Jan. 30, 1934. G. O. RUSSELL 1,945,380

SURGICAL INSTRUMENT

Filed Feb. 4, 1931

Fig. 1

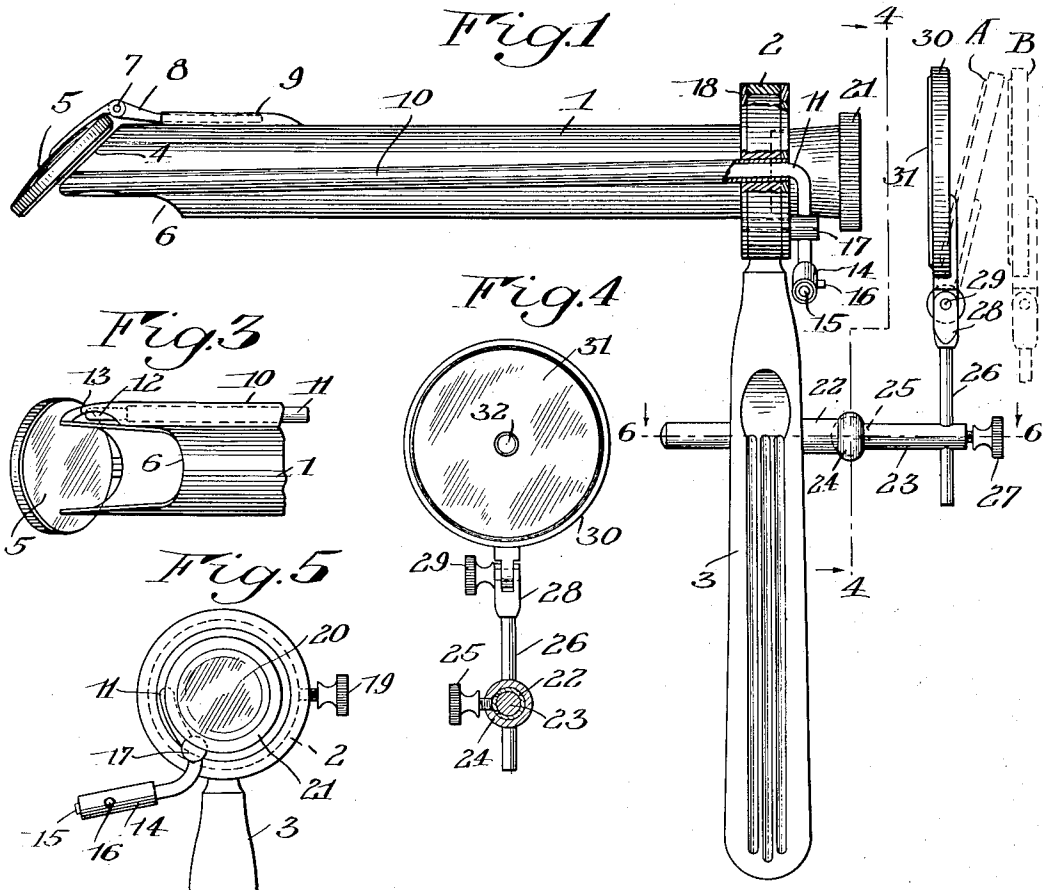


Fig. 3

Fig. 4

Fig. 5

Fig. 2

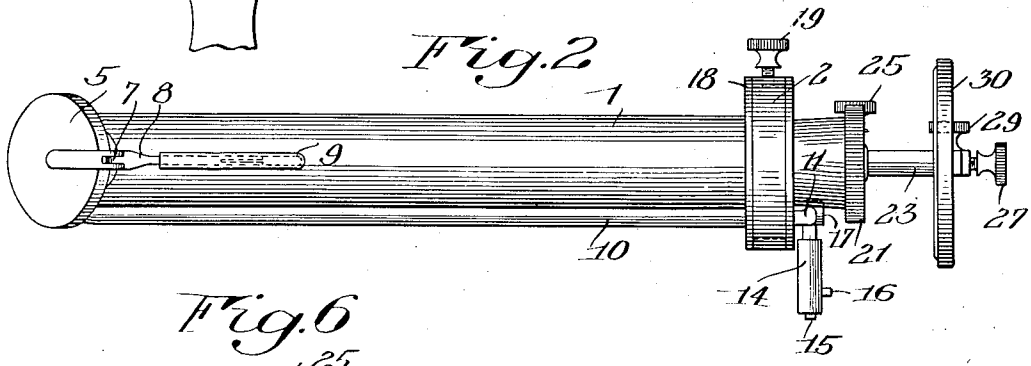
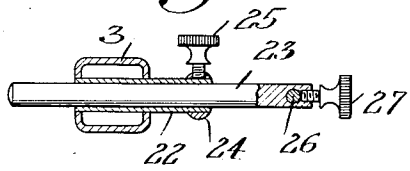


Fig. 6



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Patented Jan. 30, 1934 1,945,380

UNITED STATES PATENT OFFICE

1,945,380

SURGICAL INSTRUMENT

George Oscar Russell, Columbus, Ohio

Application February 4, 1931. Serial No. 513,371

11 Claims. (Cl. 128—11)

My present invention relates to optics and more particularly to the application thereof to surgical instruments, such as laryngoscopes for exploring the oral and nasal cavities and those of the throat, trachea, bronchial tubes and esophagus. And it has for its object to provide an instrument of such character as will be simple in construction and effective and convenient in use. Some improvements are directed in part toward making it possible for the subject or patient to see his own vocal cords and interior larynx at the same time the physician does; toward provisions whereby a number of students, relatives of the subject or other persons in the room may make the same observations concomitantly therewith; toward concentrating or condensing the view from whatever point or angle entirely on the object or organ under observation; toward illuminating the object more brilliantly without the diffusion heretofore encountered; and toward eliminating the heat of the illuminant whereby irritation and inflammation is avoided even after hour-long examinations.

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawing:

Fig. 1 is a side elevation of an instrument of the character described constructed in accordance with and illustrating one embodiment of my invention;

Fig. 2 is a top plan view thereof;

Fig. 3 is a fragmentary bottom view of the collecting mirror and associated lighting device;

Fig. 4 is a vertical section on the line 4—4 of Fig. 1 looking in the direction of the arrow into the face of the reflecting mirror;

Fig. 5 is a fragmentary rear view looking into the window or lens with the reflecting mirror removed, and

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 1 with the cylindrical part shown partly in elevation and partly in section.

Similar reference numerals throughout the several views indicate the same parts.

A suitable name for my improved instrument is a "fonofaryngoskop" because of its increased capabilities as compared with the ordinary laryngoscope, but the general construction, purposes and manner of using the latter being well known in the art, I will, in this specification, first describe the construction of the present device without much reference to the various functions of the parts and follow it with an explanation of the mode of operation and the purposes of the various instrumentalities in detail.

Referring more particularly to the drawing, 1 indicates the main tube or barrel in the normal horizontal position of Figs. 1 and 2 rotatably supported in a ring-shaped head 2 carried on the upper end of a suitable shaft handle or other support 3. The front end of the tube is chamfered or cut at an angle of about 45 degrees to the axis, as indicated at 4, to accommodate a laryngoscopic or collecting mirror 5 at this minimum angle. This mirror collects the rays from an object below through an opening 6 in the under side of the tip of the tube. The mirror frame is mounted on a stiffly frictional pivot 7 for adjustment to different set positions at wider angles. The said pivot is on the projecting end of a detachable arm 8 having a snug fit sufficient to hold it in place in a scabbarded socket 9 fixed to the top of the tube 1, the removability being, of course, for cleaning and sterilizing purposes.

Running along one side of the tube is a small tubular conduit 10, in which a lamp carrying stem 11 may be inserted or pulled out rearwardly therefrom. The electric lamp bulb 12 is carried at the forward end of this stem and the light, partially hooded and protected by the end of the conduit, issues through an opening 13 in the under side of the tip of the latter in a direction coincident with the line of incidence from the object to the face of the mirror 5. The rear end of the stem 11 is bent downwardly and to the left at an angle and carries a plug 14 with the terminal contact 15 of the usual insulated wire that runs through the stem to the lamp, the other terminal of the filament of the latter being grounded as usual. The socket of the usual cord connection is secured on the plug by a laterally projecting pin 16 and the plug carrying elbow forming the rear end of the stem is frictionally held in place and against rotation by a transverse pin 17 occupying a bore or socket in the spaced collars 18 on the tube 1 that engage the opposite sides of the head ring 2 and confine the tube to its bearing in the latter.

The tube can be turned in this bearing to any desired position of adjustment to obtain a view in all directions in the plane of its rotations, as, for instance, in a reversed position to that of Figs. 1 and 2, and is held so adjusted by a set screw in the head ring 2, terminating in the thumb nut 19.

The angle of reflection from the collecting mirror 5 is rearwardly down the tube 1 to a window

or objective 20 fixed in an eye piece 21. This eye piece is removable and replaceable and for this purpose has a tapering fit in the rear end of the tube to turn with it.

Projecting rearwardly or toward the user from the handle 3 is a fixed sleeve 22, in which a rod 23 is supported and guided both for rotary movement and longitudinal movement parallel with the tube 1. Within a collar 24, otherwise fixed to the sleeve 22, the latter is split and engaged by a clamping screw 25 threaded through the collar to hold the rod 23 in different positions of adjustment resulting from the aforesaid movements. A standard 26 is carried by the rod 23 in all of its movements and additionally it slides transversely therethrough and is held in different positions of adjustment by a knurled set screw 27. At its outer end, it carries a knuckle 28 in which is pivoted at 29 a diaphragm frame 30 carrying a stage or reflecting mirror 31, the latter and the frame being provided with alined openings forming a peep hole 32.

The whole group of parts just described allows the mirror 31 a universal adjustment with respect to its reflecting surface in a manner so obvious that further description is thought unnecessary. Furthermore, the peep hole 32 is similarly adjustable with it as it must be maintained in the axis of the tube 1 and of the lens or window 20 to give a full field of vision. For instance, if the mirror is tilted back, to the dotted line position A from the full line position of Fig. 1, it will swing the peep hole below the axis and the stem 21 must be raised slightly to restore it.

As to the general operation, the front end of the tube 1 is inserted in the patient's mouth and if, for instance, the vocal cords are the object of examination, the collecting mirror 5 is adjusted to about the position shown in Fig. 1 and the image thereon is observed by the surgeon or operator through the peep hole 32 and window 20, it making little difference for his purposes alone how far back of the window or eye piece the diaphragm 30 is adjusted. However, an object of the invention is to permit the patient or subject to also take the same view at the same time, which he gains by observing the image on the collecting mirror reflected in the stage mirror 31, though it is directionally reversed through the double reflection. For this purpose, the mirror 31 is moved back from the eye piece and preferably tilted slightly, as indicated at A in dotted lines, in order that the patient's view will not be obscured by intervening parts, such as the head 2, but the angles of incidence and reflection are so great as between the axis of the tube and the line of sight that the angle of the reflecting mirror 31 need not be great, but, in fact, a fair view of the image may be obtained by drawing it back to the dotted line position B without tilting.

Still another capability contributed by the universally adjustable reflecting stage and also by its removability is to make of the instrument not only a viewing and examination apparatus for auto-inspection purpose, but also for student-teacher demonstration purposes, or where it is desired, this part can be slipped out, thus permitting undisturbed simple laryngeal examination and operative procedures as employed by physicians and surgeons generally, because the removable feature of the eye piece carrying the lens or window 20 makes it possible to use the fonofaryngoskop for insertion of surgical instruments through the tube in normal operative procedure. The group of additional observers stand behind or to one side of the patient and the reflecting mirror is inclined in two planes relatively to the optical axis accordingly.

The objects of the invention as related in the introduction to this specification are thus accomplished and in addition, it is pointed out that the view through the tube makes it unnecessary to impede movement of the tongue, epiglottis, et cetera; to open the patient's mouth as wide as is required in ordinary laryngoscopy, the fonofaryngoskop requiring as it does a space more the size of a marble instead of spreading the mouth to the diameter of a billiard ball, as is customary where the usual laryngeal mirror is employed, and it is further unnecessary with the use of my instrument to depress the tongue, pull the tongue out, as is so often necessary in the usual laryngoscopy in order to counteract so-called retracted epiglottis (which I believe to be actually non-existent) or prevent capping the view of the vocal cords by the epiglottis. The application of force on the epiglottis as in direct laryngoscopy is also obviated.

I claim as my invention:

1. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube, and having an observation opening at the other end, of a hood on the tube adjacent to the mirror between the latter and the observation opening and adapted to contain a lamp from which the mirror is thereby shielded, the open side of the hood being arranged to confine the illumination to a direction coincident with the line of incidence from the object to the face of the mirror.

2. In a surgical instrument of the character described, the combination with a body tube having a longitudinally extending socket at one end extending along the periphery, of a detachable stem frictionally engaging within the socket, and a collecting mirror having a pivotal connection with the stem to move to different angular positions relatively to the axis of the body tube and removable with the stem.

3. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a casing running longitudinally along one side of the tube and terminating in a hood adjacent to the mirror and between the latter and the observation opening, said hood having an opening arranged to confine the illumination to a direction coincident with the line of incidence from the object to the face of the mirror, and a detachable lamp stem in the casing having electrical connections.

4. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube, supporting means near the opposite end of the latter embodying a bearing ring in which the tube rotates, and spaced collars on the tube cooperating with the ring, of a casing running longitudinally along one side of the tube through the bearing collars and terminating in a hood adjacent to the mirror, said hood having an opening arranged to confine the illumination to a direction coincident with the line of incidence from the object to the face of the mirror, and a detachable lamp stem in the casing having electrical connections on an end projecting from the bearing collars.

5. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a support for the tube at its latter end, and a reflecting mirror on the support adjustable along the axis of the tube.

6. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a support for the tube at its latter end, and a reflecting mirror on the support adjustable angularly relatively to the axis of the tube.

7. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a support for the tube at its latter end, and a reflecting mirror on the support having a universal adjustment angularly and longitudinally relatively to the axis of the tube.

8. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a support for the tube at its latter end, and an adjustable reflecting mirror on the support having a central peep opening therein.

9. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube and having an observation opening at the other end, of a support for the tube at its latter end having a guide therein, a rod slidably and rotatably adjustable in the guide parallel to the axis of the tube, a stem slidably and rotatably adjustable on the rod transversely to the axis of the tube, and a reflecting mirror having a central peep opening pivoted on the stem.

10. In a surgical instrument of the character described, the combination with a body tube having a longitudinally extending socket at one end, of a detachable stem frictionally engaging within the socket, a collecting mirror having a pivotal connection with the stem to move to different angular positions relatively to the axis of the body tube and removable with the stem, the opposite end of the body tube being provided with an observation opening, and a detachable eye piece having a slip fit inset opening.

11. In a surgical instrument of the character described, the combination with a body tube provided with a collecting mirror at one end inclined to the axis of the tube, of supporting means near the opposite end of the latter embodying a handle having a bearing ring in which the tube rotates and spaced collars on the tube closely embracing the ring, and a detachable eye piece projecting from the face of one of the collars.

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