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The Application of Graphics to
the Fetal Heart Sounds

BY

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Hugh Hamilton

THE
APPLICATION OF GRAPHICS
TO THE
FETAL HEART SOUNDS.¹

It is unnecessary to consume time to relate the history of the discovery of the sounds of the fetal cardiac pulsations in pregnancy, or even the many instruments devised to easily recognize them. The bibliography of the subject is readily accessible. The object of this paper is to show how electricity may be applied to magnify and record their *bruits*.

Among the signs of pregnancy the fetal heart sounds are the surest of a number of phenomena. They are prominently mentioned as certain in most text books. However, in some positions of the fetus they are difficult to find, or may be even, to the experienced ear, qualified by one's preconception of the case. The design of my instrument is to lift their recognition from the domain of sense to that of record by permanent tracings which may be differentiated or compared with those of maternal origin.

To accomplish this I have modified a microphone suggested by Hürthle, of Breslau,² carefully noting the criticisms of Martius, of Rostock,³ which it is not essential to reiterate here.

¹ Read before the Section on Obstetrics, Pan-American Medical Congress.

² "Ueber die Erklärung des Cardiograms mit Hülfe der Herztönenmarkierung, und über eine Methode zur mechanischen Registrirung der Töne."

³ "Cardiogramm und Herzstossproblem."

The instrument is made as follows: A double cone of electric-light carbon is held between two cups of the same material (see Fig. 1) placed in electrical circuit with the primary wire of an induction coil. A lever bearing one of these cups is attached to a diaphragm of vibrating material, as the thinnest parchment



FIG. 1.—The carbons, twice the natural size: *a* showing countersunk section of *c*; *b* showing double cone.

paper, fastened on the top of a receptacle, to convey the vibrations to the membrane. The other carbon cup is held by a movable post capable of being minutely adjusted, the two supporting the double-coned carbon between them and making a commutator for the apparatus.

The secondary wire of the induction coil is connected in closed

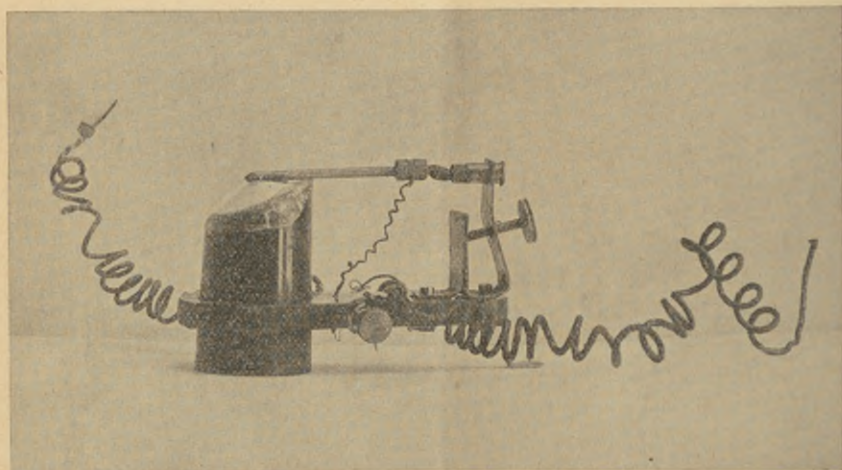


FIG. 2.—Cardiophone.

circuit with an ordinary telephone receiver, and also with the sciatic nerve of a freshly killed frog, rat, or mouse. This most sensitive galvanometer is in turn attached in balance to a Maurey tambour.

The slightest movement of the tympanum of the cardiophone will now cause the telephone receiver to vibrate, so that it can

be heard for three to four metres (ten or twelve feet), and the nerve of the frog leg to contract and record its markings on blackened (smoked) paper fixed on a drum, one hundred and fifty millimetres (six inches) in diameter, making one revolution in four or five seconds. Placing one cardiophone on the aorta of the mother and another upon her abdomen at the proper point, connected in two circuits, they are brought to record on

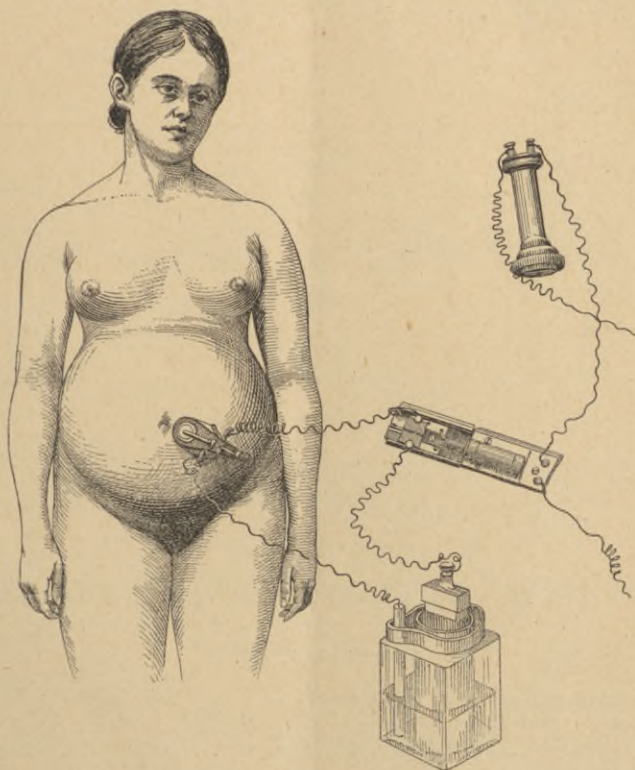


FIG. 3.

the same cylinder. The pulsations of the fetal heart being 120 to 160 and the cardiac impulses of the mother from 70 to 80 per minute, makes the difference in the cardiographs easily recognizable. (See Fig. 4.) Should the several souffles give symmetrical markings, then it would be conclusive evidence of their being maternal.

It is necessary to search for the supposed sounds of the fetal heart and then place the cardiophone on the best point for hear-

ing them. The tracings will show whether they are maternal or fetal. I have only completed the instrument sufficiently to take one tracing, but hope to perfect its mechanism so that it may be of practical benefit in the differential diagnosis of pregnancy from tumor conditions. The whole apparatus, when completed, will occupy a box 75x75x150 millimetres (3x3x6 inches) and weigh about one hundred and twenty grammes, or about one-quarter of a pound. The telephone receiver is not necessary; any indicator will do: its use is only confirmatory of the sounds

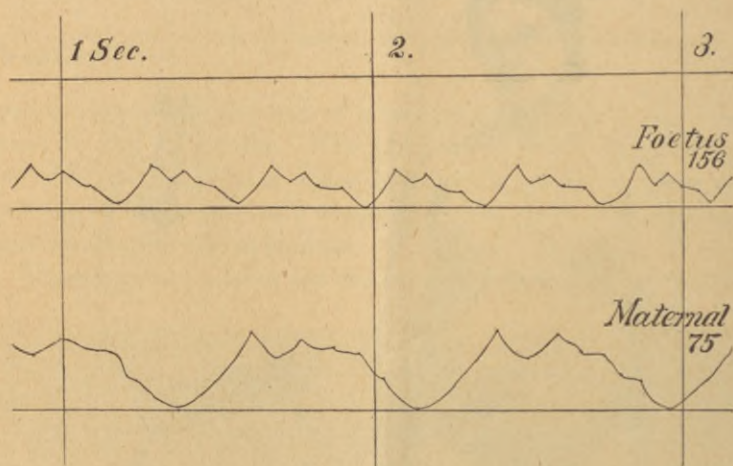


FIG. 4.

heard, and to show when to throw the recording apparatus in circuit.

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