The planning of the comprehensive program of physiographic-stratigraphic-structural researches now being carried forward in the Red Lodge region is being led by a volunteer committee consisting of Professors W. H. Bucher, R. T. Chamberlin, N. M. Fenneman, D. W. Johnson and the writers, W. T. Thom also serving as executive secretary responsible for the administration of the project.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

VOICE TRANSMISSION ON A BEAM OF LIGHT

DURING the past months there have appeared several popular articles on the transmission of speech and music over a beam of light. These papers did not give the details. It is presumed that neon tubes and photoelectric cells were used.

Recently the author has set up a demonstration experiment using an ordinary direct current arc lamp and a photronic cell, or a photoelectric cell. This experiment worked so well it is thought that a somewhat detailed description might be of general interest.

This experiment was one of Indiana University's demonstrations at the State Fair. The operators say the experiment was the one demonstration which did not fail them during the week.

The set-up of the apparatus is shown in the diagram, Fig. 1. In this diagram the microphone, M, is

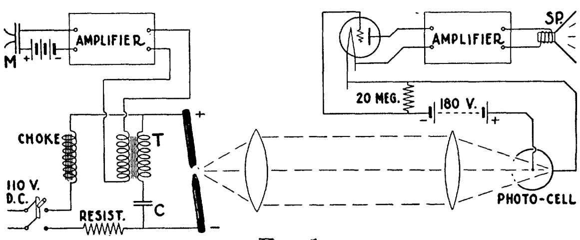

FIG. 1

connected to a two-stage microphone amplifier. The amplifier is connected to the transformer, T, which is an ordinary low impedance output transformer such as is used in connecting a tube to a dynamic speaker. The transformer, T, is connected across the terminals of the arc lamp through a four microfarad condenser, C. A large choke coil is placed in the D. C. supply line. This choke coil prevents the voice frequency being absorbed by the power line.

The diagram shows the receiving photoelectric cell connected to a resistance coupled amplifier. There should be two stages of resistance amplification and then two or three stages of transformer coupled amplification. The amplifier is then connected to a loud speaker.

It will be apparent that the exact connections will depend upon the amplifiers and speaker available.

The arc used was an old-fashioned arc projection lantern. This was focused so as to give a parallel beam of light. The parallel beam of light was focused on the light cell by means of a large reading glass.

Instead of the photoelectric cell a Weston photronic cell can be used. The photronic cell gives practically the same results with a stage or two less amplification in the amplifier. In the figure the photronic cell should be connected directly to the amplifier.

In the place of the microphone and the microphone battery a pick-up unit can be substituted and music from an ordinary record can be transmitted.

The connections of the arc lamp are the connections for a speaking arc. If the arc is working well one should hear the arc "talk" in a quiet room.

It is found that hard carbons give better results than the usual soft-cored carbons.

This set-up makes a striking experiment in a large darkened room where the length of the parallel beam is long, especially if there is enough dust in the air to make the path of the beam visible. Any object interposed in the beam causes the music to cease.

The early experiments involved in the above demonstration are:

Alexander Graham Bell[1] transmitted sound over a light beam from a mirror fastened to a membrane which was stretched over the end of a tube. By speaking into the tube the membrane was caused to vibrate. Then the light was reflected to a selenium cell. The variation of the light caused a variation of the resistance of the cell and this caused a reproduction of the sound in a receiving telephone.

Some thirty years ago it was found that an ordinary arc light could be made to talk if a microphone was connected properly across the arc. It seems that Bell and Hays in America and Simon in Germany discovered the speaking arc independently in 1897.

G. G. Blake[2] used an arc lamp and head phone.

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A UNIVERSAL STAGE FOR OPAQUE OBJECTS

THE difficulties involved in manipulating small opaque objects under the microscope have led to the

[1] *Am. Jour. Sci.*, p. 305, Series 3, Vol. 20, 1880.
[2] Exp. Wireless, p. 561, 2, 1925.

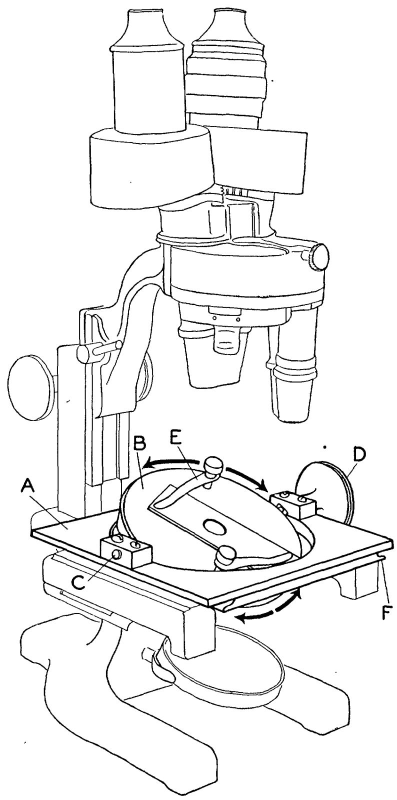
development of various devices and techniques for this purpose. This is especially true in the study of micro-fossils, where the number of specimens handled is often large. The means of obtaining different orientations vary all the way from successively gluing the specimen in different positions on the slide to complicated ball-and-socket devices. The former method often results in broken or lost specimens, while most of the mechanical devices are limited in range of movement or control.

Having these difficulties in mind I designed and built a stage which solves most of the problems encountered in this type of micro-manipulation. This stage rotates, and at the same time the axis of rotation may be tilted at any angle up to 90°, in a plane perpendicular to that of the objectives. This allows the specimen to be viewed from all sides (except that applied to the slide), at any given angle. The effect is to combine universal movement with a high degree of control.

In the accompanying figure the stage is shown in place on a binocular microscope. It consists essentially of a square stage base (A), which replaces the glass stage of the microscope, and a tilting, revolving stage (B), which is supported by the stage base. The stage proper consists of an upper and a lower disk, the upper rotating about an axis fixed in the lower. The lower disk is attached to the stage base by means of the offset shaft (C). This shaft is rotated by the wheel (D), so that the stage as a whole revolves about an axis which passes just above the surface of the slide and lies in the plane of the objectives. The slide is held in place by clips (E).

The whole mechanism is easily attached to the microscope by means of flanges (F), which slide into the grooves provided for the regular glass stage. The front and rear of the stage are interchangeable, so that the wheel (D) may be placed on either the right or the left side. In either position the axis of rotation passes through the center of the field when the back of the stage base rests against the vertical supporting pillar of the microscope.

This stage is most useful in studying or drawing small opaque objects. By changing the orientation and angle of illumination it is often possible to bring out quite sharply suture lines or surface ornamentation which otherwise would have been obscure or invisible. Then, too, the specimen can be quickly and easily turned to any desired position for drawing or



measuring. This is especially convenient when making drawings of Foraminifera, where three views at right angles are usually desired. In fact, we have found the stage most useful wherever rapid controlled orientation has been an important factor.

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SPECIAL ARTICLES

MAMMALIAN LIFE WITHOUT RED BLOOD CORPUSCLES

IN certain invertebrate animals hemoglobin occurs in solution in the circulating blood, where it functions not only to transport the oxygen but to maintain a colloidal osmotic pressure. In all vertebrates hemoglobin normally occurs only within red blood corpuscles, and other proteins have been developed in the plasma to furnish the necessary colloidal components. It has been widely assumed that, in the vertebrates, hemoglobin is incapable of performing its respiratory function when outside of the red blood corpuscles.

We have recently found this assumption to be incorrect, at least in so far as the chemical behavior of the hemoglobin itself is concerned. A "hemoglobin-Ringer" may be prepared, in which hemolyzed mammalian red blood cells have been added to ordinary