There is an ever-increasing body of evidence pointing to the interaction of dominant favorable genes as a sufficient explanation for hybrid vigor, and there is no intention here to explain this phenomenon on the basis of mock-dominance. The conditions necessary for its occurrence would not exist universally enough. Again, estimates based on available measurements indicate that the effects would be too small to account for any substantial part of such increases as are obtained, for example, in crosses between inbred lines of corn. Finally, it is doubtful whether even linkage and interference could excuse the failure to recover strains equal to the hybrid more frequently than has been the case in the past.

On the other hand, mock-dominance seems entirely adequate to account for the small excesses, of the order of 2 to 5 per cent., above the parental means that are reported from time to time in connection with breeding results. Whether it is a correct explanation in any case could be determined rather easily and definitely. When it is, such case will be eliminated from need of further consideration in connection with hybrid vigor in its broader sense, thus simplifying that problem. Moreover, it will be just those hybrids that are vigorous because of mock-dominance that will offer the greatest possibilities for isolating vigorous, true-breeding strains.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE PHOTOELECTRIC RELAY

THE combination of a mirror galvanometer and a photoelectric relay is ideal for the control of many systems where the null condition is to be maintained. The relay circuit described by Soller, Goldwasser and Beebe[1] was tried in the Kansas Agricultural Experiment Station milling research laboratory for the control of an adiabatic calorimeter for the measurement of the heating of damp wheat. Their circuit relies upon insulation leakage for the grid leak of the amplifier tube. Wide variations in the humidity of the air plus large voltage fluctuations in the electric current available caused frequent failure of the relay. This difficulty was overcome by rectifying the control circuit so that a grid leak of from 2 to 10 megohms could be used. The diode of a type 75 tube served for the rectification, while the triode replaced the 6C6 amplifier of the original circuit, so that the use of an additional tube was avoided.

With the introduction of the 117L7GT tube in 1940, considerable simplification was possible, since this tube has sufficient voltage amplification that the preliminary amplifier tube is not ordinarily necessary, and it also contains a rectifier section, which can be used to supply D.C. grid bias. Fig. 1 shows the circuit and specifies parts which will be satisfactory for most applications. Sensitivity may be increased by using higher values for R_3: 20 megohms should not cause instability. Adjustable sensitivity may be obtained by substituting a 1 megohm volume control for R_2. If a vacuum phototube is used instead of the gas-filled type 918, R_1 may be omitted and R_3 may be increased even to several hundred megohms if necessary for the required sensitivity.

[1] T. Soller, S. Goldwasser and R. A. Beebe, *Jour. Am. Chem. Soc.*, 58: 1703–1706, 1936.

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The 117L7GT tube is rated at 45 milliamperes, but when operating on A.C. as in this circuit, the output can not be expected to be more than 30 to 35 milliamperes. For this reason the relay S_1 should operate on 30 milliamperes or less at not over 90 volts. The G. M. Laboratories type DD60B(64–14)CW relay has given good results, as has the Struthers Dunn midget relay wound for 50 volts or for 90 volts D.C. Ordinarily the screen resistor, R_4, can be omitted altogether, but some tubes have been found which overheat and fail to control if this is done, so 1,000 ohms is recommended as a minimum. If a relay operating on less than 15 milliamperes is used, R_4 should be increased to reduce the plate current of the tube to about the value required by the relay: 10,000 ohms will usually be satisfactory for relays using from 10 to 15 milliamperes.

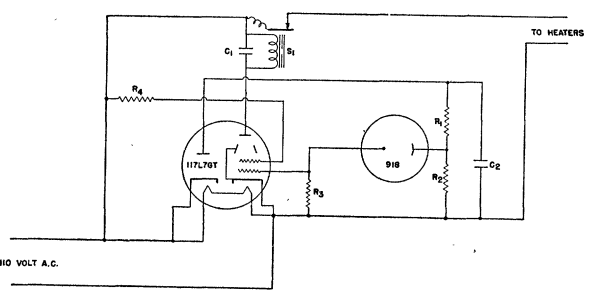

FIG. 1. C_1, electrolytic condenser, 4 or 8 mfd.; C_2, paper condenser, 0.1 mfd.; R_1, carbon resistor, 300,000 ohm; R_2, carbon resistor, 1 megohm; R_3, carbon resistor, 2 megohm; R_4, carbon resistor, 1000 ohm; S_1 relay. RCA type 918 gas-filled phototube. Type 117L7GT radio tube.

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