Comments and Communications

Improvement in Frost Resistance of Parsnip Tops Sprayed with Chemical Growth Substances

THERE is extensive literature on various responses of plants to synthetic growth substances, but, so far as we know, there have been no reports on apparent improvement in frost resistance of plant foliage sprayed with such chemicals. The present communication deals with evidence of this nature arising out of field experiments with parsnips (*Pastinaca sativa*) at Edmonton.

Test material was grown from seed of the variety Hollow Crown, planted May 22, 1952 in 40-ft rows per plot in quadruplicate randomized blocks and was sprayed with various chemicals on September 6 of the same year. A month later the first frosts occurred with minimum night temperatures of 25° F on Oct. 3, 17° F on Oct. 4, 17° F on Oct. 5, and 25° F on Oct 6. Observations on Oct. 7 showed that in every replicate, tops of plants sprayed with 2,4,5-trichlorophenoxy-propionic acid (Dow, Color Set) or with sodium naphthaleneacetate (Dow, App-L-Set) at 1 lb active chemical in 50 gal water per acre, were virtually uninjured by frost. On the other hand, most of the leaves of check material were collapsed and darkened. Tops of treated plants remained erect and green until more severe frost occurred several weeks later (Nov. 26, 5° F).

Prior to the first frost the chemical treatments caused perceptible, but not severe, brittleness in leaf stalks together with retardation of growth of the main fleshy root and an abundant development of fine lateral roots.

Apparently a hardening-off process in the parsnips was intensified by the spray ingredients. Further research to determine range of variability of response and to study its nature during the first and second years' growth of this biennial and of other unrelated crops is underway.

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The First Circuit for an Electrical Logic-Machine[1]

IT IS usually assumed that the performance of logical inference by electrical relay machines is of comparative recent date. However, in Baldwin's *Dictionary of Philosophy and Psychology* (1902) there is a reference to an electrical logic-machine designed by

Alan Marquand (1853–1924), fellow in philosophy, Johns Hopkins University, and afterwards professor of archeology and the history of art at Princeton University.

Professor Alonzo Church of Princeton recently looked through the Marquand manuscripts now in the Princeton University Library and discovered a wiring diagram which he thought important for us to see, as it was not mentioned in any of the published papers he could recall. Prepared about 1885, it is probably the first circuit of an electrical logic-machine, and is presumably the one referred to in Baldwin's dictionary article.

Marquand had originally constructed in 1883 a four-term logic-machine operated mechanically (*Proc. Am. Acad. Arts and Sci.*, 1885). The dial plate of Marquand's machine had 16 small pointers rather like watch hands, representing the 16 logical combinations of the four terms *A, B, C, D,* and their negations represented by the small letters, *a, b, c, d.* They were as follows:

Each of the pointers numbered *1–16* is able to indicate the "truth" or "falsity" of the combinations they represent. When at the horizontal, the pointer has the value "truth," when at the vertical the value "falsity." Reading down each column in turn, the left uppermost pointer, *1,* represents the combination *A, B, C, D,* and so on until we reach the right lowermost pointer, *16,* which is *a, b, c, d.* We are thus given a mechanical truth table for four terms.

The diagram which was apparently meant to operate this machine is made up of two circuits both wired in series and parallel. As we now know switches wired in series can represent a logical product and in parallel a logical sum. Marquand probably made this application intuitively since this diagram is merely an electrical translation of his geometrical diagram for *n* terms. (*Philos. Mag.*, Oct., 1881).

Each circuit is operated by a separate battery. The letter key circuit connected to eight one-way switches (i.e., the letter keys, representing the terms and their negatives) is wired to *16* electro-magnets, each of which represents a combination from *1 to 16* (only one armature of the electro-magnets is shown). Each letter key functions negatively, actuating those electro-magnets (and hence pointers) which include in their combinations the negation of this letter; the answer is read off in negative form from the fallen pointers. If,

for example, the letter key A is pressed, the a electro-magnets are actuated, this sustains the a pointers (i.e., the A's drop to the vertical when the operation key is set to position 3). If the a key is pressed the A pointers are similarly sustained, and so on for other positive and negative letter keys.

The operation key circuit worked by a separate battery is connected to the 16 electro-magnets through a three-way switch, "the operation key" (the 2nd position of which is wired to a rheostat). Position 1 of the operation key raises all the fallen pointers to the horizontal thus indicating the logical universe or truth-table for four terms; it prepares the machine for a new problem. Position 2 sustains the pointers at the horizontal (it passes sufficient current to sustain the armatures of the electro-magnets actuated by the letter key operations) but does not raise the fallen pointers. Position 3, which switches off operation key circuit, causes unsustained pointers to fall.
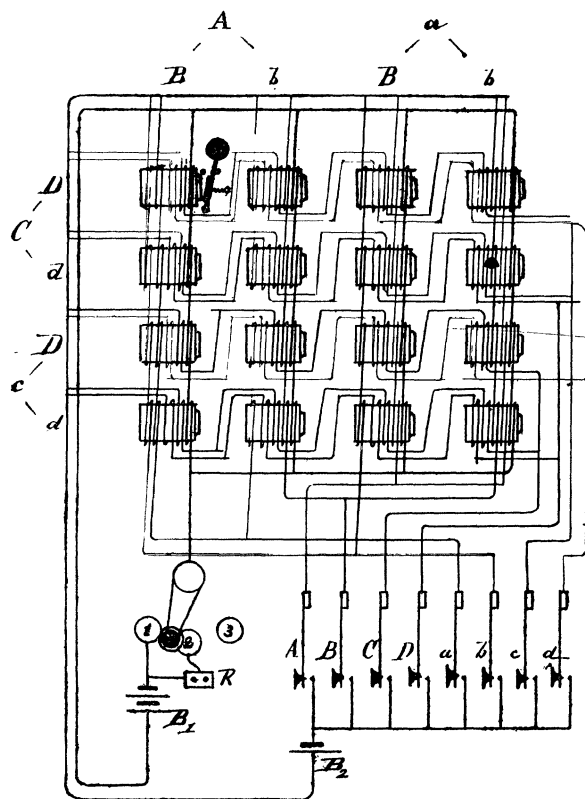
On Marquand's system the premises are inserted in a negative form. For example, the premise $A \supset B$ (A implies B) in Marquand's notation $A \prec B$, is identical with $-(A. -B)$ (it is false that both A and not B are true) or as he expresses it $A \ b \prec 0$; the premise $B \supset C$ is translated into $-(B. -C)$ or $Bc \prec 0$.

In operating the machine, the operation key is first set to position 1; this raises all the pointers to the horizontal. Assume that the proposition to be fed in is

$A \ b \prec 0$ (i.e. $A \supset B$) : we press the letter key A; this has no visible effect. The operation key is set to position 3, which causes all pointers except the a's to fall and then to position 2; this sustains the a's at the horizontal. Letter key b is then pressed and the operation key set to position 3. On the dial plate the $A \ b$ pointers fall to the vertical. We may thus continue to impress as many of the premises of a problem as we please until all the pointers have fallen. The conclusion can be read from the fallen (vertical) pointers as a negative expression in the normal conjunctive form, or from the remaining horizontal pointers as a positive expression in the normal disjunctive form. It would appear that the letter keys involved require to be closed while the operation key is set to positions 3 or 2; this seems to restrict the machine's possibilities.

The actual cardboard diagram in the Princeton Library, of which Fig. 1 is a photostat copy, is in color. Wires extending from the letter keys are colored thus: A brown (probably red faded) a red, B and b blue, C and c green, D and d yellow; the rest of the wiring is in black.

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Radioactive Colloids—Increased Danger

REPORTED recently (*1*) is a technique for recording the anatomic configuration of the liver by means of intravenous injections of radioactive colloidal gold (Au^{198}). The reticulo-endothelial (RE) system will pick up this colloidal matter with 80–90% being taken up by the liver RE cells. Due to the gamma radiation of Au^{198}, the shape and location of the liver may be estimated by measuring the gamma radiation intensity at different points over the skin. Authors of the report used the technique successfully in animal experiments, and they further state . . . "instrumentation developments are currently in progress at this laboratory in an effort to determine if such instrumentation would permit the use of a dose of radioactive colloidal gold which would be fully within the limits of safety for application to human beings."

The "limits of safety" of radiation dosage for RE cells would seem puzzling to the radiobiologist at the present time. Some experimental data published during the past few years suggest that RE cells be considered as one of the highly radioresistant tissues of the body. As much as 300 r (*2*), according to one author, and 800 r (*3*), according to another, whole body x-ray irradiation in rabbits did not alter the phagocytic function of the RE system. However, some recent direct experimental results indicate that RE cells are the most, or at least one of the most, radiosensitive cells of the organism. In rats, 25 r whole body x-ray irradiation considerably impaired RE functions, as reported by our laboratory (*4*). Another factor which has to be borne in mind is that