examine the perfected form and try to understand the machine by a series of eliminations. He first, by way of explaining his method, eliminates the improvements on the steam engine until he gets us back to a savage man blowing through a hollow reed that nature supplied. This was the starting point of invention, a purely human characteristic. The author then applies his method to bows and arrows, stone implements, etc., and is brought to the following conclusion:

"It is clear that neither to Professor Dawkins and Professor Gaudry, nor to Mr. Grant Allen, is it hard to imagine that a creature, inferior to man both in physical and mental structure, may have made such progress in art as to be able to work so difficult a material as flint, and to have developed such wants as to call for the practice of that art. All lose sight of the nature of art and the laws of human progress, and they indicate a conception of art prior to man, but an inability to conceive of man as existing without a certain degree of progress in art. It would seem to them that the first human creature, whatever his origin, must have signalized his advent and perpetuated his memory literally in a

'Monumentum aere perennius,'

by instantly, without preparation or conscious need, chipping out tools of flint. The quotation from Lucretius,

'Arma antiqua manus, ungues, dentes fuere,
Et lapides, et item sylvarum fragmina rami,'

is misapplied by archæologists. *Lapides* does not mean flaked or polished stone any more than *fragmina rami* means dressed timber."

The author traces back of the rudest wrought stone, an age of wood, and other perishable materials, and anterior to that the age without invention.

MICROSCOPY.[1]

RECENT IMPROVEMENTS IN SECTION-CUTTING.— In sectioning objects imbedded in paraffine, the knife is generally fixed, by a clamp, more or less obliquely to the carrier, and the sections almost invariably roll. The rolling of the sections, which is caused by the bevel given to the cutting edge of the knife in sharpening it, besides leading to difficulties of manipulation in the process of mounting, often injures or completely ruins the sections. Many efforts have been made to find some convenient means of preventing the rolling, and very recently successful methods and instruments have been devised to meet the difficulty. In some knives I have found places where the edge was so thin that the bevel appeared wholly wanting. Such portions of the knife usually cut without causing the sections to roll; and this fact might

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.

lead one to conclude that the entire blade could be made, by proper treatment, to cut in the same way. It was in this direction that I at first hoped to find a remedy against the difficulty in question; but I have found that when the blade is reduced to the requisite thinness, it lacks the firmness required for uniform sectioning.

In Vol. XVI, p. 782, of this journal, I have given the method used, until quite recently, at the Naples Zoölogical Station for preventing rolling. This method, which consists in holding a needle, spatula or brush lightly over the paraffine during the cutting of each section, is inconvenient and slow, and has already been abandoned for the one described below.

THE SECTION-SMOOTHER[1] DEVISED BY MAYER, ANDRES AND GIESBRECHT.—The section-smoother ("schnittstrecker") is an instrument designed to prevent the rolling of sections; it is attached to the knife itself, and thus accomplishes its work unaided by the hand.

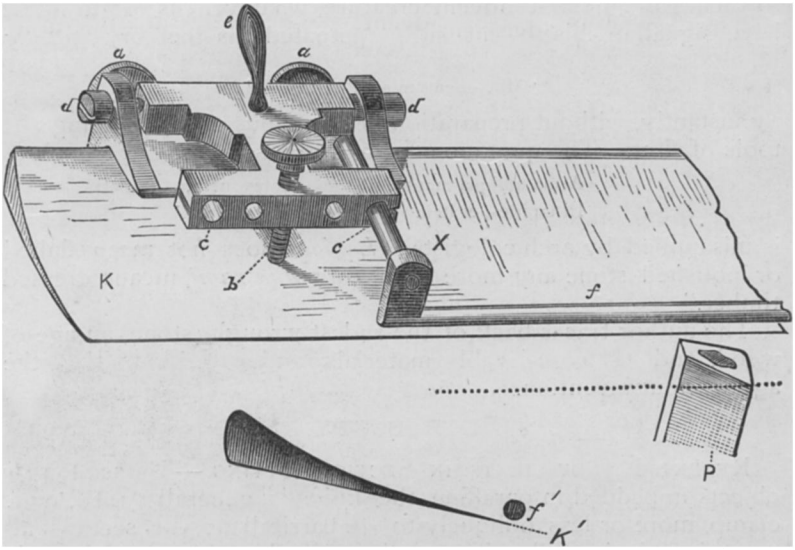

FIG. 1.—Section-smoother. After Mayer, Andres and Giesbrecht.

The accompanying figure represents a portion of the knife, *k*, with the section-smoother attached, and a block of paraffine, *p*. A section of the knife and rod, *f'*, is also given, in order to show the position of the rod above the edge of the knife.

The most important part of the instrument is the cylindrical steel rod, *f*, which is supported in a position exactly parallel to, and close above, the cutting edge of the knife. In this position

[1] "Neuerungen in der Schneidetechnik," in Mittheilungen aus der Zoolog. Station zu Neapel, Vol. IV, p. 429, 1883.

the rod compels the sections to pass between itself and the knife. The parallel position of the rod in the vertical plane is obtained by rotating it about the axis, *x*, which turns in the hole *c* or *c'*; the parallel position in the horizontal plane is reached through the screw *a* and *a'*; and the vertical distance of the rod from the edge of the knife is regulated by the screw, *b*. The entire apparatus is slipped on at the end of the blade, and held fast by two springs that press upon the under surface of the blade. The rod and its holder, which rotates on the axis, *d d*, can be lifted up from the edge of the knife by the aid of the handle, *e*, and turned back far enough to admit of cleaning the rod and the knife. The apparatus includes three interchangeable rods, differing in thickness in adaptation to sections of different sizes.

THE REGISTERING MICROMETER-SCREW.—In the "Microscopy" for the September number of this journal may be found a figure (Fig. 3, p. 996) illustrating the micrometer-screw, and an explanation of its use. In the improved form invented and described by Mayer, Andres and Giesbrecht, an arrangement for regulating its movement has been added. It consists of a spring which, after a given number of divisions of the drum, registers to the ear and finger of the manipulator the number of micromillimeters which the object has been raised. The intervals between the registering clicks can be varied by means of a vernier-like adjustment of the two halves of the drum, so as to equal an entire revolution of the drum, or only $\frac{1}{15}$, $\frac{1}{3}$, $\frac{1}{2}$ of a revolution.

An examination of Fig. 2, which illustrates the new form of the drum, will show how the intervals are regulated. The drum is composed of two symmetrical halves, *a b* and *a' b'*, so closely opposed that the dividing line (dotted in the figure) is scarcely visible. The periphery of each half is composed of two zones of unequal radii. The larger zones, *b* and *b'*, are in apposition, and together form the graduated portion of the drum. Each of the smaller zones are marked with the figures 1, 2, 3 and 15. When the drum is in order for work, it rotates with the screw, which is marked *g g* in the figure above referred to.

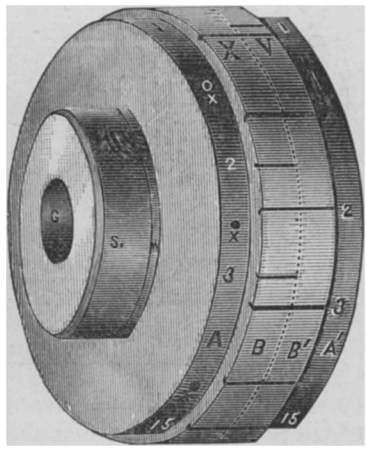

FIG. 2.—Drum of the new micrometer-screw.

The left half of the drum, *a b*, is held in position by the screw, *s*, and may be rotated indepen

dently of the right half, *a' b'*, or of the screw, *g g*, by the aid of a handle which fits the holes *x x x*.

When the half *a b* is adjusted to the half *a' b'*, in the manner represented in the figure, the fifteen equal parts into which the zone *b* is divided exactly correspond to the same number of parts in the zone *b'*, so that the grooves which mark these parts in one zone, become continuous with those of the other zone. Thus adjusted the spring, which rides on the zones *b b'* with a sharp edge parallel to the grooves, will give fifteen sharp clicks in the course of one rotation of the drum, the click being heard every time the sharp edge falls into coincident grooves. In order to adjust for fifteen clicks, it is only necessary to rotate *a b* until groove fifteen becomes continuous with groove fifteen of the opposite half (*a' b'*). For one click in one rotation, the grooves 1 1 must be made to coincide; for two clicks the groves 2 2, and for three clicks the grooves 3 3. The intervals between successive clicks may thus be made to correspond to $\frac{1}{1}$, $\frac{1}{2}$, $\frac{1}{3}$ or $\frac{1}{15}$ of a complete rotation of the drum, and the thickness of sections corresponding to these intervals should be respectively .015, .0075, .005, .001 mm.

THE NEW OBJECT-HOLDER.—The object-holder which now accompanies the Thoma microtome is an invention of Mayer, Andres

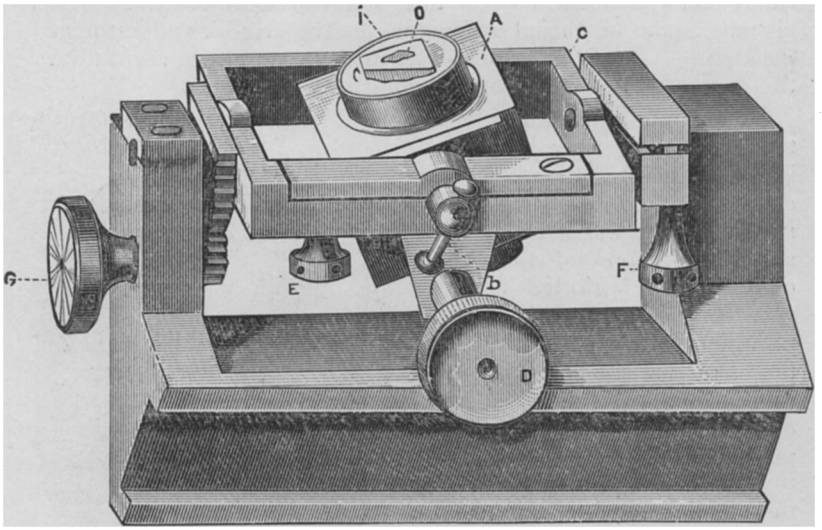

FIG. 3.—The Object-holder and Carrier.

and Giesbrecht, and has been described by them in the place before cited. The object is now movable in all three directions; it is raised or lowered, and turned about the perpendicular axis by free-hand; but in the two other planes it is moved by pinions, so that the plane of section may be altered at pleasure, during the

process of cutting. As seen in Fig. 3, the object, *o*, imbedded in a small piece of paraffine, is attached to a larger mass of paraffine contained in a hollow metallic cylinder. The cylinder, *r*, may be slipped up or down in the cubical block, *a*, and turned around its longer axis by means of a small metallic rod applied in holes near its lower end (holes not seen in figure). The position of the cylinder may be fixed by the handle, *b*, which works like the handle of a vise.

The block, *a*, may be turned about the transverse axis of the frame which holds it, by the pinion *d*, and fixed by the screw *e*, the head of which is provided with holes for the metallic rod.

In the same way the frame itself may be made to turn about its longer axis by means of the pinion *g*, and fixed by the screw *f*.

The chief merit of this holder lies in the fact that the object may be rotated very freely about the two axes of the frame, without at the same time being raised or lowered very much. This latter advantage depends on the fact that the axes of rotation are near the top of the block, *a; i.e.*, as near the object as possible.

The attachment of the object to a cylinder movable in a perpendicular direction, has the great advantage that pieces of more than two centimeters in length may be sectioned. In order to obtain room for pieces of greater length, washers of .5 or 1^{cm} thickness may be placed at first under the knife, and afterwards removed.

AN IMPROVEMENT IN THE CARRIERS.—The advantages of having the carriers slide on five points (instead of two even surfaces) between two even planes, have been thoroughly discussed by Thoma (cf. NATURALIST, September, p. 993–994). The most recent improvement, according to Mayer, consists in making the so-called "points" of ivory, and the planes, on which the points slide, of an alloy of zinc and copper (Rothguss). The result is, that these parts are no longer exposed to rust, and that the plane surfaces on which the knife-carrier slides are not exposed to injurious friction.

Prices of the Microtome and its Adjuncts.—

The older microtome, consisting of a stand of cast-iron and the two carriers, without the micrometer-screw	$24 00
Same with ivory "points" and new object-holder	27 50
The registering micrometer screw	10 00
Knife for oblique cutting (16^{cm} long) with étui	5 00
Knife for transverse cutting with étui, holder, &c	8 00
Section-smoother	2 25
The complete set, including stand with "planes" of zinc and copper alloy and ivory "points," registering micrometer-screw, the two kinds of knives with étuis, and section-smoother	58 50

This microtome can be obtained from the maker, Rudolph

Jung, 15 Hauptstrasse, Heidelberg, or can be ordered through Geo. A. Smith & Co., 7 Park street, Boston, Mass.

TYPE-METAL BOXES FOR IMBEDDING.—I have before described the type-metal boxes and the method of using them in imbedding,[1] and should now add, what was unknown to me at the time, that the credit of introducing such boxes belongs to Mr. Geo. Dimmock. Mr. Dimmock also used for the same purpose *quotations*, such as are used by printers in filling blank spaces at the beginning and end of chapters. These quotations vary somewhat in size, and are sold at 25 cts. a pound.

Mayer, Andres and Giesbrecht recommend brass instead of type-metal for these boxes, and a wash of thin collodion, where it is desirable, to keep the paraffine in a melted condition for a considerable time, as in imbedding small objects in definite positions. The glass plate forming the base of the box is first wet with glycerine, and then the box is washed with collodion and placed on a water-bath in order to evaporate the ether. In this way a box is obtained in which paraffine can be kept for hours in a fluid condition without escaping between the glass and the metallic pieces. The box is kept on a small water-bath, made for this special purpose, while arranging the object under the dissecting microscope.

——:o:——

SCIENTIFIC NEWS.

— Dr. F. C. Noll has found a fluid which is very suitable for permanent preparations of delicate Crustacea and their larvæ, preventing their shrinking or becoming too transparent.

It is a mixture of equal volumes of Farrant's medium and Meyer's fluid No. II. It is never cloudy nor entirely dry, although it has such a consistency that air-bubbles scarcely ever occur. The preparation is sealed with asphalte or some other varnish. In order to prevent the cracks arising in the asphalte varnish, it is better, after a time, to pass over it a layer of transparent shellac.

Hydroids, small medusæ and other cœlenterates which have been hardened in alcohol and then stained may, the author says, be splendidly preserved in the above fluid.

— Mr. W. S. Kent has found potassic iodide useful in preserving Infusoria. It acts in a manner almost identical with osmic acid, and in some instances even more efficiently. The medium possesses the additional advantage of yielding no deleterious exhalations, which have to be carefully guarded against in the use of osmic acid. The formula for preparation is as follows: Prepare a saturated solution of potassic iodide in distilled water; saturate this solution with iodine, filter, and dilute to a

[1] AMERICAN NATURALIST, Oct., 1882, p. 781.