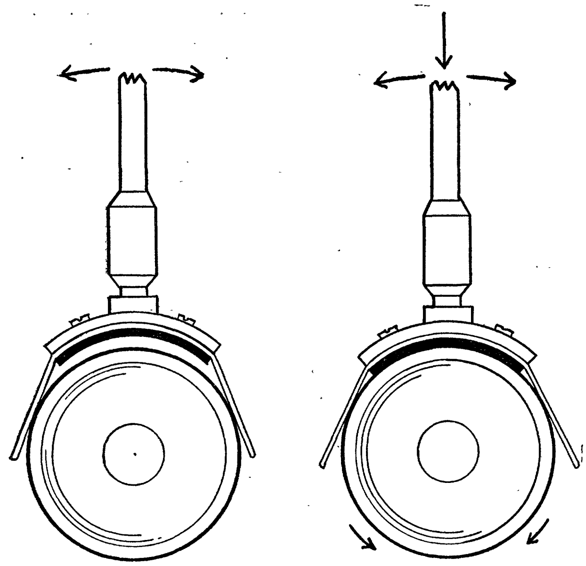

FIG. 3

band retains its flexibility and is tangent to the hand-adjustment control upon which it rests (Fig. 3, left). When the apparatus is in this position the friction between it and the hand adjustment is not sufficient to cause an active engagement, provided the tension on the pinion of the hand adjustment is properly regulated.

The apparatus is brought into use by first exerting a slight downward pressure on the chin rest. The lining of each band is thus brought into effective contact with the hand adjustment mechanism. The focus is then corrected by a second movement of the chin in the proper direction (Fig. 3, right). By a succession of such movements the focus of the microscope can be raised or lowered rapidly through any required amplitude. When not in use the lever may either be pushed forward to rest against the body of the microscope or lifted off the instrument.

For assembling the apparatus illustrated two lens holders of a brass construction furnished the greater part of the material. Their handles were soldered together end to end and bent to form an arched lever arm spanning the hand-adjustment controls. An ordinary rubber furniture coaster was then mounted on a metal plate and attached to this arm by means of an adjustable screw (Fig. 2). The flexible metal band forming the body or lens receptacle of each holder was adapted to fit over the hand adjustment in the manner described (Fig. 3).

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AN EXPERIMENTAL MICRO-DRILL

A PERFECTED technique of working on polished surfaces under the microscope is acquired only with practice, but even the experienced worker often has difficulty in scratching, or obtaining material for a microchemical test from some of the harder minerals such as arsenopyrite (hardness 5.5–6) or others in the group listed as hard minerals by Short.[1]

During the past two years of work with polished surfaces, the writer has been experimenting with a small, electrically powered drill for use on polished surfaces. Some practice is necessary to become a skilful operator of the instrument, but in the writer's opinion, the results obtained are well worth the time spent in developing the proper technique.

When a particularly small area of hard mineral surface is under observation, a sewing needle ordinarily is used as a scoring medium. However, a needle strong enough to score the mineral without breaking usually is so large that it is cumbersome and can not be readily controlled. The problem of obtaining a portion of the hard mineral for microchemical purposes can be overcome by use of the micro-drill which is herein described.

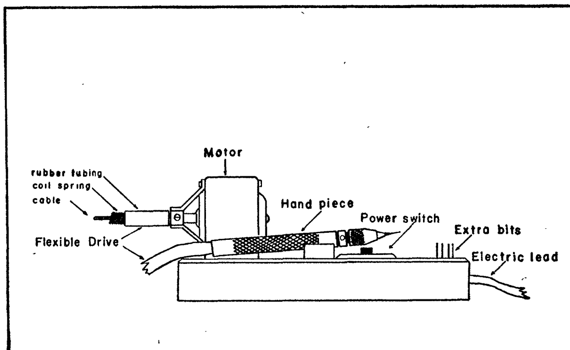

FIG. 1. Micro-drill. The flexible drive assembly interrupted to show construction.

The micro-drill (Fig. 1) consists of a motor mounted on a wooden base $9\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1\frac{1}{2}''$, a flexible shaft connected to the motor at one end and to a hand-piece and chuck-drive arrangement at the other, and a chuck to hold the cutting tool. The base also contains the power switch, clamp for the drill and space for a variety of drill bits.

The motor is small, similar to the type used on electric fans. It is manufactured by the F. H. Smith Mfg. Co., New York City, and is rated at 40 watts with speed of 3,400 r.p.m.

[1] N. M. Short, "Microchemical Determination of the Ore Minerals," *U.S.G.S. Bulletin* 914, 2nd ed., pp. 110–111, 1940.

As the instrument is small, some difficulty was experienced in obtaining a lightweight, flexible shaft. After a number of unsuccessful attempts, a suitable shaft was constructed and is described as follows: The shaft-housing is a 24″ length of nickel-plated, curtain rod, coil-spring having an outside diameter of 3/16″ and an inside diameter of ⅛″. One fourth inch rubber tubing forms the outer covering of the drive assembly. The cable, or actual driving part of the shaft, was obtained by unwinding the two outer layers of the flexible cable-drive of a discarded hair clipper. A 3/32″ cable which fitted freely into the housing thus was obtained. One end of the assembled drive was then anchored to the motor shaft by brass fittings, while the other end was fitted into a hand-piece and drive attachment for the chuck.

The chuck (Fig. 2) is a split jaw type and screws onto the drive fittings at the free end of the flexible shaft. By changing the jaws of the chuck, either needles or dental burs may be used.

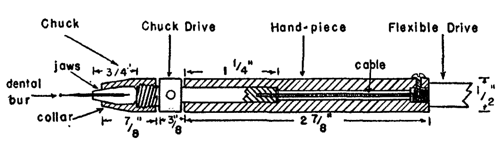

FIG. 2. Chuck and hand-piece. Section showing detail of chuck construction, chuck drive assembly and method of anchoring flexible drive.

Ordinarily, dental excavating burs are used for drill bits; however, sewing needles or abrasive dental points may be substituted as the need arises. The cutting tool which can be used most satisfactorily for any given test is dependent not only on the size and hardness of the mineral particle but also on the skill of the operator. The smallest standard dental bur is 800 microns or 0.8 millimeter in diameter, and as the cutting heads of the burs are spherical, the smallest, serviceable cutting area is 50–70 microns. Unless extremely small areas are being studied, standard excavating dental burs make the most efficient cutting tool. For very hard metallic minerals or hard gangue minerals, abrasive dental points may be required. The smallest, standard abrasive points are from 2–3 millimeters in diameter and must be dressed or worked down to usable size. The dental burs and abrasive points used were manufactured by the S. S. White Dental Mfg. Co., Philadelphia, Pa., and are listed in their general catalogue for 1943 on pages 63, 64 and 66.

Care must be taken to avoid injury to the objective lens of the microscope while the micro-drill is being used. If abrasive dental points are being used as cutting tools, extreme caution must be exercised. The short-mounted Bausch and Lomb 16-millimeter, Spencer 18-millimeter or Leitz No. 3 objectives, all have sufficient working distance between the lens and specimen; objective lenses of higher magnification focus too closely to the specimen for easy manipulation of the cutting tool.

Although the drill was developed originally for use on the harder minerals, it is also useful on the softer ones. Usually, one brief touch of the cutting tool to the surface of a soft mineral will produce an abundance of powder for microchemical tests. The harder minerals require slightly more pressure and time for a quantity of cuttings to accumulate.

The ore minerals are, on the whole, quite heavy, thus the cuttings pile up near the bit and can be readily collected and transferred to a glass slide. The transfer may be accomplished by the method recommended by Short[2] or they may be brushed from the specimen onto the glass slide with a small, soft brush.

The instrument, with suitable points, can be used for the index-marking of thin sections, hand specimens or metal objects.

The experimental micro-drill works well, but the present design has some minor defects. The writer, in cooperation with Mr. Roy Kayler, Machine Shop Foreman, General Maintenance Shops of the University of Idaho, is working on an improved design. The new model will have ball-bearing joints and a smaller and improved chuck.

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[2] N. M. Short, *U.S.G.S. Bulletin* No. 914, 2nd ed., pp. 176–177, 1940.

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