown at 25 and helps to provide general illumination in the room with a soft pleasing effect.

Fig. 4 indicates the application of the system to an installation having a plurality of dental chairs. Such an installation might be placed in a dental college. Wherever the proper location of lenses in such a system brings the lenses together, they are grouped together in the same box to obtain the advantages of a bank construction of the boxes for the lamps.

Fig. 5 illustrates a triple spot lighting unit suspended from the ceiling by a single support. A triangular box 30 carries three lenses 31, 32, and 33, each with its individual lamp. The lamps are so set with reference to the lens foci as to produce concentration at the operating point. In this unit, the top cover of the box is made of diffusing glass. This diffusing glass transmits light to the ceiling and provides general illumination in the room to supplement the high intensity at the operating point. The stem or support 34 may be provided with adjustable joints for raising and lowering or tipping, so that, by means of the handle 35, in the center of the lower side of the unit, adjustment can be secured. This adjustment would consist in raising or lowering the unit or tipping it in any desired direction so that the spot may be placed exactly where desired, after which it will require no attention.

Another variation in the form of a unit supported by a single stem from the ceiling is shown in Fig. 6. In this case the lenses are not carried in a single box but each is placed in its own individual box shown at 36, 37, and 38. The arrangement of the individual boxes is the same as in Fig. 2. One box 36 has lens and lamp adjusted to direct the beam straight downward and the unit is placed so that this lens is directly over the operating point. Two other boxes 37 and 38 have lenses set at an angle and lamps so placed with reference to the lenses that beams are directed from the front and each side toward the operating point. The distance of the lens boxes 36, 37, and 38 from the axis of the unit may be adjusted by the sliding joints 39 and 40. The height of the complete unit may be varied by the sliding joint 41 so that if desired the lens boxes can be moved up to the positions 36', 37', and 38'. A handle 42 permits ease in making these adjustments. Tilting

adjustment may also be introduced if desired.

It may sometimes be necessary to have the lighting unit 12 slightly offset, so as not to be directly over the center of the operating region.

5 Slight inclination of the beam of this unit corrects for the displacement of the unit.

The lenses and reflectors are designed to produce beams of very small divergence so that the cross section of the beam of controlled light is 10 but little larger than the lens. A large amount of scattered and uncontrolled light is emitted from each unit so that a high level of general illumination is available without additional lighting apparatus.

15 It is obvious that the invention may be embodied in many forms and constructions, and I wish it to be understood that the particular forms shown are but a few of the many forms. Various modifications and changes being possible, 20 I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

25 1. Apparatus for illuminating the interior of the mouth of a patient reclining in a dental chair at the usual angle for dental operations comprising one lighting unit directly above the mouth

for providing intense illumination vertically, and two lighting units each having light concentrating lenses, the latter light units being spaced from one another and equally spaced from the first lighting unit and arranged to project intense beams 5 of light toward the mouth cavity, the three units having fixed spacial relationship and angularity, said lighting units being a predetermined distance above the dental chair, the light beams crossing in the region of the mouth cavity to 10 provide illumination of vertical surfaces such as teeth and gums, the latter mentioned lighting units being placed sufficiently close to the first unit so as to be behind the normal direction of sight of the patient to reduce glare from the 15 surface of the lenses in the patient's eyes.

2. Lighting apparatus as set forth in claim 1, characterized in that the axes of the oblique beams are at substantially 35° with the axis of the vertical beam. 20

3. Lighting apparatus as set forth in claim 1, characterized in that the lighting units are at the apices of an equilateral triangle, the slanting beams being projected at equal angles to the ver- 25 tical.

HENRY L. LOGAN.