light is turned off. A single knob adjacent to this switch controls the motor speed. The threadlight is located at the side of the objective lens, and illuminates the upper and lower sprocket and the gate so that no other light is needed for changing reels in a darkened room.

The lamp house and the fan are designed to give adequate cooling for high-wattage lamps, insuring ample lamp life. The optical system was specially designed, and is remarkably efficient both as to picture quality and screen brilliance.

Elevating or tilting either upward or downward to center the picture upon the screen is accomplished by pivoting the mechanism on the pedestal base. This is controlled by an elevating knob which actuates a new elevating mechanism; it operates easily and affords a fine adjustment. Similar to the Model *EE* Kodascope, the base of the Model *G* fits over the handle of the carrying case, which may be used as a projection stand.

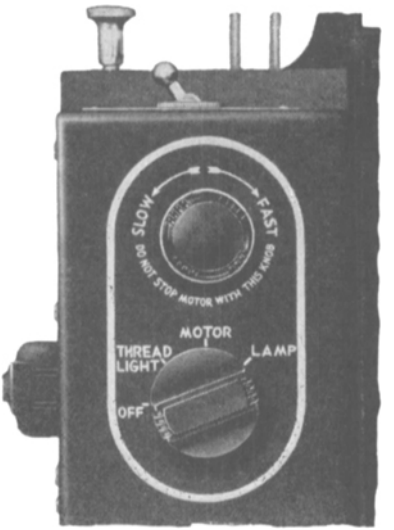

FIG. 4. Unit control for threadlight, motor, and lamp.

A new 2-inch, $f/1.6$ lens, especially designed for flatness of field, is standard equipment. Other lenses include a 1-inch $f/2.5$ for short throws, and either a 3-inch $f/2.0$ or a 4-inch $f/2.5$ for longer throws. These lenses, with the 400-, 500-, and 750-watt lamps permit selection from twelve possible combinations. The standard model is fitted with arms for 400-ft. reels; however, a model for 1600-ft. reels will be available. The machine is finished in hand-rubbed glossy black lacquer, with all fittings in buffed chrome plate.

A NOVEL SURGICAL FILMING STAND*

A. LENARD**

Up to now surgical filming has always been accompanied by sundry difficulties, which have often resulted in the decision not to film certain types of operations that may not have been of paramount interest or the outcome of which could not be predicted. This is easy to understand when one stops to consider all the complications and preparations necessary before undertaking to film an operation, the

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many accessories and paraphernalia required in the operating room, and the time taken to get everything ready for filming such feats. In the case of emergency operations it has been nearly impossible to rig up the equipment in the short time available, and it is fairly safe to say that the preparations for filming an operation required at least half an hour before bringing in the patient.

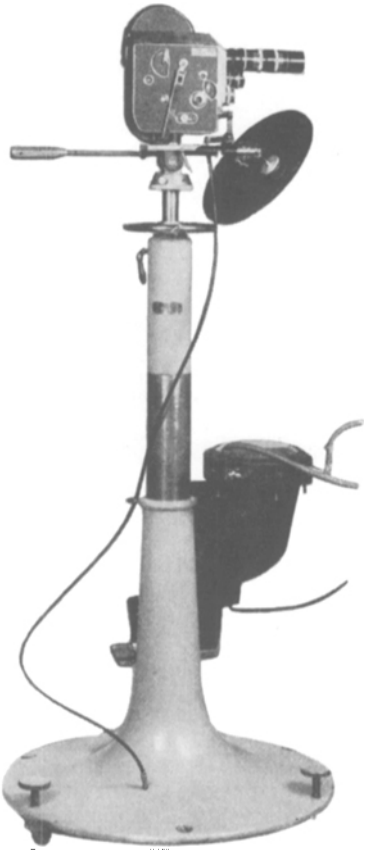

FIG. 1. General view of surgical camera stand.

Some of the difficulties generally encountered are cited below; but, in addition, special problems arise in almost every case that have to be solved in the shortest possible time.

It is obvious that the cameraman must stand outside the sterile zone and work in such a way as not to hinder the surgeon; in spite of which he nearly always wants extreme close-up shots. The lighting is perhaps the "trickiest" problem. Everybody who has tried to take pictures of operations knows very well how difficult it is to place the lights in such positions as to provide really uniform illumination over the area of interest; not interfere with the surgeon, assistants, and nurses; and yet be sufficiently removed from the sterile zone. Nothing must be in the way of the light-beams that will cast shadows upon the operation field and the rubber-covered cables must be led along the walls so that no one may tread upon them. To accomplish all this the lights have usually been placed very high, necessitating the use of very high stands. High stands of sufficient rigidity for use in operating rooms are not of the low-priced variety. When the operations were performed within cavities, as within the throat, ear, nose, teeth, and in gynecological and other operations, the lighting offered generally such insurmountable difficulties that as a rule such regions were rarely if ever filmed. In these instances the light-source can be only a single unit, must be constructed so as to provide a very narrow beam, and should be positioned as near the optical axis of the taking lens as possible. The ideal condition would be realized if the beam could be made coincident with the optical axis. At the same time the beam must be able to follow, within certain limits, such pan or tilt movements of the camera as may be necessary during the shooting. Since there is only a single beam in such cases, it must be highly concentrated; but it must not be allowed to

cause excessive heating of the tissues and consequent discomfort of the patient in cases when no anesthetic is used. A very important matter is the possibility of making quick adjustments of the camera during the operation, so that the cameraman may avoid positions from which the surgeon would obstruct the view. The ability to change cameras is very useful when the reel runs empty during an interesting phase or when the camera is spring-driven rather than electrical.

The difficulties outlined above have been eliminated effectively and by the surgical filming stand of original construction shown in Fig. 1. The stand is completely self-contained and once it is rolled into place the cameraman needs only to make the single connection to the current output and connect two rubber hoses to the water drain, which requires about ten minutes.

The base is of heavy cast iron, to provide the necessary strength and eliminate all vibration even when working at high speeds for slow-motion effects. With minute adjustments at full lens opening it is important that the camera should not move because the depth of field is then very critical. Also, when shooting small areas (teeth, *etc.*) with the telephoto lens by using extension rings under the lens and thus working from great distances, the slightest wabbling of the stand can easily spoil the macro-shot or even displace the camera sufficiently so as not to take in the required field. The total weight of the stand is about 50 kilograms. It moves on three rubber-covered rollers, and when in position is fixed by screwing three steel points down to the floor, thus obviating the slightest chance of wabble or vibration. The upright of the stand telescopes in two sections. One section provides the rough setting in height and the second (with a hand-wheel) is an accurate vernier adjustment. All adjustments can be fixed rigidly when in place. When raising or lowering the camera the lenses always point in the same direction. The lowest position of the tripod head is 85 cms., the highest 152 cms. above the ground. Thus every possible taking angle can be covered in minimum time.

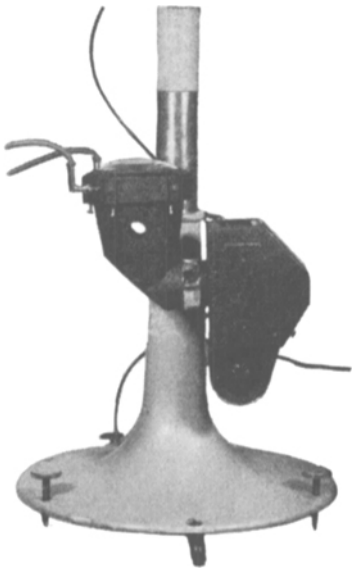

FIG. 2. Lamp house attached to base of stand, showing cooling fan and hose connection for water circulation.

A special lamp house clamped to the lower part of the stand has been developed into a medical spotlight (Fig. 2). The lamp house is positioned vertically because most projection lamps require a vertical filament position. The beam is directed through a condenser and concave mirror system to an internal plane mirror, which throws the beam upward and through a second lens system which produces the required directional spotlight effect. The lamp house is cooled by a revolving fan and the funnel-like middle piece has ample holes for ventilation. Under the

top lens is a waterholder to cool down the beam although in practice this is not really necessary, except when photographing inflamed tissues. The water can circulate through the reservoir, entering by one rubber hose and leaving by the other. The lamp is a standard 250-watt projection bulb with two plane filaments, and provides ample light for all purposes, even for slow-motion shots at 64 frames per second on supersensitive reversal material at a distance of about 2 meters from the stand with a stop of $f/2.8$.

The stand has a conventional pan and tilt tripod head for supporting the camera. A special device allows instantaneous attachment of the camera to the head by clamping, without screws, so that cameras may be changed in one second of time. Thus a loaded camera may be always held ready and put into place at

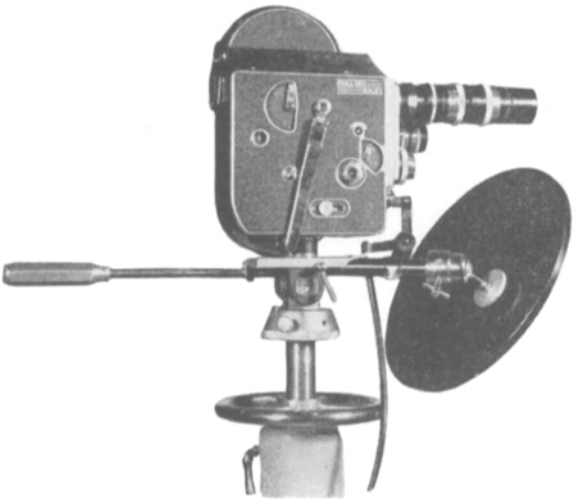

FIG. 3. Detail of camera, showing plane mirror for directing light on operation field.

the moment the one on the stand runs empty. There is always time, however, to rewind the taking camera upon the stand between phases of the operation. An electrical drive may, of course, be provided to permit shooting the full length of the 100-ft. reel, when required, without rewinding; but in practice this has never been found to be necessary, the 18-ft. run of the spring-drive having always been adequate. A wire release operated by means of a pedal allows the surgeon to make shots himself during an examination or an easy operation. Of course, he must have an assistant in any event.

The beam of the spot is directed to the operating field by a plane mirror fixed to the pan and tilt head (Fig. 3). This mirror can be moved and clamped in any desired direction by the universal ball-joint on its back. The area illuminated is checked in the view-finder, and the beam can be made fairly close to the optical axis of the lens, giving the best illumination for every purpose and the most ex-

cellent results when photographing cavities. Furthermore, as the mirror moves together with the camera when tilting or panning within reasonable limits (such as occur in work of this sort) the beam always follows the direction of the lens and illuminates the photographed area in all cases. The divergence of the beam has been calculated to have an angle of divergence of approximately 30 degrees so as to cover the field to its borders even with relatively generous angles of tilt and pan.

A Paillard Bolex 16-mm. camera was used, equipped with a special eyepiece for controlling the focus from the back. Also extension rings were used under the telephoto lens to make macro-shots from relatively great distances. The inside of the throat of a dog, for instance, filled the whole screen. The shot was made using an extension ring with a telephoto lens of 75-mm. focus from a distance of 1.5 meters.

As an example of the splendid results attained with this stand may be mentioned a slow-motion shot of vibrating vocal chords taken in the living throat Of course, the spotlight may be put out of use if not needed; for simple surgical shots two horizontal rod-holds are provided for two regular photoflood bulbs in standard reflectors on both sides of the camera. It is believed that cameramen using this stand for surgical shots will greatly enjoy the extraordinary facilities that its use makes possible.