3, and all we have to do is write this in binary and tell our machine do it:

0101 times 1010 times 1010 plus
1001 times 1010, plus
0011.

And this our machine can do because it has an addition circuit and a multiplication circuit.

It will be neater to program this operation with:

5 times 10, plus 9,
all times 10, plus 3.

Thus for a ten-digit decimal number, we shall only need nine multiplications.

Binary to decimal

Now suppose that we have the opposite problem. Given a binary number, we want to find the corresponding decimal number. We divide this number by 1010 (one-oh-one-oh, or 8 plus 2, or 10 in binary) and find the remainder, which will be less than 10, and store it. Then we take the quotient, and divide that by 1010, and store the new remainder. And so on.

For example, suppose we desire to convert the binary number 10000101 into a decimal number.

```
          1101
1010 ) 10000101
       1010
       ----
        1101
        1010
        ----
         1101
         1010
         ----
          11,
```

which is 3 in decimal, and becomes our first decimal digit.

```
          1
1010 ) 1101
       1010
       ----
         11,
```

which is 3 in decimal, and is our second decimal digit

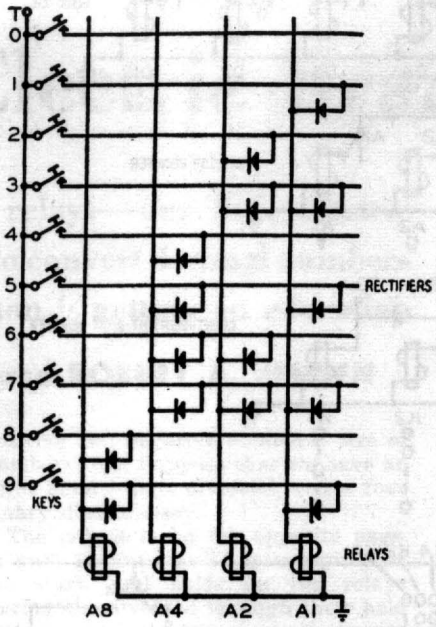

Fig. 2—Circuit for converting a decimal digit to a 4-digit binary number.

```
          0
1010 ) 1,
```

our dividend being also our remainder, and becoming the first decimal digit.

Our relay electric brain has division circuits and registers where we can store remainders; and so we can convert from binary into decimal. In this case we obtain the coded decimal form 0001 0011 0011 which is the same as 133.

How do we get this out of the machine? For example, suppose we have ten typewriter keys, bearing the characters 0,1,2,3,4,5,6,7,8,9. We wish to impulse these keys in order. The circuit in Fig. 3 will do this. When terminal T is energized, the appropriate K relay is energized, depending on the state of the A relays which hold the corresponding binary number.

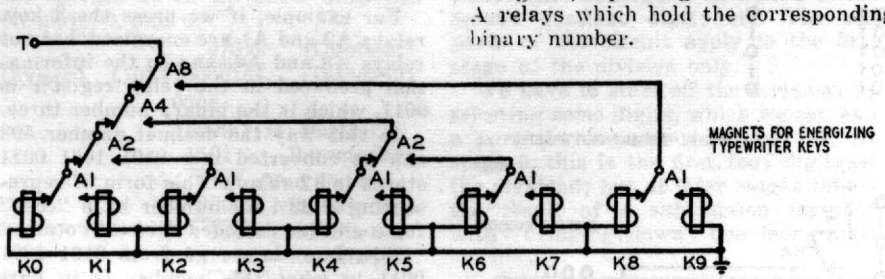

Fig. 3—Circuit for converting 4-digit binary system digits to decimal digits.