A PHOTOGRAPHIC ATTACHMENT TO A CATHODE-RAY OSCILLOGRAPH FOR USE AS A PHOTOKYMOGRAPH

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One of the most accurate methods of recording rapid muscular contractions (including single contractions) is by means of an isometric mirror myograph, reflecting a beam of light on to a moving strip of photographic paper. This system of recording is practically inertia-free, and from this point of view it is much more accurate than the system of recording on a smoked paper sometimes used.

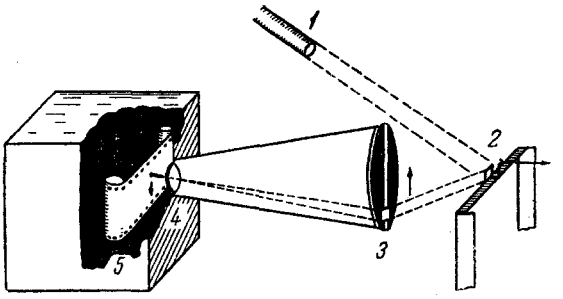

Fig. 1. Diagram of the apparatus for recording movements of the beam of light from an optic myograph with a photographic attachment. 1) Light source; 2) mirror of optic myograph; 3) matt screen covered with black paper at the sides; 4) optical system of the photographic attachment; 5) photographic film.

The isometric mirror myograph is comparatively simple to construct. It is a more difficult matter to construct the photokymograph and choose the photographic paper.

A satisfactory recording of a moving spot of light can only be obtained on a wide enough strip of photographic paper of high sensitivity. A photokymograph using paper of this sort is bound to be a cumbersome instrument, difficult to construct and to use.

To overcome these difficulties, we suggest using a photographic attachment to a cathode-ray oscillograph (a standard unit available in most laboratories) as photokymograph, fitting it with a few additional accessories. Without such accessories it would be practically impossible to record the movements of a beam of light on photographic film for its optical system is not adapted for such purposes. This type of recording can easily be done, however, if a matt screen is placed in front of the "tube" of the photographic attachment and the light from the mirror myograph is projected upon it. In this way a spot of light is obtained on the matter screen and focussed by the optical system on the film (Fig. 1).

By covering the matt screen from the sides, the width of the spot of light can be made as small as convenient. The height of the spot of light is determined by the height of the mirror and the character of the light source. If a

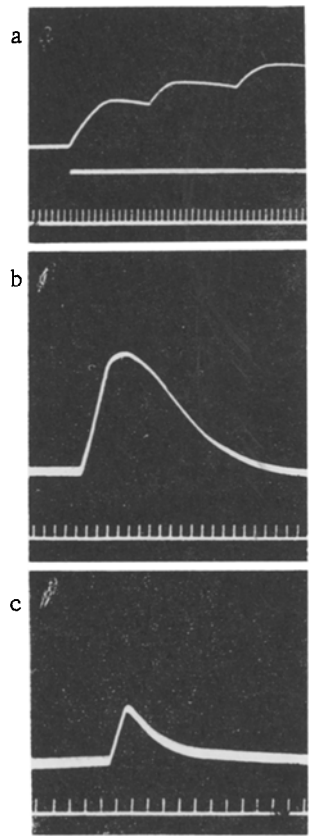

Fig. 2. Recordings of muscular contractions by means of an isometric optic myograph and photograph attachment. a) Clonic tetany of the gastrocnemius muscle of a frog; b) a single contraction of the sartorius muscle of a frog; c) a single contraction of the superior oblique muscle of the eye of a rabbit. Below the tracings is shown the time marker, given by flashes of a neon lamp supplied by the mains (100 flashes per second). Below tracing a is the stimulation marker, given by the flash of a neon lamp included in the circuit of the electrical stimulator.

"low" mirror is used (a horizontally mounted mirror strip), and a light source giving a parallel beam (for example, the light source for a mirror galvanometer), the height of the spot cannot exceed 1-2 mm. Under these circumstances the movements of the spot of light on the film are recorded as a thin, clear line.

Highly sensitive fluorographic film can be used in the photographic attachment for recording the movements of the spot of light. In this case satisfactory recordings can be obtained at high speeds of winding (of the order of 30 cm/sec). In this case a time marker can be added in the form of a neon lamp, supplied from the mains (100 flashes per second), illuminating the moving photographic film from behind.

The recordings of muscular contractions made on photographic film can easily be enlarged for publication by means of ordinary photographic enlargers.

Examples of a recording of single and tetanic contractions of muscles obtained by the method described above are given in Fig. 2.

The suggested photokymograph may also be used to record other mechanical phenomena (pulse waves, etc.) by means of mirror pick-ups.

SUMMARY

A method is presented of recording the ray movement of a mirror pick-up on a phtographic film with the aid of a photographic extension to a cathode oscillograph. This method consist of projection of the ray of the mirror transducer on a dull screen, to which the attachment is oriented as to the screen of the cathode oscillograph.