indicating increased stroke volume and believe that, with a normal diastolic pressure, pulse pressure variations indicate variations in stroke volume and that a reciprocal relationship exists between pulse pressure and pulse rate if the minute volume remains constant. This is a preliminary report.

[1] Read, J. Marion, *Arch. Int. Med.*, 1924, xxxiv, 553.

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The Use of the Cathode Ray Oscillograph for Electrocardiography.

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In order to time the point in the cardiac cycle at which a number of rapid roentgen ray films of the heart are taken, it was wished to develop a small portable electrocardiograph with no string or delicate part to be damaged by the currents from the X-ray circuit. The cathode ray oscillograph, as first used by Erlanger and Gasser,[1] has proved quite satisfactory for making electrocardiographs. Gasser[2] found that with his amplifier the heart currents gave lower curves than similar voltages in nerve preparations, due to the low resistance of the body as compared with the resistance of the amplifying tube. The apparatus with which this record was made differs from that of Gasser and Erlanger (a) in that the same source of current is used for cathode ray tube and amplifiers; (b) the sensitive film moves over the face of the tube giving a continuous curve instead of standing curves; (c) four amplifying tubes are used, the first three with amplification constant 20, the last a UX112 tube with a constant of 7; (d) one lead goes directly to the filament of the first tube, the other passes through a 2 microfarad condenser to the grid, which connects to the filament through a one megaohm leak. The apparatus gives curves with a motion of one cm. per one millivolt input and at rates of motion of film up to fifteen cm. per second.

[1] Erlanger, J., and Gasser, H. S., *Am. J. Physiol.*, 1924, lxii, 496-524.

[2] Gasser, H. S., personal communication.