SCIENTIFIC APPARATUS AND LABORATORY METHODS

DEVICES FOR THE STUDY OF TWO PLANE SHIFTS IN THE CENTER OF GRAVITY OF A SWAYING BODY[1]

FIGS. 1 and 2 illustrate equipment assembled to record the magnitude and direction of the involuntary postural sway of man in the upright stance and to locate the center of weight with respect to the feet as a function of time. A base platform of channel iron rests on leveling screws. Upon it are mounted a platform scale, remodeled to record graphically transverse changes in load, and a second platform of channel iron resting, one side on knife-edges borne upon the scale, the other on frictionless ball-and-socket joint leveling screws. Upon the second platform is another scale modified to record antero-posterior changes in load. Finally, surmounting this is a third platform, which also rests upon knife-edges and leveling screws. Progressing from base to top, each platform may be independently made horizontal. The upper two are set at right angles to each other. They remain essentially level at all loads.

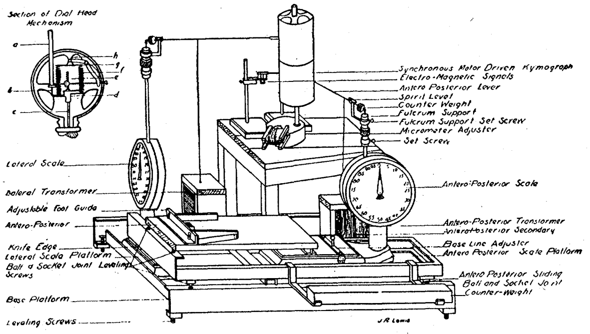

FIG. 1. Semi-perspective sketch of the equipment developed for the graphic registration of concurrent shifts of the center of gravity in the antero-posterior and transverse vertical orientation planes of a subject maintaining an upright stance. The key to the dial head symbols is as follows: a—vertical brass supporting tube; b—connecting rod joining the runner to the auxiliary lever system; c—steelyard connecting the long lever nose and the runner; d—runner; e—rack; f—mainspring; g—equalizer yoke; h—zero adjusting lever.

The inset of Fig. 1 shows a section of the dial head mechanism transformed to convert variations in main spring tension into vertical movements of a lever writing on the drum of a sub-synchronous motor operated kymograph driven at constant speed. Inserted in the dial head is a vertical brass tube sheltering a connecting rod brazed to the scale runner at its lower extremity and linked with a counterweighted auxiliary lever system at its projecting end. The fulcrum support for the auxiliary lever is provided with a wingnut set-screw. It rests upon a main support supplied with a micrometer adjustment device bearing a knurled nut and a locking screw. By turning the knurled nut the fulcrum support is conveyed to such a position that the lever, guided by a permanently mounted spirit level, is brought easily to the horizontal. The whole system is then locked in position. Weight on the platform causes the nose of the long lever to be pulled down, depressing the runner, putting tension on the springs and proportionately rotating the lever. Knowing the knife-edge to joint distance, the weight of the subject, the scale indications and the tares, the location of the center of gravity may be calculated by equating moments. The oscillations in the center of gravity of a standing subject due to physiological sway may thus be graphically recorded and, by fixing the position of the feet with respect to the platform fulcra, may also be projected into a footprint of the base of support.

The secondary of a slotted core transformer excited from a constant potential source is suspended from each auxiliary scale lever. The voltage induced in each secondary is proportional to its distance in the slot and hence to the scale load. The secondaries are in series with the current coils of rotating standard watt hour meters. Since the potential coils are excited from the same source as the transformers, the watt

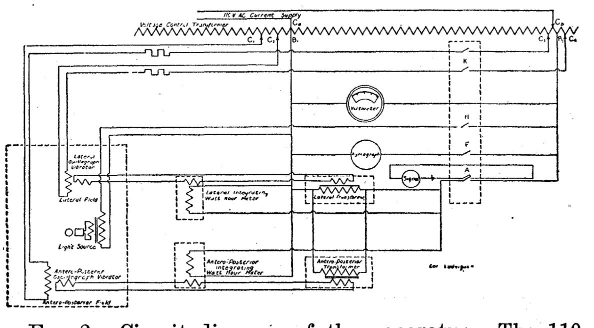

FIG. 2. Circuit diagram of the apparatus. The 110 volt AC supply leads into a partial underload tap changing auto-transformer. Lead C_a goes through a fuse to a semi-permanent connection. Lead C_b goes to a wiper arm on a terminal board, permitting this side of the power circuit to be connected to any of the low voltage taps at the right end of the windings in the diagram of connections. Bus bars B_1 and B_2 are also semi-permanently connected. They are in circuit with the voltmeter. By rotating the contact arm the voltage may be changed over a 9 volt range. Thus the bus bar voltage may be kept constant although the power supply voltage fluctuates. The left hand windings in the diagram are high voltage taps to which removable clip contacts C_1 and C_2 are connected. Contacts C_3 and C_4 are connected to the low voltage terminals. They pass through a double pole single throw switch K and from there connect to special resistors. Switch K energizes both the C_1C_3 and C_2C_4 circuits. It controls the power to the two fields of the compound watt oscillograph. Switch F controls the power to the synchronous motor driven kymograph. Switch H controls the power to the light source of the compound watt oscillograph. Switch A is a special two circuit switch. One circuit energizes the two slotted core transformers and the potential coil of two rotating standard watt hour meters. The second connection is a direct current circuit composed of a battery and an electromagnetic signal to indicate the beginning and ending of each observation. Thus the bus bars furnish power to several devices in parallel through switches F, A and H.

[1] Supported in part by a grant from the Wisconsin Alumni Research Foundation.

hour meters may be used to denote scale indications, or, if run for time T, to specify the average load. Thus may be calculated the location of the projected center of weight at any instant or its average position for time T.

A compound watt oscillograph was developed to expedite the location of successive instantaneous positions of the center of weight. It consists essentially of two slow speed watt units perpendicular to and facing each other. Each is composed of a laminated field made of transformer iron bent into a rectangle with an air gap on one side, and a shuttle wound vibrator. The vibrator and its field are so mounted on an aluminum base that their physical relations remain constant. The field coil consists of two spirals in parallel, excited from the auto-transformer that powers the slotted core transformers and the potential coils of the watt hour meters. Its voltage may be changed to allow for differences in the body weight of subjects. A shuttle is used to increase the inertia of the vibrating system, which thus indicates average, not instantaneous watts. It also increases the torque for the same current and provides a mirror base well out of line of the field, allowing good immersion in oil for damping. A beam of light falling on the mirror of watt unit No. 1 is reflected to the mirror of watt unit No. 2 and thence to a viewing screen or film. The current in the vibrator reacting against the flux due to the field sets up an instantaneous force which tends to rotate the vibrator from its no-current position. Since the field is constant, the vibrators occupy positions dependent upon distances of the secondaries in the slots, and hence, scale loads. Thus the projection of a light on a screen or film may be made to reproduce the oscillations of the center of gravity of a swaying subject. The unique feature of the oscillograph is its ability to compound two rectilinear motions, the resultant spot of light tracing concurrent shifts in the center of gravity occurring in the two cardinal vertical orientation planes.

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A METHOD FOR RAPIDLY EXCYSTING METACERCARIAE

STUDENTS of Trematodes commonly resort to the use of digestive enzymes to induce excystment of metacercariae. By this means the cyst wall may be broken down and the larva freed. This method, however, does not succeed at all times, nor in all forms; and usually requires the control of temperature within rather definite limits for several hours or longer. It is possible by a comparatively simple and rapid technique to dissect away the cyst wall and free undamaged metacercariae from cysts as small as those of Cryptocotyle (length *ca.* 0.35 mm, width *ca.* 0.26 mm).

The points of sewing needles (No. 9 or smaller), driven eye first into small, soft wooden handles, may be ground on a stone to flat cutting blades. At least two such needles are necessary. The cysts to be opened are placed with an appropriate fluid in a watch glass, and rolled onto the surface of a small piece of lens paper or cleansing tissue, either of which will serve as a convenient substratum to prevent rolling of the cyst. The cyst is held with one needle, while an opening in the wall is made with the other. The metacercaria immediately begins to emerge, and in so doing leaves a clear space in the cyst opposite the puncture. By pressing gently on this clear space, while the cyst is still anchored by the needle with which the opening was made, one may free the larva quickly and easily. The actual operation is carried out under an ordinary dissecting microscope and, with practice, should require little more than a minute.

Metacercariae so liberated may be mounted, covered and studied immediately.

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BOOKS RECEIVED

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