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KOLLMORGEN PERISCOPE ADAPTATIONS FOR USE IN THE HIGH RADIATION LEVEL EXAMINATION LABORATORY AT THE OAK RIDGE NATIONAL LABORATORY

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ABSTRACT

Detailed designs are presented for inexpensive modifications to a Kollmorgen sealed hot-cell periscope to permit installation from the outside of the cell, simplify movement between viewing stations, and prevent motion of the optics during use. The modifications include a carefully prepared penetration of the cell wall, an O-ring sealed dome and sleeve assembly, and replacement of a counterweight with a simple brake shoe. Use of the modified instrument will permit periscope viewing at fifteen locations in the High Radiation Level Examination Laboratory with only four sets of optics.

INTRODUCTION

In designing the remote metallurgical examination facility at the Oak Ridge National Laboratory (ORNL),[1] it was desirable to augment with periscope optics the normal viewing through lead-glass windows. Since the Kollmorgen Optical Corporation has manufactured a periscope that has proven very satisfactory in such applications, this instrument was the obvious choice. As the number of hot-cell installations and the requirements for containment have increased, the Kollmorgen Corporation developed a protective or sealing dome as part of the optic train. Normally, this dome is mounted from the hot side to cover the in-cell end of the periscope penetration. Because the High Radiation Level Examination Laboratory (HRLEL) is a sealed alpha-gamma facility designed for no personnel entry,

[1] A. R. Olsen, "A New Postirradiation Examination Laboratory at the Oak Ridge National Laboratory," p 3 in Proceedings of the Ninth Conference on Hot Laboratories and Equipment, American Nuclear Society, Chicago, 1961.

it was necessary to provide some means of installing or replacing such a dome without access to the in-cell end of the penetration. Consequently, working with the engineers from the Kollmorgen organization, ORNL helped to devise a separate dome-supporting sleeve which, when inserted into a prepared penetration in the cell wall, provides a complete seal. In addition to the requirement for providing replaceable seal domes, there is an economic advantage to having the optical instruments themselves usable in more than one location. Sealing units were installed at all locations in the cell bank where a periscope would be needed and a limited number of instruments were purchased to be moved from one location to another to provide the periscope optics wherever desired. It was desirable to modify the counterbalance to reduce the amount of labor involved in transferring these units from one sleeve location to another and to reduce the space requirements for the counterbalancing device. A simple brake shoe was designed by ORNL and installed on each periscope to replace the counterweight normally provided. Although these design modifications were made several years ago and briefly reported,[2] it is apparent that the information about them has not been adequately disseminated. It is the purpose of this report to make known the modifications and their useful functions.

DESIGN FEATURES

The HRLEL is provided with thirteen operating cells, two of which are located at corners. As a consequence of this arrangement, there are fifteen windows, each provided with penetrations for sealed Model A master-slave manipulators. In arranging for periscope viewing, a simple, straight, cylindrical penetration pipe was also installed adjacent to each window. Since the HRLEL is an alpha-gamma facility and the containment is obtained through complete stainless steel lining of the in-cell walls, the penetration assembly was made of stainless steel and welded to this liner. Figure 1 shows the detailed design. A centrifugal

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[2] Technical Function and Operation of the High Radiation Level Examination Laboratory, Bldg. 3525, ORNL CF-61-1-75, Rev. 1 (Jan. 31, 1961) pp 19–21.

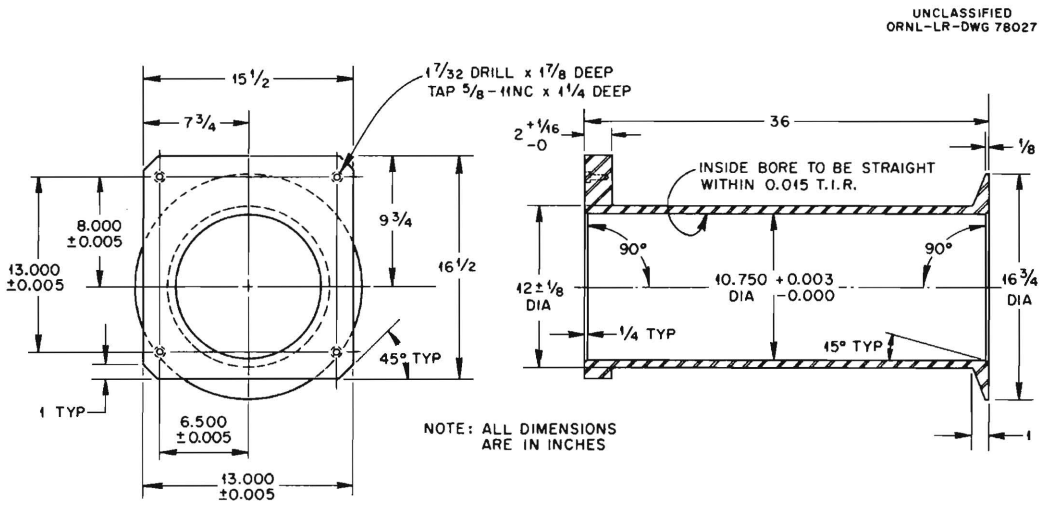

Fig. 1. Periscope Sleeve Penetration Detailed Design.

casting with flange plates welded to each end was used in fabricating these units. The inside diameter was machined to 10.750 in. with a diametral tolerance of $^{+0.005}_{-0.000}$ in. and a 32 rms finish suitable for O-ring seals after attachment of the end flanges. The cold- or operating-end flange was 2 in. thick and provided with the bolt holes necessary for attachment of the periscope seal-sleeve assembly. The hot-end flange separated the field welding from the machined bore to reduce the possibility of heat-promoted distortion.

Figure 2 is a photograph of the periscope seal-sleeve assembly ready for installation in one of the above penetrations. The O-rings around the sleeve provide a gas-tight seal with the penetration. Since the dome is sealed to the sleeve, the installed sleeve provides gas-tight containment. Detailed design drawings of this periscope sleeve are available from the Kollmorgen Corporation, Drawing No. H-10532, "Sealing Dome and Sleeve Assembly Model 301-40-D Wall Periscope." When the seal sleeve is installed in the previously described penetration, the friction between the O-rings and the penetration is sufficient to prevent the rotation of the dome and sleeve assembly in normal use. A slight relaxation of the interference tolerance would be desirable to permit easier rotation for locations where viewing well above the normal penetration height is required. This will not be needed in the HRLEL. The cold-end assembly of the sleeve is designed to prevent its being pulled into the cell or pushed out of the penetration, and yet permit rotation of the dome and sleeve assembly within the penetration. In some installations, rotation would be required because the optics of the dome restrict the undistorted view to a relatively narrow angular viewing band. Normally, this restriction does not interfere with routine operations. In an installation where easy rotation of the periscope seal sleeve is required, a rotation lock is needed but would not be difficult to provide. The arm installed on the operating end to be used to rotate the sleeve could be fitted with a lock to prevent unwanted rotation. In the HRLEL, the resistance to rotation afforded by the degree of interference on the O-rings of the seal sleeve eliminates the need for such a lock when the brake shoe described in this report is used.

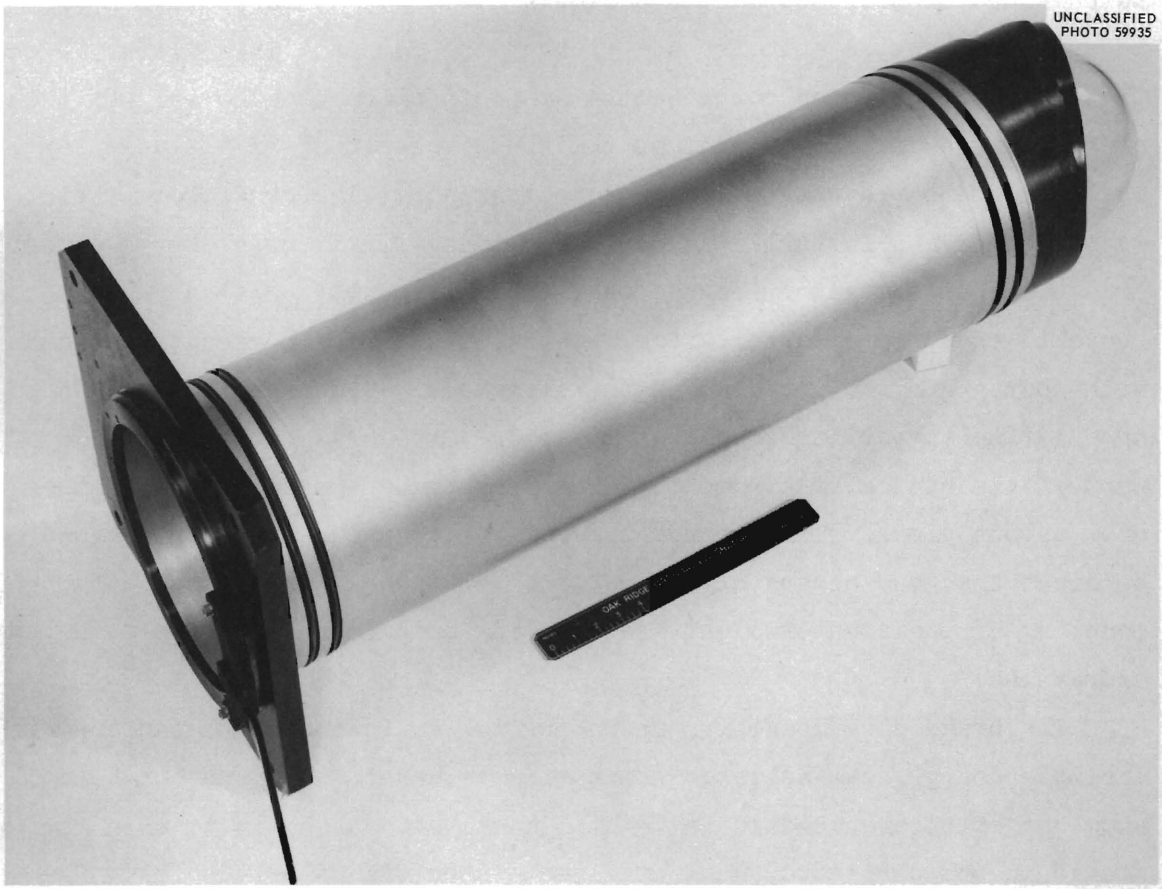

Fig. 2. Kollmorgen Periscope Seal-Sleeve Assembly Ready for Installation.

Perhaps the most useful modification is the brake shoe. Figure 3 shows a normal installation utilizing the 75-lb counterweight, which is commonly provided as an extra by the Kollmorgen Corporation. When mounted to the scope, this counterweight describes an arc of approximately 21-in. radius about the pivot point. No items may be attached to the cell wall in the area covered by this movement. The counterweight has been adjusted to balance the microscope with a camera attached; and it requires re-adjustment when the unit is used without the camera. In addition, because the counterweight does not lock the scope in place, the normal manipulation of the camera causes movement of the scope, resulting in the need for realignment to prevent taking poor photographs. The brake lock, which was designed and installed at ORNL, provides within the scope-penetration area a mechanism that frees the wall above the unit and firmly locks the scope in any desired orientation, so that the normal movements associated with photography do not disturb the alignment. Since it is attached to an existing supporting flange on the scope, the brake shoe becomes a part of the optical instrument and can easily be transported with the unit as one piece. This is not true of the counterbalance, which must be disengaged and separately transported. Disengaging, dismounting, and mounting of the counterweight are awkward, dangerous, and time-consuming operations.

The brake-shoe assembly, shown in Fig. 4, in its completed form is a simple design, cam-actuated and spring-released. The two hex-head shoulder bolts are used to fasten the brake-shoe assembly to an existing flange on the periscope, utilizing two of the flange bolt holes. The shoulder bolts support the fixed plates and thus the cam shaft. Rotation of the cam forces the movable shoe out against the inside of the periscope seal sleeve. When the cam is returned to the unlock position, internal springs retract the movable shoe. Figures 5 and 6 are detailed drawings of the components of this simple brake. It should be noted that this design is specific for those installations that use the same seal-sleeve as the HRLEL. However, since development of this device, the Kollmorgen Corporation has started manufacture of a similar brake shoe, for use in installations not involving the seal-sleeve concept, at the request of hot-cell operators from other installations who have seen the units

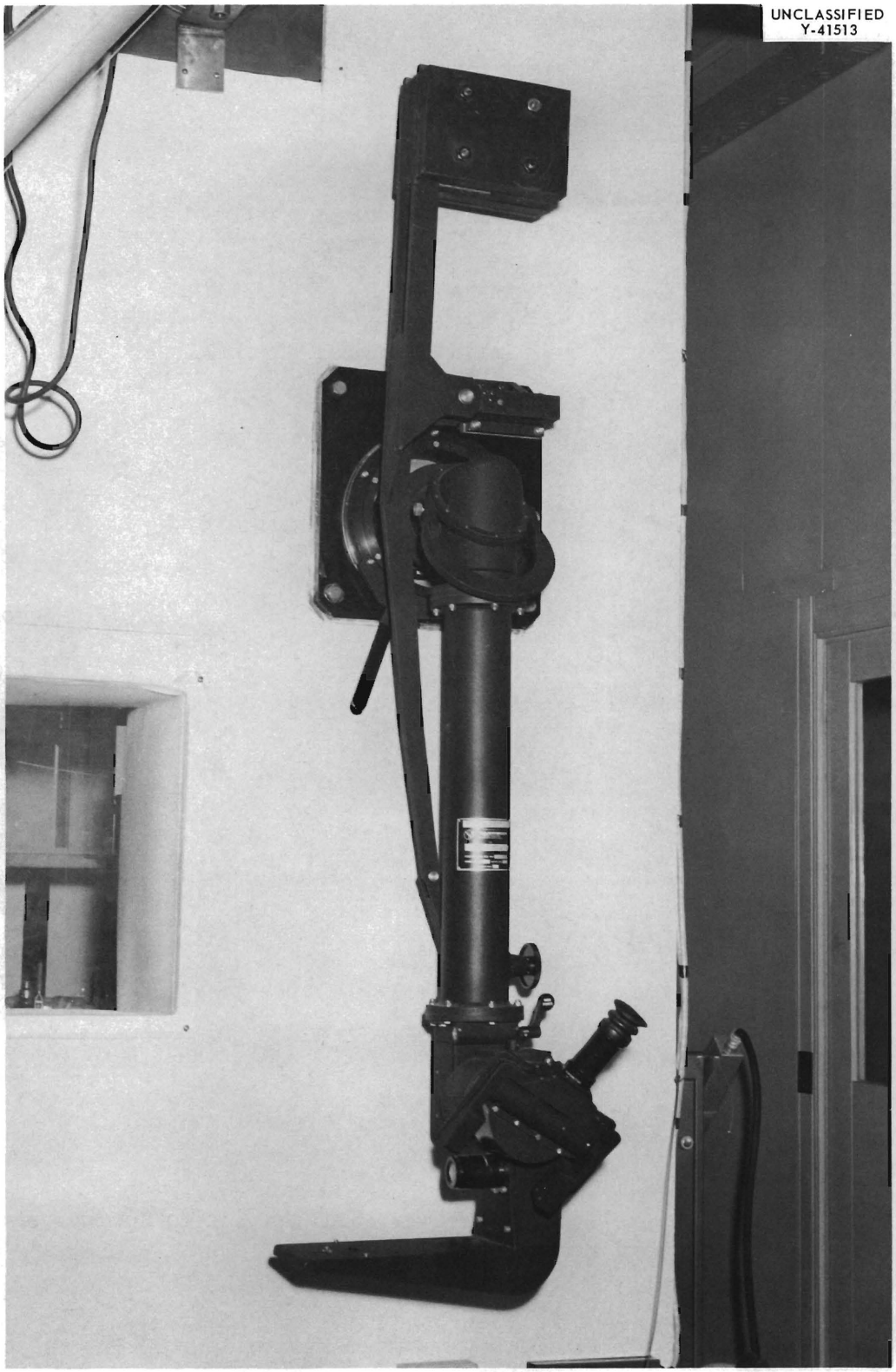

Fig. 3. Periscope Installation Using a Counterweight—HRLEL Mockup.

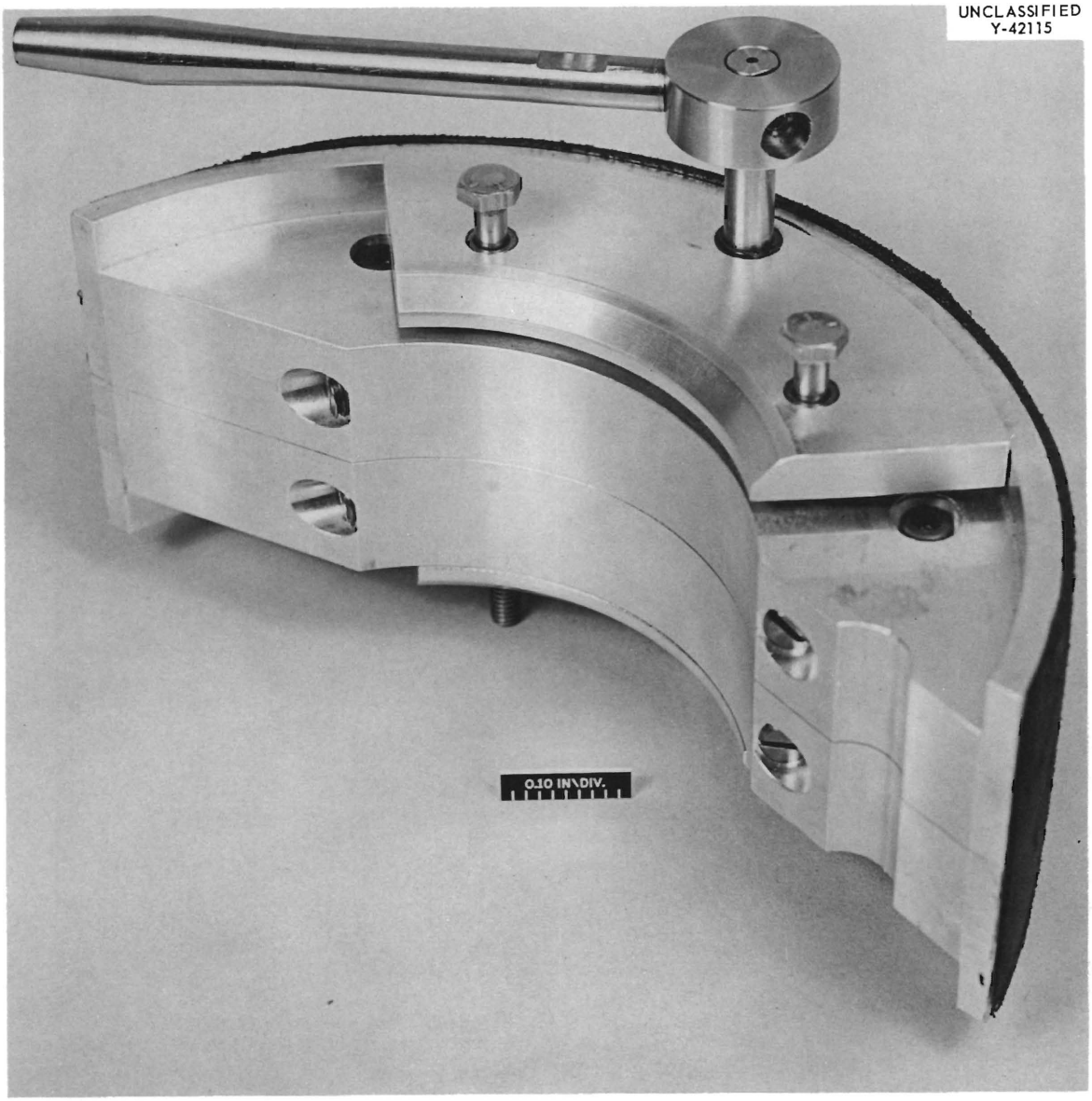

Fig. 4. Brake-Shoe Assembly for Attachment to Kollmorgen Model 301-40-D Wall Periscope.

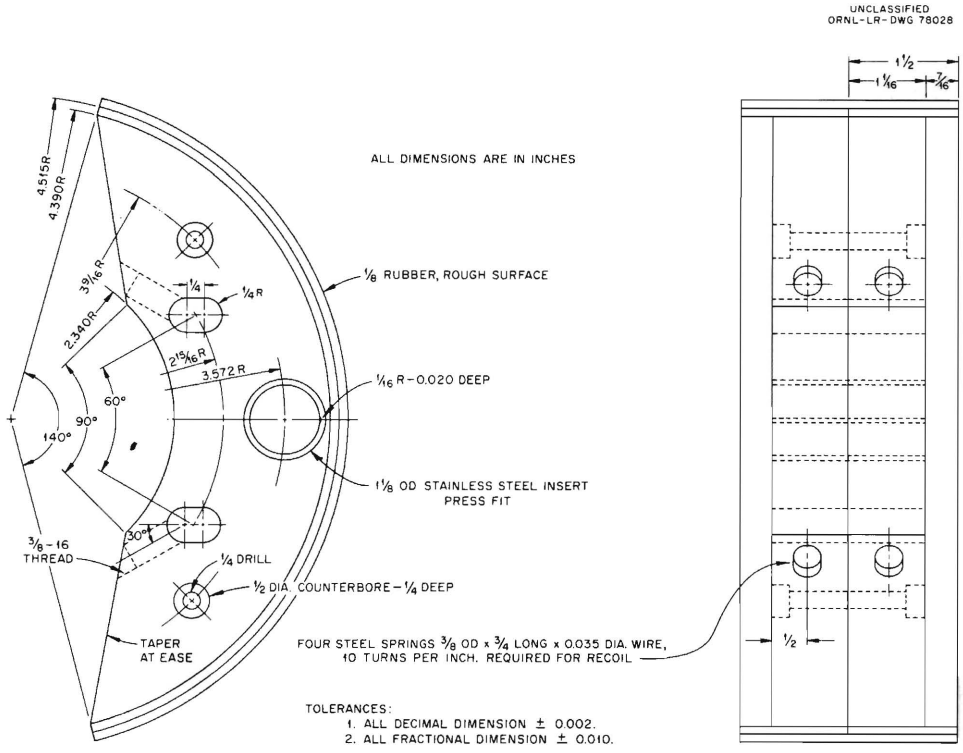

Fig. 5. Detailed Drawing of the Kollmorgen Brake Shoe.

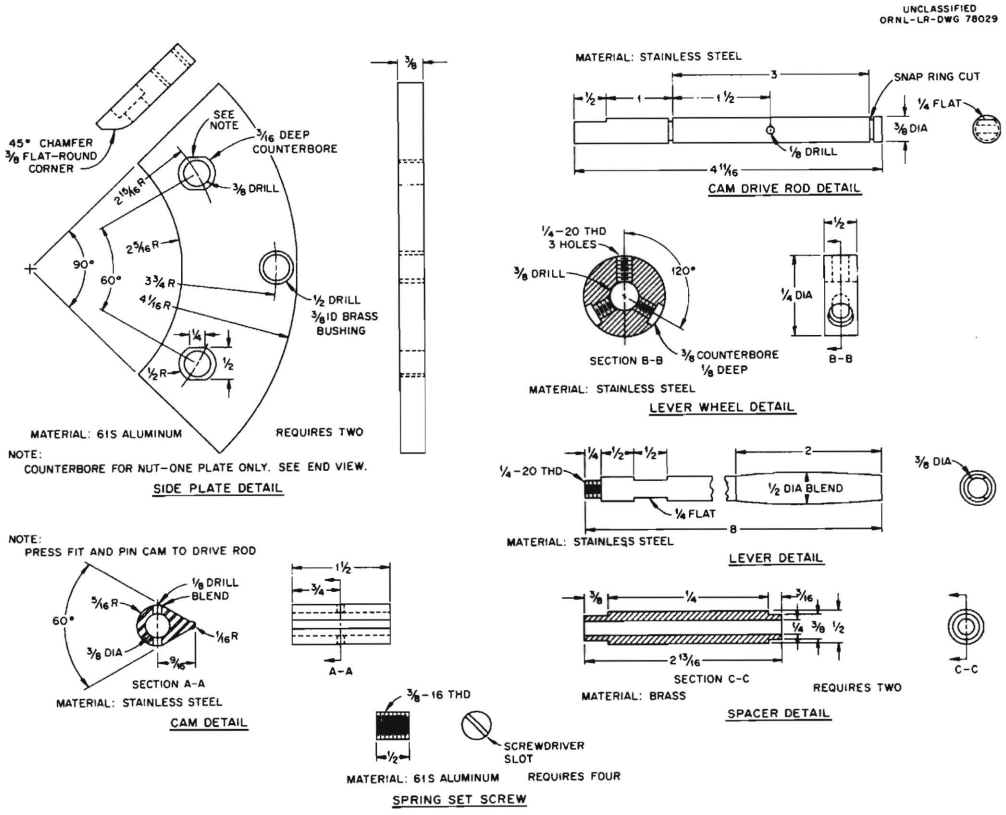

Fig. 6. The Kollmorgen Brake Shoe Shown in Detail.

described here. Figure 7 shows a brake shoe installed on an optical unit partly retracted from the seal-sleeve in the HRLEL Mockup facility. Figure 8 shows a closeup of the brake shoe in operation in the seal sleeve.

One of these seal-sleeve brake-shoe combinations has been installed and in use on the HRLEL Mockup for the past three years. A second unit has been installed and in use for approximately two years in Cell No. 6 of Building 3025, a prototype sealed cell of the HRLEL concept. In both cases, the fixed location, locking, and nonmovement during photographic operations have resulted in easier operation, considerable time savings, and more reliable photography. Currently, a modification to the design is being considered to provide two brake shoes operating on opposite sides of the periscope to preclude any possible mechanical strain on the periscope.

CONCLUSION

Utilizing an existing periscope and seal-dome combination, simplified installation has resulted from minor modifications to the means of mounting the seal dome and the replacement of a standard counterweight device with a simple brake shoe. These two simple modifications have made available periscope viewing at fifteen different locations around a bank of sealed hot cells, using only four optical units and never interrupting the containment. The optical units can be quickly and economically moved from one location to another as the use demands. No basic changes have been made in the proven optical device. In addition, the fabrication and installation of the brake shoe are actually less expensive than the purchase and installation of the counterweight device used in the past.

ACKNOWLEDGMENTS

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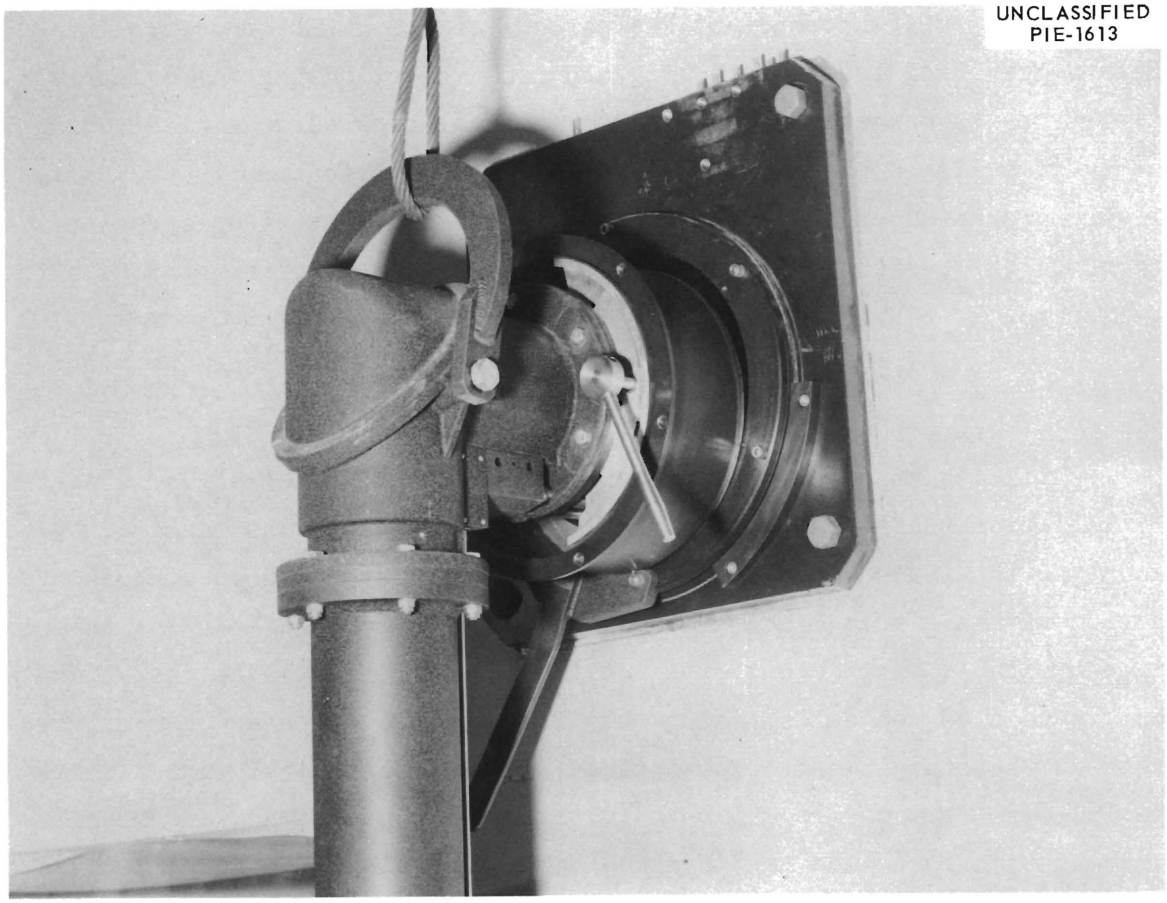

Fig. 7. Periscope with Attached Brake Shoe Partially Withdrawn from Seal-Sleeve in Normal Transfer Operation.

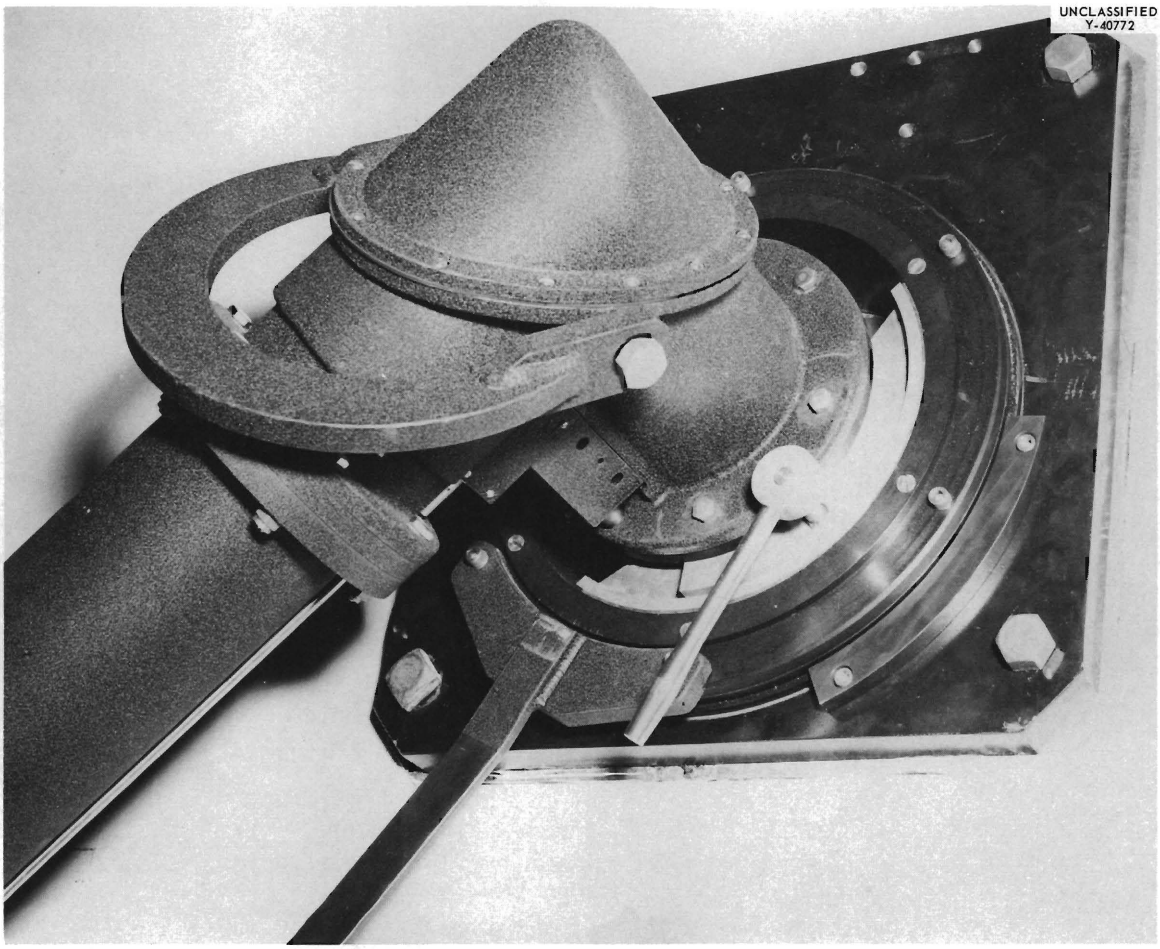

Fig. 8. Closeup View of the Periscope Brake Shoe Locking the Scope in a Nonvertical Orientation.

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