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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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SIEVE TESTING APPARATUS

There has recently been developed at the Bureau of Standards a new projection apparatus intended primarily for the testing of sieves, but readily adaptable to various other purposes.*

The Bureau has found by experience that in testing sieves for conformity to the "Standard Specifications for Sieves", the most reliable results are obtained by measuring the wire diameters and determining the number of wires per centimeter, and then computing the opening by the formula

$$O = \frac{10}{N} - W$$

where O = average opening in millimeters

N = number of wires per centimeter

W = average diameter of the wires in millimeters.

Until recently the wires have been measured directly by means of a micrometer microscope. As this process is both tedious and fatiguing to the eyes, a better method was sought. The projection method developed is much quicker and much less wearing on the observer than was the method formerly used. Measurements can be taken on any number of the warp and of the shoot wires of the cloth, and the cloth also examined for maximum openings in a small fraction of the time formerly required.

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*The final form of this apparatus was developed after seeing photographs of a projection apparatus developed by Mr. Schoof of the Greenfield Tap & Die Corporation.

The final development of this apparatus consisted of several steps: The construction of a suitable light-tight box of proper dimensions; the selection of a microscope combination to give the best general results of the light source and its location, and of the screen on which the image is cast; the development of a method of measuring this image so as to avoid parallax, of a means of reducing to a minimum the color bands on the edge of the image, and of a device for focusing and for moving the sieve at right angles to the beam of light. The apparatus at present consists of a light-tight box about 40 cm square and a meter long with a microscope mounted on one end and a ground glass plate 2 mm thick in the other end. The source of illumination is a microscope illuminator containing a concentrated filament lamp, 6 volts, 108 watts, connected through a transformer to a 110 volt alternating current supply circuit. The light passes through a lens in the end of the illuminator and is focused on the objective of the microscope. After passing through the microscope it diverges to the ground glass plate which is mounted with the ground side in. A 50 cm steel scale is mounted against the inner face of the ground glass screen in such a way that the graduations of the scale may be seen through the glass. The position of the scale allows a direct reading on the edges of the image cast by the wire of the sieve and avoids parallax due to the thickness of the glass. It was found that by oiling the ground surface slightly, the visibility was greatly increased without diminishing the distinctness of the image.

A frame for holding the sieve is placed on a platform so arranged as to permit a lateral motion of about 8 inches, and also motion at right angles for focusing. Long rods, extending to the end of the apparatus at which the observer is seated, enable the observer to move the sieve without leaving his place, the lateral motion being accomplished by means of a rack and pinion and the focusing by the use of beveled gears. A green filter is held before the objective by means of a clamp fastened to the tube of the microscope. The filter relieves eye strain very considerably and practically eliminates the color bands otherwise appearing on the edges of the image.

In use, the sieve is mounted in its holder on the focusing platform, between the illuminator and the objective of the microscope, and is focused by the observer until a sharp image is seen on the ground glass. Measurements are then taken in millimeters by reading the positions on the steel scale where the two edges of the image of the wire cross it, a reading glass being sometimes used. The sieve is then moved across the field, readings being taken at several places on the cloth, until the whole diameter of the sieve has been covered, care being taken at the same time to watch for the uniformity of spacing and to measure any excessively large openings. The sieve is then rotated through 90° and the process repeated.

The magnification of the apparatus may be determined by placing a standard wire of known diameter in place of the sieve and making several readings on its image. This should be done

at least twice a day to guard against any possible change in magnification while the apparatus is being used.

By using a microscope having a tube about 15 cm long and an eyepiece with a magnifying power of approximately three diameters, together with a 16 mm objective, a magnification of about 260 diameters is obtained. This is found to be very satisfactory for the fine-mesh sieves. Measurements good to 0.2 mm can be made of the image as seen on the ground glass plate, individual readings repeating to 0.5 mm or better. This gives an accuracy of better than 0.001 mm for the average wire diameters and width of opening.

Sieve Testing Apparatus.
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