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The Torques and Forces between Short Cylindrical Coils Carrying Undamped Alternating Currents of Radio Frequency

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THE TORQUES AND FORCES BETWEEN SHORT CYLINDRICAL COILS CARRYING UNDAMPED ALTERNATING CURRENTS OF RADIO FREQUENCY

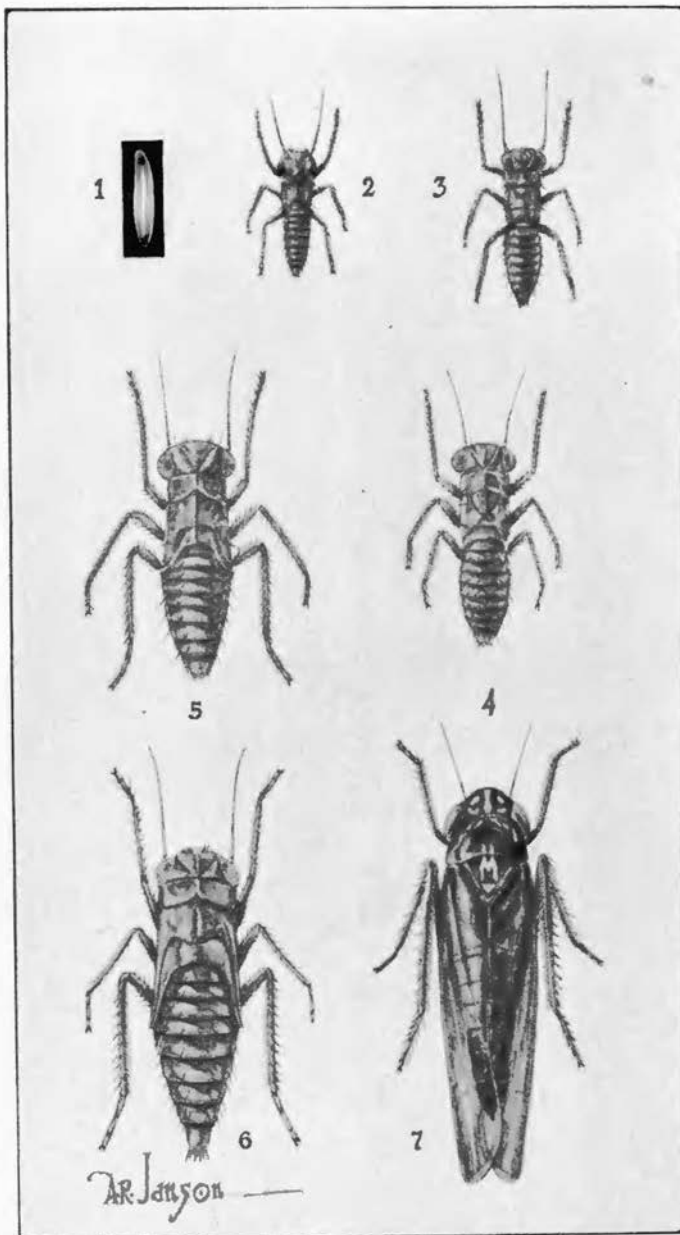
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(ABSTRACT)

Measurements of the torques and forces between two short single layer cylindrical coils carrying undamped currents alternating at radio frequencies showed variations with the frequency of the current oscillation not predicted from the classical formulas of Maxwell and others. When the current in the coils and the angle between the planes of the coils were maintained constant, the torque between the two coils connected in series, with the currents in the same sense, was found to remain approximately constant as the frequency of the current increased from 60 to 0.3×10^8 cycles per second, but when the frequency increased from 0.3×10^8 to 1.5×10^8 cycles per second, the torque increased with the frequency, in some cases being more than doubled. The rate of increase of the torque with the frequency decreased to zero as the angle between the planes of the coils increased from 10° to 90° , and remained zero within the error of experiment as the angle changed from 90° to 180° , *i. e.*, when the currents were in the opposite sense.

The forces between the two coils connected in series with their planes parallel showed a similar change with frequency. When the currents in the two coils and also the distance between the coils were maintained constant, and the currents were in the same sense, the force increased, in certain cases to twice its initial value, as the frequency of the current increased from 0.3×10^8 to 1.5×10^8 cycles per second. The rate of increase of force with frequency increased as the distance apart of the coils increased. When the currents in the two coils were in opposite senses no change in force with frequency was observed.

From a consideration of the various phenomena of radio frequency currents not taken into account by the classical theory, it seems that an explanation of the foregoing facts is to be sought in the effect of the energy radiated from the coils in the form of electromagnetic waves.



EXPLANATION OF PLATE I

Empoasca mali LeBaron. 1. Egg. 2. First instar nymph. 3. Second instar nymph. 4. Third instar nymph. 5. Fourth instar nymph. 6. Fifth instar nymph. 7. Adult.