CHAPTER XIV

The Microscope in the Manufacturing Plant

In Chapter XIII the several illustrations presented show a number of applications of the compound microscope to the work of the toolmaker. It is the purpose under the present heading to illustrate some further advantages of the microscope in connection with manufacturing processes. The instruments and processes shown should also be of interest to toolmakers as suggesting numerous other applications of the microscope to fine work.

The Lanston Monotype Machine Company, of Philadelphia, Penn., has for several years made extensive use of the compound microscope for facilitating the production and inspection of certain very accurate members entering into the construction of their casting machine. While there are in this machine many other parts the workmanship on which is of the finest character, the members particularly referred to here are the matrices from which the type is cast; these parts and the hardened-steel punches for sinking the characters in the matrix bodies pass in their production through some very accurate and interesting operations.

A typical microscope and its stand, as used in this establishment, are shown in Fig. 158, mounted on a bench; certain details of construction are illustrated by the line drawing, Fig. 159. In the photographic view a matrix will be noticed in position for inspection under the microscope tube.

THE MONOTYPE MATRIX

The matrix is sketched in Fig. 160 about double size, the body being $\frac{2}{10}$ inch square for type sizes from 4- to 14-point, and $\frac{15}{32}$ inch high. The punch is sunk into the matrix (which is of hard copper) 0.065 inch in making the impression therein for the character afterward to be formed in reverse on the type. The matrices (225 in number) are carried in a matrix case in the casting machines. There are 15 rows of 15 matrices each in the case, and each row is carried upon a wire passing through holes drilled crosswise of the matrix bodies. The case may be moved horizontally in two directions at right angles, to bring any matrix into casting position over the mold. Each matrix is centered with the mold by a taper pin fitting the hole in the end of the matrix, the movement of the case being automatically controlled by a perforated paper ribbon

which has been previously punched on a keyboard machine. Now in order that each character on the type when cast shall be of proper size, with each line composing the letter or other character of the correct width, and each character correctly located on the type body — not only squarely positioned thereon, but also at the right distance from the edges of the body, so that perfect alinement will be assured between all the characters — it is absolutely essential that the punches (which are really

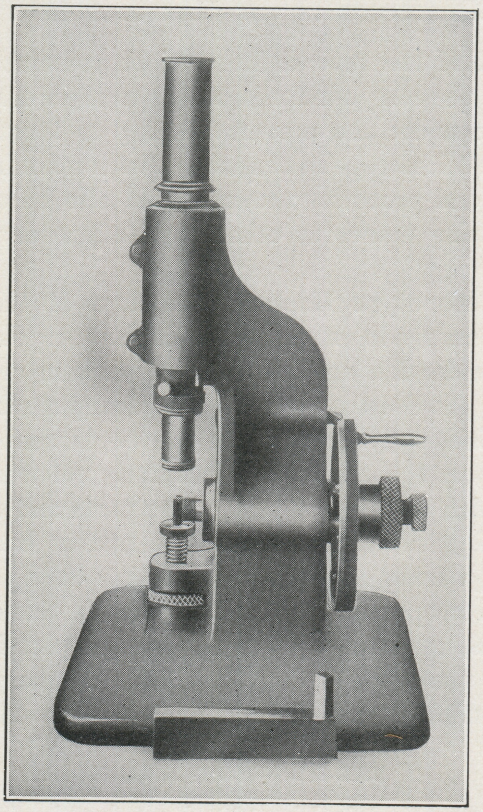

FIG. 158. — MICROSCOPE WITH WORK IN PLACE

master type of hardened steel) shall be made with the greatest accuracy. The characters must be dead square in their position on the punch end, each and every line forming the character must be of the exact width desired, and the lines forming the top and bottom and the sides of the character must be at a given distance from the sides of the punch body.

INSPECTING THE MATRIX

After the punch has been finished in an engraving machine and hardened, it is ready for sinking the impression in the copper matrix, which operation is performed in a power press. After the impression is formed

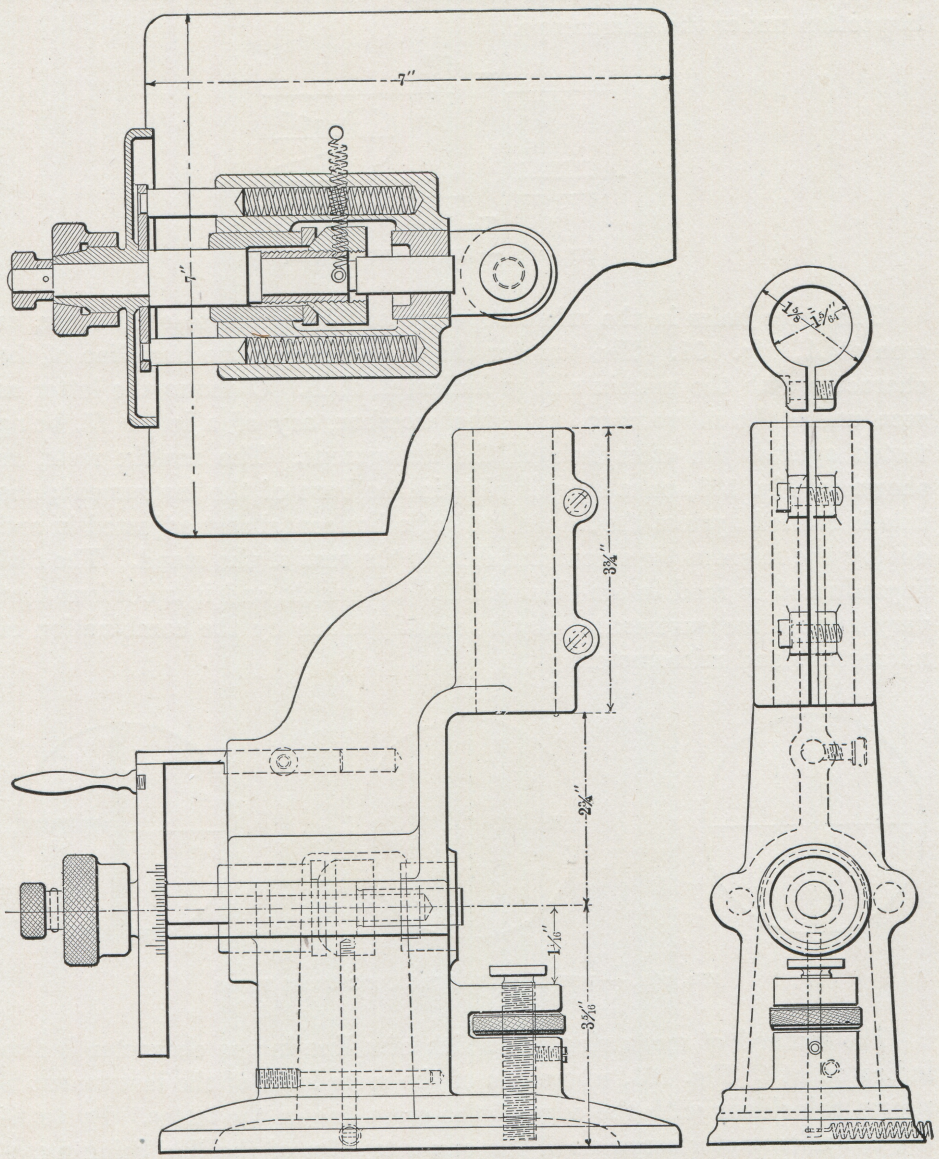

FIG. 159. — CONSTRUCTION OF MICROSCOPE STAND

the conical centering hole is finished in the end, the hole for receiving the matrix case wire drilled through the matrix body and the copper matrix milled off to exact length and to leave the exact depth of impression required, in an ingenious special machine. The matrix is then ready for inspection under the microscope.

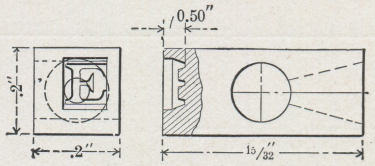

FIG. 160. — MONOTYPE MATRIX

The cross hairs in the microscope are at 90 degrees to each other, as seen at *A*, Fig. 161. The test for the squareness of the base line of the character with the matrix side is indicated at *B*. *C* shows the letter as seen under the microscope, with the crossbar, say of a letter *H*, being tested against the cross hair of the instrument. The matrix rests, as shown in Fig. 158, on a lapped plug in the base of the instrument; one side is carried against the lapped end of a horizontal rest adjusted in and out by the micrometer screw and dial at the rear of the stand. The dial is graduated to read to ten-thousandths of an inch, and it is obvious that very minute measurements may be readily made by the combination of microscope and micrometer.

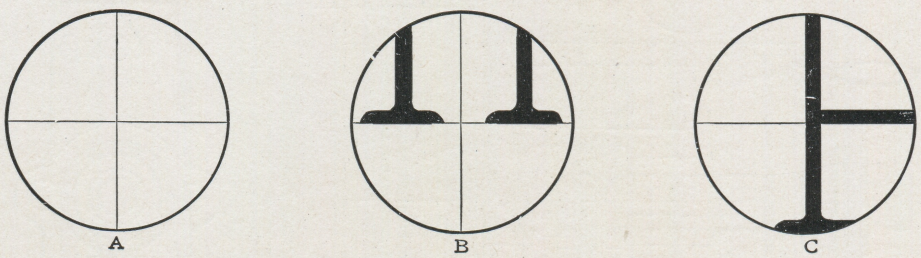

FIG. 161. — USE OF THE MICROSCOPE CROSS HAIRS

The method of measuring the width of a line in the character is also indicated at *C*, Fig. 161, where one of the cross hairs of the instrument is shown coincident with the edge of the cross line in the letter. By turning the micrometer screw until the opposite edge of the line being measured coincides with the microscope cross hair, the width may be read at once from the micrometer dial.

The knife-edge square shown in front of the microscope stand in Fig. 158 is used in testing the squareness of the sides of the work with one another. This square is used quite generally in the Monotype shops.

The microscope stand construction will be sufficiently clear from the photograph and the line drawing, Fig. 159, without detailed explanation. Ordinarily, while in use, the base of the stand is covered with a piece of felt, so that if a matrix drops accidentally, there will be no risk of its being injured.

MICROSCOPE WITH TWO SCREWS

Fig. 162 illustrates another microscope for matrix inspection, which has two micrometer screws at right angles to each other.

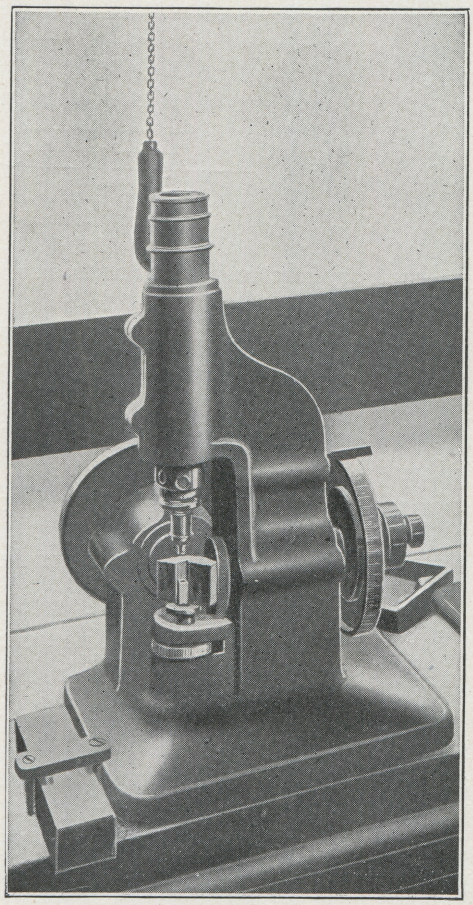

FIG. 162. — MICROSCOPE WITH TWO MICROMETER SCREWS

The photograph shows plainly the method of locating the matrix under this microscope, where it rests in a notch cut in a right-angle shoe, which in turn rests against the ends of the two micrometer screws. This feature is also shown in the right-hand sketch in Fig. 163.

It is obvious that with this microscope and its two screws it is an easy

matter to measure the matrix impression from one side to the other, or from the top to the bottom of the character, without changing the position of the work in the V-block in which it is held squarely. It is also a convenient instrument for testing the correctness of the position of the different lines of the impression relatively to the edges of the matrix body.

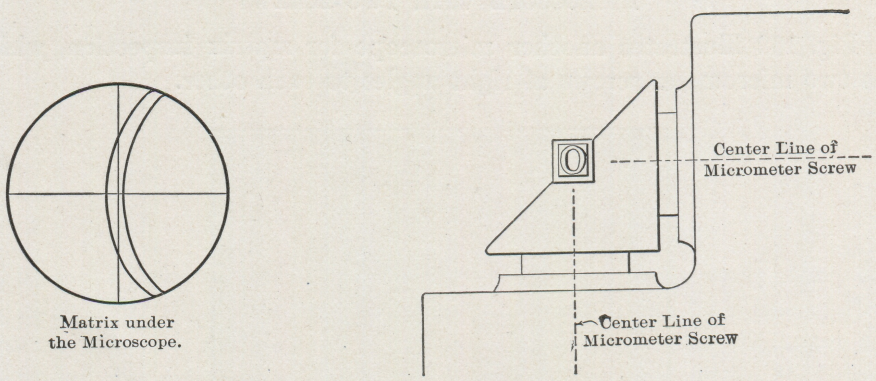

FIG. 163. — PLAN OF MICROSCOPE WITH MATRIX IN POSITION

To illuminate the impression in the work sufficiently to allow easy manipulation under the microscope, a small magic lantern is employed, into which is dropped a regular incandescent light bulb, the reflector then lighting the work nicely. A number of illuminating devices thus arranged will be noticed in other photographs in this chapter. In this particular case the lantern was moved prior to the taking of the picture.

OTHER MICROSCOPES IN THE MATRIX DEPARTMENT

Fig. 164 shows in a striking manner the extent to which microscopes are used in connection with the production of the matrices, there being on the bench in this view at least a dozen such instruments. With the microscopes in this department the inspection of the impressions in the matrix is carried on with facility, as the method of lighting, which is clearly indicated and which has already been referred to, enables the operator to view the bottom of the impression plainly through the microscope, as he examines the various portions of the character stamped in the matrix. As all these tests are carried along from the bottom of the impression, it is obvious that the type cast therein must be perfect on the face.

It should be stated that the row of machines shown to the right, in Fig. 164, is a part of the group of presses used in forming the matrix impression.

ANOTHER INTERESTING OPERATION

Another application of the microscope is represented in Fig. 165, which shows a special arrangement for the inspection of display matrices.

FIG. 164. — ROW OF MICROSCOPES IN MATRIX DEPARTMENT

The blanks in which the matrix is formed are about $1\frac{5}{32}$ inches long by $\frac{25}{32}$ inch wide. The character is formed in this matrix by a special process, the details of which need not be taken up at this time.

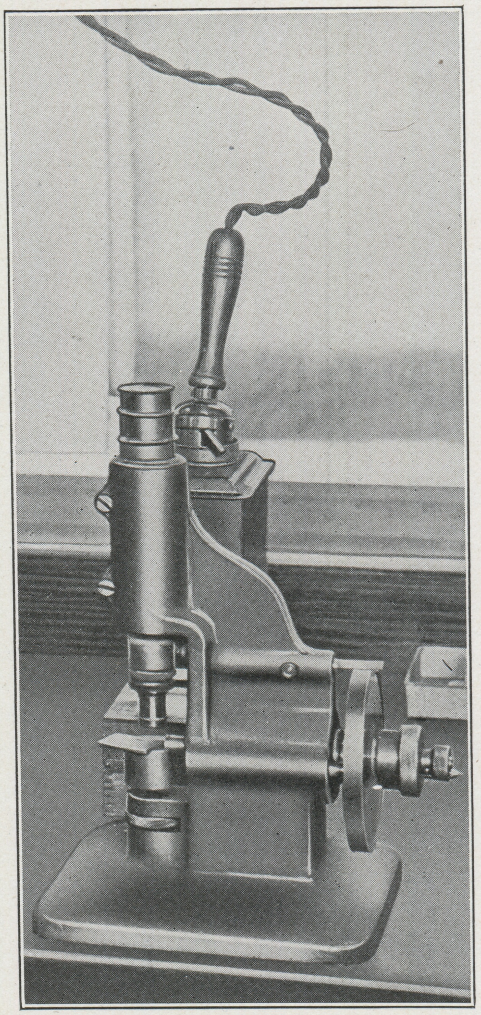

FIG. 165. — MICROSCOPE FOR INSPECTING DISPLAY MATRIX

With the display matrix, as with the other form of matrix already shown, it is important that the impression from which the type is to be cast should be square with the edges of the blank and located at a certain distance from the ends and sides. The work is placed under the microscope, Fig. 165, for inspection. The micrometer dial on this instrument like those on the other microscopes reads to 0.0001 inch, and forms a very convenient means of measuring the work accurately.