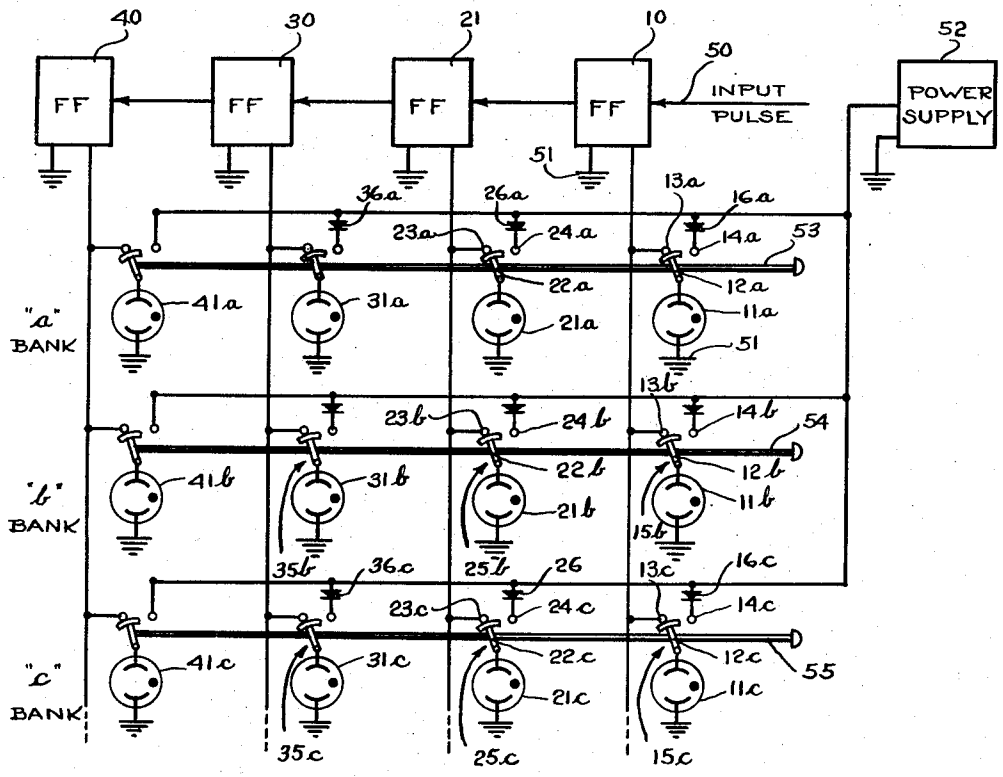
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READOUT DEVICE

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READOUT DEVICE

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The present invention relates to electronic computing machines and has particular reference to readout devices therefor.

According to the present invention many readouts of either total count or time may be derived from a single recycling count chain. Banks of glow discharge tubes, such as neon filled bulbs, are triggered on and off by the output flip-flops and at the desired instant of a readout a single bank of the neon lamps is switched from the firing voltage of the flip-flop to a glow discharge sustaining voltage. The sustaining voltage will keep those neon lamps lit that were lit at the time of transition, but will not ignite those lamps which were not lit.

In this way a great many read outs can be obtained from a single count chain by using as many banks of neon lamps as are desired with a resultant saving of duplicate count chains.

For a more complete understanding of this invention reference may be had to the accompanying diagram, Fig. 1, which schematically illustrates the present invention.

In Figure 1 a plurality of bi-stable circuits **10**, **20**, **30**, **40** are connected in a manner such as to form a multistage counter commonly found in binary computing devices. Such counters are useful in counting the total number of pulses arriving at the input terminal **50** over a given interval of time. The number of pulses may indicate the elapsed time, for example. (Alternatively, the total count of pulses may represent constants which are stored or determined elsewhere in the computer and which are to be read out at certain predetermined instants of time.) The bi-stable circuits **10**, **20**, **30**, **40** are conventionally termed "flip-flop" circuits and may be such as that shown in Fig. 6.24 on page 231 of "Automatic Digital Computers" by M. V. Wilkes, published in 1956 by John Wiley & Sons, Inc., for example, although they need not be limited thereto.

In Figure 1, the output of flip-flop **10** represents the first digit of the binary number which indicates, for example, the elapsed time; the output of flip-flop **20** represents the second digit and so on.

Associated with each flip-flop circuit is a plurality of glow discharge tubes such as neon lamps **11***a*, **11***b*, **11***c*, **21***a*, **21***b*, **21***c* and so on, one side of each tube being connected to a common terminal **51**, such as ground, and the other side of each lamp being connected to the respective movable arm **12***a*, **12***b*, **12***c*, **22***a*, **22***b* and **22***c* of the corresponding shorting type selector switch **15***a*, **15***b*, **15***c*, **25***a*, **25***b* or **25***c*. The left hand stationary contacts **13***a*, **13***b* and **13***c* of switches **15***a*, **15***b*, **15***c* are each connected to the output of flip-flop **10**; the left hand stationary contacts **23***a*, **23***b* and **23***c* of switches **25***a*, **25***b* and **25***c* are each connected to the output of flip-flop **20**. Similarly the flip-flop **30** output is connected to neon lamps **31***a*, **31***b* and **31***c* through switches **35***a*, **35***b* and **35***c* and the output of flip-flop **40** is connected to

neon lamps **41***a*, **41***b* and **41***c* through switches **45***a*, **45***b* and **45***c*.

The right hand stationary contacts **14***a*, **14***b*, **14***c*, **24***a*, **24***b*, **24***c*, etc. of all the selector switches are connected to the high potential side of a voltage source **52**. The voltage of the source **52** is sufficiently high to maintain the glow discharge in the lamps once they have been fired by a higher voltage, but it is not high enough to ignite a lamp by itself. Diodes **16***a*, **26***a*, **36***a*, etc. are interposed in each of the connections between the right hand stationary contacts of the selector switches and the voltage source **52**.

The movable contacts such as **12***a*, for example, are shorting type contacts where both the right hand and left hand stationary contacts such as **13***a* and **14***a* are both momentarily connected to contact **12***a* as the contact **12***a* is operated from one position to the other.

In operation, it is required that at certain predetermined instants of time the signal at input **50** be retained for some period of time. In prior devices a plurality of flip-flops was required, one for each desired instant, with its own readout device. The present invention removes the necessity for duplicating the flip-flops and uses merely one set of flip-flops with a plurality of readout devices actuated to retain each reading at the desired instant.

Prior to operation, all of the armatures **53**, **54** and **55** are initially positioned to the left in Fig. 1 so that the movable contact of each switch is connected to its respective left hand contact, and therethrough to the respective flip-flop output.

Each of the lamps **11***a*, **21***a*, **31***a* and **41***a* which is connected to a flip-flop having an output corresponding to the digit, one will be lit and the others will be dark, the outputs of the flip-flops being sufficient to ignite the lamps. Obviously, the lamps in each of the other banks *b*, *c*, connected to any one flip-flop will have the same condition as the lamp in the "*a*" bank.

At the instant the first reading is desired, the armature **53** is operated to the right in Fig. 1 removing lamps **11***a*, **21***a*, **31***a*, **41***a* from the influence of the flip-flops and connecting them to the constant voltage of supply **52**. The condition of each lamp is maintained by the voltage supply **52** as the transfer from the flip-flops to the constant voltage supply is made through the make-before-break switches. Thus, the lamps which were lit, remain lit, but the ones which were dark are not lit by the sustaining voltage of supply **52**. The diodes **16***a*, **26***a*, **36***a* prevent the flip-flop voltages from igniting glow lamps other than the proper ones through the electrical connections which would exist between the right hand stationary contacts of all the switches in the absence of the diodes.

Similarly at the second instant, the armature **54** is operated to the right, and at the third instant the armature **55** is operated to the right to preserve the instantaneous output of flip-flops **10**, **20**, **30**, **40** on the corresponding bank of lamps *b* or *c*. Here again, the diodes prevent ignition of any of the dark glow lamps of the "*a*" bank, as well as any in the "*b*" bank itself, as the momentary shorting action of switches **15***b*, **25***b* and **35***b* occurs.

The armatures **53**, **54** and **55** may be operated by any means, and specific devices are not enumerated here. Although Fig. 1 shows provision for taking three readings of a four digit number, it should be recognized that any amount of readings may be taken of a number having any amount of digits in the same manner by adding a bank of lamps for each reading and an extra lamp in each bank for each additional digit to be read.

Furthermore, the switching means between the flip-flops and the supply **52** need not be limited to the mechanical

construction shown, but such devices as electronic switching, for example, may be used for speed, if desired. The diodes **16***a*, **16***b*, **16***c*, etc. may be omitted if non-shorting type switches having an operating or transition time shorter than the de-ionization time of the glow tubes are used in place of the transfer switches **15***a*, *b*, *c*, and so on.

I claim:

1. In a device of the character described, a circuit having an output, said output having two discrete voltage levels, a glow discharge tube, a power supply, the voltage of said power supply being less than the ignition voltage but more than the sustaining voltage of said glow tube, and switching means for connecting said glow tube selectively to said output of said circuit or said power supply, said switching means being momentarily connected to both outputs simultaneously during the switching operation.

2. In a device of the character described, a circuit having an output, said output having two discrete voltage levels, a plurality of glow discharge tubes, a power supply, the voltage of said power supply being less than the igniting voltage but more than the sustaining voltage of said glow tubes, and switching means for severally connecting said glow tubes selectively to said output of said circuit or said power supply, said switching means being momentarily connected to both outputs simultaneously during the switching operation.

3. In a device of the character described, a plurality of circuits, each circuit having an output and each output having two discrete output voltage levels, a plurality of glow discharge tubes, a power supply, the voltage of said power supply being less than the igniting voltage but more than the sustaining voltage of said glow tubes, said glow tubes being arranged in a symmetrical pattern of banks with one tube in each bank for each of said circuits, switching means connecting to each of said glow tubes for selectively connecting said glow tubes to said circuit associated therewith or to said power supply, and means for actuating all of said switching means for each bank simultaneously, said glow tubes being momentarily connected to both said associated circuit and said power supply at the same time during the switching operation.

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