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SECTIONAL READ-OUT TUBE AND CIRCUIT

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2 Sheets-Sheet 1

Fig. 1

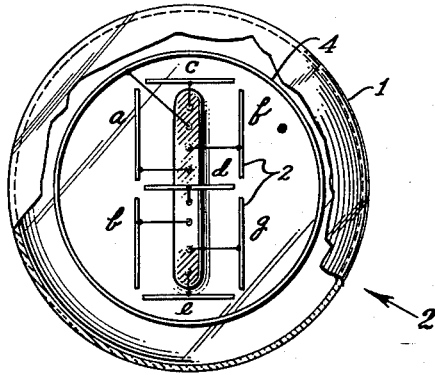
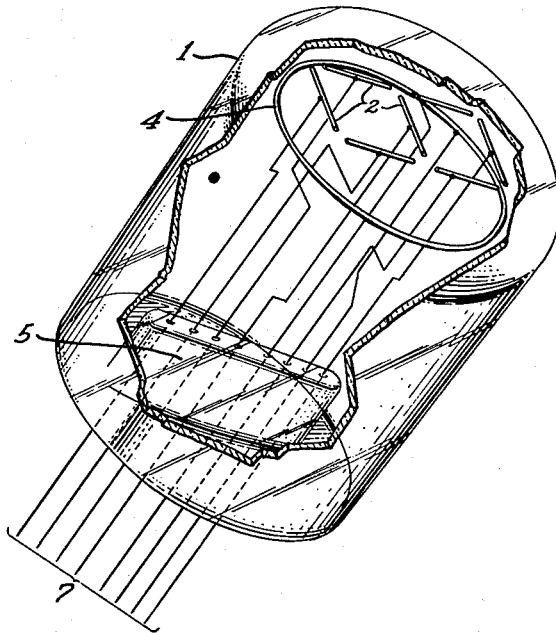


Fig. 2



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Fig. 3



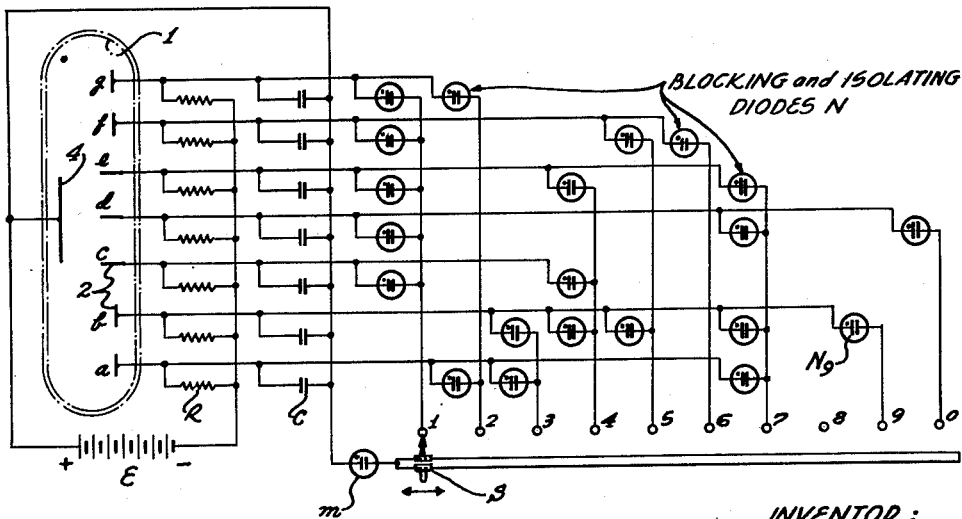
Fig. 4

CATHODES

	a	b	c	d	e	f	g
1	X	X	0	0	0	0	0
2	0	X	X	X	X	X	0
3	0	0	X	X	X	X	X
4	X	0	0	X	0	X	X
5	X	0	X	X	X	0	X
6	X	X	X	X	X	0	X
7	0	0	X	0	0	X	X
8	X	X	X	X	X	X	X
9	X	0	X	X	X	X	X
0	X	X	X	0	X	X	X

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Fig. 5



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SECTIONAL READ-OUT TUBE AND CIRCUIT

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6 Claims. (Cl. 315—169)

This invention relates to read-out tubes and more particularly to a selective circuit for sectional readout tubes of the cold cathode glow type.

A sectional read-out tube is constructed of a plurality of coplanar cathodes which are suitably disposed with respect to a mutual anode and contained in a transparent glass envelope filled with an ionizable gas at glow discharge pressure. When selected groups of cathodes are energized to glow, different intelligible symbols are illuminated because of the cathode section arrangement. A sectional read-out tube will provide a large number of useful symbols with a minimum number of cathodes.

It is an object of this invention to provide a circuit wherein a plurality of symbols, all the decimal digits for example, can each be selectively formed in a read-out tube employing a plurality of coplanar cathodes totalling less than the number of different numerals formed through selective illumination of various groups of cathode elements.

In short, the foregoing object and other object ancillary thereto are accomplished by employing a single pole, multiple terminal selective switch acting through a blocking and isolating diode network which utilizes a minimum of diodes to control the potentials across the cathodes and anode of a sectional read-out tube.

This invention possesses other objects and features, some of which together with the foregoing, will be set forth in the following description of a preferred embodiment of the invention, and the invention can be more fully understood by reference to the accompanying drawings, in which:

Figure 1 is a top view of a sectional read-out tube illustrating a preferred cathode arrangement.

Figure 2 is a somewhat diagrammatic perspective view in the direction indicated by the small arrow 2 in Figure 1, the envelope being partially cut away to show a preferred construction of the complete read-out tube.

Figure 3 is a composite view which shows the appearance of all the different numerals of the decimal system as presented by the cathode pattern of Figure 1 when selected cathode groups are energized.

Figure 4 consists of a table compiling the particular cathode conditions forming each corresponding numeral.

Figure 5 is a circuit diagram showing a preferred diode network and selective switch which will control a sectional read-out tube having the cathode pattern of Figure 1.

Referring to Figures 1 and 2, a sectional read-out tube envelope 1 filled with an ionizable gas as neon at glow discharge pressure, contains seven cathode bars 2 arranged in a pattern which form an equally divided rectangle lying in a flat plane parallel with a transparent end window 3 of the glass envelope. A ring anode 4 lies in a parallel plane located somewhat below the cathode plane. This is more clearly shown in the perspective view of Figure 2.

A hermetic stem seal 5 is made at one end of the sectional read-out tube 1 in order to grip insulated in-

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ternal leads 6 which are sufficiently rigid to mount cathodes 2a, 2b, 2c, 2d, 2e, 2f, 2g and anode 4. These leads pass through the seal as external leads 7.

The cathode pattern of Figure 1 employing the seven separate glow cathodes 2a, 2b, 2c, 2d, 2e, 2f and 2g can form all of the digits of the decimal system as well as several letters of the alphabet. The numerals are produced by selective energization of particular groups of cathodes and take the appearance of the digits gathered together in Figure 3. For example, if the numeral 2 is desired, cathodes 2b, 2c, 2d, 2e, and 2f (of Figure 1) are energized to glow and cathodes 2a and 2g are maintained dark. Similarly, the numeral 3 is obtained by glowing all the cathodes except 2a and 2b. Figure 4 is a tabulation of all the cathode states for each numeral glowed. An X represents an "on" condition or glowing cathode, and O indicates an "off" condition for each cathode. It is noted there is a total of 49 "on" positions but only 21 "off" positions. Thus it is clearly easier to control the tube "off" conditions than it is to control the tube "on" conditions.

The schematic of Figure 5 is a preferred circuit wherein all the digits of the decimal system can be indicated with the sectional read-out tube of Figures 1 and 2 by changing the tap of a multi-position switch. An economy of diodes is obtained by using the switch to turn cathodes off because of the smaller total number of "off" positions. The sectional read-out tube 1 is shown in extended form for circuit clarity. The D. C. voltage of the battery E is applied across the sectional read-out tube 1 and the series current limiting resistors R. A capacity C is placed across the anode 4 and each cathode to form an RC oscillatory circuit at 16 cycles per second or greater to assure a uniform cathode glow. Also attached to the anode 4 is a diode m in series with a ten terminal switch S which connects with different diodes N to different cathodes 2. In this way, various sets of two series diodes, consisting of the diode m and some other diode N, are connected across the anode 4 and cathodes 2 via the switch S. Diode m is used for its constant voltage drop characteristics to conveniently maintain switch S at a desired potential. If desired diode m can be replaced with a fixed potential source.

These diode sets prevent respective cathodes from glowing by operating at voltages below the striking voltage between cathode and anode of the sectional read-out tube. For example, if the switch S is positioned to terminal 8 all the cathodes 2 are illuminated forming a figure 8 as no diodes N are in the switch-cathode circuit. Moving the switch S to the next terminal 9 will place diodes m and one diode N₉ in series across the anode 4 and cathode 2b. Consequently, these two latter diodes will conduct and prevent the voltage from rising to the striking potential which would illuminate the cathode 2b. Thus the figure 9 is produced by extinguishing the cathode 2b. Other cathodes are extinguished the same way to form the other numerals.

Switch S, which is shown as a simple, manual switching device is merely illustrative of a digit selection means. It can be easily replaced by electro-mechanical or wholly electrical means well known in the art such as electronic gates controlled by an electronic counter or adder. Other variations and uses will be apparent to those skilled in the art.

The sectional read-out tube circuit presented herewith will provide a large selection of cathode groups, the number greater than the total number of cathodes. In particular, the cathode configuration of Figure 1 can easily provide a selection of ten digits by the above described and preferred circuit wherein a minimum of diodes is employed.

From the above description it will be apparent that

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there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principles involved or sacrificing any of its advantages.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise a preferred form of putting the invention into effect, and the invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed is:

1. In combination: a sectional read-out tube having an anode and a plurality of cathodes; a like plurality of oscillatory circuits; each of said oscillatory circuits being connected between one of said cathodes and said anode, each of said oscillatory circuits being adapted to be energized in such a manner as to develop a transient potential greater than striking potential for said sectional read-out tube; a like plurality of unilateral conducting devices; a switching means for selectively connecting predetermined of said plurality of unilateral conducting devices individually between certain of said cathodes and said anode of said sectional read-out tube, in such a manner as to maintain said certain of said cathodes at a potential with respect to said anode which is below striking potential for said sectional read-out tube.

2. A device according to claim 1 wherein said oscillatory circuits comprise a serially connected resistance-capacitance circuit.

3. In combination: a sectional read-out tube having an anode and a plurality of cathodes, said cathodes being so positioned as to be capable of selectively manifesting various symbols; a plurality of oscillatory circuits adapted to be energized in such a manner as to form a plurality of transient potentials of greater magnitude than a potential energizing each of said oscillatory circuits; means for applying each of said transient potentials to said sectional read-out tube between one of said cathodes and said anode; a plurality of unilateral conducting devices; switching means for selectively connecting predetermined of said unilateral conducting devices between said anode and certain of said cathodes in such a manner as to maintain voltages between said anode and said certain of said cathodes below striking potential.

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4. Means for energizing a sectional read-out tube having an anode and a plurality of cathodes, wherein said cathodes are so disposed as to selectively manifest various symbols comprising: a plurality of oscillatory circuits adapted to be energized by a source of energy such as to develop transient voltages of higher magnitude than said source of energy; connecting means for connecting each of said transient voltages between each of said cathodes and said anode in said sectional read-out tube; a plurality of unilateral conducting circuits; switching means for selectively coupling certain of said unilateral conducting circuits between said anode and certain of said cathodes in order to render said certain of said cathodes cut off by maintaining said certain of said cathodes below the striking voltage of said sectional read-out tube.

5. A device according to claim 4 wherein said switching means comprises a manually-operative multiple-contact switch.

6. In combination: an envelope having a light transmitting portion, an ionizable gas disposed in said envelope for producing a glow discharge; an anode disposed within said envelope; a plurality of cathodes disposed within said envelope in energizable relationship to said anode; a like plurality of oscillatory circuits; each of said oscillatory circuits being connected between one of said cathodes and said anode, each of said oscillatory circuits being adapted to be energized in such a manner as to develop a transient potential; a like plurality of unilateral conducting devices; a switching system for connecting predetermined of said plurality of unilateral conducting devices between certain of said cathodes and said anode in such a manner as to cause said certain of said cathodes to be at a potential with respect to said anode which is below striking potential for said sectional read-out tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,531,036	Skaupy	Mar. 24, 1925
1,938,538	Henninger	Dec. 5, 1933
2,073,062	Henninger	Mar. 9, 1937
2,142,106	Boswau	Jan. 3, 1939
2,150,902	Van Bain	Mar. 21, 1939
2,404,920	Overbeck	July 30, 1946
2,427,533	Overbeck	Sept. 16, 1947
2,443,407	Wales	June 15, 1948
2,446,249	Schroeder	Aug. 3, 1948
2,467,734	Essig	Apr. 19, 1949
2,505,006	Reeves	Apr. 25, 1950
2,568,767	Seaman	Sept. 25, 1951
2,618,697	Metcalfe	Nov. 18, 1952