

RECONSTRUCTION OF THE EKP-4M ELECTROCARDIOGRAPH AS A TWO-CHANNEL APPARATUS

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In many cases during clinical and physiological research it is desirable to make a simultaneous record of several phenomena.

In recording a ballistocardiogram, for example, it is essential to establish the time correlations of the waves of the ballistocardiogram and the electrocardiogram. In the absence of a multi-channel recording apparatus it is possible to use for this purpose an EKP-4m apparatus, taking one of the leads of the electrocardiogram to the ballistocardiogram. The curve obtained in this way is of some diagnostic value but there is inevitably some distortion of both the shape and amplitude of the ballistocardiographic waves. For this reason we decided to redesign the EKP-4m electrocardiograph, incorporating a second channel in it, completely identical with the first (a set taken from a second EKP-4m apparatus).

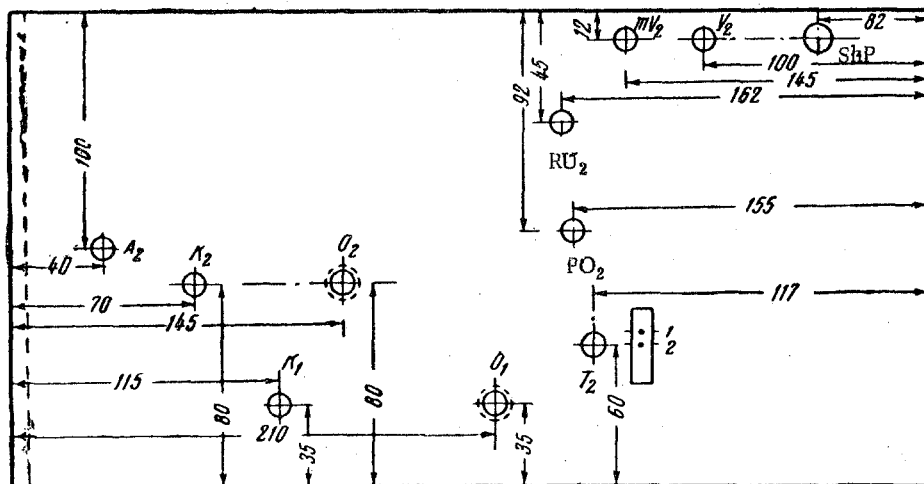


Fig. 1. Plan of the control panel of the supplementary channel (measurements in millimeters) to the EKP-4m apparatus. A_2 — Supplementary switch for BAS_2 ; K_2 — corrector of the supplementary channel; O_2 — illuminating light of the supplementary channel; T_2 — tumbler switch for the supplementary channel; PO_2 — switch for the leads from the supplementary channel; RU_2 — amplification regulator of the supplementary channel; mV_2 — push-button (millivoltmeter) of the supplementary channel; ShP_2 — leads to the patient from the supplementary channel; K_1 — corrector of the main channel; O_1 — illuminating light of the main channel; 1) center of the beam of the main channel; 2) center of the beam of the supplementary channel.

As our experiment showed, the reconstruction of the apparatus is not very complicated and, moreover, it permits a perfectly steady simultaneous recording to be made of the ballistocardiogram and the electrocardiogram.

The apparatus was modified in the following sequence: 1) all the knobs are taken from the control panel; 2) the ebonite (facing) panel of the apparatus is removed; 3) the partition which separates the filament battery is moved 14 mm to the left, which frees space for a second galvanometer (the filament battery [2 NKN-10] like the anode batteries can be controlled by an outside switch); 4) the supplementary galvanometer with its corrector is mounted 70 mm from the left border of the upper panel and 80 mm from the lower border; 5) the existing galvanometer with its corrector is moved 25 mm downward; 6) in line with the supplementary galvanometer and at a distance of 145 mm from the left border of the panel is mounted the illuminating light of the supplementary galvanometer; 7) the illuminating light of the existing galvanometer is moved 25 mm downward; 8) the upper front portion of the middle partition of the apparatus is removed; 9) the charging system is transferred to the partition mentioned in item 3, from which a window measuring 40×25 mm is cut out in order to connect the terminals of the flex during charging of the filament battery; 10) the amplifier of the supplementary channel, on shock-absorbing springs, is mounted in the place formerly occupied by the selenium column; 11) at a distance of 92 mm from the right upper border of the panel and 144 mm from the right side is mounted the supplementary switch for the leads, made from a type PD-4-6 radio switch; 12) above the supplementary switch for the leads is mounted the supplementary amplification regulator; 13) behind the amplification regulator are placed 2 push-buttons: one for the voltage calibrator (MV), the other for the damper; 14) to the right of the push buttons a hole is drilled for

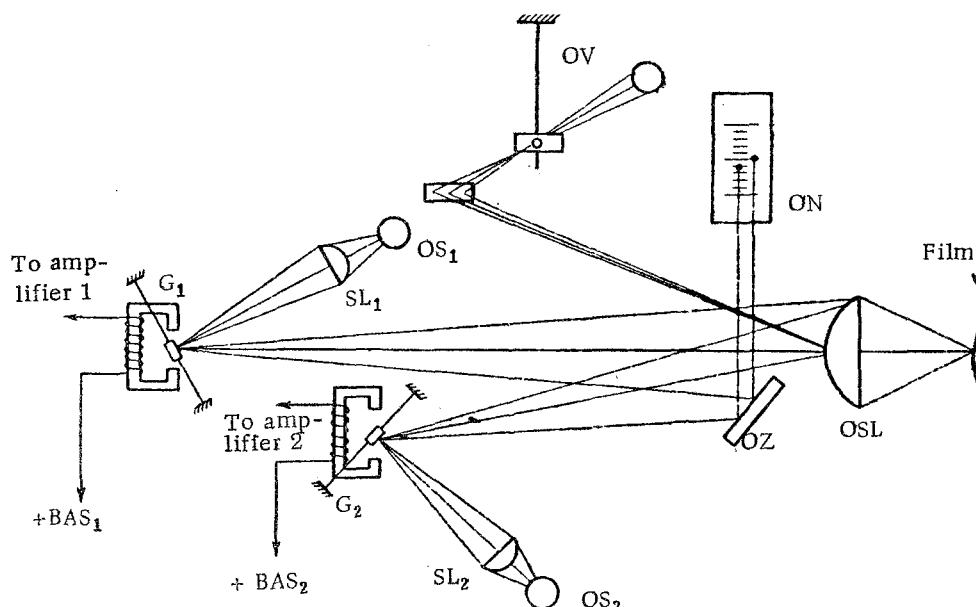


Fig. 2. Optic system of the reconstructed EKP-4m apparatus. G_1 - Newly installed galvanometer; OS_1 - SL_1 - newly installed illuminating light; G_2 - existing galvanometer; OS_2 - SL_2 - existing illuminating light; OZ - reflecting mirror; OSL - existing common collecting lens; OV - existing time marker; ON - existing visual control window.

coupling the supplementary triple lead from the patient to the circuit; 15) in the place formerly occupied by the transformer is placed the voltage divider of the calibrator (MV); 16) below the switch A, at a distance of 22 mm is mounted the switch for the second anode battery (common negative; the second battery is added to prevent harmful electrical connections between the 2 amplifiers through a common source of power); 17) next to the "On" tumbler switch is mounted a second tumbler switch; 18) the appropriate connections are made between the components of the circuit of the supplementary channel; 19) holes are drilled in the ebonite facing panel of the apparatus in suitable places for accommodating the axes of the supplementary equipment (Fig. 1) and the necessary inscriptions or signs are made; in view of the fact that after the reconstruction the galvanometers are "dispersed" and a slight angle is formed in relation to the collecting lenses, marks are placed on the window for visual observation corresponding to the center of the beam on the film; 20) the ebonite panel is replaced.

The optic system of the reconstructed apparatus is shown in Fig. 2.

The apparatus is simple in use. The patient's leads from the main channel PR and LR are connected to the ballistocardiographic output and those of the supplementary channel to electrodes fixed to the patient, as usual. Both tumbler switches are switched on and the lead switches are in the O position. By means of the correctors both beams ("crests") are fixed on the visual observation window so that the distance between them is sufficient to enable the curves to be distinguished and the required degree of amplification is established. The switch for the leads of the main channel, through which the recording of the ballistocardiogram is effected, are set in position 1. The switch for the leads of the supplementary channel are set in the required position and then the tape-winding mechanism is set in motion. If it be proposed to record the electrocardiogram only, then only the tumbler switch of the main channel is switched on and the electrocardiogram is recorded in the usual way.

SUMMARY

An apparatus for simultaneous registration of ballistocardiogram and electrocardiogram is recommended. A second channel which is identical to the first one is mounted into the EKP-4 m electrocardiograph.