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AN INSTRUMENT FOR CLEANING SMALL FOSSILS

BY

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CONTENTS

INTRODUCTION

THE instrument described in this paper has been used successfully for removing particles of adhering rock matrix from the surface of small fossils (about one to ten millimeters in diameter). It has been particularly advantageous in cleaning ostracods and charophytes.

In paleontology it is essential that as much as possible be learned from the specimens, whatever their preservation. Many of them have structures so obscured by particles of the rock in which they were embedded that classification cannot be made with certainty. The washing and chemical treatment necessary to dislodge the particles from some specimens may have to be so severe that it will abrade or corrode them in the process. From the surfaces of such specimens the particles must be scraped, scratched, gouged, chipped, plowed, scoured, pulverized, or dug. Most workers do not possess enough dexterity to clean microfossils by manipulating small implements with the hand alone. With very little practice, however, a worker can operate this instrument and clean small specimens satisfactorily.

The author expresses his appreciation to Mr. William H. Buettner for helpful suggestions on construction of the instrument and to Dr. Chester A. Arnold, Dr. George M. Ehlers, and Dr. Lewis B. Kellum for their criticism of this paper. He also thanks the American Optical Company for permission to illustrate the Spencer microscope in the plates.

STRUCTURE OF THE INSTRUMENT

The instrument is designed so that movements of a needle can be mechanically controlled while seen through a binocular microscope. The three principal parts of the instrument are (1) a rigid base, (2) a series of three control units arranged to produce movement in three directions, and (3) a pantograph to reduce the amplitude of this movement as imparted to the tip of a needle. Each control unit consists of a mounting, rack, pinion, rod, and knob. The orientation of the three mountings permits the tip of the needle to be applied to any point on the surface of the specimen by the three control units or to be moved forward and backward, left and right, or up and down by one of the series of control units. Because the instrument can be restricted to linear movement only, it is especially useful in cleaning matrix from long sulci or grooves.

The base of the instrument is a thin rectangular board, approximately 10 by 12 inches (Pl. I). A block attached to its rear left part forms a dais to support a binocular microscope (Pl. II, Figs. 3, 5, 6). A sheet-metal platform is set above the dais with enough clearance to accommodate the base of the microscope (Pl. I). The sides of the platform are bent down and fastened to the dais (Pl. II, Fig. 2). Near the center of the platform a small block is mounted. A cardboard microscope slide with the specimen to be cleaned is held on this small block by a clamp made of heavy aluminum plate and four bolts with wing nuts (Pl. I). When the wing nuts are tightened, the plate is held firmly against the top of the slide. The specimen can be seen through a hole in the plate (Pl. II, Fig. 4). Specimens can be quickly placed in position or removed by tightening or loosening the clamp. On the back part of the platform is a turntable to which the pantograph is pivoted (Pl. I). The turntable consists of two circular discs and an S-shaped strip of metal. The lower disc is perforated with seven holes, a small one at the center and six larger ones equally spaced near its periphery; the six large holes control the positions of six small ball bearings. The upper disc rests on the ball bearings. The S-shaped strip has a small hole near each end, with one hole immediately above the other. A small bolt passes through the lower hole of the S-shaped strip, the two discs, and the platform. The turntable is free to rotate in a horizontal plane. A small bolt passes through the upper hole of the S-shaped strip and the lower rear end of the pantograph to form a pivot.

The series of three control units is connected to the pantograph at the upper end of the rack of the vertical-control unit (Pl. I). This rack can be moved up or down through the mounting of its unit by a turn of the vertical-control knob. The knob is fastened to the end of a short steel rod that passes through a pinion. The teeth of the pinion are meshed with those of the rack. The entire vertical-control unit is movable relative to the base of the instrument. It is attached, at the lower end of its mounting, to the left end of the rack of the lateral-control unit. The vertical-control unit is maintained in an upright position on its base at all times by a flat strip of metal projecting to the front and back (Pl. II, Fig. 6). Each end of the strip is curved up like the front of a toboggan (Pl. II, Fig. 1), so that the unit slides smoothly on the base.

The lateral-control unit resembles the vertical-control unit in consisting of a mounting, rack, pinion, rod, and control knob and in being movable on the base of the instrument, but it differs in having the rack horizontal instead of vertical. The mounting is made of an outer three-sided trough, which fits against the sides and bottom of the rack, and an inner narrower and shorter three-sided trough which fits against the top of the rack (Pl. II, Figs, 1, 4). The left end of the rack is attached to the mountings of the vertical-control unit (Pl. II, Fig. 4). When the lateral-control knob is turned, both the lateral-control rack and the entire vertical-control unit are displaced to the right or left. The mounting of the lateral-control unit is attached to the front end of the forward-control rack.

The forward-control unit is similar to the other two. Its rack is horizontal and at right angles to that of the lateral-control unit. The front end of the rack is attached to the mounting of the lateral-control unit. When the forward-control knob is turned, both the lateral-control unit and the vertical-control unit are moved forward or backward. The mounting of the forward-control unit is bolted to the base of the instrument.

The pantograph is made of two horizontal bars and three pairs of vertical bars joined together by small bolts at six pivots (Pl. II, Figs. 1, 6). The arrangement is like that in an artist's pantograph or in a draftsman's space divider; movements at one end are reproduced on a smaller scale at another point. The same principle was used in the Labgear-Harding microdissector by Harding and Washtell (1950, pp. 89–92). A third pair of vertical bars, however, was added to the instrument here described to produce smoother operation. The pantograph is pivoted to the turntable on the platform by a small bolt, which passes through holes in the lower parts of the rear pair of vertical bars and in the upper part of the S-shaped strip of metal (Pl. II, Fig. 2). The pantograph is held at an angle of about 75 degrees to the base at all times, but can be rotated on the turntable to other positions and at any position can be raised or lowered on its rear pivot. The needle used for cleaning specimens is clamped in a simple vise between the lower ends of the middle pair of vertical bars by small bolts. At the front end of the pantograph is a device to maintain it at the proper angle to the base and yet permit it to be moved in all directions by the control units. The device consists of a short bent rod with two short bars bolted to its sides to form a yoke. The arms of the yoke fit on the sides of the long bar of the pantograph at a pivot, and the lower end of the bent rod fits into a cylinder drilled in the top end of the rack of the vertical-control unit.

The pantograph bars are spaced so that the lateral and vertical movements applied by the control units are reduced at the tip of the needle by a ratio of about 15/1. The reduction of the forward movement depends upon the position of the tip of the needle. If the needle extends as far as the lower rear pivot, its tip will remain at the same point for all forward or backward movement. By shifting the needle in or out within the vise, the movement applied by the forward control unit can be changed from about 10/1 to more than 1000/1.

Most of the instrument is made of materials readily available. The base is masonite, the dais is hardwood, and the platform is galvanized iron; all are painted with white enamel. The mountings of the control units are heavy galvanized iron coated with chromate primer and white enamel. The plate of the slide clamp and the two discs of the turntable are heavy sheet aluminum. The bars of the pantograph and the S-shaped strip are Monel metal. The racks, pinions, and knobs are brass. The pinions are connected to the knobs by short steel rods. The instrument is mostly assembled with 1/72-inch brass bolts. The slide clamp is fitted with stove bolts and wing nuts.

OPERATION OF THE INSTRUMENT

The specimen is attached to the removable slide with gum tragacanth. The pantograph can be lifted free at its front and tilted back to facilitate mounting of the slide. The slide is inserted below the aluminum plate of the slide clamp, the specimen centered in the field of view of the microscope, and the wing nuts tightened. If there are sulci to be cleaned, the slide is adjusted so that they are aligned in the direction of movement of either the lateral- or forward-control units. The rack of the vertical-control unit is raised and the pantograph placed in position. The rack is lowered slowly until, as seen through the microscope, the tip of the needle rests on the spot to be cleaned.

Most specimens, such as those with shale matrix, are best cleaned by a number of strokes of very small amplitude. Silicified specimens with quartz grains cemented to them by siliceous cement are more difficult to clean; the grains can best be dislodged by steady pressure.

The needle to be used is selected according to the configuration and composition of the specimens. The end of the needle may be left pointed or made into a gouge or chisel. Needles are sharpened with a fine oilstone. Brass needles are generally more satisfactory for calcareous specimens than steel, because they have less spring. Steel needles are preferable for siliceous specimens.

The pivots of the pantograph should be loose enough to prevent twisting or sticking under stress and tight enough to eliminate wobble. They can be adjusted by the bolts through them. The bottoms of the lateral- and vertical-control mountings should be polished with fine sandpaper and emery cloth to slide smoothly over the base. If a chattering is produced by friction, it can be eliminated by a small application of talc or graphite.

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HARDING, J. P., and WASHTELL, C. C. H. 1950. The Labgear-Harding Micro-Dissector. Journ. Quekett Microscopical Club, Ser. 4, Vol. 3, No. 2, pp. 89–92, 1 text fig.

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EXPLANATION OF PLATE I

Cleaning instrument, with a binocular microscope in position, as seen in a left rear view. Approximately × ½.

PLATE I

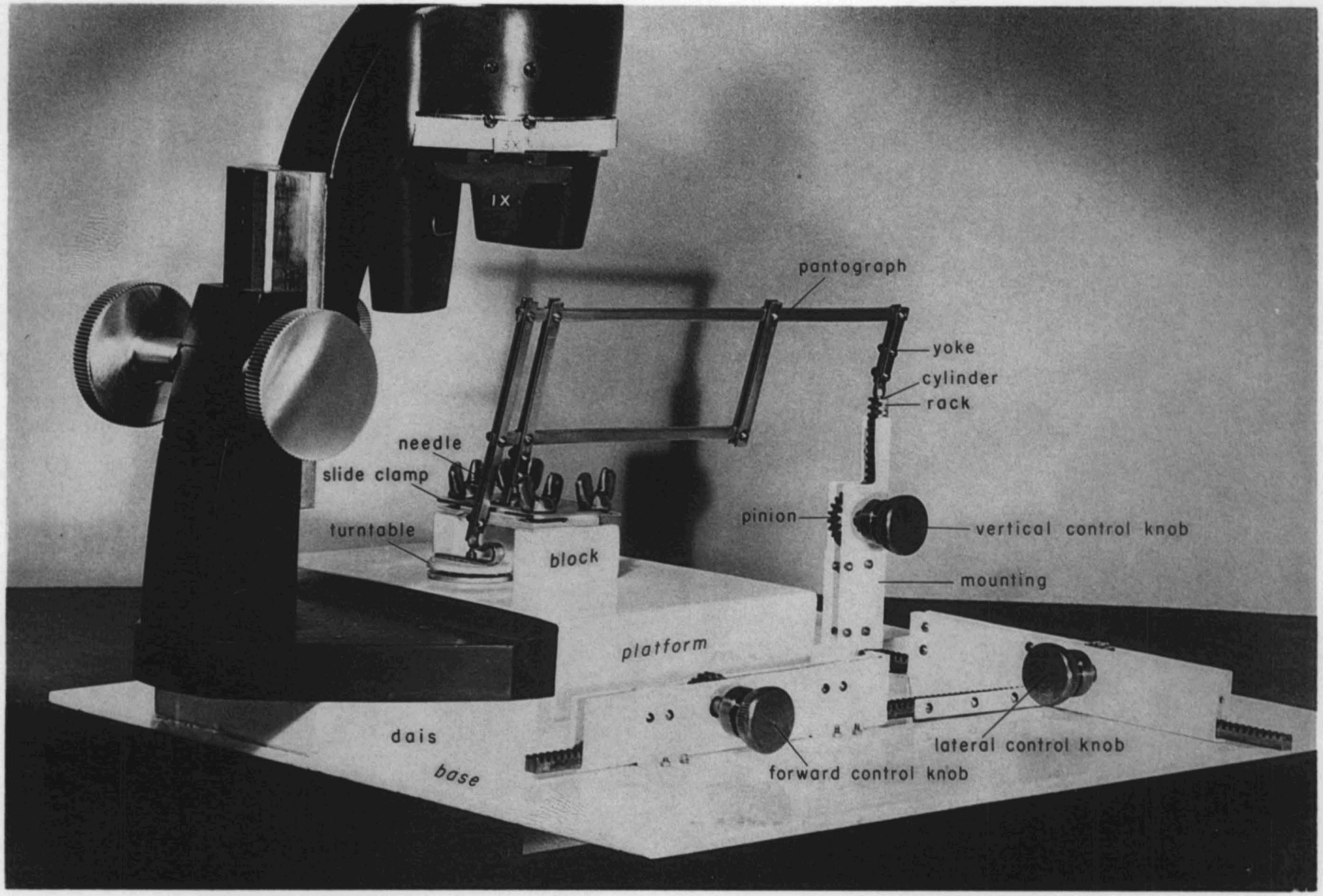
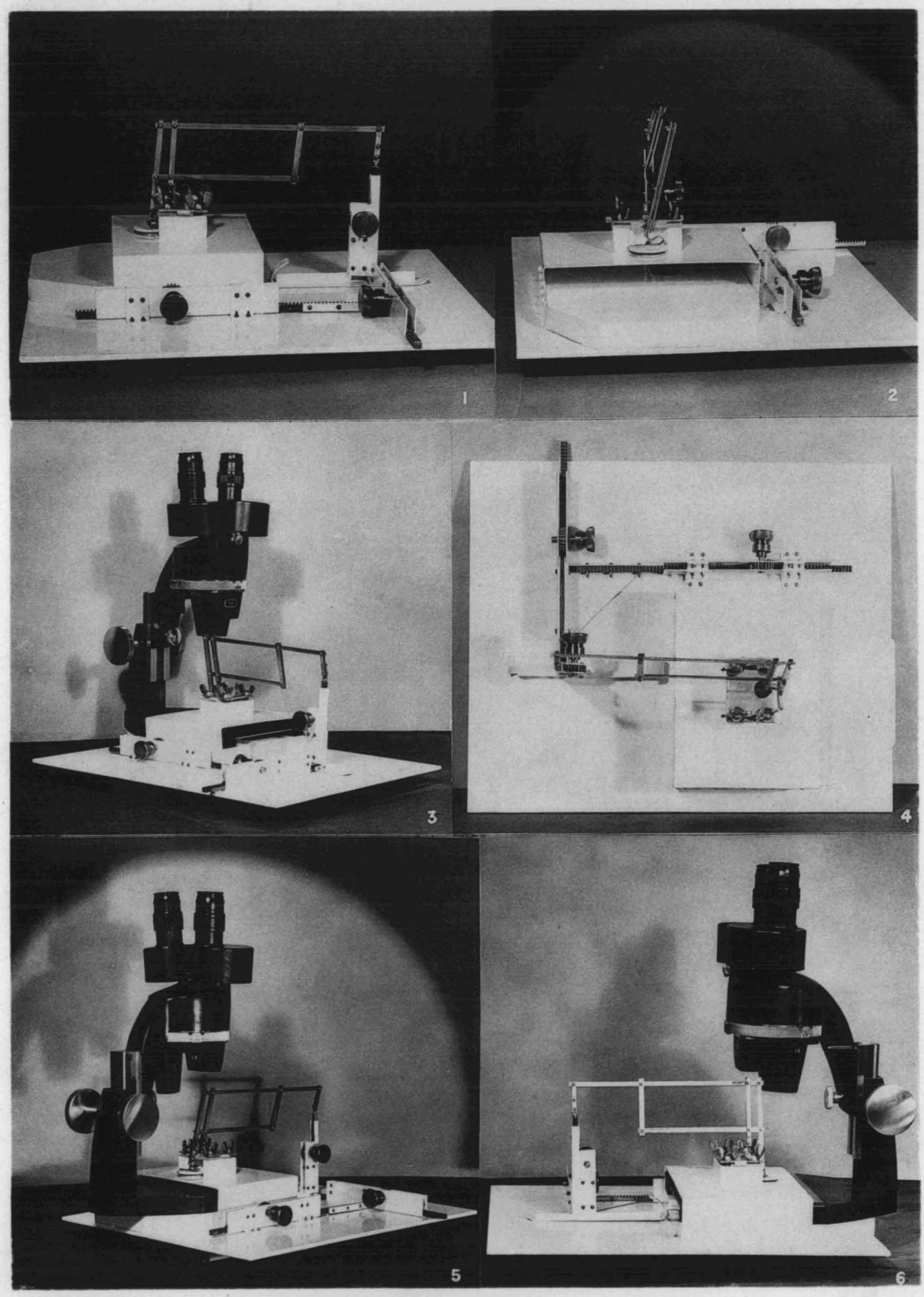

pantograph
yoke
cylinder
rack
needle
slide clamp
pinion
vertical control knob
turntable
block
mounting
platform
dais
base
lateral control knob
forward control knob
3X
1X

PLATE II



EXPLANATION OF PLATE II

FIGS. 1–2, 4. Cleaning instrument, as seen in right, rear, and top views. Approximately × 1/5.

FIGS. 3, 5–6. The instrument with a binocular microscope in positions as seen in right front, right rear, and left views. Figures 3 and 5, approximately × 1/7; Figure 6, approximately × 1/6.

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