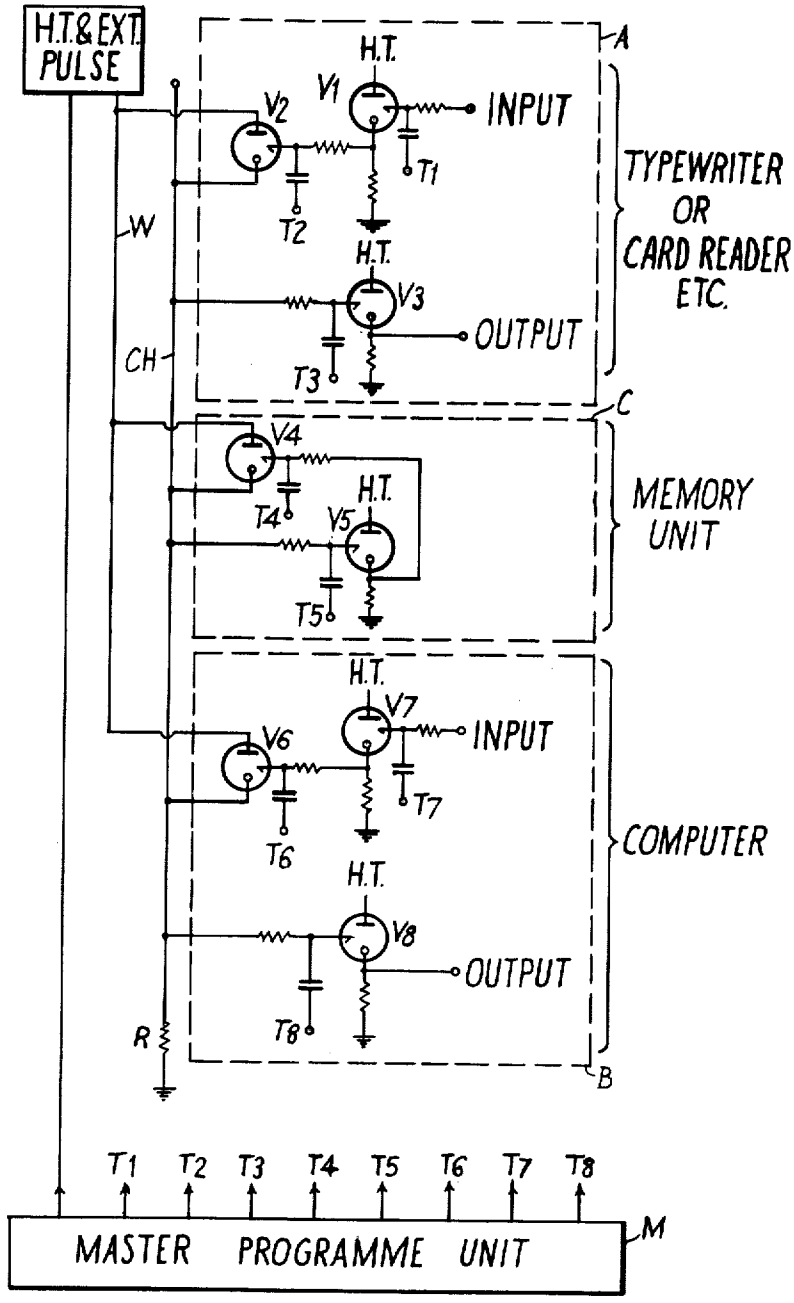
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INFORMATION TRANSFER ALONG A COMMON CONDUCTOR IN BOTH DIRECTIONS BETWEEN INPUT AND OUTPUT COMPUTER DEVICES

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Inventor

Donald Weighton

By Holcomb, Wetherill & Brisebois

Attorneys

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INFORMATION TRANSFER ALONG A COMMON CONDUCTOR IN BOTH DIRECTIONS BETWEEN INPUT AND OUTPUT COMPUTER DEVICES

Donald Weighton, Cambridge, England, assignor to Pye Limited, Cambridge, England, a company of Great Britain

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The present invention relates to electronic computer or calculator circuits and more particularly to a circuit arrangement providing the required connections between a calculating unit and a plurality of input and output stores.

The arrangement is particularly advantageous where information is to be transferred in the parallel mode as a great number of connections are then required between the output terminals of any given unit and the input terminals of the next unit, comprising one conductor for each digit, or other information element of the storage capacity of the computer.

Arrangements hitherto proposed have required numerous sets of conductors, each of which is only capable of transmitting information in one direction and the necessary cables and switching means are of such complexity that the arrangements become both expensive and unreliable.

According to the present invention, a circuit arrangement for transferring information in both directions between a calculating unit and a plurality of input and output stores or between two computers having input and output stores, comprises a common conductor for each numerical digit or other information element to be handled by the computer and a plurality of stores for storing that digit or other information element associated with that conductor, each of said stores comprising a cold cathode gas discharge tube. Each of the input stores for feeding information to the common conductor is connected to said conductor through a further cold cathode gas discharge tube serving as a transfer store. Each of the output stores is connected to be fed directly from the common conductor.

Each common conductor terminates in a resistive connection to earth, so that the individual conductors are normally near earth potential but are raised to a positive priming potential whenever a cold cathode tube having an output connected to that conductor is made to conduct.

Each of the transfer stores may have its cathode connected to the common conductor and is primed on its trigger by means of an output voltage developed at the cathode of an input storage tube.

The arrangment is such that the transfer storage tubes are primed from the input stores and are fired by controlling pulses which may be applied to the triggers and be derived from a master programme unit. Thus several transfer stores may be primed simultaneously but the only tube struck is that which is triggered by the controlling pulse from the programme unit. This avoids the danger of transferring information from more than one transfer store on to the common conductor at the same time.

All of the transfer storage tubes are fed from the high tension supply over a single wire to which a clearance pulse may also be supplied in order to extinguish the transfer storage tubes when desired after a pulse has been fed from one of these tubes on to the common conductor.

Each of the output storage tubes has its trigger connected via a suitable resistor to the common conductor and is primed by means of the voltage produced on the common conductor, and fired by means of a controlling pulse which may be produced from the master programme unit.

The arrangement may also include a memory circuit consisting of a transfer store and an output store interconnected so that information may be stored until required.

In order that the invention may be more fully understood, an embodiment thereof will now be described with reference to the accompanying drawing which is a circuit diagram showing the connection of various input and output stores to a common conductor capable of handling one digit or other information element to be fed to or derived from a calculating unit.

Referring to the drawing, it will be understood that the circuit shown may only comprise a part of the stores connected to one common conductor, hereinafter called a "common highway", for handling one digit or other information element in both directions to and from the computer. In practice a separate common highway and associated stores will be provided for each digit or other information element to be handled by the computer.

The information storage unit A may have its input terminal fed from a typewriter, a card reader or any other appropriate device which supplies a priming potential to the trigger of the cold cathode gas discharge tube V1 serving as an input store. The cathode of this tube is in turn connected to the trigger of a further cold cathode gas discharge tube V2, serving as a transfer storage tube and having its cathode connected to the common highway CH. The anode of the tube V2 is fed with a H.T. potential from a common wire W which also feeds the anodes of the transfer storage tubes V4 and V6 also connected to the common highways. The tube V3 of storage unit A comprises an output store having its trigger connected to the common highway and the output derived from its cathode. The storage unit B comprises a similar unit to unit A and consists of input store V7, transfer store V6 and output store V8. The unit may form part of an electronic computer or calculator. The unit C comprises an output storage tube V5 directly connected to a transfer storage tube V4 and forms a memory unit in which information may be lodged until required. The circuit also comprises a master programme unit M producting pulses controlling the operation of the various stores.

In operation, a positive input potential applied to the trigger of the tube V1 will prime the tube and when a positive pulse is also applied to the trigger via terminal T1 from the relevant connection on the master programme unit M, the tube V1 will strike and prime the trigger electrode of the transfer storage tube V2. Upon receipt of a transfer pulse on terminal T2 from the master programme unit, tube V2 will conduct so raising the potential on the common highway CH, as the current flowing through the tube passes to earth through the terminating resistor R. If a transfer pulse is now applied to the output store V3 from the master programme unit M, via terminal T3, then since this tube is primed by the potential on the common highway, it will now conduct. In a similar manner the potential on the common highway CH could be transferred to the output store V8 or to the memory unit V5, by applying transfer pulses to T8 or T5 from the master programme unit M.

As mentioned above the circuit connections are only shown to one common highway conductor whereas in practice a large number of conductors will be provided one for each digit to be handled by the computer and the pulses fed at any time from the master programme unit can operate simultaneously on the tubes connected to each of the common highways, whereby informa-

tion is passed along some or all of the common highways simultaneously.

When it is desired to clear the common highway for further operation after transferring a digit, a transfer clearance pulse derived from the master programme unit is applied to the anodes of all the transfer storage tubes connected to that common highway, e.g. **V2, V4** and V6 via the conductor W, in order to extinguish any of these tubes which are struck. This clearance pulse can be arranged to be coincident with the transfer pulse triggering an output store as the time constant of the trigger network provides an adequate delay to allow this pulse to be transferred before the clearance pulse becomes operative.

It will be understood that by means of the arrangement according to the present invention any number of computers and reading devices may be interconnected via the common highway.

The arrangement according to the present invention may be employed in the calculator arrangement described in my copending application Serial No. 22,231, filed April 14, 1960, now Patent No. 3,145,295.

I claim:

1. A circuit arrangement for transferring information between a plurality of stores, comprising a conductor for each information element to be handled, said conductor being common to said stores and along which said information element may be passed in both directions between said stores, an input storage device for each store, means for feeding an information element to said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, means for conditioning each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, means for producing a potential on said common conductor when any one of said transfer storage devices is operated to pass said information element to said common conductor, said potential conditioning said output storage devices, means for generating a series of triggering pulses and means for applying said triggering pulses to said storage devices to render said conditioned storage devices operative to pass said information element from a chosen one of said stores to another chosen store via said common conductor.

2. A circuit arrangement for transferring information between a plurality of stores, comprising a conductor for each information element to be handled, said conductor being common to said stores and along which said information element may be passed in both directions between said stores, an input storage device for each store, means for feeding an information element to said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, means for conditioning each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, means for producing a potential on said common conductor when any one of said transfer storage devices is operated to pass said information element to said common conductor, said potential conditioning said output storage devices, means for generating a series of triggering pulses, means for applying said triggering pulses to said storage devices to render said conditioned storage devices operative to pass said information element from a chosen one of said stores to another chosen store via said common conductor, means for generating a clearance pulse, and means for applying said clearance pulse to said transfer storage devices after an information element has been passed from one store to another.

3. A circuit arrangement for transferring information between a plurality of stores, comprising a conductor for each information element to be handled, said conductor being common to said stores and along which said information element may be passed in both directions between said stores, an input storage device for each store, means for feeding an information element to said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, means for conditioning each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, means for producing a potential on said common conductor when any one of said transfer storage devices is operated to pass said information element to said common conductor, said potential conditioning said output storage devices, means for generating a series of triggering pulses, means for applying said triggering pulses to said storage devices to render said conditioned storage devices operative to pass said information element from a chosen one of said stores to another chosen store via said common conductor, and at least one memory store comprising a transfer storage device connected to an output storage device and both connected to said common conductor for storing said information element until required by another store.

4. A circuit arrangement for transferring information between a plurality of stores, comprising a conductor for each information element to be handled, said conductor being common to said stores and along which said information element may be passed in both directions between said stores, an input storage device for each store, each input storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for feeding an information element to the trigger electrode of said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, each transfer storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for priming each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, each output storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for producing a potential on said common conductor when any one of said transfer storage devices is made conducting to pass said information element to said common conductor, said potential priming said output storage devices, means for generating a series of controlling pulses and means for applying said controlling pulses to said storage devices to render said primed storage devices conducting to pass information from a chosen one of said stores to another chosen store via said common conductor.

5. An arrangement as claimed in claim **4**, in which each of the transfer storage tubes connected to the common conductor has its cathode connected to the common conductor and is primed on its trigger by means of an output voltage developed at the cathode of the associated input storage tube.

6. An arrangement as claimed in claim **4**, in which all of the transfer storage tubes connected to a common conductor have their anodes fed from a high tension supply over the same high tension conductor and means for applying a clearance pulse to said high tension conductor in order to extinguish the transfer storage tubes after an information element has been transferred from one store to another.

7. An arrangement as claimed in claim **4**, in which each of the output storage tubes has its trigger connected via a resistor to the common conductor and is primed by means of the potential produced on the common conductor.

8. An arrangement as claimed in claim **4**, in which each common conductor terminates in a resistive con-

nection to earth so that the individual common conductors are normally near earth potential but are raised to a positive priming potential for said output storage tubes whenever a transfer tube having an output connected to that conductor is made to conduct.

9. A circuit arrangement for transferring information between a plurality of stores, comprising a conductor for each information element to be handled, said conductor being common to said stores and along which said information element may be passed in both directions between said stores, an input storage device for each store, each input storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for feeding an information element to the trigger electrode of said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, each transfer storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for priming each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, each output storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for producing a potential on said common conductor when any one of said transfer storage devices is made conducting to pass said information element to said common conductor, said potential priming said output storage devices, means for generating a series of controlling pulses, means for applying said controlling pulses to said storage devices to render said storage devices conducting to pass information from a chosen one of said stores to another chosen store via said common conductor, and at least one memory store comprising a transfer storage device connected to an output storage device and both connected to said common conductor for storing said information element until required by another store.

10. A circuit arrangement for transferring information representing numerical digits between a plurality of stores, comprising a conductor for each numerical digit to be handled, said conductor being common to said stores and capable of passing said numerical digit in both directions between said stores, an input storage device for each store, each input storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for feeding said numerical digit to the trigger electrode of said input storage devices, a separate transfer storage device connected between each of said input storage devices and said common conductor, each of said transfer storage devices comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode, means for priming each of said transfer storage devices by the output of the associated input storage device, an output storage device for each store connected to said common conductor, each output storage device comprising a cold cathode gas discharge tube having an anode, a cathode and a trigger electrode means for producing a potential on said common conductor when any one of said transfer storage devices is made conducting to pass said numerical digit to said common conductor, said potential priming the trigger electrodes of said output storage devices, means for generating a series of controlling pulses, means for applying said controlling pulses to said storage devices to render said storage devices conducting to pass a digit from a chosen one of said stores to another chosen store via said common conductor.

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MALCOLM A. MORRISON, *Primary Examiner.*

DARYL W. COOK, *Examiner.*