How an Electronic Brain Works

Part XII—Pulse patterns rearranged and programmed

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IN THE last few articles, we have shown how an electronic brain can store information, add, subtract, multiply, divide, and arrange different timing pulses and select them. We have also shown how, when the right control pulses are provided, an electric brain can pick numbers out of storage, run them into the computer, produce computed results, and put the results back in storage.

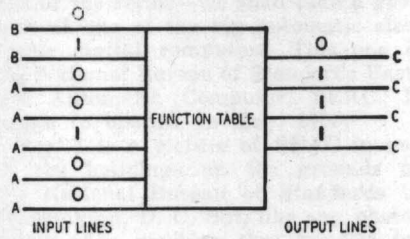

Fig. 1—The function table converts incoming pulses into other pulse patterns.

In this article we shall finish with such of the theory of electronic computer construction as we intend to cover.

We must emphasize again that not all the work in the design of a miniature electronic brain has been done yet, not by a long way. For example, one of the elements that will turn up in such a computer over and over again is the AND circuit; there are many different ways of making one; energy spent on perfecting an AND circuit useful for all parts of the machine would be well repaid; but we shall not investigate that subject here. Furthermore, the authors have as yet constructed only a miniature relay Simon, not a miniature electronic Simon; no one has yet made a miniature automatic electronic sequence-controlled digital computer (to give it its full name).

It is interesting to note one reader of RADIO-ELECTRONICS, Thomas P. Weir, W7GDM, of Powell, Wyoming, has written us that he has started construction of "a small machine using tape and a pulse frequency of 60 cycles"; and it may well be that one of the readers of RADIO-ELECTRONICS will be the first man to make a miniature automatic electronic computer.

Function tables

The term *function table* means an arrangement of equipment which will take in any one of a number of patterns of pulses and will put out any one of a number of other patterns of pulses, in such a way that any outgoing pattern is precisely determined by the incoming pattern. See the block diagram in Fig. 1, where the pattern 0100100 on seven input lines is being converted into the pattern 0111 on four output lines. Other names for function-table are *matrix, coding device, coder,* or *decoder.*

In an electronic computer, function tables may be used in many different ways, in fact wherever a mathematical function of pulses is desired. Examples are: 1—a built-in multiplication table; 2—conversion of binary digits to decimal digits, or of decimal to binary; 3—built-in tables of first approximations to reciprocals, so that hardware for dividing can be left out and the accurate reciprocals can be calculated by successive multiplications (see article X of this series); 4—built-in tables for first approximations to square roots, logarithms, etc., with the same kind of scheme for successive approximation;

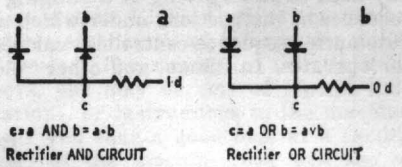

Fig. 2—Function tables use rectifiers.

5—conversions of orders (i.e., one kind of a set of pulses) given to the computer into control signals (i.e., another kind of a set of pulses) for gates (AND circuits), so that the machine can be automatically controlled.

One of the most convenient elements to use in a function table is a crystal

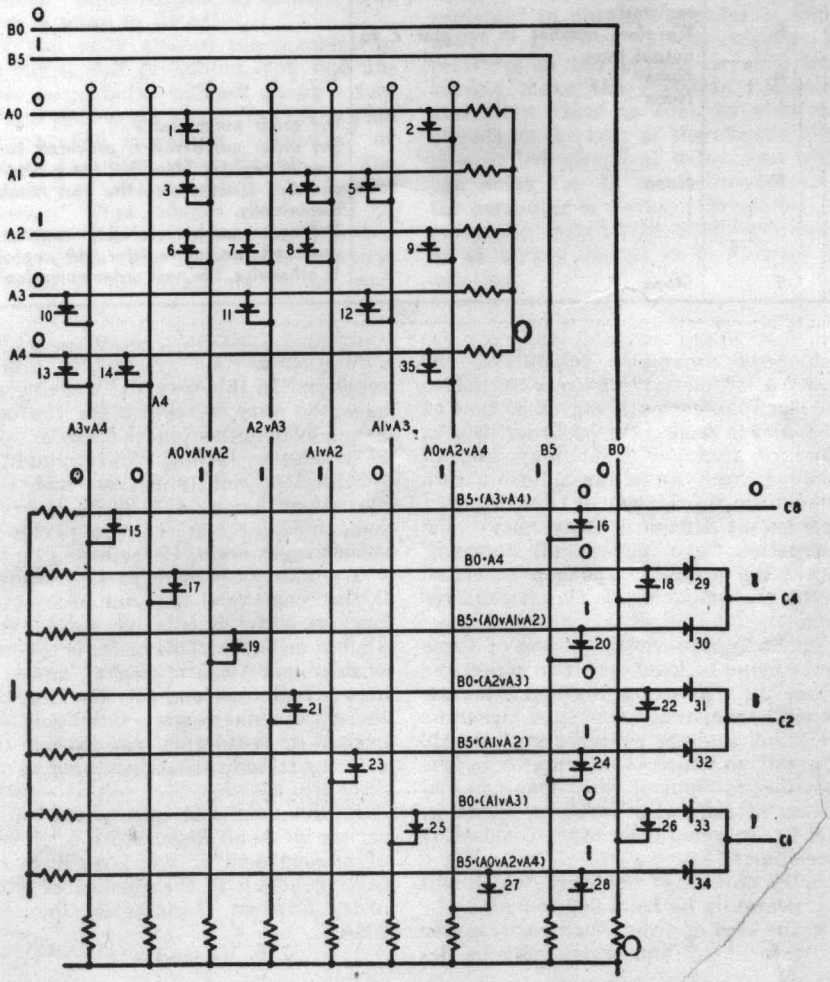

Fig. 3—A complete function table for converting biquinary notation to binary.