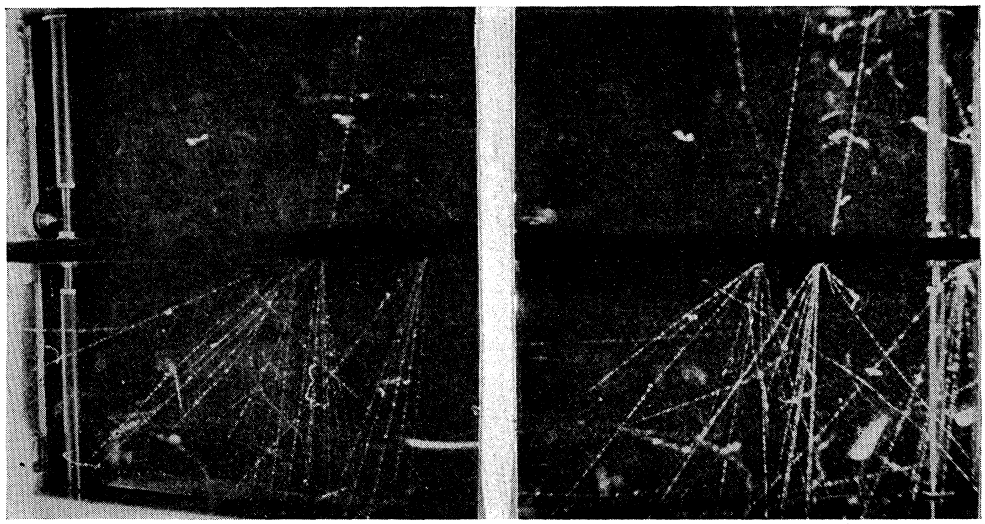

A. B.

FIG. 4. Stereoscopic pair (each at 30° with the normal) showing complex shower phenomena. In this remarkable event three showers emerge from the lead with every appearance of simultaneity. Two are produced by electrons with very closely parallel paths and the third by a non-ionizing ray.

be excited by secondaries from scattered photons which arise at a nuclear collision in the lead. Although the number of photographs taken is too small to make a reliable estimate of the relative frequencies of these three types it is of interest to note that out of 35 successful photographs 13 may be definitely classified as type (1).

E. C. STEVENSON
J. C. STREET

Research Laboratory of Physics,
Harvard University,
July 27, 1935.

[1] Anderson, Millikan, Neddermeyer and Pickering, Phys. Rev. **45**, 352 (1934).
[2] Blackett and Occhialini, Proc. Roy. Soc. **A139**, 699 (1933).
[3] Street and Johnson, Phys. Rev. **42**, 142 (1932).
[4] J. H. Sawyer, Jr., Phys. Rev. **47**, 515 (1935).

## Additional First Negative Oxygen Bands

To five bands of the first negative system, those at λλ5295, 5631, 6026, 6419 and 6856A, the quantum numbers (2,0), (1,0), (0,0), (0,1) and (0,2) were early assigned. The measurement of three further bands at λλ5005, 7334 and 7891A, with the numbering (3,0), (0,3) and (0,4) was given some time ago.[1] An additional band, joining on the high frequency side of the 6026A band at about 5900A was reported by Steubing,[2] but the later investigators, e.g., Cario[3] and Frerichs[4] assigned no quantum numbers to this band. This is not surprising if one considers that on the pictures of these authors,* because of the high effective temperatures of their strong hollow-cathode light sources, the very complicated rotational structure of the main band overlaps that place completely.

The high frequency discharge which proved successful in Zeeman effect work (see above), being rather cooler and at the same time not much less intense, allows the various vibrational bands to appear at the expense of the rotational development of each. About nine additional bands could be recognized fairly well, not only by their heads, but by several other typical parts too. The present status of experimentally identified heads (long wavelength side "most obvious" heads) is given in Table I. Steubing's

TABLE I. *First negative oxygen bandheads.*

| $v'$ \ $v''$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 0 | 16,589 | 15,575 | 14,581 | 13,606 | 12,669 |
| 1 | 17,751 | 16,736 | 15,741 | | |
| 2 | 18,878 | 17,860 | 16,871 | | |
| 3 | 19,972 | 18,953 | 17,959 | 16,992 | |
| 4 | | | | 18,043 | 17,097 |

band, with proper head measurement of course, represents the (2,2) band. Since the recognition of the interlacing higher vibrational bands renders the appearance of the main bands ($v''=0$ and $v'=0$ progressions) somewhat less complicated, the prospects of a rotational analysis seem to be increased by the present work.

L. BOZÓKY
R. SCHMID

Physical Institute of the Royal Hungarian University for Technical and Economic Sciences, Budapest,
August 9, 1935.

[1] R. S. Mulliken and D. S. Stevens, Phys. Rev. **44**, 720 (1933).
[2] W. Steubing, Ann. d. Physik **33**, 553 (1910).
[3] His pictures have been measured by F. Holland, Zeits. f. wiss. Phot. **23**, 342 (1925).
[4] R. Frerichs, Zeits. f. Physik **35**, 683 (1926).
* Thanks should be expressed to Dr. Frerichs for letting us have his and Dr. Cario's old plates.