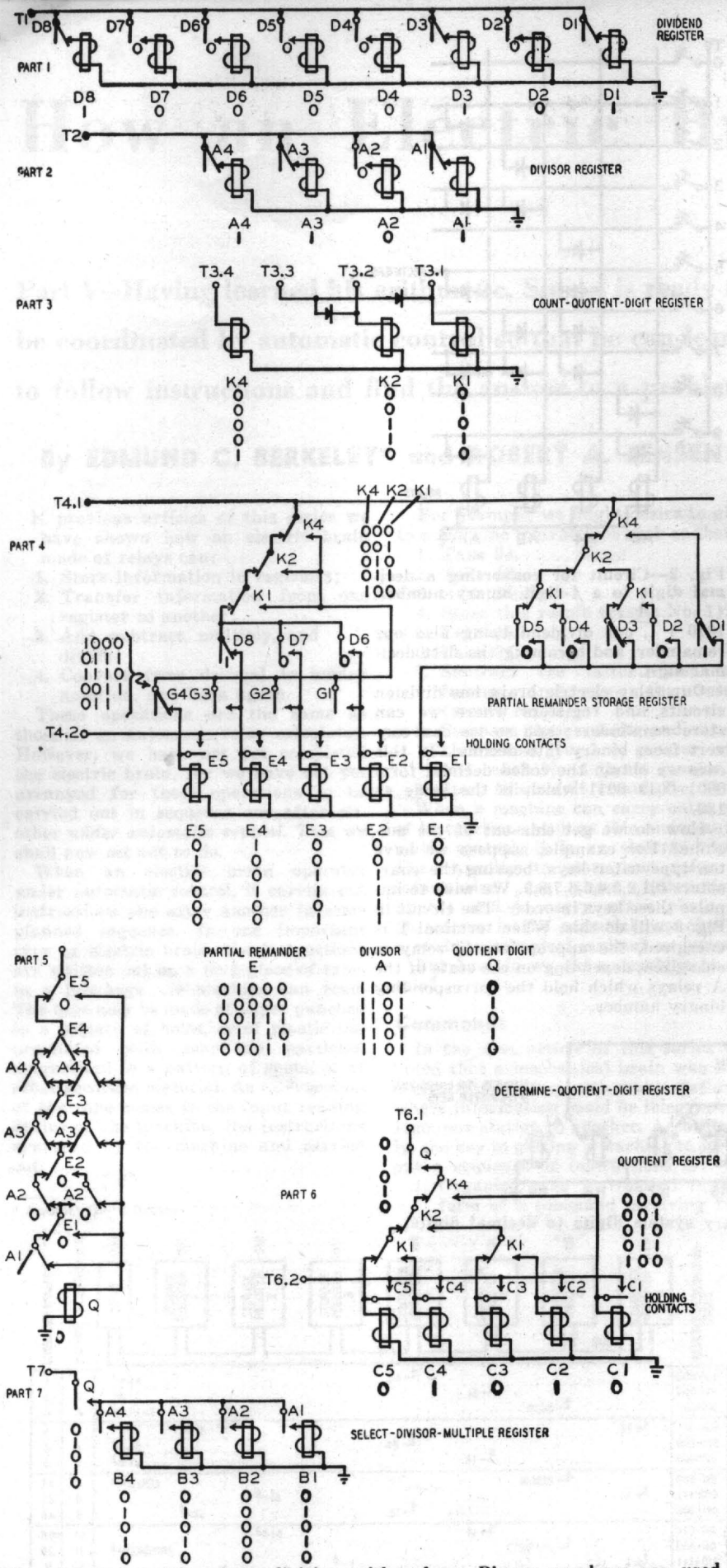

The circuit for doing long division with relays. Binary numbers are used for the process, and the circuits that carry current are shown in red.

intervals 1,2,3,4, are shown from left to right. In the first column, the different terminals are shown from top to bottom; in the second column, the names of the relays which the terminals energize; in the third column the names of the relay contacts through which the relays are energized. Each horizontal line begins when its terminal is energized, and stops when its terminal ceases to be energized. There are some vertical lines showing X's and O's. X marks the relays energized at a certain time, and the O's mark the contacts through which they are energized.

Now, you may say, it is all very well to be able to add, subtract, multiply and divide in binary notation, but how do we go from decimals to binaries?

In fact, even before we ask this question, we have to ask: how will the machine take in a decimal number? In other words, how will the machine accept it, record it, and store it?

Ordinarily a calculating machine (or some auxiliary part of it) will have a keyboard, containing keys numbered 0,1,2 up to 9. Often the keyboard will have a different column for each column of the number to be inserted in the machine. To put in a number like 593, we press down the 5 key in one column, the 9 key in the next column, and the 3 key in the third column.

In many calculating machines, the result of pressing down a key, say 3, is to turn some little counter wheel $\frac{3}{10}$ of one complete turn. But in our machine we want the result of pressing down the 3 key to be the energizing of certain relays, so that we can use the information later in the machine.

We would reasonably desire to convert any one of these ten decimal digits 0 to 9 into a pure binary number according to Table I.

Fig 2 is a circuit which will do this (using 15 rectifiers and 4 relays).

For example, if we press the 3 key, relays A2 and A1 are energized, but not relays A8 and A4, and so the information produced in the relay register is 0011, which is the binary number three.

In this way the decimal number 593 can be converted into 0101 1001 0011 stored in 12 relays. This form of representing a decimal number by a "code" for each digit is *coded decimal* notation.

Now how do we go from 0101 1001 0011 to what this number is in pure binary notation? 593 of course is 5 times 10 times 10, plus 9 times 10, plus

Table I—Decimal to Binary Conversion

Decimal	Binary	Decimal	Binary
0	0	5	101
1	1	6	110
2	10	7	111
3	11	8	1000
4	100	9	1001