

tions, that the particles of the powder necessarily arrange themselves in planes at right angles to the direction of the vibratory movements, and that their observed distribution at the loops and nodes is in accordance with the same laws.

*Method of Slow Movements.*—Before the invention of the preceding methods the acoustician occasionally resorted to the device of deducing the vibrations of a sounding body from the behaviour of a similar body whose movements were of sufficient amplitude to be seen by the eye, and so slow that they could be readily counted. In this way Mersenne counted the vibrations of a cord 15 feet long under a stretching force of 7 pounds, and found them to be 10 per second. In shortening the cord to 1/20 of its length, he obtained an audible sound whose pitch he concluded corresponded to 10 vibrations per second. In the same way Chladni employed a long thin metal rod, which gave in the first instance only 4 vibrations per second. He then shortened the rod until it gave an audible sound, whose pitch he determined from the law expressing the relation between the length and the number of vibrations. This method, however, which appears so simple in theory is subject to large errors and gives in practice very poor results.

*The Stroboscopic Method.*—Mersenne's and Chladni's method has accordingly given place to another—the stroboscopic—which allows the vibrations of the sounding body to be viewed directly, its movements relatively to a vibrating eye-piece being rendered as slow as we please. The first use of stroboscopic discs for the purpose of observing very rapid periodic movements was made by Plateau in 1836. His discovery, however, remained unnoticed, for Doppler in 1845 published a note on the same subject, without referring to Plateau's discovery. It was Töpler who first made the method generally known by employing it in a series of acoustical experiments, which he published in Poggendorff's "Annalen," volume 128. In the earlier applications of this method, the view of the vibrating body was rendered intermittent by looking through slits which were opened and closed in rapid succession. This plan was modified by Mach who caused the vibrating body to be illuminated by intermittent light.

If now we allow the stroboscopic images of a moving body to fall on a photographic plate, giving the plate a movement of translation which is arrested before each appearance of the image, we thereby obtain a series of photographs of the successive positions assumed by the body. If, further, matters are so arranged that the beginning and duration of the phenomenon are traced on the images, we have a new method, which is called Chronophotography. It was M. Janssen who first conceived the idea of taking automatically a series of photo-