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PAPAC-00, A DO-IT-YOURSELF PAPER COMPUTER

In less than an hour you can build the simplified digital computer shown in Figure 1, using only a pair of scissors, three dozen common pins, and the parts shown in Figures 1 and 2. This computer was developed from the model demonstrated in the Concord, Massachusetts, High School lectures on computers reported in SENEWS Volume I, Number 1.

From the discussion below, the computer expert will recognize that "*PAPAC double zero*" contains most of the units of a large-scale computer, but in simplified form. The *control unit* includes a counter and a system for controlling the parts of the computer according to the instruction being performed (in this model a simple fixed instruction is used; a large computer can draw from several instructions obtained from storage). The *storage unit* includes registers, bus, and selection switch; register contents are changed by hand rather than by the computer. The *arithmetic unit* can add. *Input and output units* have been eliminated by allowing the operator to deal with the insides of the computer directly rather than by way of complicated equipment. Proprietary rights are held by the author.

In *operation*, PAPAC-00 follows the same fixed instruction over and over again. This instruction is: "Read the number out of the currently-selected storage register and add it to the adder, then get ready to use the next storage register for the next time." The "Counter" keeps track of which storage register to use next; since there are only two registers, numbered "0" and "1," the counter alternates between them. The "Switch" is controlled by the counter and allows only the selected register to be operated. Each "storage register" contains only a single binary "cell"; when the register is operated, the cell is forced against the "Bus" if the cell is set to "1." If a "1" has been read out in this way, the bus actuates the "Adder," preparing it to add the "1." If the cell is set to "0," the bus and adder are not operated, and "0" is added to the adder. Binary sums are as follows: $0+0=0$, $0+1=1$, $1+0=1$, $1+1=10$. The adder forms these sums correctly except that in the last case it forms a sum of "0" because it can handle only one digit. The "Control," pushed back and forth by hand, performs this fixed instruction by operating the counter and switch, and by returning the bus to its "0" position (if it had read out a "1") causing the sum to be formed in the adder.

To *assemble* PAPAC-00, Figure 1 should be used as the base, and the shapes of Figure 2 should be fitted over it by following these steps:

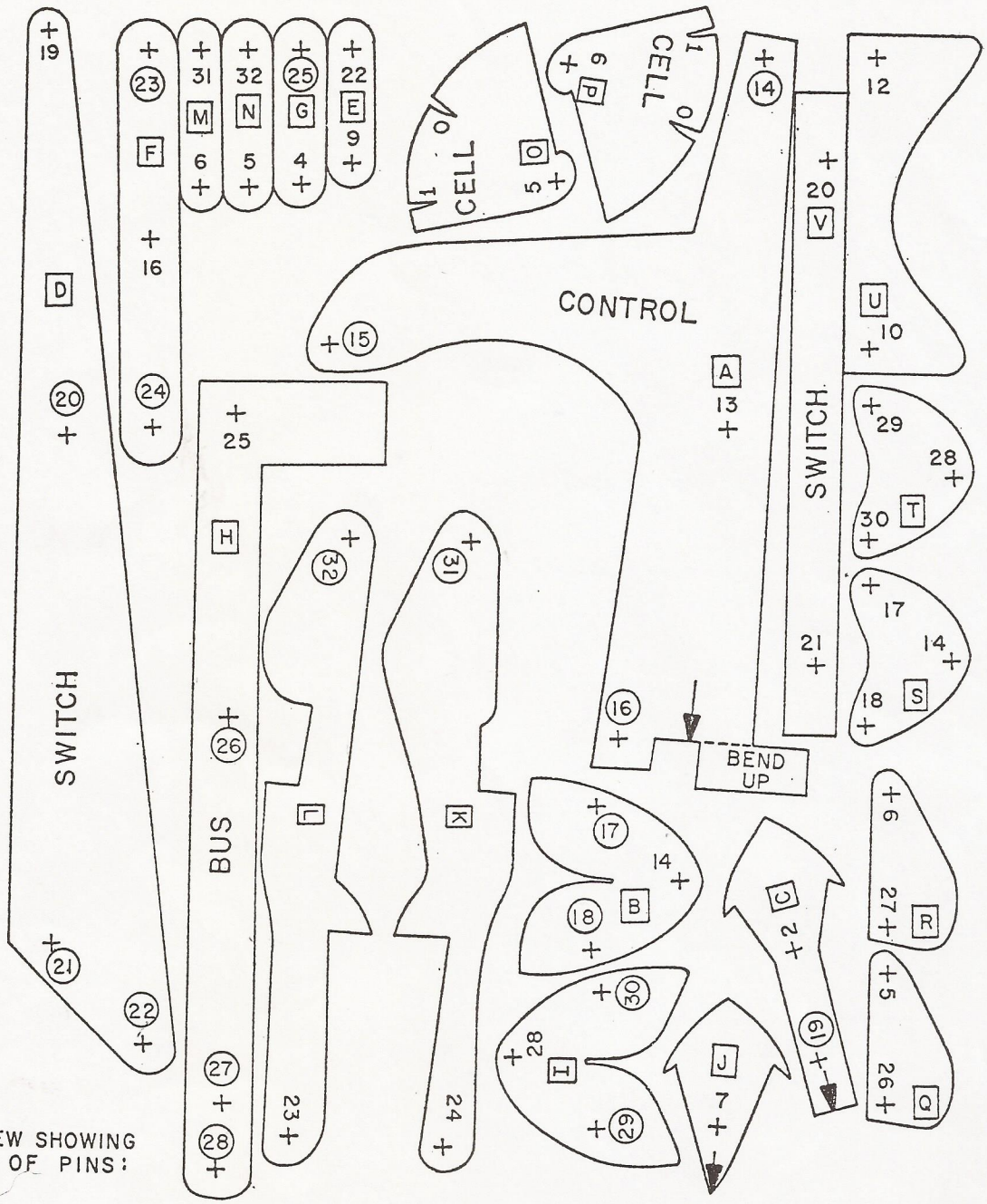

FIG. 2

PARTS FOR PAPAC-00

(ROLLIN P. MAYER, JULY 14, 1958)

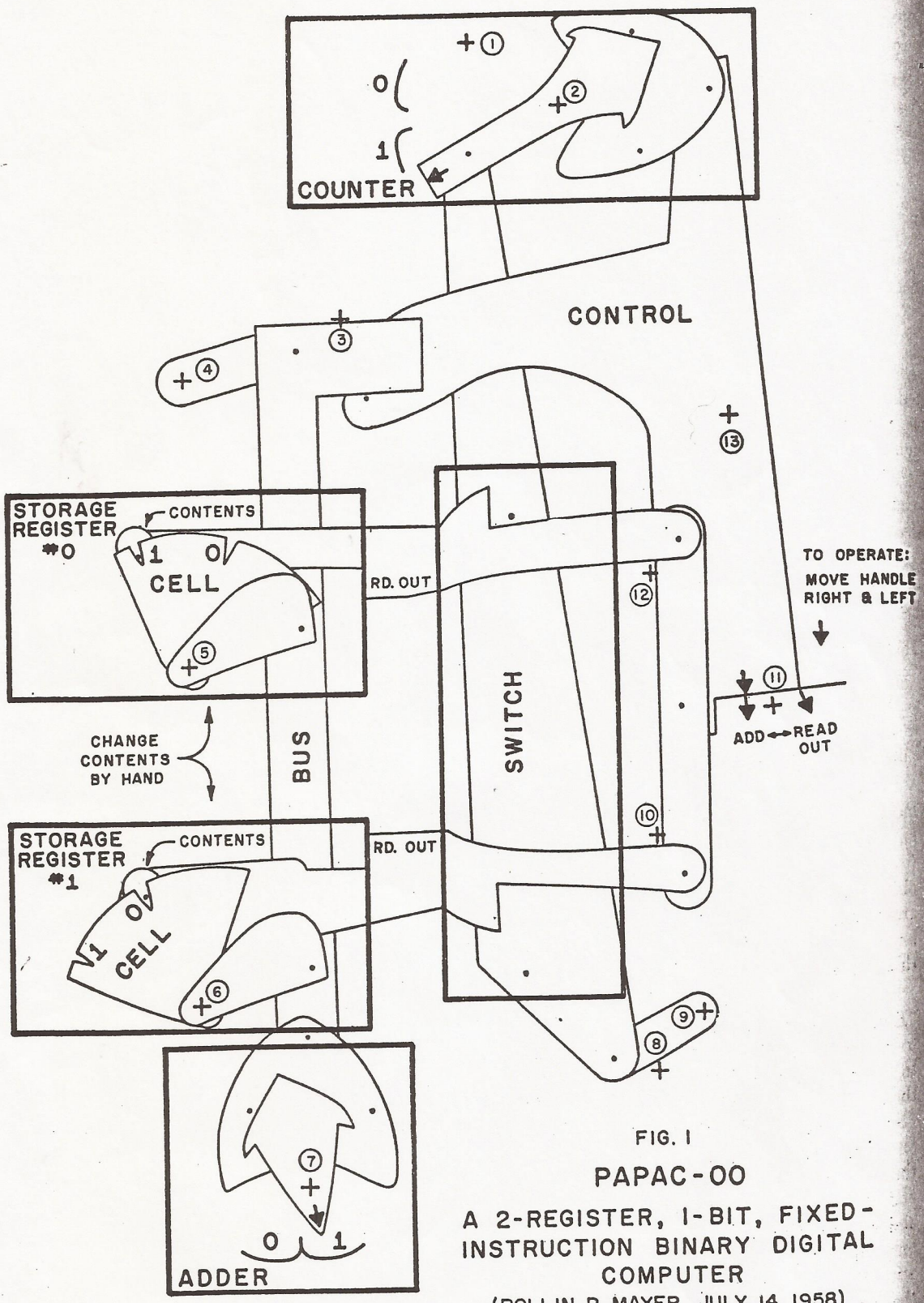

FIG. 1

PAPAC-00

A 2-REGISTER, 1-BIT, FIXED-INSTRUCTION BINARY DIGITAL COMPUTER

(ROLLIN P. MAYER, JULY 14, 1958)

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1. Punch a pinhole exactly through the intersection of each cross (+) in Figures 1 and 2 (but not the dots in Figure 1).

2. Cut out exactly on the lines, the parts in Figure 2, in any order. They are marked with a letter in a square box, from [A] to [V], and the next steps will be easier if you place each piece on the table in alphabetic order as you cut it out.

3. Place a pin up through each hole with a circled number (from *1* to *32*).

4. Taking each part of Figure 2 in alphabetic order, place its *un*circled number holes down over the correspondingly numbered pins.

5. In first operating the computer you may find that some parts jam because the upper piece is down too far on the pins: pry such pieces up a little to provide space for free motion.

6. The construction can be refined by cutting the pins and gluing the uppermost part to the remaining length. Caution:

   (a) Don't cut the stop pins too short.

   (b) Glue only *one* moving part to the same pin.

Rollin P. Mayer