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# Comparison of fields of view of sub-normal vision aids

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## Abstract

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## Degree Type

Thesis

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Master of Science in Vision Science

## Committee Chair

C. B. Margach

## Subject Categories

Optometry

# COMPARISON OF FIELDS OF VIEW OF SUB-NORMAL VISION AIDS

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# COMPARISON OF FIELDS OF SUBNORMAL VISION AIDS

I. Purpose of the experiment: to compare experimentally the fields of selected subnormal vision aids under standard conditions.

II. Equipment:

4 x 5 Crown Graphic, with 127 mm. f.4.7 Kodak Ektar lens.

Target consisting of two 5 inch by 5 inch cards imprinted with a solid field of "E's". The cards were printed by a local printer, using standard capital letters.

Near point reading bar with holder for target.

Ring stand with lens holder.

Distometer.

Goose-neck lamp with 100 watt bulb.

Weston photo-electric exposure meter.

Subnormal vision aids used:

A.O. Microscopic Lens Trial Set: 2X, 4X, 6X, 8X, 10X.

A.O. Aspheric Microscopic Lens Trial Set: 8X, 10X, 12X.

Feinbloom Aspherical Microscopes: 4X, 8X, 10X, 12X.

Volk Conoid Microscopes: 15D, 30D, 40D, 50D.

Univis Telescopic Units:

1.5X telescope with 4d, 6D, 8D and 10D reading caps.

2X telescope with 8D reading cap.

III. Procedure: the field of view of each subnormal vision aid included in the study was determined photographically in the following manner. The target card described above was photographed, using the subnormal vision aid as an auxiliary lens. The distance between the back surface of the aid and the front surface of the camera lens was kept at a constant 17 mm. for each device, as measured by the distometer. The following camera settings were kept constant: focus at infinity; diaphrahm at f. 32; shutter speed at 1/2 second.

The distance between the target and the front surface of the device was varied by moving the target card along the reading bar until the sharpest focus was obtained on the ground glass of the camera. The goose-neck lamp was adjusted for each set-up to give the proper illumination for correct exposure, as measured by the Weston exposure meter. The negatives were developed and contact prints were made by a commercial photo finisher. The extent of the fields was determined by examining the photographs, along the widest horizontal line, and determining the total number of E's which could reasonably be discerned as such. The results are listed in Tables 1 and 2 and shown pictorially in Graphs 1 and 2.

IV. Results.

A. Comparison based on manufacturers' stated powers. See Table 1 and Graph 1. All the devices used except the Volk Conoid and the Univis Telescopic Units are calibrated by the manufacturer in terms of magnification (X). The Volk Conoid units are marked in diopters. In Table 1 and Graph 1, these latter devices were convered to magnification on the basis of 4D = 1X. The Univis Telescopic Units are calibrated in terms of magnification for the basic telescope. The reading caps which fit over the telescopes are marked in diopters. These caps were converted to magnification on the same basis as that used for the Volk devices. The figure thus obtained was multiplied by the magnification power of the telescopic unit upon which the reading cap was placed.

B. Comparison based on experimentally determined back vertex power of the devices. See Table 2 and Graph 2. The back vertex power of each device was determined in the following manner: a plus 5.00D lens was set 20 cm. to the right of a light source on an optical bench. The holder for the subnormal vision aid was set 10 cm. to the right of this collimating lens. A piece of ground glass was moved along the optical bench, to the right of the aid, until the best focus was obtained. Where possible, the distance between the back vertex of the device and the ground glass was measured with the distometer. In the cases where this distance was too great for the distometer, a centimeter rule was used.

V. Comparison to fields determined subjectively. As a check on results obtained by photographic means, a comparison was attempted between the photographic results and results obtained by a subjective evaluation of the field of view. For the subjective method,

one of the authors held each of a number of aids with the ocular surface touching the lens of his own glasses. The target used previously was brought close enough to focus the letters, and the number of E's in the longest horizontal line were counted. The results are shown in Table 3 and Graph 3. In comparing the objective and subjective methods, it would seem that in some cases agreement between the results obtained by the two methods is lacking, and further investigation into these discrepancies is indicated. At first it was thought that an explanation of this could possibly be that the entrance window of the optical system was the rim of the lens of the camera, but close examination of the photographs indicates the entrance window to be the subnormal vision aid, thus requiring that some other factor or factors be postulated to account for the lack of agreement.

However, because of such lack of agreement, the findings obtained photographically should not be taken as a basis for comparative fields of view in the clinical use of these devices.

## INFORMATION OBTAINED FROM MANUFACTURERS

Letters were written to the various manufacturers of subnormal vision aids requesting the information that was available concerning the fields of view in degrees, and the criteria used to determine the fields of view. The information obtained is as follows:

Albert Aloe Co., 805 Locust St., St. Louis 1, Mo.

"Naturally, a field of view depends on the individual, but as a standard, we would say it encompasses approximately four inches on the horizontal and about one and one half inches vertically. It would be difficult to determine how much this would be in degrees. It could be done, but we have never done it."

American Bifocal Co., 1440 St. Clair Ave., Cleveland 14, Ohio.

"The field of view in degrees of 40 mm. Volk Conoid Lenses varies from 82 degrees for the 15 diopter down to 61 degrees for the 100 diopter lenses. For the 37 mm. size the corresponding values are 77 degrees and 59 degrees. These values were obtained by actual visual experiment looking through the lenses. For this test knife-edge lenses were used."

American Optical Co., Southbridge, Mass.

No specifications were given on the field of view of the Microscopic or Aolite Aspheric Microscopic Lenses.

Continental Optical Co., 1402 N. Capital Ave., Indianapolis 6, Indiana.

The Continental Optical Company does not produce microscope type subnormal vision aids.

William Feinbloom, 130 E. 74th St., New York, N. Y.

No response.

Kollmorgen Optical Corp., 347 King St., Northampton, Mass.

Specifications were given for the 1.7x and 2.2x Spectel telescopic spectacles without reading caps. The field of view for the 1.7x was given as 35 degrees. The field of view for the 2.2x was given as 22 degrees. No criterion was given for the determination of these specifications.

J. Lederer, Broadway, Sydney, New South Wales.

The fields of view for the Lederer Lenses were given as 84 degrees for the 2.5 X, 78 degrees for the 4 X, and 64 degrees for the 6 X. These fields of view were determined mathematically. Dr. Lederer also says, "...the field of view can then be verified experimentally in the usual manner."

New Era Optical Co., 17 North Wabash Ave., Chicago 90, Ill.

No field of view was given for New Era's Telecopter telescopic spectacle with reading caps. We were referred to Dr. Rosenbloom's article on subnormal vision aids in the Optometric Weekly, September 18, 1958 issue.

Univis Lens Company, Dayton 1, Ohio.

Specifications were given for the 1.5x and 2.0x Univis ophthalmic telescopes without reading caps. "The fields of view with the 1.5 and 2.0 X telescopes at an average vertex distance are 18 and 12 degrees respectively." No criterion was given for the determination of these specifications.

TABLE 1

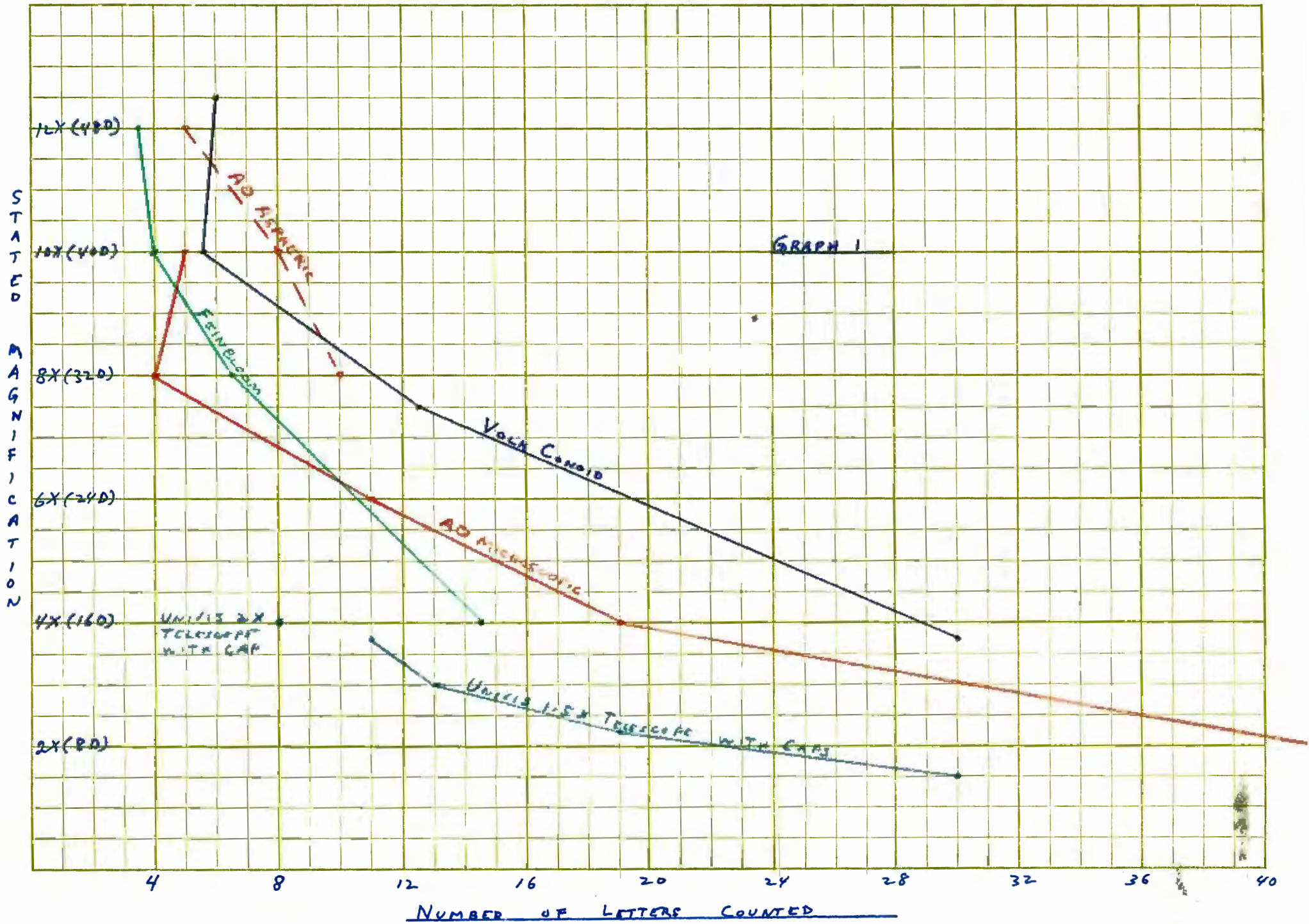
| Magnification | A.O. Aspheric | A.O. Microscopic | Feinbloom | Volk Conoid | Univis 1.5X w/Reading Caps | Univis 2X w/Reading Caps |
|---|---|---|---|---|---|---|
| 1.5X | | | | | 30 | |
| 2X | | 42 | | | | |
| 2.25X | | | | | 19 | |
| 3X | | | | | 13 | |
| 3.75X | | | | 30 | 11 | |
| 4X | | 19 | 14½ | | | 8 |
| 6X | | 11 | | | | |
| 7.5X | | | | 12½ | | |
| 8X | 10 | 4 | 6½ | | | |
| 10X | 8 | 5 | 4 | 5⅓ | | |
| 12X | 5 | | 3½ | | | |
| 12.5X | | | | 6 | | |

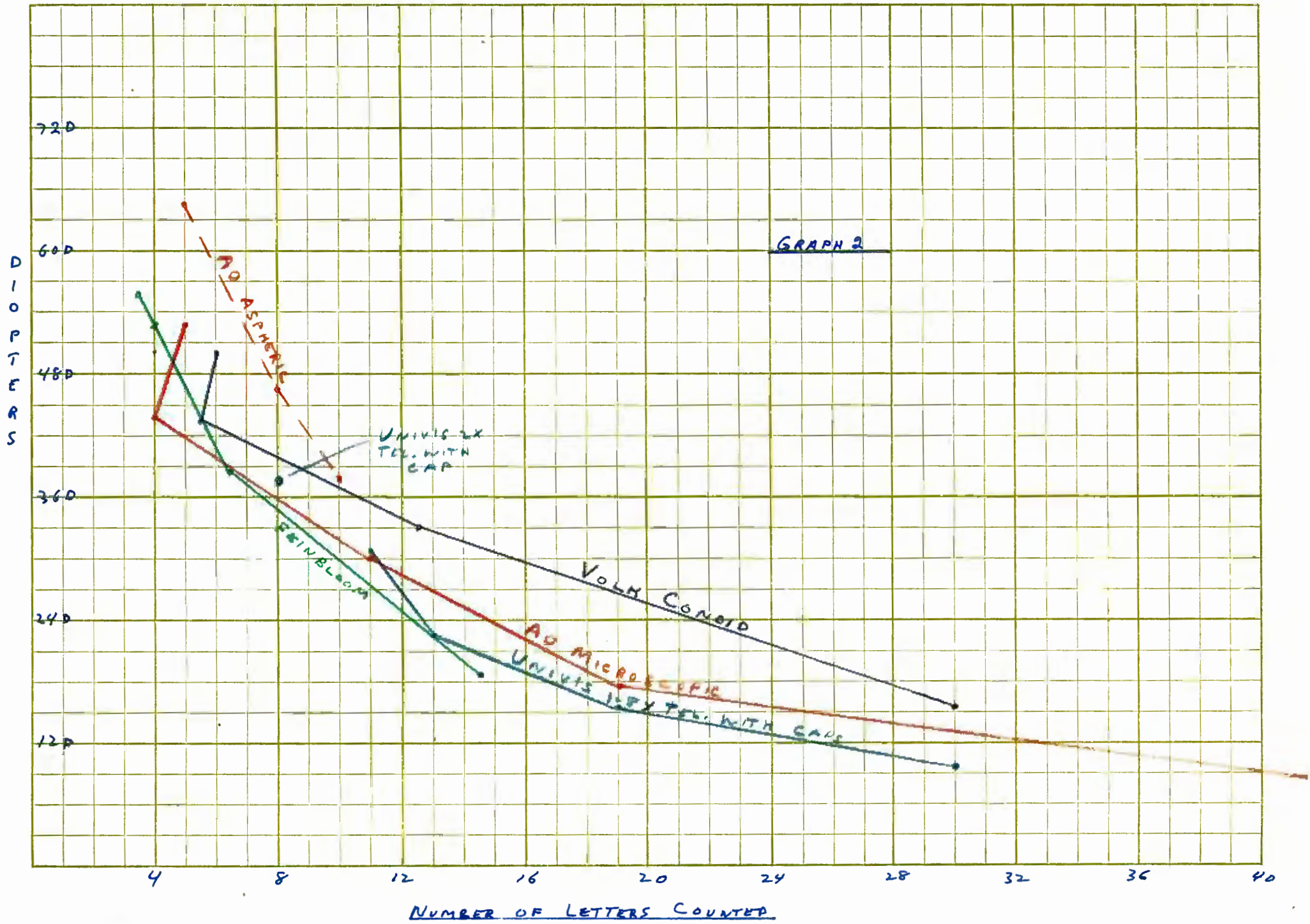
TABLE 2

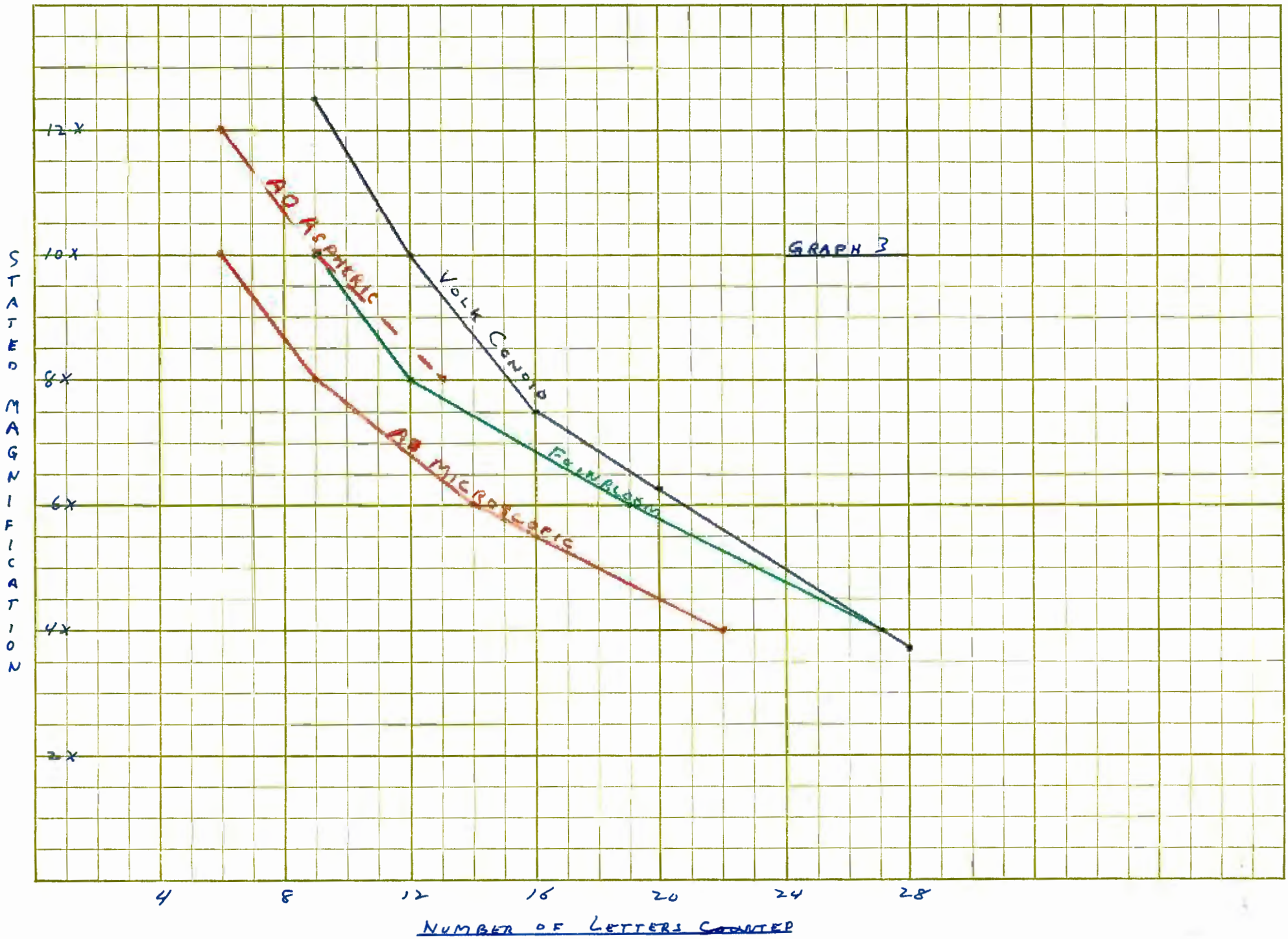
| Name of Device | Back Vertex Distance (d) | Diopters (1/d) |
|---|---|---|
| Volk Conoid: | | |
| 15D | 6.3 cm. | 15.87 |
| 30D | 3.0 cm. | 33.00 |
| 40D | 2.3 cm. | 43.48 |
| 50D | 2.0 cm. | 50.00 |
| A. O. Microscopic Lens Trial Set: | | |
| 2X | 11.8 cm. | 8.47 |
| 4X | 5.6 cm. | 17.85 |
| 6X | 3.4 cm. | 29.44 |
| 8X | 2.3 cm. | 43.48 |
| 10X | 1.9 cm. | 52.63 |
| A. O. Aspheric Lens Trial Set: | | |
| 8X | 2.65 cm. | 37.73 |
| 10X | 2.15 cm. | 46.51 |
| 12X | 1.56 cm. | 64.10 |
| Univis Telescopic Units (1.5X Telescope): | | |
| 1.5X | 10.2 cm. | 9.80 |
| 2.25X | 6.4 cm. | 15.62 |
| 3.0X | 4.4 cm. | 22.73 |
| 3.75X | 3.3 cm. | 30.30 |
| Univis Telescopic Units (2.0X Telescope): | | |
| 4X | 2.65 cm. | 37.73 |
| Feinbloom: | | |
| 4X | 5.30 cm. | 18.86 |
| 8X | 2.60 cm. | 38.46 |
| 10X | 1.90 cm. | 52.63 |
| 12X | 1.80 cm. | 55.55 |

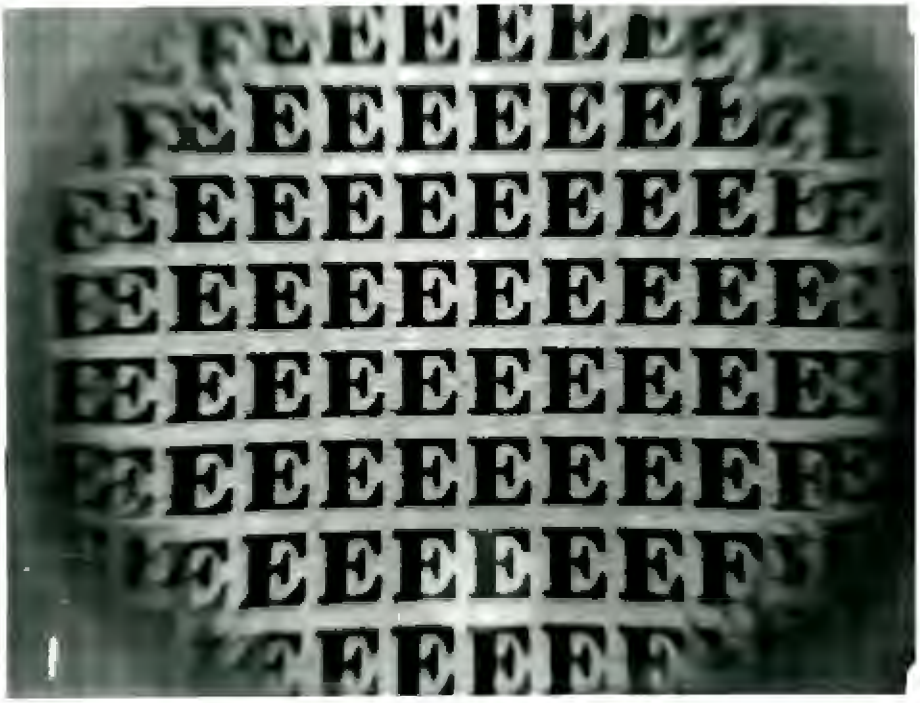
TABLE 3

| Magnification | A.O. Aspheric | A.O. Microscopic | Feinbloom | Volk Conoid |
|---|---|---|---|---|
| 3.75X | | | | 28 |
| 4X | | 22 | 27 | |
| 6X | | 14 | 19 | |
| 6.25X | | | | 20 |
| 7.5X | | | | 16 |
| 8X | 13 | 9 | 12 | |
| 10X | 9 | 6 | 9 | 12 |
| 12X | 6 | | | |
| 12.5X | | | | 9 |

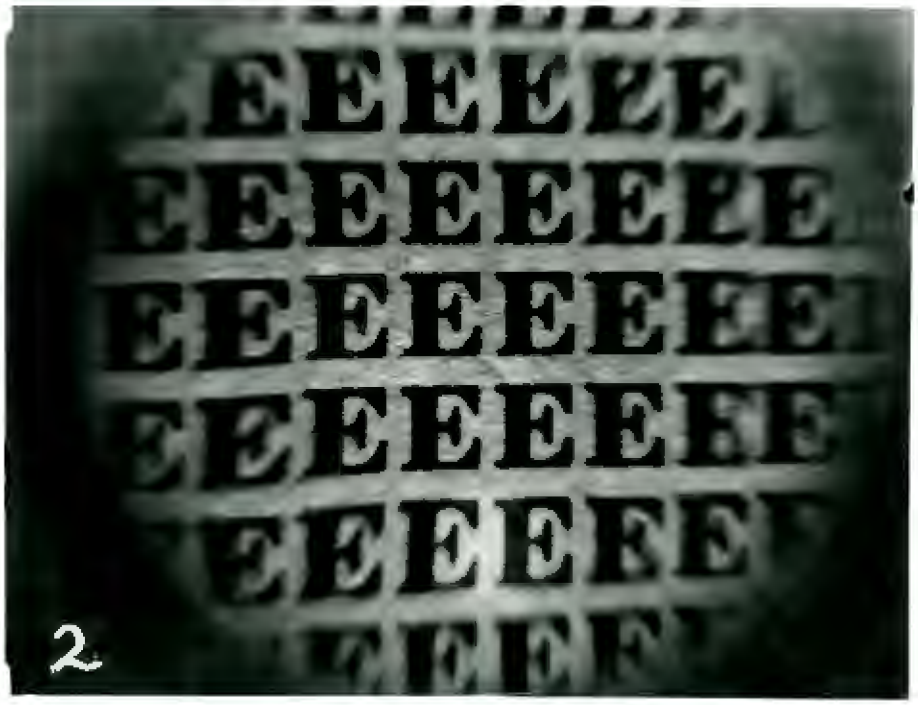

GRAPH 1
STATED MAGNIFICATION
12X (480)
10X (400)
8X (320)
6X (240)
4X (160)
2X (80)
AO ASPHERIC
FEINBLOOM
VOLK CONOID
AO MICRASCOPIC
UNILIT 2X TELESCOPE WITH CAP
UNILIT 1.5X TELESCOPE WITH CAP
4
8
12
16
20
24
28
32
36
40
NUMBER OF LETTERS COUNTED


GRAPH 2
DIOPTERS
72D
60D
48D
36D
24D
12D
4
8
12
16
20
24
28
32
36
40
NUMBER OF LETTERS COUNTED
TO ASPHERIC
UNIVIS 2X TEL. WITH CAP
FEINBLOOM
VOLK CONOID
AO MICROSCOPIC
UNIVIS 1.5X TEL. WITH CAPS


GRAPH 3
STATED MAGNIFICATION
12X
10X
8X
6X
4X
2X
AO ASPHERIC
VOLK CENTER
FEINBLOOM
AO MICROSCOPIC
4
8
12
16
20
24
28
NUMBER OF LETTERS COUNTED

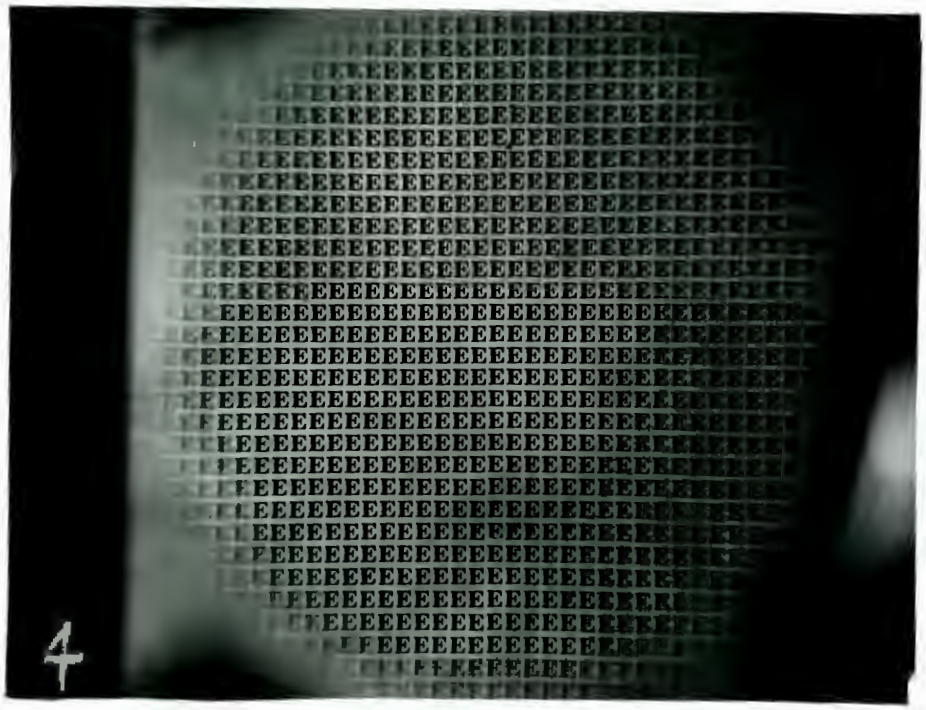


1. A.O. Aspheric Microscopic Lens: 8X

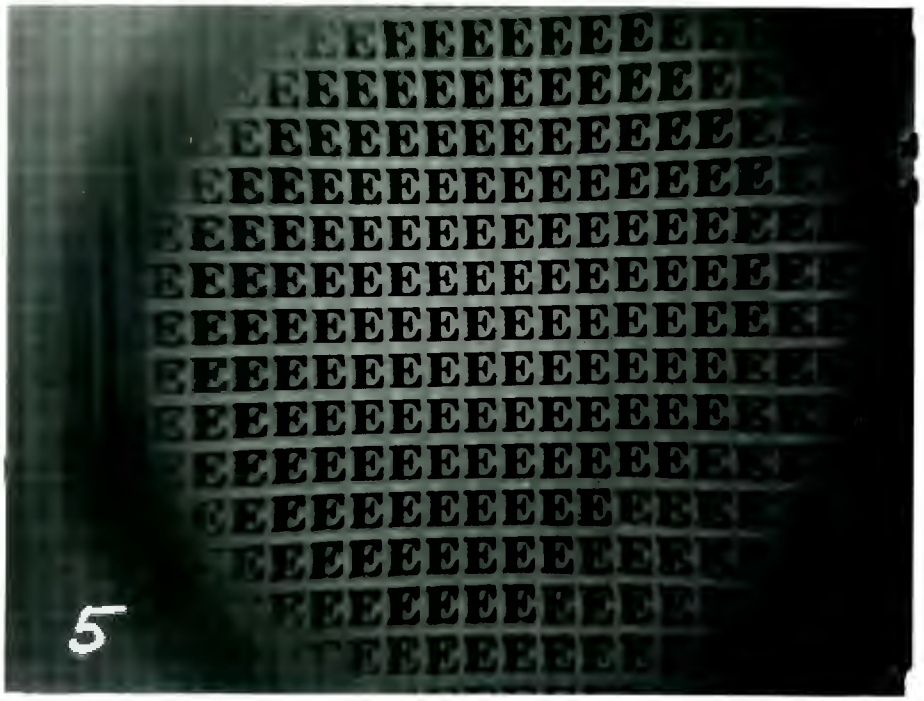


2. A.O. Aspheric Microscopic Lens: 10X


3. A.O. Aspheric Microscopic Lens: 12X

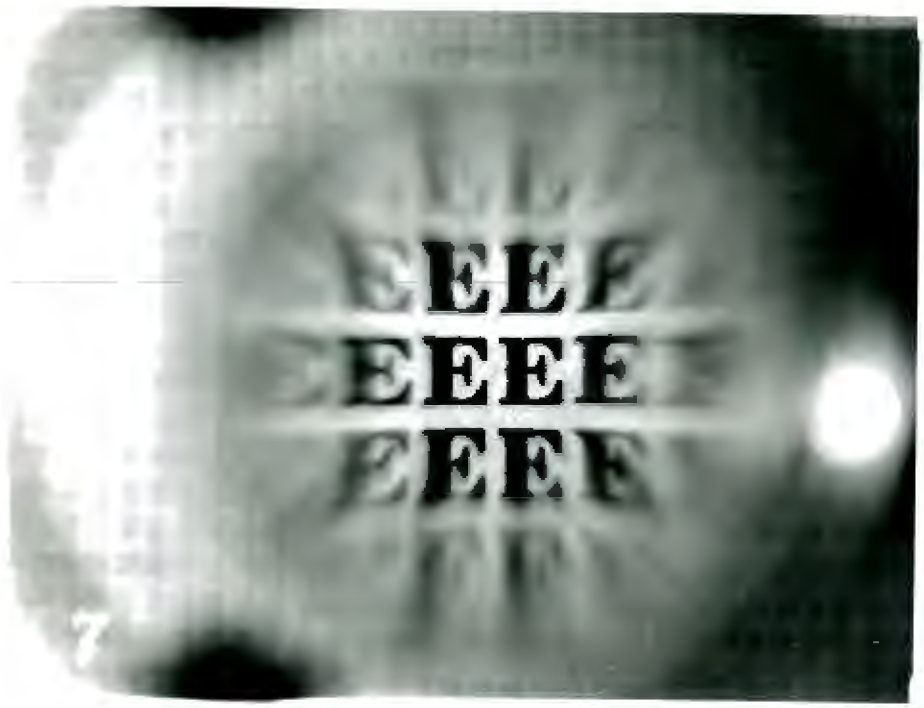



4. A.O. Microscopic Lens: 2X

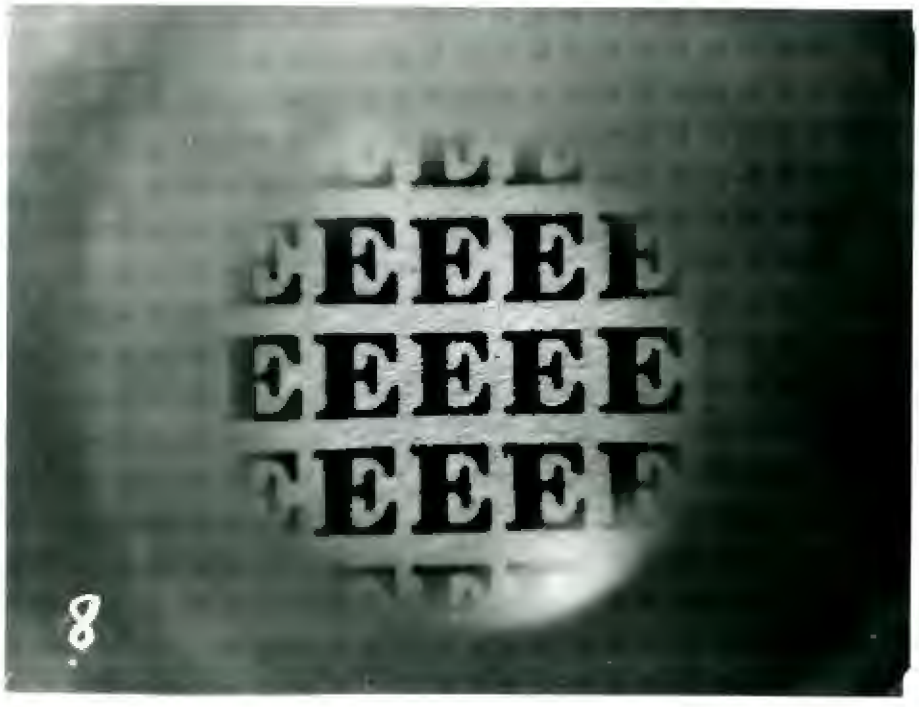



5. A.O. Microscopic Lens: 4X

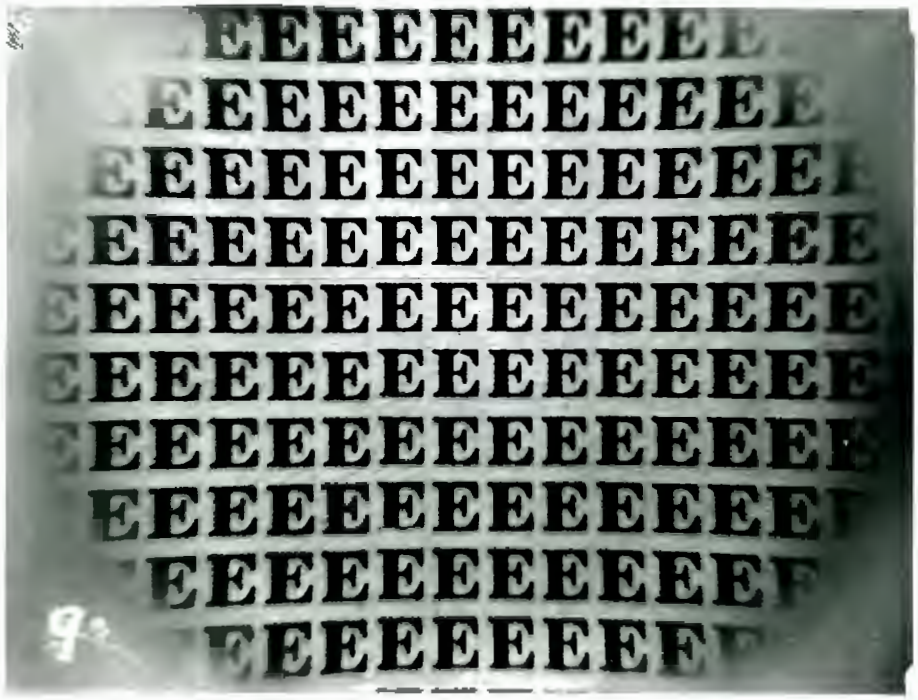

6. A.O. Microscopic Lens: 6X




7. A.O. Microscopic Lens: 8X



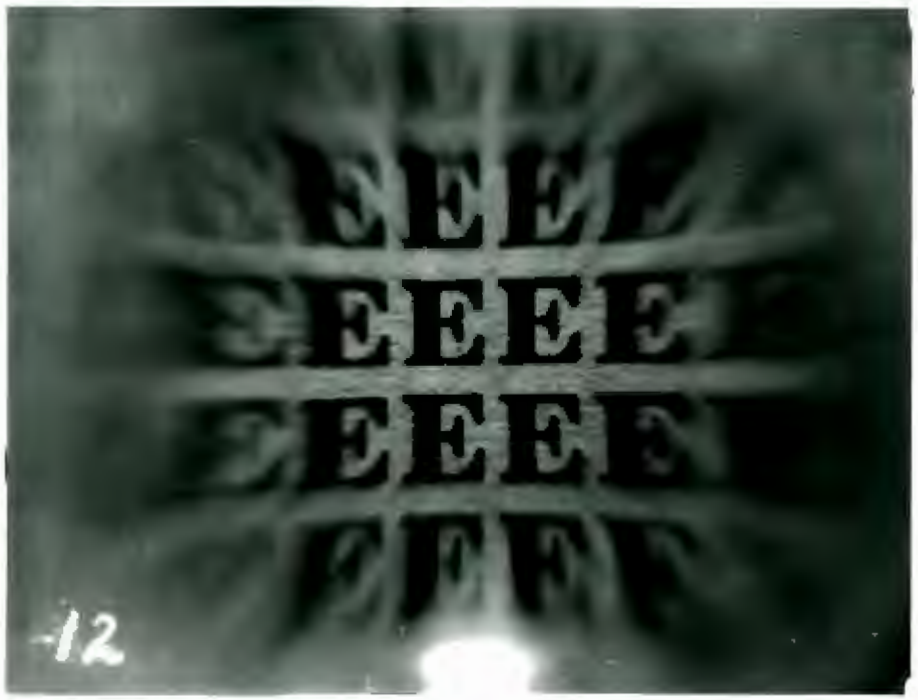

8. A.O. Microscopic Lens: 10X



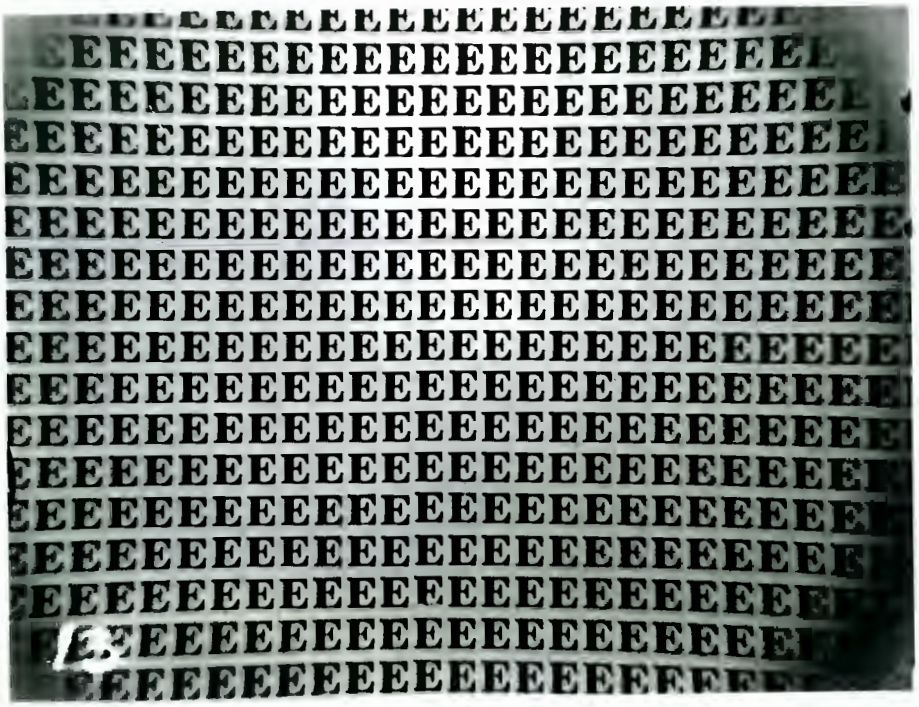

9. Feinbloom Aspherical Microscope: 4X


10. Feinbloom Aspherical Microscope: 8X

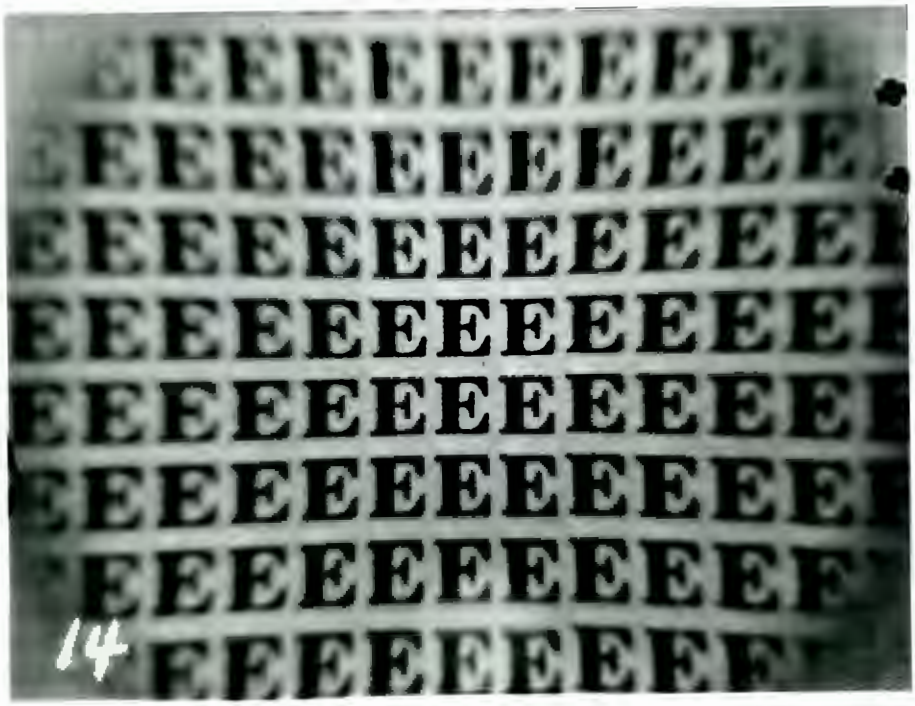

11. Feinbloom Aspherical Microscope: 10X




12. Feinbloom Aspherical Microscope: 12X



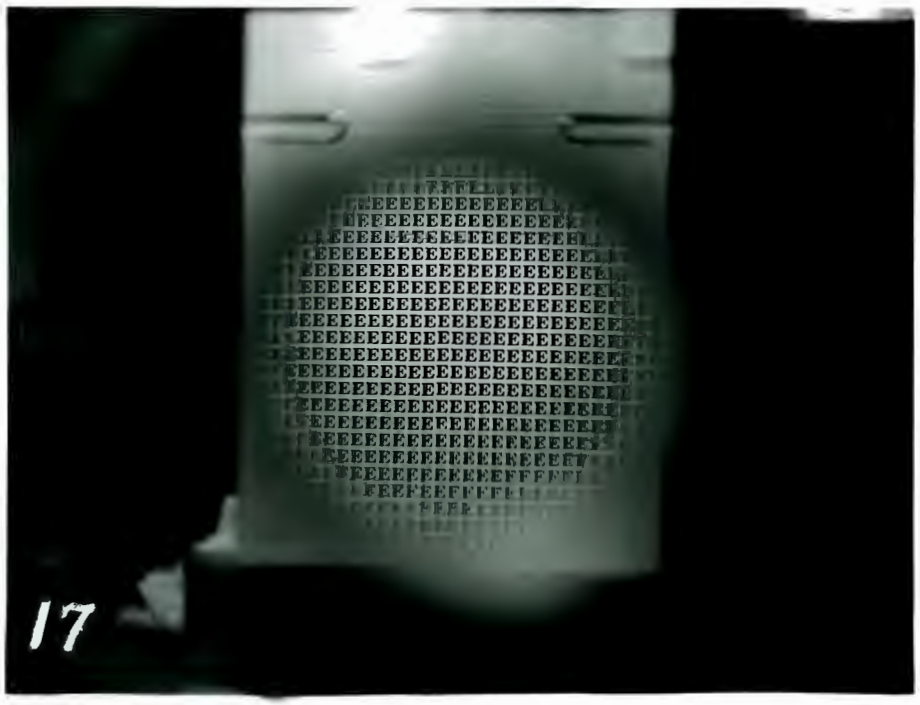
13. Volk Conoid Microscope: 3.75X (15 D.)



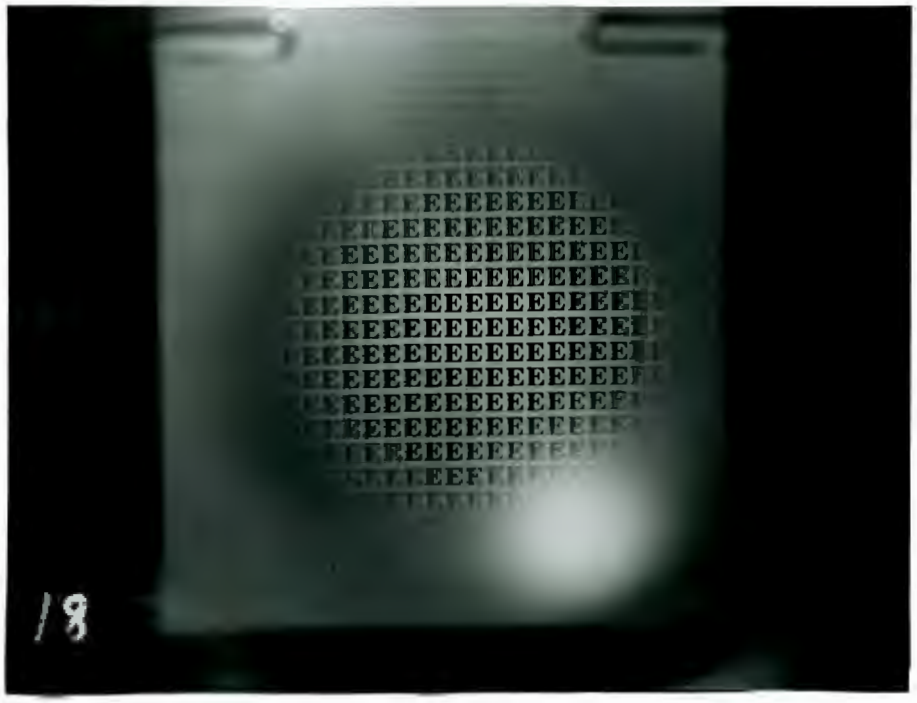
14. Volk Conoid Microscope: 7.5X (30 D.)


15. Volk Conoid Microscope: 10X (40 D.)

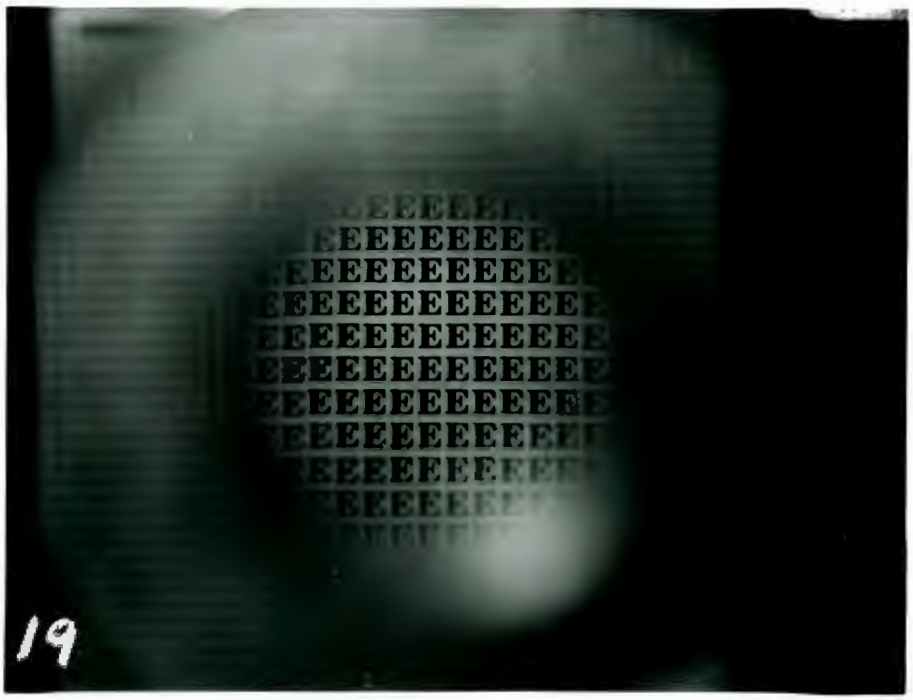

16. Volk Conoid Microscope: 12.5X (50 D.)



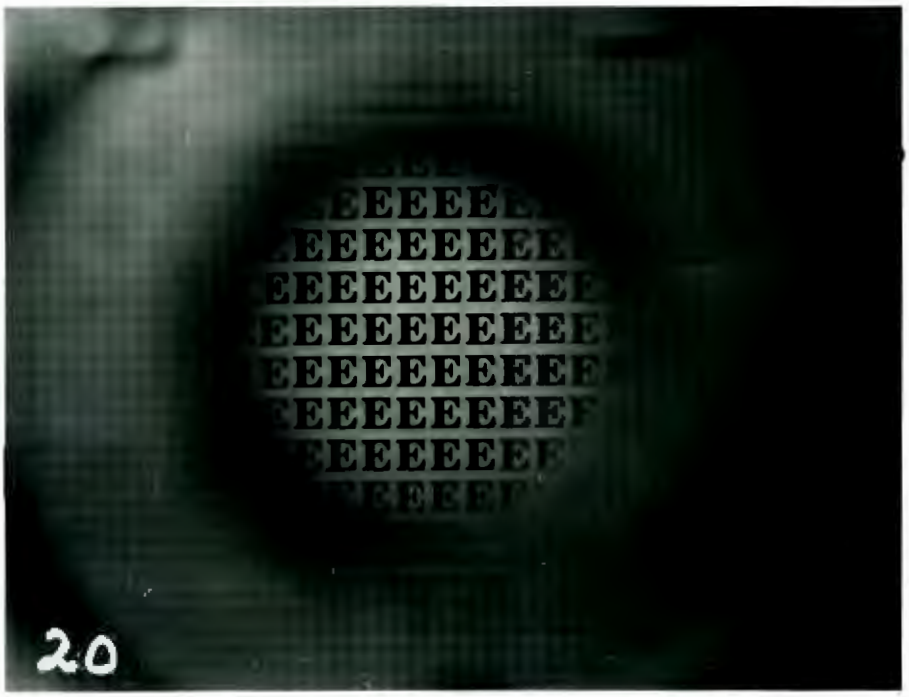

17. Univis 1.5X Telescope with 4D. Reading Cap (1.5X)



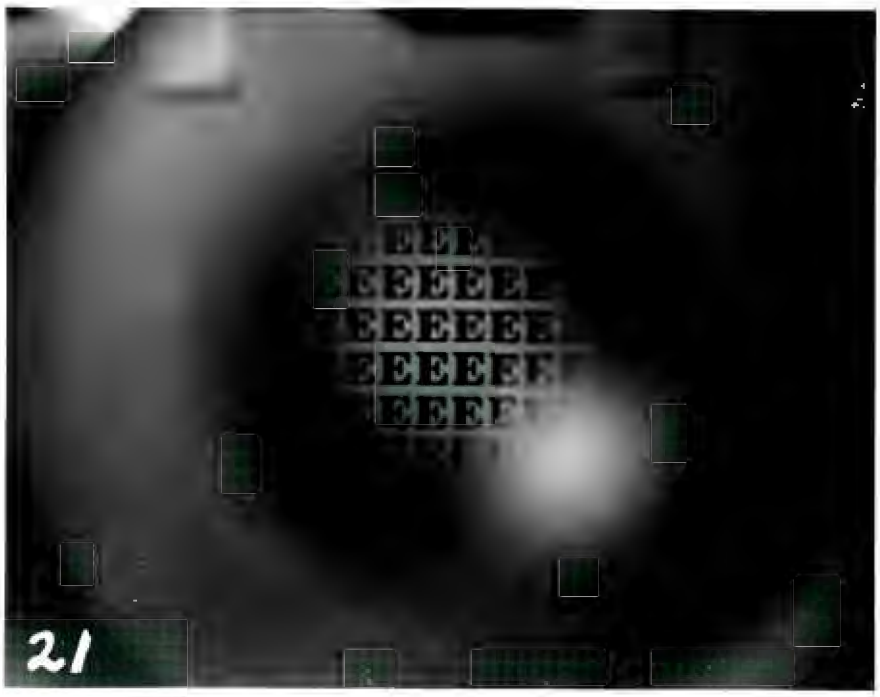

18. Univis 1.5X Telescope with 6 D. Reading Cap (2.25X)




19. Univis 1.5X Telescope with 8 D. Reading Cap (3X)




20. Univis 1.5X Telescope with 10 D. Reading Cap (3.75X)




21. Univis 2X Telescope with 8 D. Reading Cap (4X)