"fine silver sand," from which the smaller particles, to the extent of about one third of the mass, had been sifted out for another purpose. There is to my knowledge nothing critical about these specifications. They are simply the result of guess and circumstance, with the result about to be stated.

Several resonators were tried until one was found that worked properly in the position shown in the figure. Along with the general hiss and roar of the impact of the stream a faint, fluttering musical tone could then be distinctly heard when the ear was held close to the mouth of the bottle. By repeating the experiment with various amounts of water in the bottle tones of various pitches could be obtained, in every case sensibly identical with the tone obtained by blowing across the mouth of the bottle.

It would seem in advance that out of a helter-skelter series of impacts a group could be selected having, within certain limits, any given period with a sufficient degree of accuracy to set a resonator into action. Naturally such a state of things could not continue indefinitely. The individuals of the group could be expected to get out of step, stop the resonance by interference and set it going again in another phase. Hence the fluttering quality of the note, due apparently to the separate wave-trains so set up.

If the regular periodicity is a function of the analyzer, how may two pulse-series as supposed in the case of black-body radiation at two different temperatures give rise to characteristically different spectra? The answer to this question seems to me now quite natural. If we consider the effect, in this experiment, of varying the size of the constriction which limits the outflow of sand, it seems probable that increasing the outflow, by increasing the average number of impacts per unit time, would cause the resonator to give relatively greater response (as to amplitude or energy) at higher frequencies and *vice versa*. Another condition bearing on the "spectral distribution" of energy in this case would seem to be the relative numerousness of the different-sized particles composing the sand; other conditions being equal, the smaller ones presumably tending on the whole to give rise to high, the larger to low frequencies. This is merely speculation, as the careful experimentation necessary to show such changes has not been carried out.

The experiment as described here is scarcely demonstrable to more than one person at a time. It has certainly yielded large educational returns, to me personally at least, considering the insignificant outlay of time and material. I am especially interested in knowing whether it is essentially new or whether it has been proposed or used before.

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A PRIMARY CIRCUIT KEY FOR QUANTITATIVE INDUCTION WORK

Physiological investigation requiring either the calibration of an inductorium or the use of such calibrated inductorium necessitates a

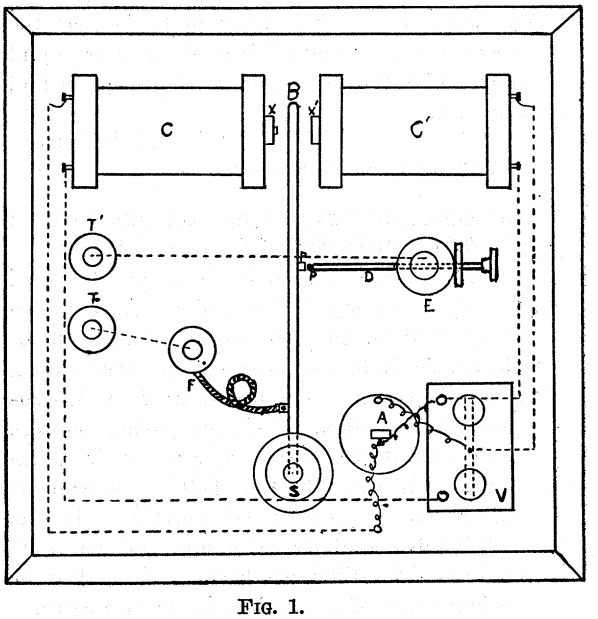

Fig. 1.

"make" and "break" key in the primary circuit which possesses certain qualities. Each

"make" and each "break" must occur with a constant velocity. The contact must be made and broken suddenly and firmly and there must be no vibration at the contact points.

Martin's key[1] has proved to answer these qualities but is not so compact as the key here described. Erlanger's key[2] designed to be used as a "knock over" key is not suitable for use except with a pendulum.

Such a large number of keys have been described that one hesitates to add another. It seems, however, that the simplicity of this principle and the ease with which this key may be used merits description.

In this key the well-known principle of induced magnetism is employed. The current for the coils (C and C') is obtained from a dry cell battery (A) so connected through an ordinary push-botton key (V) that when one button is down the current passes through one coil (C); when the other button is down the current passes through the other coil (C'). The coils contain soft iron cores (x and x'). One iron core (x) has a brass pin projecting from its center which prevents the steel band

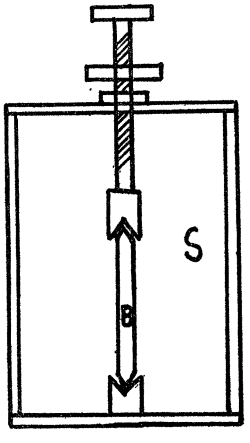

FIG. 2.

(B) from touching the core, thus eliminating any possibility of a "dead center" in the swing of the steel band. The contact points prevent the steel band from touching the other core. The steel band swings in an adjustable brass socket (S), the details of which are shown in Fig. 2. From the steel band a light spring wire (W) leads to a post (F) thus permitting free swing. For contact points, platinum iridium is used (P and P'). The one (P) is soldered onto the steel band and has a flat contact surface. The other (P') is soldered onto an adjustable brass pin (D) and has a convex contact surface. T and T' are the terminal binding posts from which connections are led to the induction coil. The whole is mounted on black fiber 3/8" thick, the connecting wires being imbedded on the under side.

The key has not been tested out with the string galvanometer, but has been used in making calibrations and found to give satisfactory results.

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[1] Martin, *Am. Jour. Phys.*, XXIX., 1910, 181.

[2] Erlanger and Gerrey, *Am. Jour. Phys.*, XXXV., 1914, 384.

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The Synthesis of p-Cymene Monocarboxylic Acids and of certain of their Derivatives: M. T. BOGERT AND J. R. TUTTLE.

The authors have prepared the two possible ring isomers, cymene 2-carboxylic acid and cymene 3-carboxylic acid, from the corresponding bromo derivatives by the Barbier-Grignard reaction, using CO_2 under pressure, and have studied these acids and the following derivatives thereof: Na, K, Ba, Ca, Cu and Ag salts, methyl and ethyl esters, acid chlorides, amides, anilides, hippuric ester and acid compounds, hydrazides, furo- and thio-diazoles. Small amounts of the 2-acid have been obtained heretofore by other investigators and a few salts have been recorded, but we believe that this is the first time that the acid has been prepared in sufficient amount for more extended study. The isomeric 3-acid appears to be entirely new.

Benzoylene Urea and Some of its Nitro Derivatives: M. T. BOGERT AND G. SCATCHARD.

The preparation of benzoylene urea from anthranilic acid, through o-ureidobenzoic acid, has been improved. The nitro derivatives were prepared either from the corresponding nitro anthranilic acids or by direct nitration of benzoylene urea itself. These nitro benzoylene ureas are struc-