March 28, 1961 E. P. G. WRIGHT 2,977,577

INTELLIGENCE STORAGE EQUIPMENT

Filed July 5, 1957

Fig. 1

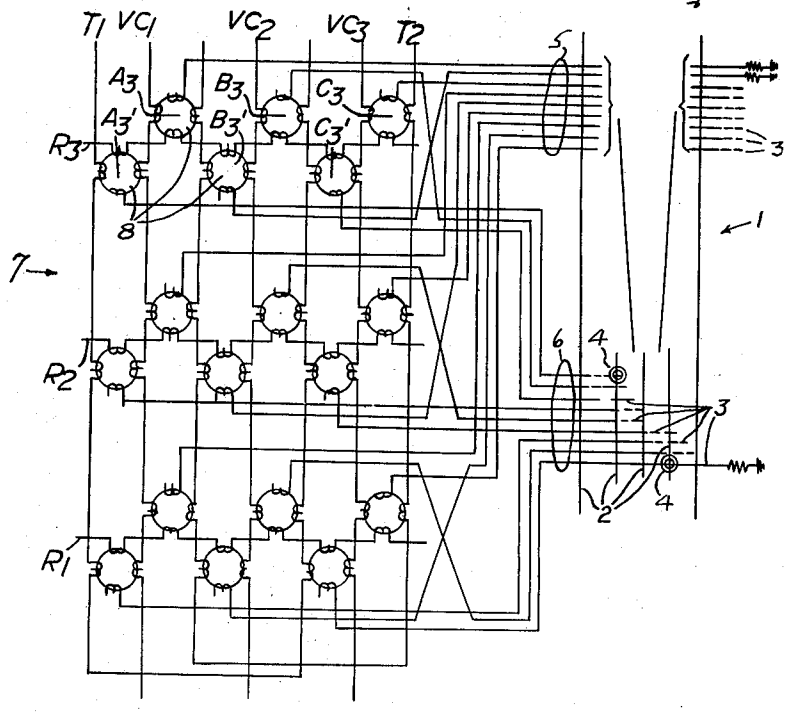
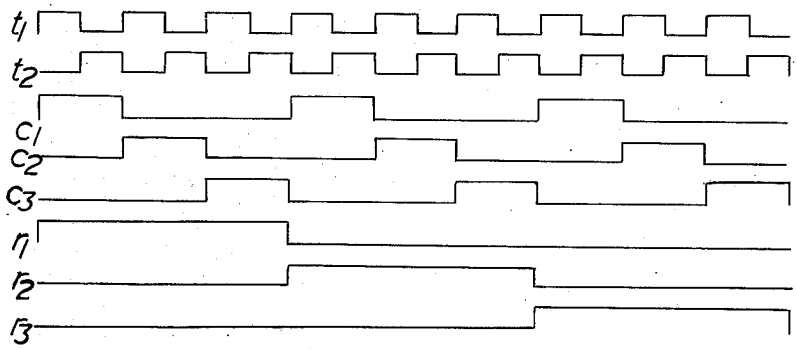


Fig. 2.



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INTELLIGENCE STORAGE EQUIPMENT

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1 Claim. (Cl. 340—174)

This invention relates to electrical distributors or scanning circuits.

The main object of the invention is to provide a static electrical distributor comprising a coordinate array of bistable devices in which each cross-point in the array comprises a plurality of bistable devices, and which comprises horizontal control wires, vertical control wires, and cross-point control wires, whereby three degrees of distribution are available.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, in which:

Figure 1 is a circuit diagram of a ferrite core matrix distributor incorporating the invention; and

Figure 2 is a diagram of wave forms used to control the distributor.

In the drawing of Figure 1 the co-ordinate array 1 of lines on the right hand side indicates vertical and horizontal wires 2 and 3 threading individual ferrite toroids one of which is assumed to be located at each crossing point of the vertical and horizontal wires.

The individual toroids 4 may in fact be constituted by discrete volumes of ferrite within a block of ferrite, operating wires 2 and 3 passing through each said discrete volume. It will be seen that the horizontal wires 3 are in two blocks 5 and 6 of nine wires each, both crossed by the vertical wires 2. The ferrite distributor 7 on the left-hand side of the drawing gives access to the wires 3 of each block 5 and 6 of horizontals. In other words, the wires 3 are the output wires of the distributor 7. The distributor toroids 8, which may also be individual cores or constituted by a single block, are arranged to scan the two blocks 5 and 6 of horizontal wires 3 in two successive time periods which form a cycle, which can be repeated as required.

The distributor comprises 18 toroids 8 in nine pairs. The pairs being arranged in columns and rows of three each, the toroids labelled A_3—$A_{3'}$, B_3—$B_{3'}$, C_3—$C_{3'}$, indicating the pairs of the first row, and the second and third rows having corresponding pairs. Three vertical wires VC_1, VC_2, VC_3 thread the toroids of the three columns; that is, each wire thread six toroids in all. Three horizontal wires R_1, R_2, R_3 respectively thread all the six toroids of the three rows. For instance A_3—$A_{3'}$, B_3—$B_{3'}$, and C_3—$C_{3'}$ are threaded by the wire R_3. In addition two sub-cycle wires T_1 and T_2 each thread one toroid of each pair. It will be seen that wire T_1 passes down the left-hand three toroids and then up between the second and third columns, threading in turn six toroids, three from each of the second and third columns. Likewise the wire T_2 passes down the right hand three toroids (which are those not threaded by the wire T_1) and up between the first and second columns, threading the adjacent six toroids of the first and second columns (which are those not threaded by the wire T_1).

Three pulse cycles are used, as shown in Figure 2. Firstly, a cycle of two pulses t_1, t_2 which have durations substantially equal to the spaces between them and are staggered with respect to each other. Secondly, a cycle of three pulses c_1 . . . c_3, each pulse having a duration equal to the complete cycle of t pulses and the pulses c_1 . . . c_3 being staggered with respect to each other. Thirdly, a cycle of three pulses r_1 . . . r_3, each pulse having a duration equal to the complete cycle of c pulses and the pulses being staggered with respect to each other.

The t pulse cycle is used for identifying the two blocks 5 and 6 of horizontal wires 3 in the store. The voltages of the various pulses are adjusted so that each core will be activated only if three pulses are applied to it: a t pulse, a c pulse, and an r pulse. In other words, it will take three simultaneous pulses to create coercive force sufficient to change the state of any core. When a pulse of the c cycle is applied, for instance, to C_1 while R_3 is being pulsed, then during the first half of that pulse, namely t_1, the left hand core $A_{3'}$ is activated by c_1, r_3 and t_1 simultaneously, while in the second half of the sub-cycle namely t_2, the right hand core A_3 is simultaneously pulsed by c_1, r_3, t_2.

In this way, by suitable pulse arrangement, sub-cycles can be applied in turn to the first wires, the second wires, the third wires, and so on, of the two blocks 5 and 6 in sequence. Other arrangements of pulse cycles could give different distribution. It will be seen that the second vertical wire 2 from the left in the array 1 only crosses the lower block 6 of horizontal wires. This is to indicate that any such variation in the arrangement of the co-ordinate array can be made for special purposes.

The third vertical wire is also confined to the lower block, but it will be seen that at this point the upper block of horizontals has been split and the two halves separately bracketed with lines drawn downwardly from the brackets towards the vertical in question. This is to indicate that the top block of wires, as well as the lower block, are threaded through the toroids at the intersection of the third vertical wire and the lower block of horizontals. Thus the top wire of each block will pass through the top toroid in the third column, the second wire through the second toroid, and so on. In this way a toroid in the third column can be operated from either block of horizontals and each toroid in this column will be operative throughout a cycle t_1, t_2.

While the drawing shows two blocks of horizontals, additional blocks of horizontals can be provided by adding additional toroids to each of the pairs of toroids A_3—$A_{3'}$, B_3—$B_{3'}$, etc. in the distributor, so that the pairs become groups containing 3, 4 . . . toroids.

The vertical and horizontal wires would still be threaded through every toroid in every group forming part of the columns and rows of groups. But the t-cycle, equal in length to a c pulse, would be divided into a number of parts x (instead of 2 only) equal to the number of blocks of horizontal wires in the main store and a corresponding number of t wires will be provided and threaded each through a corresponding one of the toroids of each group.

It will be seen that in this way a coordinate array of magnetic toroids is arranged to pulse in turn all the first wires of x blocks of horizontals in a t cycle of x pulses per cycle, as the first wire in block 6 from $A_{3'}$ lower and the first wire in block 5 from A_3 upper during the simultaneous occurrence of pulses c_1, r_3; then to pulse all the second wires of the blocks, as the second wire in block 6 from B_3 upper and the second wire in block 5 from $B_{3'}$ lower during the simultaneous occurrence of c_2, r_3, and so on in an overall recurring cycle the period of which is y times that of the t cycle, in which y is the number of wires per block and equals $p \times q$, where p is the number

of pulses in the c_1, c_2, . . . cycle, and q is the number of pulses in the r_1, r_2, . . . cycle.

It will be seen that the drawing shows a coordinate array of bistable devices, which, as illustrated, are ferromagnetic cores, in which a plurality of devices are provided at each cross-point, e.g. A_3—$A_{3'}$, B_3—$B_{3'}$, and control wires of three types are provided, vertical e.g. one per column; horizontal, e.g. one per row; and cross-point, e.g. one per device in each cross-point.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What is claimed is:

Static electric distributor comprising a coordinate array of bistable magnetic toroids in which each cross-point comprises a plurality of bistable magnetic toroids, a plurality of horizontal control wires, there being one for each horizontal row of cross-points, each horizontal control wire being electrically coupled to each of the bistable toroids at each cross-point of its associated row, a plurality of vertical control wires, there being one for each vertical row of cross-points, each vertical control wire being electrically coupled to each of the bistable toroids at each cross-point of its associated row, a plurality of cross-point control wires, there being one for each bistable toroid at a cross-point, each cross-point control wire being coupled to corresponding bistable toroids in each vertical row of cross-points, an independent output winding in each toroid, means for energizing said horizontal control wires in succession, means for energizing said vertical control wires in succession, and means for energizing said crosspoint wires in succession, said energizing means arranged to operate so that a first plurality of control wires is successively energized during the energization of each control wire of a second plurality of control wires, and said second plurality of control wires is successively energized during the energization of each control wire of a third plurality of control wires, whereby all the toroids are successively driven from a particular bistable condition to the other.

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