1919, number. We also note that that most useful publication, Michel's (once Nagel's) *Jahresbericht*, has ceased to exist. At the close of the war it was announced that a single volume covering the period of the war was in preparation.

**Help for the Blind**

The text of the Government Bill to promote the welfare of blind persons, which came into operation on September 10, 1920, deserves universal approval. Its chief provision is that every blind person who has attained the age of 50 shall be entitled to such pension as, under the Old Age Pensions Act, 1908 to 1919, he would be entitled to if he had reached the age of 70. But that is not all. County and Borough Councils are authorized to provide and to maintain or to contribute towards workshops, hostels, homes, or other places for the reception of the blind. With the approval of the Minister of Health, they may make such further arrangements for the welfare of blind persons as they may think fit. The measure applies to Scotland and to Ireland. Its short title will be "The Blind Persons Act, 1920."

In this connection it may be noted that a memorandum has been issued by the Board of Education dealing with the training of blind students. The chief object of the Board is to provide a link between the special school giving primary education, on the one hand, and the workshop, on the other. The Board is prepared materially to increase the grants it makes in aid of training institutions, and these and other grants mentioned in the memorandum will be retrospective as from April 1, 1919.

**INTERIM REPORT OF THE JOINT COMMITTEE APPOINTED BY THE ILLUMINATING ENGINEERING SOCIETY TO ENQUIRE INTO "EYE-STRAIN IN CINEMAS"**

This Committee was formed in response to a request conveyed to the Illuminating Engineering Society from the London County Council (April 28, 1919) for information as to possible causes of eye-strain in cinemas, and the best means of removing them, and in particular "The question of the strain on the eyes caused by the proximity of seats to the screen at cinematograph halls, and of the possibility of devising some means of lessening the ill-effects

* Reprinted from the *Illuminating Engineer*, June, 1920.
referred to." A joint committee, representing the Council of British Ophthalmologists, the Physiological Society, the Illuminating Engineering Society, the Cinema Industry, and the London County Council, was appointed, the whole being presided over by Mr. J. Herbert Parsons, C.B.E. The Council of British Ophthalmologists sent Messrs. B. Cridland, M. S. Mayou, W. H. McMullen, O.B.E., and J. Herbert Parsons, C.B.E.; the Physiological Society was represented by Professors W. M. Bayliss, F.R.S., C. S. Sherrington, F.R.S., and C. Spearman. Dr. James Kerr represented the Public Health Department of the London County Council.

Meetings were held, sub-Committees appointed, experimental demonstrations witnessed, and cinema halls visited, and the following recommendations and suggestions embodied in an interim report dated June, 1920:

**Limit to vertical angle of view (angle of elevation).**—In considering the question of close proximity of seats to the screen the Committee have formed the opinion that the ocular discomfort arising is due mainly to the fact that the eyes of spectators are directed upwards at an abnormal angle, a condition which is conducive to eye-fatigue and liable to give rise to headache and, general discomfort; whereas the direction of the eyes horizontally or downwards appears natural and agreeable. The condition of discomfort referred to is not determined solely by the proximity of the front row of seats to the screen and the vertical measurement of the picture. Another important circumstance is the height above the observer’s eye-level at which the picture as a whole is viewed. It would therefore not suffice to specify a minimum distance of seats from the screen, nor even a certain ratio between this distance and the vertical measurement of the picture. The requirement should include all the three factors enumerated above, but should be of a simple and definite character, capable of easy application.

The Committee, in determining such a requirement, have been guided partly by the knowledge of the physiological and ophthalmological experts on conditions liable to cause discomfort and fatigue to vision, and also on the experience of all the members of the Committee, when visiting a number of cinema halls in the London district. In each case the pictures were viewed successively from various rows of seats, the positions from which discomfort and eye-strain were experienced noted, and the corresponding angles of elevation recorded. In framing a general recommendation based on these experiences, due account was taken of such variable factors as the proportion of screen occupied by the picture and the extent to which the eye is directed respectively to the upper, central and lower areas of the screen, with the ordinary available seating accommodation.
In some of the cinema halls visited the conditions were found to be such as are likely to cause visual discomfort and eye-strain. By comparing the record of their experience in this respect with the tabular data summarising the angles of elevation in the various cinemas visited, the Committee came to the conclusion that it would be possible to secure conditions suitable for the eyes, and to diminish the possibility of eye-strain materially if a moderate value for the angle of elevation were adopted. It appeared that the desired conditions could be suitably expressed by stating that the angle of elevation, conveniently measured from the top of the picture as defined below, should not exceed 35°—a simple and easily interpreted recommendation which is to be regarded as embodying all the various factors mentioned above.

The Committee accordingly make the following recommendation:

"(1) That the angle of elevation, subtended at the eye of any person seated in the front row, by the length of the vertical line dropped from the centre of the top edge of the picture to the horizontal plane passing through the observer's eye shall not exceed 35°, the height of the eye above floor-level being assumed to be 3 ft. 6 in."

Investigations have shown that in some cinema halls in London this condition is complied with, while in others it is approached. In other cases the angle of elevation exceeds 60°—a condition that is clearly prejudicial and could be removed by eliminating some of the seats in the front rows. It should be noted that in such cases it may not be necessary to eliminate a complete row of seats, as in the seats nearer the sides of the hall the angle of elevation is less than in those immediately facing the screen, and may fall within the prescribed value of 35°. The most favourable condition is thus to arrange the seats in an arc of a circle, the concave edge of which faces the screen—an arrangement already adopted in some modern cinema halls.

The limiting circle, corresponding with an angle of elevation of 35°, will have as its centre the intersection of a vertical line from the centre of the top of the screen with the horizontal plane at eye-level (3 feet 6 inches above floor); and as its radius a distance equal to 1·43 (i.e., rather less than one-and-a-half) times the height of the top of the picture eye level.

Limit to lateral angle of view.—Assuming that the above recommendation (i.e., that the angle of elevation should not exceed 35°) is complied with, the effect of viewing the screen at an unduly oblique angle from side seats requires to be considered. While this condition is productive of inconvenience and constitutes a possible source of eye-strain, it appears to be of less importance than the avoidance of an unduly great angle of elevation.
The Committee accordingly make the following recommendation, which has been framed to apply equally to cases where vertical or inclined screens are used:

"(II) That provided recommendation (I) is complied with, the angle between the vertical plane containing the upper edge of the picture, and the vertical plane containing the observer's eye and the remote end of the upper edge of the picture should not be less than 25°."

**Minimum distance of seats from screen.**—The Committee has had under consideration the question of undue proximity to the screen as a source of difficulty in following movements in the picture, leading to possible eye-strain. While conscious that undue proximity to the screen impairs the ease with which pictures can be examined, the Committee are of opinion that compliance with requirements (I) and (II) renders further recommendations in regard to such distance unnecessary at present.

**Maximum distance of seats from screen.**—It is clear that a limit to the distance of observation beyond which it is difficult to distinguish pictures satisfactorily, exists, although managers of halls will usually ensure, in their own interest, that this limit is not exceeded. It has been suggested that the angle subtended at the eye by the height of the screen, viewed from the most remote seat, should not be less than 5°, or alternatively, that the distance of the most remote seat should not exceed twelve times the height of the picture. The Committee, however, require further evidence before making recommendations on this point, and in the data at present collected, no case has been noted in which the above suggested limit has been exceeded.

**Flicker.**—There are several phenomena which are included in the common use of the term flicker, and have been the subject of investigation by the Committee. The two most important for our purpose are:

(a) **Physiological flicker.**—This occurs when light and dark are alternated. It disappears at a certain critical rate of alternations which rate depends upon the brightness of the illumination. It is most noticeable with the periphery of the retina so that on a large screen it may be absent from the part of the screen directly looked at, though the observer is conscious of the flicker on the outlying parts of the screen. Under normal conditions of projection no appreciable physiological flicker is observable in the pictures unless there is a large expanse of brightly illuminated screen (e.g., sky or snow field).

(b) **Disintegration flicker.**—The pictures shown on the screen are composed of a series of rapidly succeeding pictures which are integrated physiologically and should give the impression of continuous movement. Under certain conditions, e.g., figures
moving rapidly in the foreground, especially from side to side, the separate impressions become perceptible—an effect which is most noticeable near the screen, but is frequently visible from all parts of the hall. It is possible that the effect might be minimised by taking more pictures per second and projecting at a correspondingly increased rate, but this presents technical difficulties.

Of all the disturbing factors manifesting themselves by jerkiness of movement, disintegration flicker is undoubtedly the most serious.

**Film and mechanical defects.**—The Committee have devoted attention to various irregularities arising from defects in films or apparatus. Scratches on old films give rise to an appearance of vertical black lines like rain. Holes in the gelatine cause flecks of light. Worn sprocket holes, and mechanical defects arising from instability of apparatus may give rise to disturbing effects. Various promising improvements in projecting apparatus and screens have been brought before the Committee.

While the elimination of imperfect apparatus and films, and faulty operation, such as may occur in halls in the poorer districts, is much to be desired, the Committee do not at present see their way to recommend a definite criterion by which to condemn the exhibition at any particular theatre.

**Brightness of screen.**—The Committee have made a series of measurements of the brightness of screens while pictures are being shown. Here, again, faulty apparatus, involving inadequate screen brightness, undoubtedly increases the difficulty of following pictures. The observations of the Committee suggest that a possible standard of minimum brightness may eventually be given, but their researches on this point are as yet incomplete, bearing in view the great variations in light required with different subjects, films of different density and different types of screens.

**Portable cinema outfits for schools.**—The Committee have witnessed some demonstrations of the use of portable cinema outfits for schools, a type of device which appears to be in the experimental stage but has promising possibilities, and in view of the growing demand for apparatus of this type improvements may be anticipated in the near future.

As an educational medium the cinema has possibilities, but in view of the fact of its being intended for display before young children, the conditions of use for exhibitions in schools require careful consideration. One difficulty at present is to obtain a portable light of sufficient brightness which can be obtained from the electric lighting supply usually available. In order to render the picture sufficiently visible it is necessary to darken the schoolroom by the use of blinds, and it would be advantageous to have the screen recessed and surrounded by a narrow curtain, with a view to further protection of the screen from extraneous light.
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In order to secure additional brightness, semi-polished aluminium screens are sometimes used. In this way the brightness, to observers immediately facing the screen, is much increased, but the brightness as seen from side seats is seriously diminished. From the experiments conducted by the Committee they are disposed to prefer a dead white screen for general use and recommend that aluminium screens should only be used in exceptionally long and narrow rooms, where the angle of lateral view does not become unduly oblique.

Another point to be considered is the method of fixing the projecting apparatus, which, owing to its lightness, is apt to vibrate, causing unsteadiness in the picture.

Inflammability of films as a possible source of danger of fire demands special precautions in such cases, but this is not a matter falling within the terms of reference of the Committee.

Conditions of artificial illumination in theatres.—In accordance with the Council’s recent requirement a minimum standard of illumination is now generally maintained in theatres whilst the pictures are being shown. From the observations already made in cinema halls the Committee are satisfied that the requirement that the illumination in all parts of the theatre should not be less than 1-40th of a foot candle can be readily satisfied without prejudice to the picture. Indeed there seems no doubt that by using suitable methods of distributing the light this illumination might be somewhat increased without interfering with the display of the pictures. A practice that might well be encouraged when the design of the lighting of the halls is under consideration, is the gradual diminution of the intensity of illumination, passing from the rear of the theatre (where illumination is chiefly needed to facilitate the work of the attendants), to the seats near the screen where stray light is most apt to affect the picture on the screen (and where such illumination is less needed because the seats are to some extent illuminated by light reflected from the screen). This practice would also be advantageous in facilitating the accommodation of the eyes of persons, passing from the bright light outside into the relatively dark interior of the hall. Recommendations in regard to arrangements of light with a view to conforming with the requirements of vision as regards absence of excessive contrast and glare are also in contemplation. Meantime the Committee would suggest as a definite rule, already observed in the best cinema halls, that no unscreened source of light should be visible to the observer in any seat in the theatre whilst looking towards the picture.

In conclusion the Committee desire to draw attention to Recommendation (I) relating to the Angle of Elevation, and Recommendation (II) relating to the Lateral Angle of View, as embodying conditions which appear desirable in cinema halls. The
Committee do not anticipate that any supplementary recommendations which they may submit as a result of their further inquiries will necessitate any modification of the two recommendations now submitted.

The three representatives of the cinema industry while approving Recommendation No. I of the foregoing Report as an ideal one, which would add greatly to the comfort of the public, draw attention to the absence of definite evidence of serious injury by eye-strain. In view of this fact they are of the opinion that where application of this condition to existing halls would entail serious financial hardship there is no justification for its imposition. They are further of the opinion that the normal development of the cinema theatre will rapidly remove all causes of possible discomfort.

NOTES

Deaths

We regret to announce the death at St. Louis, Mo., on June 28th last, of Adolf Alt at the age of 69 years, after an illness of many months' duration. He was born at Mannheim, Germany, and was the son of Dr. Dettmar Alt. In 1875 he graduated in medicine at the University of Heidelberg, and soon migrated to Canada, where he was appointed lecturer on ophthalmology and otology in the Trinity Medical School, Toronto. His well known "Lectures on the Human Eye in its Normal and Pathological Conditions," appeared in English in 1880, having been translated from the German "Histologie des Auges." Alt settled in St. Louis, Mo., in 1885, the year after he had founded the American Journal of Ophthalmology, and when that journal was merged in the newer periodical of that same name, Alt retained his editorial connection with the journal. He was a member of the American Ophthalmological Society.

Samuel Éperon, professor of ophthalmology in the University of Lausanne, died shortly after a surgical operation. He was born in 1857, studied at Geneva, Leipsig, Würzburg, and Paris, and acted as assistant to Landolt in the city last-named. He is one of the editors of the Revue Générale d'Ophthalmologie. He succeeded Marc Dufour in the Chair of Ophthalmology in 1910.

Richard Nunn, who was educated at Trinity College, Dublin, died at Oregon on August 17, 1920. He was Professor of Diseases of the Eye, Ear, Nose, and Throat, at Oregon University.
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