

Rood (O.N.)

on the duration of flashes of lightning.

---

SURGEON GENERAL'S OFFICE  
126.  
LIBRARY



## ON THE DURATION OF FLASHES OF LIGHTNING.

By OGDEN N. ROOD.

—•••—

AFTER the completion of my first set of experiments on the duration of the discharge of a Leyden jar, I became anxious to make some measurements of the duration of a flash of ordinary lightning, which may be considered as equivalent to the discharge of an immense jar with an enormous striking-distance. The results of Feddersen have shown that the duration of the discharge is increased by an addition to the size of the jar, as well as by augmentation of the striking-distance, and as both these quantities are so large with a flash of lightning, it was reasonable to expect that the duration of its discharge would be prolonged in some corresponding ratio. During the violent thunder-storm of last August, which occurred in the evening, I happened to be at a house commanding an unobstructed view of the horizon, and this circumstance taken in connection with the frequency and proximity of the electrical discharges, induced me, although entirely unprovided with apparatus, to attempt a measurement of their duration. A circular disc, five inches in diameter, was hastily cut from white cardboard, while a steel shawl-pin served as an axis, on which it was made to revolve by constantly striking its edge tangentially with the right hand, the pin being held in the left. The *maximum* velocity attainable in this way was always employed. The general indications at the time were that the rate thus obtained was considerably more uniform than might have been expected, and subsequent quantitative experiments have confirmed this idea. The first experiments were made by observing black figures traced near the circumference of the disc, which was illuminated solely by the rapidly recurring flashes, and it often happened that the figures, with their details, were seen quite as clearly and sharply as though the disc had been stationary; on the other hand, sometimes the edges seemed blurred, as though

the disc had moved through a few degrees during the act of discharge. The result being doubtful, the mode of experimenting was quickly changed; about fifteen narrow radial apertures were made near the circumference of the disc, and the flashes and illuminated clouds were observed through these openings, the disc being made to revolve as before. The distance of the eye from the apparatus was about eight inches, and it was of course adjusted so as to obtain distinct vision of the disc. The result was that sometimes the openings were seen quite unchanged in appearance, but more frequently they were most distinctly elongated into well defined streaks some degrees in length. They were observed often and without difficulty, but as farther confirmation I may add that I requested Prof. Joy, who was ignorant of the actual form of the aperture, to state his opinion of their apparent shape while the disc was in rotation. The reply was that they resembled Prince Rupert's drops—a not unfair description of the phenomena in question. Repeated estimates of their size were then made with paper and pencil. Some time afterward I measured the velocity which I could communicate to this disc in the manner above described, by attaching to it a small hollow axis through which the steel pin passed, the disc being then caused to wind up a thread stretched by a small weight. The rate of rotation thus attainable was found to be about twelve revolutions per second, which is a little more than I had anticipated. The average size of the streaks was  $9^\circ$ , corresponding to a duration of  $\frac{1}{12}$  of a second. It hence results that the duration of the flashes of lightning on the occasion referred to was in round numbers about  $\frac{1}{3}$  of a second, some of them, however, seeming to be confined to smaller limits.

I know of only a single circumstance which might militate against the correctness of the above conclusion, and it is but fair to give it such weight as it may carry. Becquerel has succeeded with some difficulty in observing a faint phosphorescence when an electric discharge is passed through rarefied air, and it is not absolutely impossible that the effects observed by me were due to a cause of this kind.

This point can hereafter readily be decided by observing with a revolving disc, not the distant clouds, but a sheet of white paper, placed so as to receive the light from the electrical flashes.



the light had moved through a 100 degrees during the act of  
 reflection. The result being evident, the mode of experi-  
 menting was entirely changed, about fifteen narrow radial  
 slits were cut near the circumference of the disc and  
 the upper and illuminated slits were observed through these  
 openings, the opening made to revolve as before. The dis-  
 tance from the aperture was about eight inches,  
 and it was observed that the opening was in plain distinct vision of  
 the disc, and it was that sometimes the openings were  
 seen quite distinctly in appearance, but more frequently they  
 were lost in twilight. They were observed often and without dis-  
 tinction, but as further confirmation I may add that I requested  
 a friend, who was ignorant of the actual form of the ap-  
 erture to state the nature of their apparent shape while the dis-  
 c was in rotation. The reply was that they resembled French  
 slits in appearance and in the direction of the phenomenon in  
 the same manner as the slits in their own eyes when they made  
 a rapid motion. I was then asked and I answered the  
 question which I could not communicate to this disc in the manner  
 intended, by observing to the eye, small hollow rods through  
 which light passed in a quantity. The rate of rotation  
 was such that the rods in about twelve revolutions per  
 second, showed a little more than I had anticipated. The  
 result was the effect of a corresponding to a duration  
 of a second. It seems probable that the duration of the  
 light in passing on the camera is nearly the same as would  
 be the case in a camera of a second, but I am not however, com-  
 petent to judge of the exact duration of the light in passing  
 through the camera. I know only a single instance which might illustrate  
 what the duration of the above mentioned and it is but  
 little to give it such weight as to give any support to  
 the idea that the duration of the light is a half second.  
 The result when an electric discharge is passed through a radial  
 slit and is not observed through the slit, but through a  
 narrow slit in a wall of the disc.  
 The result was that the light was observed by a camera with  
 a lens of one inch diameter, but a slit of white  
 paper was used to receive the light from the electrical flash.