starting from the very first principles; and it is from such study that this purely mechanical account of the physical evidence has been obtained.

"Micro-crystalline Structure of Platinum." By THOMAS ANDREWS, F.R.S., F.C.S. Received October 26,—Read November 28, 1901.

[PLATE 6.]

The crystalline structure of platinum does not appear to have been studied, although it forms an interesting subject for investigation.

A small ingot of pure platinum was obtained for the experiments. A section was cut therefrom and machined to $\frac{5}{16}$ inch square and $\frac{1}{10}$ inch in thickness. The section was then carefully polished and etched in aqua regia of the following strength:—

4 parts of hydrochloric acid (sp. gr. 1·2).
1 part of nitric acid (sp. gr. 1·42).

When the polished micro-section was immersed in the aqua-regia solution in the cold, no solvent action occurred, although the metal was exposed for a considerable time in the reagent.

The temperature of the etching solution was then gradually raised to boiling point, at which it was maintained for 15 seconds, but it had apparently no visible effect on the platinum, as ascertained by microscopical examination, after having previously washed the section with water and pure alcohol.

The etching process was repeated and the metal again exposed for a further period of 30 seconds, but after microscopical examination of the surface of the metal it was found that even this exposure had not satisfactorily developed a structure in the metal.

The etching process was again repeated and the micro-section exposed for another 15 seconds to the boiling aqua-regia solution above described. This developed a better crystalline structure, though not a thoroughly satisfactory one. The same micro-section of platinum was therefore again exposed to the action of boiling aqua regia for a further period of 45 seconds, resulting in the development of a beautiful crystalline structure which manifested not only the large or primary crystal grains but also the secondary or very minute crystalline development which is illustrated on Plate 6.

Fig. 1 shows the micro-crystalline structure of pure platinum as seen in transverse section by oblique illumination at a magnification of 50 diameters.

Fig. 2 shows, at a magnification of 120 diameters, the crystalline structure as indicated in transverse section by the direct or vertical method of illumination. This micro-section illustrates the general

form of the primary or large crystal grains, and also indicates the existence of very minute crystals within the boundary lines of the larger crystal grains.

The structure and general orientation of the minute secondary crystals, as seen in section by vertical illumination at the higher magnification of 360 diameters, are illustrated on figs. 3 and 4.

The larger or primary crystal grains were observed to consist of irregular polygons of varying size, the etched indications of the facet junctions being often clearly and sharply defined.

The minute or secondary crystals (whose inter-crystalline junctions were also clearly seen) were in the mass observed to be in varied positions of orientation, but the orientation was generally identical, or on the same plane, within the area of each larger crystal grain.

The general orientation of the smaller crystals varied, however, in each separate larger crystal, and the consequent varied reflection of the light has given the face of the micro-section, as a whole, the appearance of lighter or darker areas in the photo-micrographs. This effect is merely optical.

In some portions of the mass there were observed minute triangular crystals; these appear, however, to be only developments resulting from the cutting of certain crystals in section.

The general micro-crystalline structure of platinum was observed to be allotriomorphic in character and derived from a system of interfering cubes and octahedra, the cubic and hexagonal form being frequently noticeable.

The size of the large crystal grains varied from about 0·002 inch to 0·04 inch in size, and the smaller crystals ranged from about 0·0002 inch to about 0·007 inch.

There were indications that the smaller or secondary crystals were each built up of even more minute crystalline ramifications.

The crystalline structure of platinum appears to generally resemble that of gold and silver.

The descriptive words "primary" and "secondary" crystals are only used in relation to size, and they are not intended to convey the idea of distinctive times of formation during solidification.

Addendum. February 3, 1902.

In connection with the present investigation reference may be made to the valuable researches of Professor Liversidge on "The Crystalline Structure of Gold and Platinum Nuggets."* On comparison there appears to be considerable identity between the crystalline structure of natural platinum nuggets and that of the platinum ingot

* 'Journal, Royal Society of New South Wales,' 1897, vol. 31, p. 70, Plate 9.

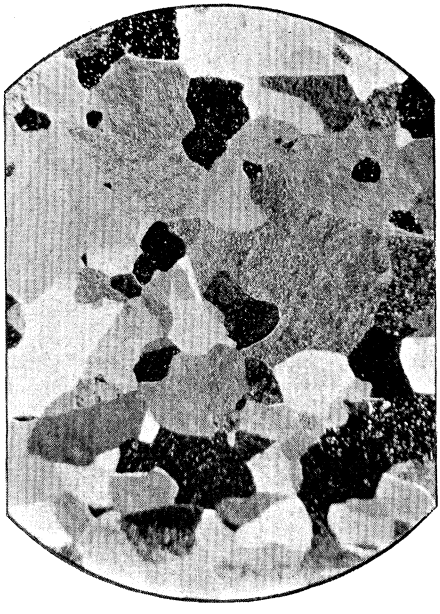

FIG. 1. × 50 diams.

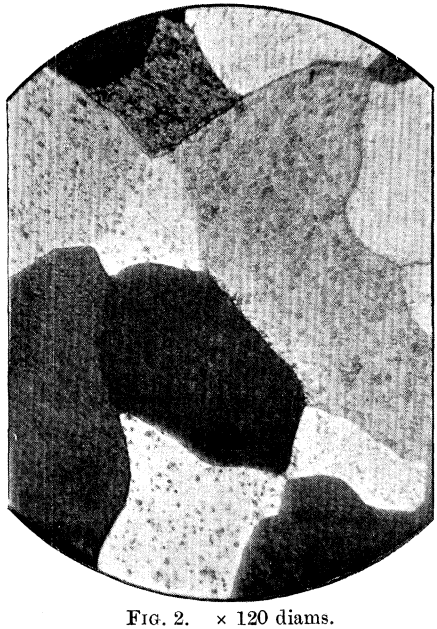

FIG. 2. × 120 diams.

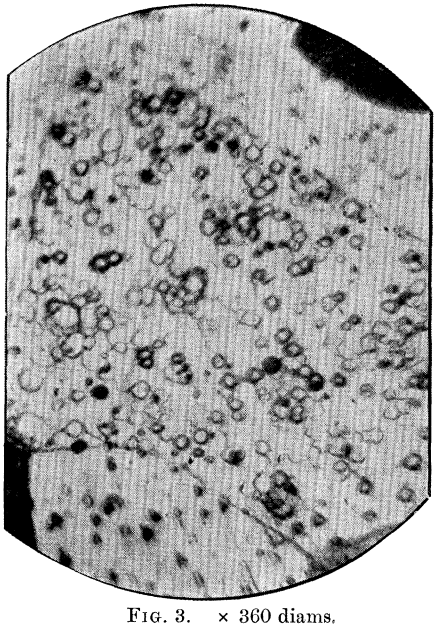

FIG. 3. × 360 diams.

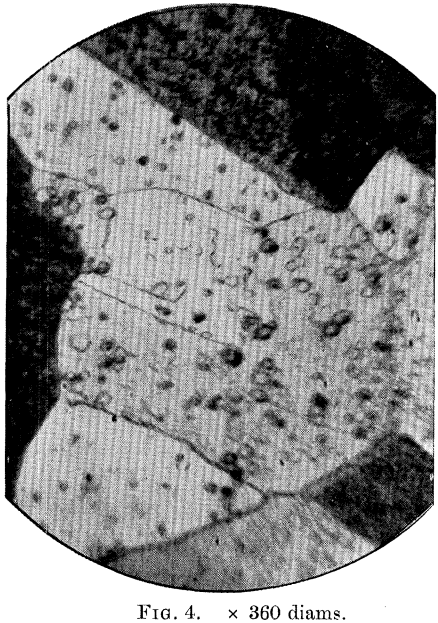

FIG. 4. × 360 diams.

examined by the author (Mr. Thos. Andrews), the crystalline jointings appearing to be similar in character.

A general analogy appears also to exist between the crystalline structure of pure platinum and that of pure gold, which is noticeable on comparing the illustrations in the present paper with those in the following papers, viz.: "On the Structure of Gold and Gold Alloys," by Professor J. O. Arnold,* and "On the Structure of Metals, its Origin and Changes," by M. Osmond and Sir Roberts-Austen.†

This identity of structure is further seen on referring to the illustrations in the paper on "The Microscopic Structure of Gold and Gold Alloys," by Mr. Thomas Andrews.‡

DESCRIPTION OF PLATE 6.

Micro-crystalline Structure of Platinum.

Fig. 1. Structure seen in section magnified 50 diameters. Oblique illumination.

Fig. 2. Primary and secondary crystals seen in section magnified 120 diameters. Vertical illumination.

Fig. 3. Primary and secondary crystals seen in section magnified 360 diameters. Vertical illumination.

Fig. 4. Primary and secondary crystals, magnified 360 diameters. Vertical illumination.

"The Distribution of Magnetism as Affected by Induced Currents in an Iron Cylinder when Rotated in a Magnetic Field."

By ERNEST WILSON, Professor of Electrical Engineering, King's College, London. Communicated by Sir W. H. PREECE, F.R.S. Received January 3,—Read January 30, 1902.

One object of this research§ is to investigate the effect which induced currents have upon the distribution of magnetism in an iron cylinder when it is rotated about its longitudinal axis in a magnetic field whose direction is normally at right angles to the axis of rotation. Another object is to investigate the rate of dissipation of energy by these induced currents, and to compare the same with the result of theory. This second part of the work will be dealt with in a subsequent paper.

The variables dealt with are the total flux of magnetism between

* 'Engineering,' vol. 61, 1896, p. 176.

† 'Phil. Trans.,' A, 1896, p. 417, fig. 10, Plate 9, and fig. 16, Plate 10.

‡ 'Engineering,' September 30, October 28, December 9, 1898; see also "Micro-metallography of Iron," by Mr. Thomas Andrews, 'Roy. Soc. Proc.,' vol. 58, 1895.

§ I wish to acknowledge the grant of £80 for the purposes of this research, which was voted to me by the Council of the Royal Society out of the Government Grant.

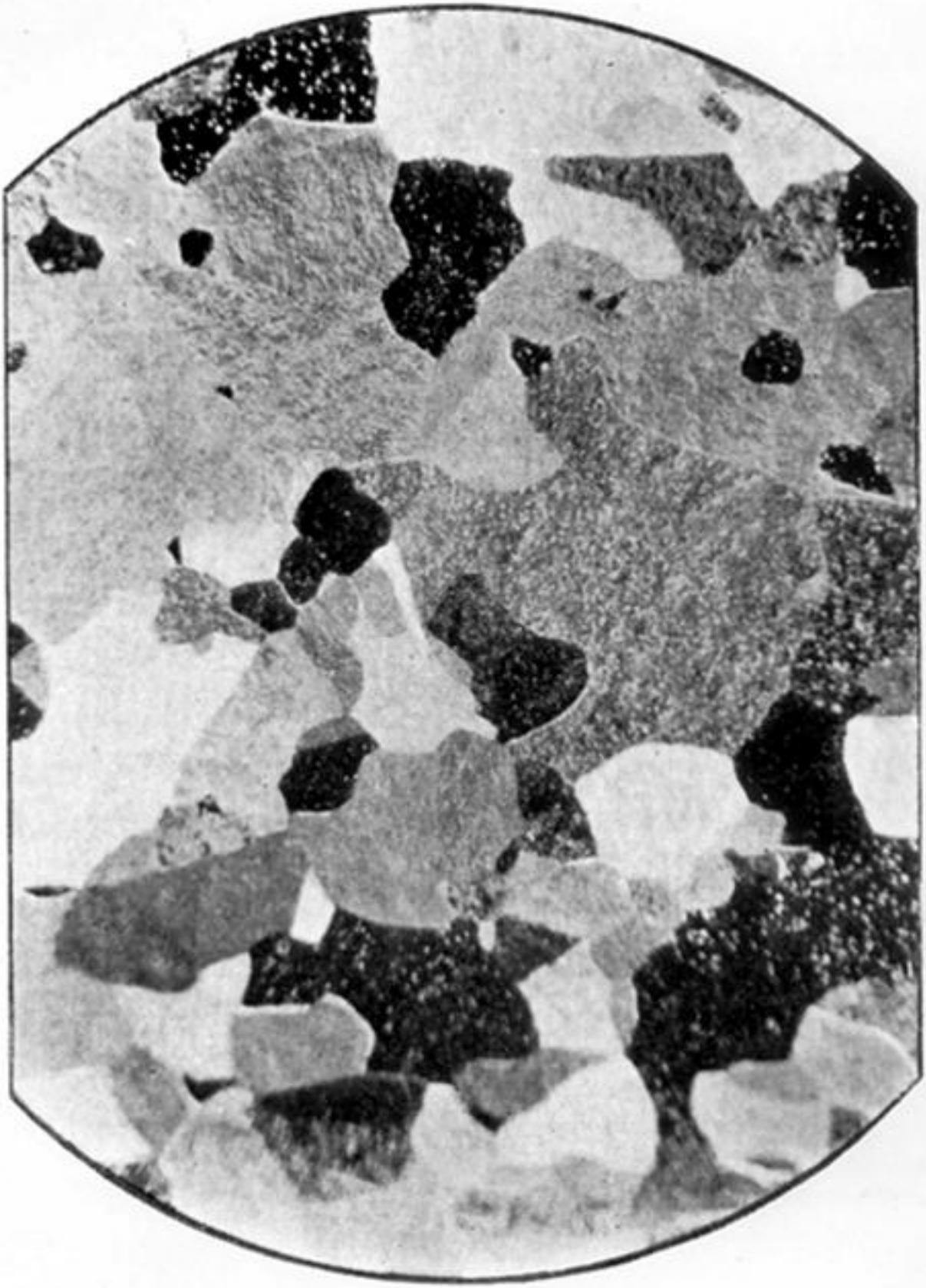

FIG. 1. × 50 diams.

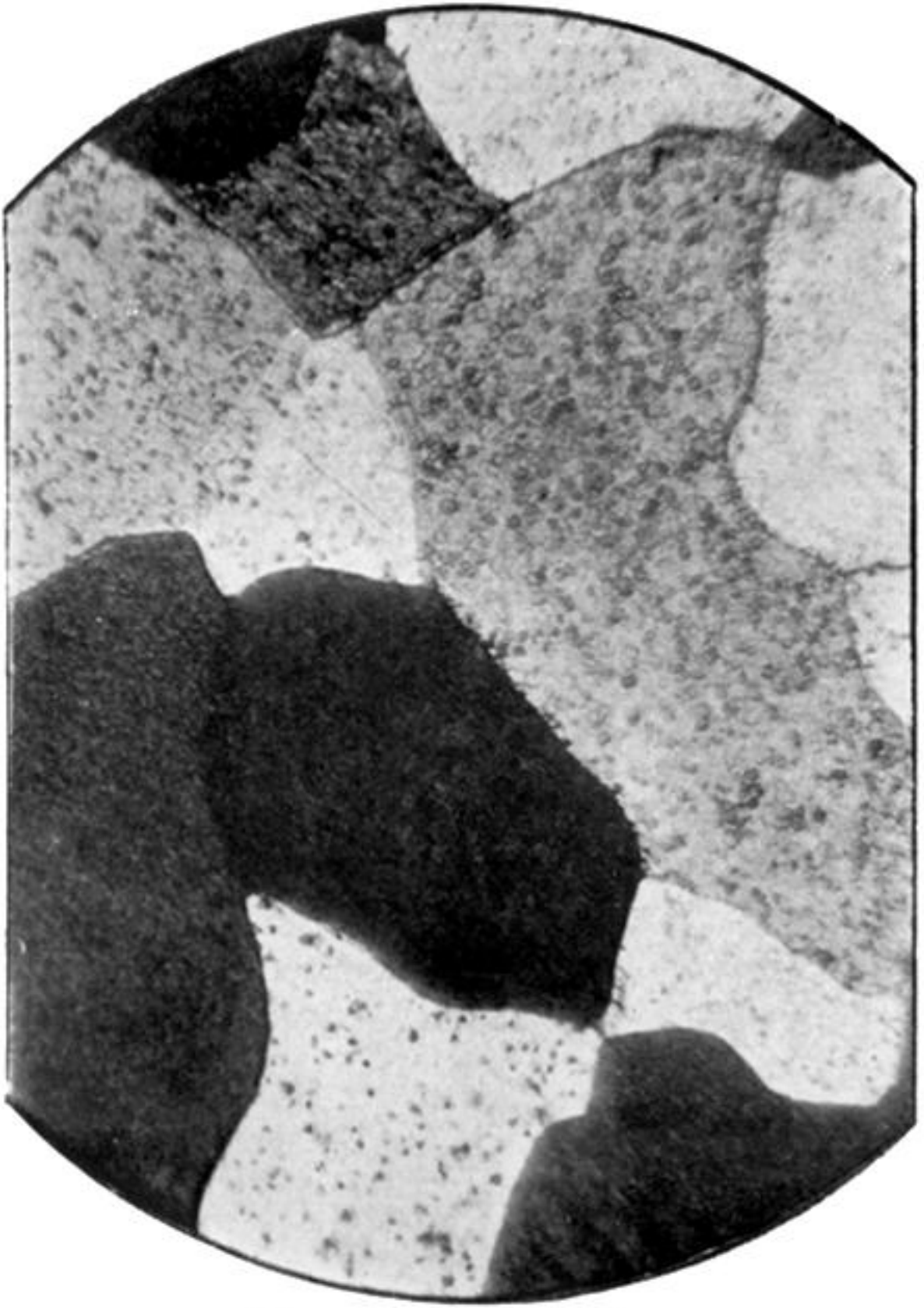

FIG. 2. × 120 diams.

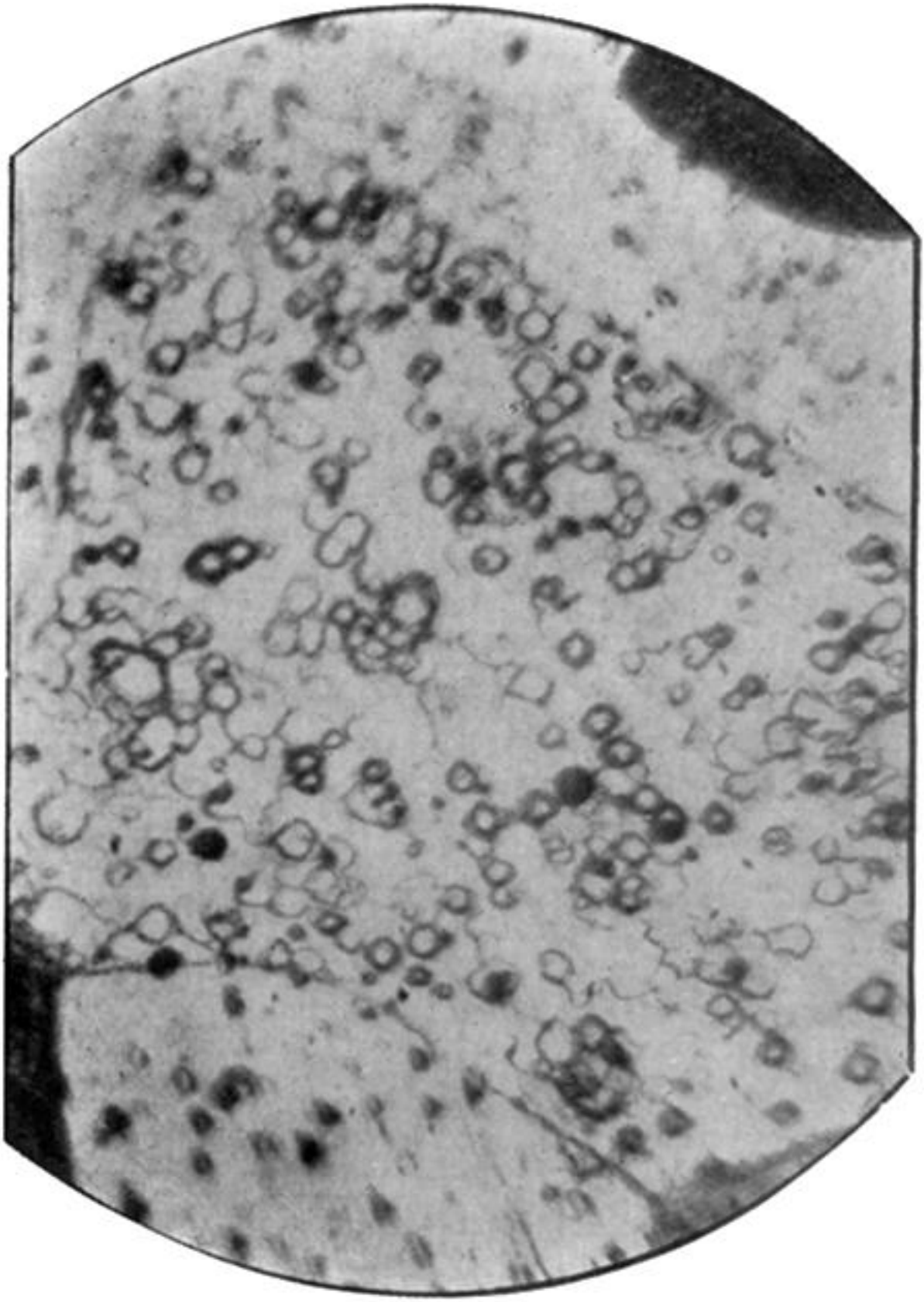

FIG. 3. × 360 diams.

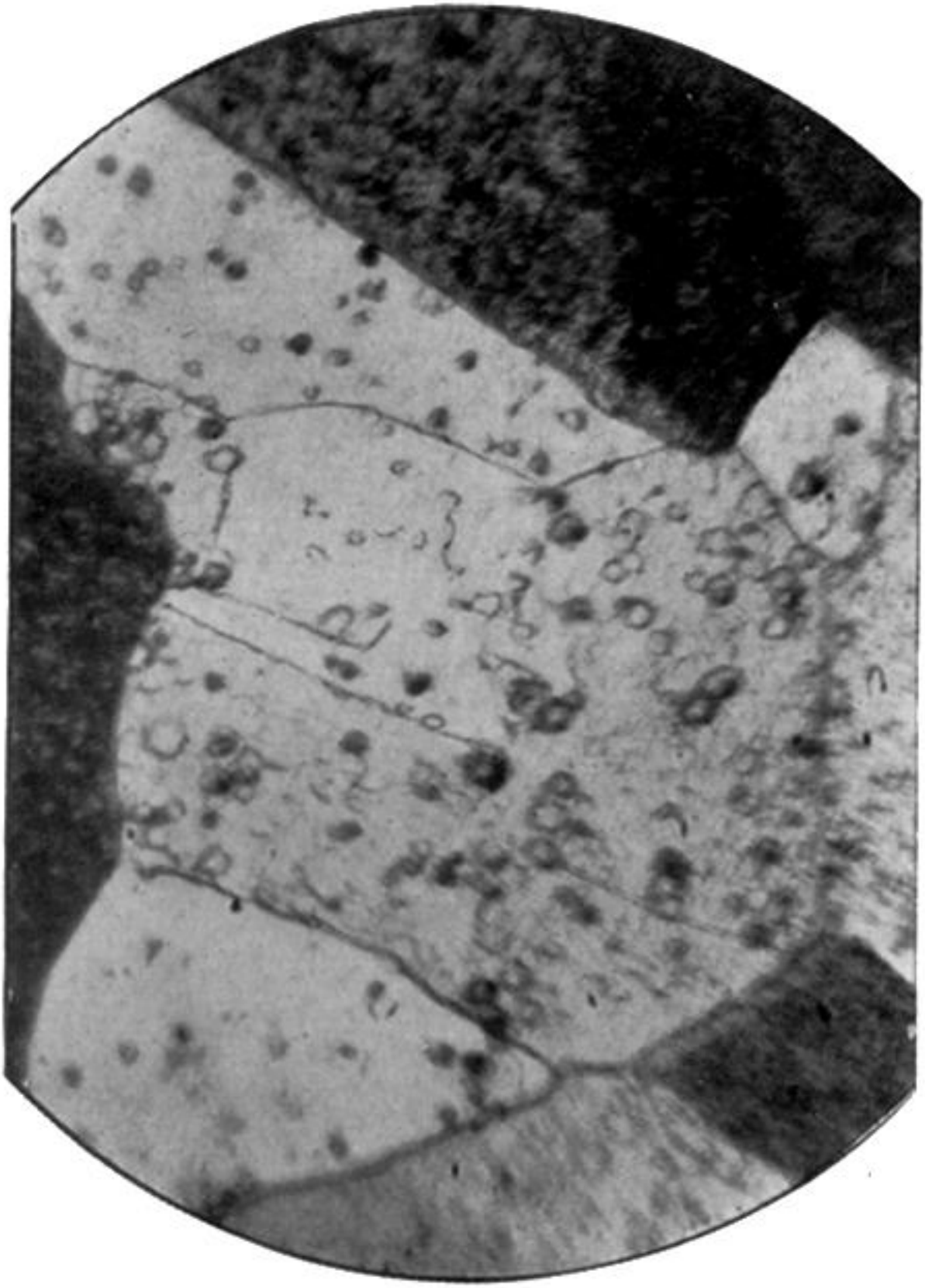

FIG. 4. × 360 diams.