

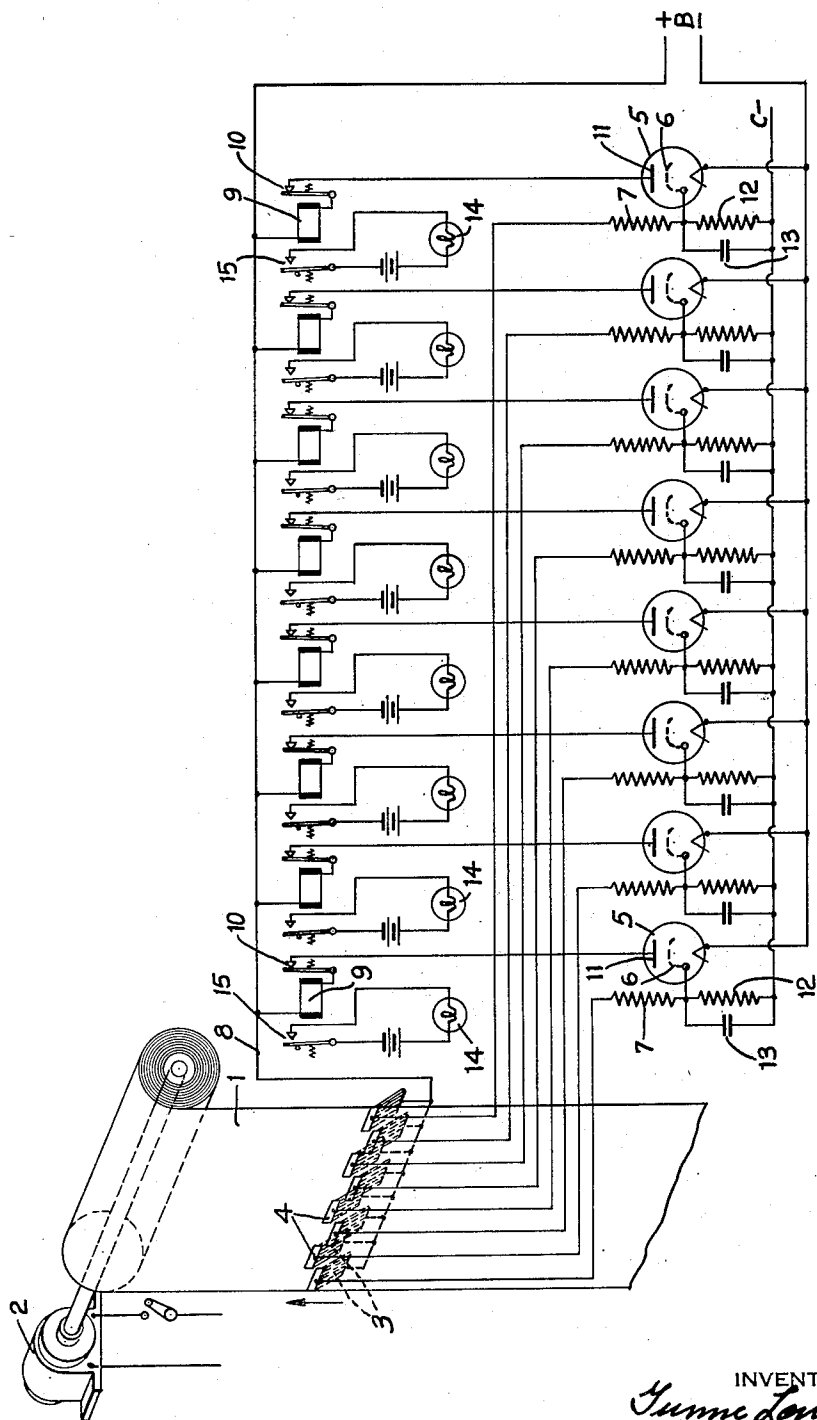
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SENSING DEVICE

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SENSING DEVICE

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4 Claims. (Cl. 175—183)

This invention relates to a sensing device and more particularly to sensing mechanisms adapted to detect electrical conducting spots in insulating materials.

6 An object of the present invention is to provide a more sensitive device to detect flaws such as carbon specks, slime spots or deposits, holes or like defects in paper compositions which must act as electrical insulators.

10 It is known that paper stock with perfect insulating characteristics is necessary to produce control cards for use in electrical statistical machines. Such machines, for example, those based on the Hollerith principle, are controlled by perforated cards, the perforations thereof representing certain data and facts which are to be tabulated by the machines. Electrical sensing circuits embodying sensing brushes control the tabulating circuits by means of the control cards, 15 which when not perforated maintain the sensing circuits open as the cards are fed past the sensing brushes and which, when perforated, permit the sensing brushes to complete a circuit for controlling the tabulator. However, if carbon specks or other conducting spots were present in the control cards, erroneous energization of the sensing circuits would occur and thus cause faulty operation of the machines.

For this reason, the paper stock from which 20 the cards are produced must be rigidly tested to detect such unwanted conducting spots, and remove such faulty sections from the paper webs. Speck detecting devices have been used for the purposes described and employed electromagnetic relays in the sensing circuits, and in turn control circuits which are adapted to cause a colored ink stripe to be produced along the surface of the defective section.

40 It is another object of the present invention to provide, in place of the usual electromagnetic relays, electrical discharge tubes of a type in which the discharge is started by a momentary application of a signal condition thereto, the discharge continuing independently of the applied signal condition until interrupted by other control means. The advantages of the present invention will be obvious, so that it will not be necessary to set them forth in detail.

50 A convenient form of discharge tube for this apparatus may comprise a gas filled thermionic tube of such construction that when the anode is connected to positive battery and a certain potential is applied to the grid, the tube will start and current will flow from the anode to the 55 cathode. As soon as the plate current begins to

flow, the grid is instantly surrounded by a sheath of positive ions and has no further effect in controlling the plate circuit. Changing the grid voltage merely changes the thickness of the sheath and has no effect on the potential of the rest of the space. Hence, removal of the grid potential will not stop the plate current once it is started. However, it can readily be stopped by removing the plate voltage. The function of the grid may therefore be likened to a trigger. The amount of power required to start the tube is exceedingly small.

A form of thermionic tube having the characteristics described is the type known commercially as "thyatron" and consists of an envelope containing a low pressure of vapor such as mercury, argon, etc. and a plurality of electrodes consisting of cathode, grid, and anode.

In the embodiment shown hereinafter, all the grids of the discharge tubes are maintained at a predetermined negative bias, and adapted so that when the grid bias is sufficiently reduced momentarily, the gas becomes ionized and the anode will draw current until its circuit is broken or the plate potential reduced to a minimum value. The tubes in the present invention are triggered and made to start by means momentarily conditioning the grid circuit thereby reducing the grid bias sufficiently for the tube to operate.

30 By referring to the accompanying drawing, which shows diagrammatically a circuit diagram embodying a preferred form of the invention, and the following description of the device, a complete understanding of its operation will be had.

35 The paper stock 1 is fed by any suitable means such as motor 2 so that the stock is advanced through the sensing station comprising a plurality of staggered brushes 3 and conducting plates 4 so that the entire width of the roll is tested or sensed for foreign conducting substances, etc. 40 A plurality of electric discharge tubes 5, of the type described hereinabove, are provided, one tube for each sectional sensing station shown as a brush and associated conducting plate. The individual conducting plates 4 are connected to the individual grids 6 of separate tube devices 5, through resistors 7. The brushes 3 are connected in common to conductor 8 which is connected to the positive side of the "B" battery. 50 One of the terminals of the coils of magnets 9 are connected to the said common conductor 8, the other terminals of which are connected through individual normally closed contacts 10 to the plates 11 of the individual and correspond- 55

ing tubes 5. The individual grids 6 are connected to a common biasing battery designated as "C—" through individual resistors 12. The grid bias is of such order that no current can flow between the plates and filaments (which are connected to the supply in the usual manner) of the tubes. Individual condensers 13 are also provided and connected to shunt the said resistors 12.

The operation of the device is as follows: If a conducting speck or a hole in the paper stock 1 permits one of the brushes 3 to engage the associated plate 4, positive potential through conductor 8 is applied to the corresponding resistor 7 connected to the control grid 6 of the tube 5. Resistors 7 and 12 act as a potential divider bringing the grid potential to a positive value with respect to the filament thereby triggering the tube 5 and permitting current to flow in the associated plate circuit.

The described signal condition may exist for an extremely short interval of time; however, the characteristics of the type tube described are such that it is only necessary to bring the grid potential above the triggering point for a like short interval of time to permit the tube to be triggered. Even though the grid is then restored to its normal potential which in the example is a negative potential with respect to the filament, current will continue to flow between the plate and filament, the circuit is as follows: from positive battery to conductor 8, corresponding magnet 9, associated normally closed contact 10, to the particular plate 11 of the tube triggered to filament to the negative side of the battery, energizing the said magnet 9.

The magnet 9 may represent any type of controlling magnet, for example, such as the clutch magnet of a striping device disclosed in a co-pending application Serial No. 22,664, filed May 21, 1935, operating a one revolution clutch which mechanically operates an ink striping mechanism which marks the paper to indicate the defect. It will be sufficient to refer to the magnet 9 as an indicating control element; therefore, it is only necessary to indicate a lamp device 14 adapted to be energized upon energization of the magnet 9 through the controlled contacts 15.

The normally closed contacts 10 may be associated with and operated directly by magnet 9 and adapted to be slow operating contacts and operated at a predetermined timed interval after energization of the said magnet to open the plate circuit of the triggered tube 5, thereby restoring the tube to a normal inoperative position, that is, to a condition whereby the grid once again regains control of the tube, thus restoring the device to the normal position shown in the drawing. The contacts 10 may also represent cam operated contacts; for example, a cam positioned on the shaft of the one revolution clutch mentioned hereinabove may open and then restore the contacts to a closed position before the clutch is rendered inoperative.

It has been found that the charging surge due to the brushes and contact plates in the sensing station which form in effect condensers of small but definite capacity (the brushes act as one condenser plate, the card stock as the dielectric, and the contact plate as the other condenser plate) was sufficient to bring the grid potential to a point which would permit the corresponding tubes to be triggered. This condition is overcome by adding the condenser 13 in each grid circuit, and each condenser having a capacity

greater by far than the capacity between the brushes and contact plates; therefore, with the condensers as shown in the circuit, the charging surges at the sensing stations are not great enough to bring the grid to the triggering point of the tube.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. A device of the character described comprising, in combination, sensing means, means to present thereto an element substantially free from electrical conducting areas, a thermionic device having input and output circuits, said thermionic device being characterized by continued operation unaffected by grid potential after starting, said sensing means associated with said input circuit and in conjunction with said element adapted to build up a certain capacity, means controlled by the sensing means upon detection of a conducting area in said element to start the said thermionic device including means to detect a discrete conducting area immediately upon presentation to the sensing means to effect immediate operation of the thermionic device, and means associated with said input circuit to reduce the capacity effect of said sensing means and element.

2. A device of the character described comprising, in combination, a thermionic device having input and output circuits, sensing means included in said input circuit, means to present thereto an element substantially free from electrical conducting areas, said sensing means and element adapted to develop a certain capacity and capable of affecting the operation of said thermionic device, means controlled by the sensing means upon detection of a conducting area in said element to render the thermionic device operative including means to detect a discrete conducting area immediately upon presentation to the sensing means to effect immediate operation of the thermionic device, and means associated with said input circuit to render the capacity developed by said sensing means and element incapable of affecting the operation of said thermionic device.

3. A device of the character described comprising, in combination, a thermionic device having input and output circuits, means to maintain the grid of said device normally at a negative bias, sensing means associated with said input circuit, means to present thereto an element substantially free from electrical conducting areas, said sensing means and element adapted to develop a certain capacity and capable of affecting the grid bias of said device, means controlled by the sensing means upon detection of a conducting area in said element to reduce the grid bias so as to render the thermionic device operative including means to detect a discrete conducting area immediately upon presentation to the sensing means to effect immediate operation of the thermionic device, means controlled in the output circuit upon operation of the said device, and means associated with said input circuit to render the ca-

capacity developed by said sensing means and element incapable of affecting the operation of said thermionic device thereby preventing faulty operation of the output circuit and said means included therein.

5 4. A device of the character described comprising, in combination, a plurality of individual sensing stations, means to present thereto an element substantially free of electrical conducting areas, said stations being disposed across the
10 entire width of the element and including individual sensing means to analyze the portion of the element as presented thereto, a thermionic device for each of said stations and having
15 input and output circuits, the sensing means of each station being included in the input cir-

cuit of the corresponding thermionic device, means controlled by each sensing means to render the related thermionic device operative upon detection of a conducting area in said element, indicating means controlled by the operation of
5 the thermionic devices to indicate the sensing station which detected the conducting area, each of said sensing means being adapted in conjunction with the element to develop a certain capacity capable of affecting the operation of the
10 corresponding thermionic device, and means associated with each input circuit to render the capacity developed by said sensing means and element incapable of affecting the operation of
15 said thermionic device.

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