#45

Handwritten draft (in pencil) of a letter from Miller to Rayleigh which was to accompany a roll of photos made with the phonodeik.

June 1909

My dear Lord Rayleigh

I am taking the liberty of sending you in a roll some photographic records of sound waves, which may be of interest. I have long wished to make a detailed study of the physics of tone quality. I have constructed a sound recorder for this purpose. Only an abstract description of this instrument has not yet been published, and so I may briefly explain it. A glass diaphragm 1/10 mm thick is held firmly by its edges, so as to receive the air wave. A fibre is cemented to the center of the diaphragm and passes around a small steel staff pivoted in jeweled bearings; the fiber is kept taut by a delicate spring. Motions of the diaphragm thus give rotation to the staff; a minute mirror is attached to the staff and reflects light from an arc to a moving film. At a distance of 16 ¼ inches the spot of light moves 2000 times as far as does the diaphragm, showing the staff to have an effective radius of about 0.3 mm. The staff and mirror weigh 2.8 mg, and this mass is so distributed (so) as (to) reduce the inertia as much as possible. There is no appreciable lost motion, and no lag or distortion so far as I have been able to discern. There is nothing novel in the application unless it be its simplicity and delicacy, which make for efficiency.

The following plates are sent in this roll:

(a) Two small prints. These were made early in the work, mainly to test the instrument and not for exhibition! One shows that the record of simple sound (Koenig fork 256) is a close approximation to a sine curve, and that the compounding of two such sounds is satisfactorily accomplished. The other shows that a given loud sound of high frequency can be added to a sound already complex.

(b) Sound of flute tones. They show incipient overtones which continually change and produce a peculiar lack of symmetry.

(c) Bell. The overtones are very intense of frequencies up to 2000 or more. At the ¼ portion of the length of this record, the high partials are especially strong; at 2/3 length the sudden increase of amplitude is caused by the bell being struck by the ivory hammer.

(d) The original negative film record of the words “Lord Rayleigh” spoken by the writer in ordinary voice. There is also a print from this negative.

(e) For comparison, I send a print from another photograph of the same words made at another time.