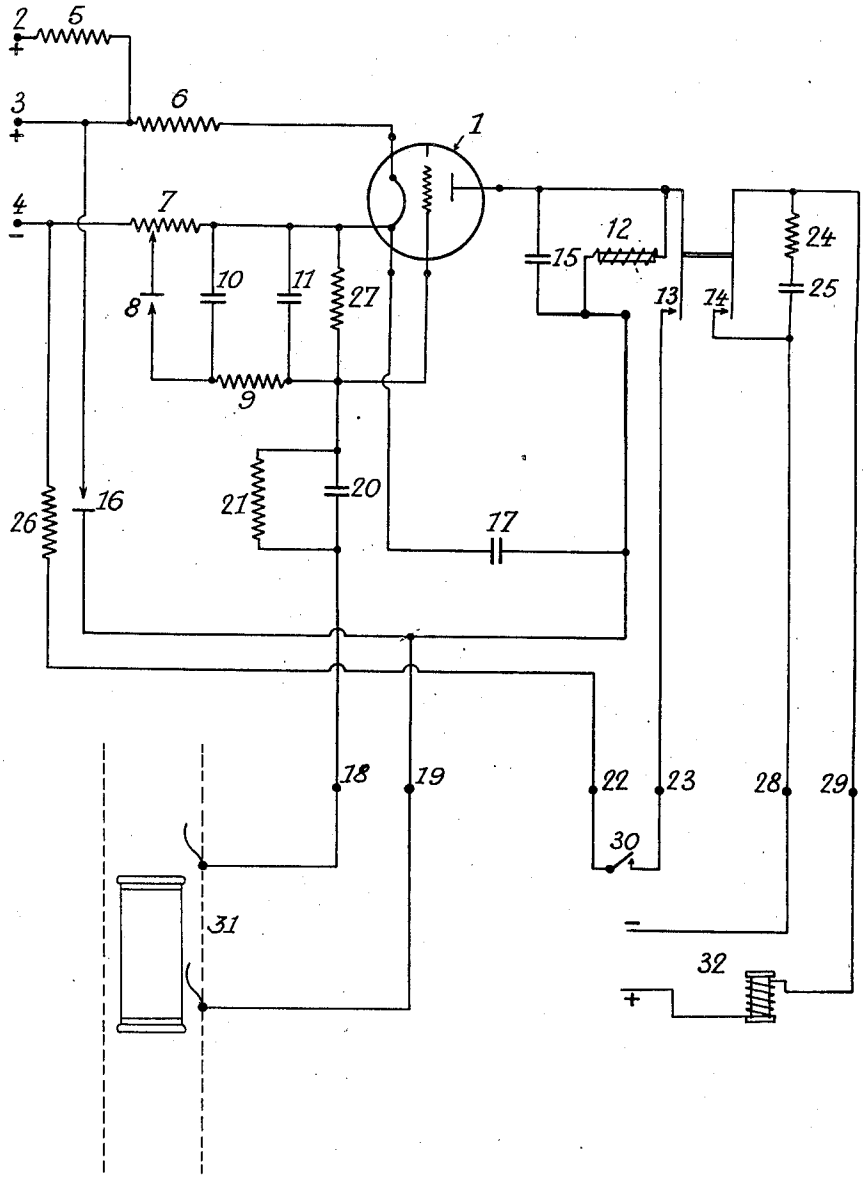
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ELECTRICAL SWITCHING DEVICE

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ELECTRICAL SWITCHING DEVICE

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1 Claim. (Cl. 243—29)

This invention relates to improved apparatus which is particularly adapted to effect electrical switching operations in conveying systems especially pneumatic tube conveying systems.

The switching operations may be arranged to effect movement of routing devices, for example the control of a shutter for guiding the carrier in a pneumatic tube system to a discharge point or to effect signalling operations.

It is necessary for efficient operation in pneumatic tube conveying systems that the switching device be not sensitive to variations in speed of the carrier when the latter is arranged to control the circuit of switching apparatus while the apparatus must respond promptly to the action of the carrier.

These necessary qualities are provided in the apparatus according to the invention, which apparatus comprises a grid controlled thermionic tube, a switching device responsive to changes in the plate current of the tube, and a biasing circuit for applying a potential to the control grid which comprises a condenser connected across the cathode and grid of the tube, and a further condenser adapted to be connected across the grid and plate of the tube by a moving carrier, a resistance across the grid and cathode, and another resistance in parallel with the last mentioned condenser, said resistances being so relatively proportioned as to reduce change in the plate current to a value below that initially caused when the biasing circuit is closed by the carrier.

In order to control the biasing circuit, spaced insulated contacts may be arranged upon a pneumatic tube or other stationary conveyer member and by means of contacting elements on the carrier these contacts are adapted to be short circuited to close the biasing circuit.

In carrying out the invention the operating coil of a relay may be arranged in series in the plate circuit of the tube and the biasing circuit arranged to apply a positive potential to the control grid whereupon the relay is operated. Upon operation the relay may be arranged to close the circuits of heavy current electromagnets which move shutters or other mechanical devices to effect the required routing or signalling operations.

Means may be provided which allow the relay or a number of relays to be maintained energised until their circuit is broken or for a predetermined period.

One of the features of the invention is the very small amount of electric power through the contacts, a feature which makes the system operative even when the conducting elements of the carrier have a very great electric resistance, either designedly so or caused accidentally.

In the accompanying drawing which illustrates diagrammatically the invention, 1 is a thermionic tube having three or more electrodes. The tube 1 may be directly or indirectly heated and be supplied with direct or alternating current from a supply system through the voltage dropping resistance 6 or two such resistances 5 and 6 connected in series. The resistance 6 is used in the case of a supply system supplying 115 volts, the supply being in this case connected with the terminals 3 and 4. In the case of a system supplying 230 volts, the two series connected resistances 5 and 6 are used and the supply system is connected with the terminals 2 and 4. By suitably changing the value of the resistances 5 and 6 other voltages can be employed to supply the apparatus.

The grid of the tube is negatively biased with respect to the cathode by using the voltage drop in the resistance 7 either in the cathode leads or, where the tube is directly heated, in the heater leads. A rectifier 8 allows the tube to be operated with either a direct or an alternating current supply source. The resistance 9 and condensers 10 and 11 serve as a smoothing circuit which assures a steady biasing voltage when the device is connected to an alternating current system. In the plate circuit of the tube 1 an operating coil 12 of a relay is arranged having two contacts 13 and 14, the coil being shunted by a condenser 15. The plate circuit is fed by the same current source as the heating circuit. In the case of an A. C. supply source the current required for operating the relay 12 is converted into direct current by a rectifier 16 and smoothed by the condenser 17.

The grid of the tube 1 is biased by means of the resistance 7 to such a voltage that normally the relay 12 is not operated.

When a carrier passes the contacts 31 which are suitably arranged in the path of the carrier, it short circuits the terminals 18 and 19 and the grid of tube 1 becomes positively biased for a very short period the duration of which is determined by the capacity of the condenser 20 and is independent of the time during which the carrier is operative on the biasing circuit. The value of the positive bias thus applied to the grid is proportional to the ratio of the capacities of condensers 20 and 11 and is arranged to be such that the resulting plate current is sufficient to cause

the relay 12 to operate and consequently close the contacts 13 and 14.

By the closing of contact 13 the relay 12 is held closed until the carrier leaves the switching apparatus as the terminals 22 and 23 are short-circuited by a contact 30 which is located at the exit of the apparatus and is arranged to be temporarily opened by the carrier as it leaves the apparatus. The contact 14 is arranged in a circuit separate from that described above and controls the circuit of an electromagnet 32 which controls the operation of a switching device (not shown). A condenser 25 in series with a resistance 24 is arranged to prevent surges in the circuit of the electromagnet when the contact 14 is opened.

Should the carrier stop in the position in which it short-circuits the terminals 18 and 19, the plate current of the tube cannot attain a dangerously high value because after the condenser 20 has been charged the bias voltage falls to a negative value which is determined by the proportions of the resistances 9, 27 and 21 and these resistances are determined with consideration of the biasing voltage obtained by means of the resistance 7 and are such that the plate current is limited to a relatively low value soon after the contacts 31 are closed.

By adjusting the initial bias voltage by means of the resistance 7 and so regulating the plate current of the tube the operation of the relay 12 can be controlled. By suitably choosing the constants of the operating coil of the relay 12 and the capacity of the condenser 15, the relay, within limits, can operate sufficiently slowly for the contact normally connected to the terminals 22 and 23 to be omitted in some cases.

What I claim is:

In a carrier conveyor system, a switching device for the carrier comprising terminals adapted to be connected with feeding mains, a three-electrode vacuum tube, a relay actuated by the anode current of said tube, means for maintaining said relay in operative position when said anode current is interrupted, switching means for controlling the path of the carrier responsive to the action of said relay, means responsive to the passage of the carrier at a point after said switching means for restoring the relay to an inoperative position, means responsive to the passage of the carrier at a point before the switching means for modifying the bias of the control electrode of said vacuum tube, said last mentioned means consisting in a network comprising condensers and resistances connecting said control electrode with the negative terminal, a condenser shunted by a resistance and connected to said control electrode, and a contact system responsive to the passage of the carrier at said last mentioned point adapted for connecting said shunted condenser with the positive terminal during said passage, and the network and shunt resistance being so constructed and arranged that the resistance through which said condenser is discharged is much greater than that through which it is charged.

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