Oct. 13, 1953 G. C. HARTLEY ET AL 2,655,605

ALTERNATING CURRENT SWITCHING DEVICE

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FIG. 1.

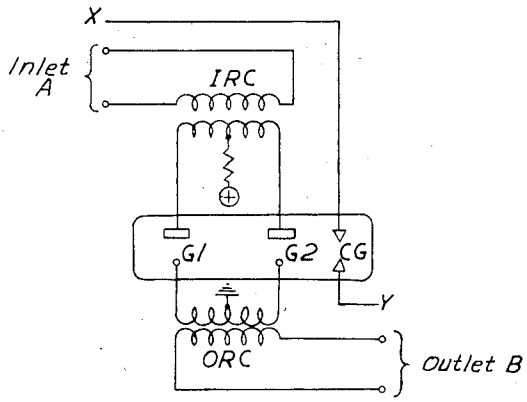

FIG. 2.

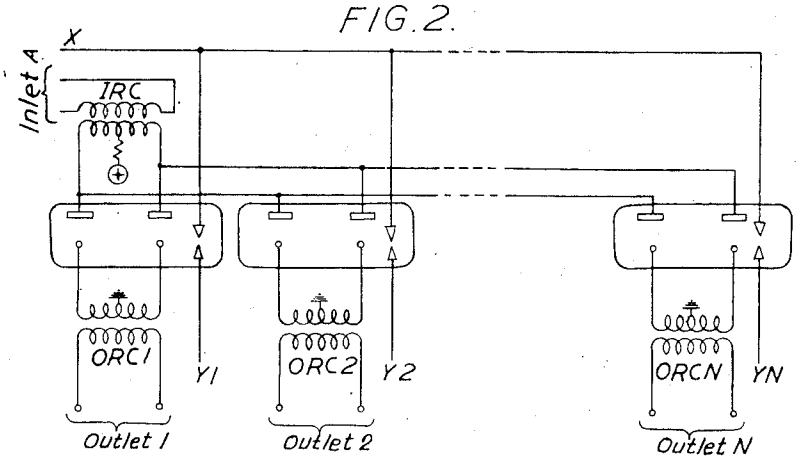

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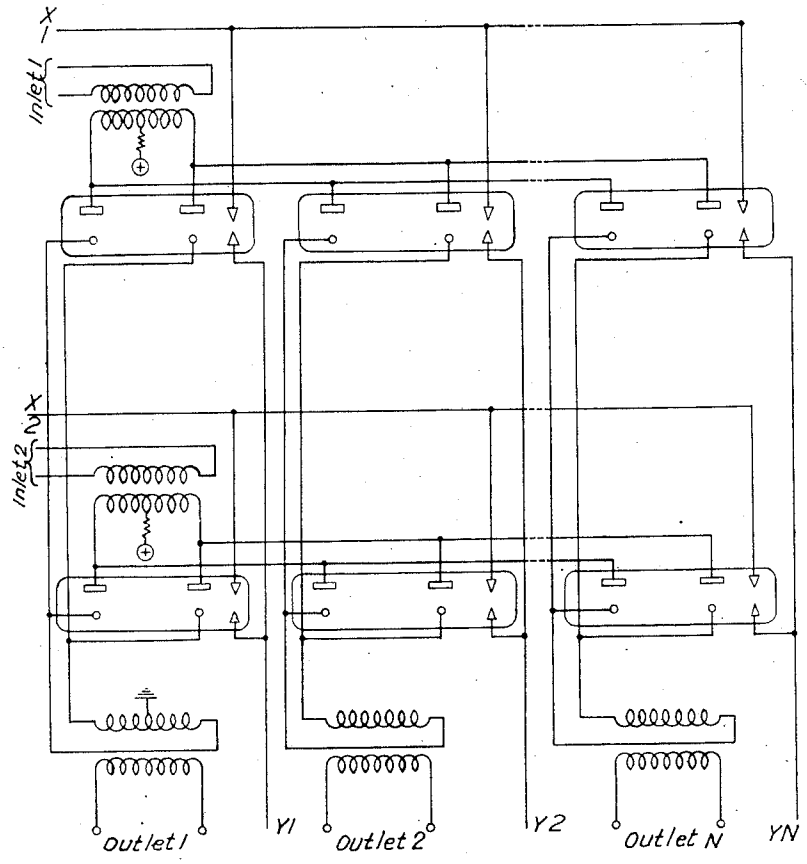
FIG. 3.



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UNITED STATES PATENT OFFICE

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ALTERNATING CURRENT SWITCHING DEVICE

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6 Claims. (Cl. 307—38)

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This invention comprises means for establishing alternating current transmission connections between an "inlet" and to an "outlet," or any one of a plurality of "outlets" by electronic means.

According to the invention an alternating-current switching device comprises, in combination, a gas discharge tube having a priming gap and two or more mutually independent gaps and in which discharge across said priming gap is sufficient to cause discharge across said other gaps, two-wire transmission circuits connected respectively to the anodes and to the cathodes of a pair of said mutually-independent gaps and provided with D. C. connections for maintaining the discharge via said mutually independent gaps when the priming gap discharge is removed, so that said mutually independent gaps will pass alternating current between said transmission circuits.

Also according to the invention, an alternating current switching device comprises, in combination, a cold cathode gas discharge tube which has three or more pairs of anode-cathode gaps, one of which is a priming gap and the others are working gaps, and in which discharge across said priming gap is sufficient to cause discharge across said working gaps, two pairs of A. C. terminals, two transmission bridges which are each connected between a corresponding pair of A. C. terminals, and respectively the anodes and the cathodes of a pair of working gaps of said tube, and D. C. discharge maintenance current terminals connected to said transmission bridges whereby D. C. discharge maintaining potential is connected across said gaps in parallel, while A. C. currents are passed via said gaps in series.

The invention will be described with reference to certain embodiments shown in the accompanying drawings in which:

Fig. 1 illustrates the basic principle and shows a single switching device for connecting an input or inlet "A" to an output or outlet "B;"

Fig. 2 shows an extension of the principle whereby means are provided for connecting an inlet to any of the "*n*" outlets, each of which is similar to outlet B, Fig. 1 and to all of which the inlet is connected in multiple;

Fig. 3 shows a further extension in which any one of a number of inlets (only two are shown) can obtain connection to any one of a number of outlets 1 to N.

The switching device, Fig. 1, consists of a gas-filled tube comprising a control gap CG and two mutually-independent working gaps G1 and G2. A two-wire inlet A is connected via a repeating

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coil IRC to the anodes of G1, G2; while the corresponding cathodes are connected via a repeating coil ORC to outlet B. The repeating coils may be replaced by any other usual form of voice frequency transmission bridge, e. g. the Stone bridge. When potentials are applied to X and Y the priming gap discharges, ionisation occurs, and the tube sustains across the working gaps G1 and G2 when the potentials on X and Y are removed by virtue of +*ve* D. C. potentials connected in parallel from the centre point of coil IRC to the anodes of gaps G1 and G2 and earth connected in parallel from the centre point of coil ORC to the cathodes of G1 and G2. If now a source of V. F. current is applied to the inlet A then V. F. current will be passed through the gaps G1 and G2 to the outlet or output B. Alternatively, if the V. F. source is applied to the output B, current will be passed through the ionised gaps to the input A. Fig. 1 thus illustrates means for the connection of conversation between two two-wire voice channels in an auto telephone exchange system.

In Fig. 2, a single repeating coil IRC is connected to the inlet A and in multiple to the anode of the working gaps of a group of N gas tubes. The anodes of the priming gaps are connected in multiple to a single inlet wire X. The cathodes of the working gaps of each tube are connected respectively to corresponding individual repeating coils ORC1 . . . ORCN, while the priming gap cathodes are connected to individual outlet wires Y1 . . . YN. To select, say an outlet 2, a potential is applied to wires X and Y2 causing ionisation to occur in the second tube. On removal of these potentials the tube sustains and a V. F. transmission path is established between the inlet A and outlet 2.

In Fig. 3, several arrays of tubes, each array similar to that of Fig. 2, have different inlets 1, 2 . . . each inlet being multipled to the anode pairs of all tubes of one array. The outlets 1, 2 . . . N are multipled each to the cathode pairs of the corresponding tubes (e. g. 11, 21) of all the arrays.

The priming anodes of each horizontal array of tubes are multipled to a common priming inlet; X1, X2.

The priming cathodes of each vertical array of tubes are multipled to a common priming outlet Y1, Y2 . . . YN.

By operating the corresponding control gap, connection can be established between any inlet and any outlet, e. g. by applying the correct potentials to control wires X1 and Y2 connection

can be established from inlet 1 to outlet 2 via the second tube in the top horizontal array.

Each switching element is shown as having a control gap for initiating ionisation and two independent gaps for passing V. F. intelligence. There is no limitation to the number of these independent gaps so that in addition to two gaps used for passing V. F. other gaps may be used for miscellaneous control purposes. Four-wire switching could also be provided in which case two pairs of speech gaps would be provided in each tube plus any additional gaps required for control purposes. A number of such switching elements, each comprising a priming gap and a plurality of working gaps, may also be housed in the same envelope, ionisation being limited to one element without effecting others.

While the principles of the invention have been described above in connection with specific embodiments and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What we claim is:

1. An alternating current switching device comprising, in combination, a gas discharge tube having a priming gap and two or more mutually independent gaps and in which discharge across said priming gap is sufficient to cause discharge across said other gaps, two-wire transmission circuits connected respectively to anodes and to the cathodes of a pair of said mutually independent gaps and provided with D. C. connections for maintaining the discharge via said mutually independent gaps when the priming gap discharge is removed, so that said mutually independent gaps will pass alternating current between said transmission circuits.

2. An alternating current switching device as claimed in claim 1 and in which said transmission circuits each includes a transmission bridge via which said D. C. discharge-maintaining connections are made via said pair of gaps in parallel.

3. An alternating current switching device comprising, in combination, a cold cathode gap discharge tube which has three or more pairs of anode-cathode gaps, one of which is a priming gap and the others are working gaps, and in which discharge across said priming gap is sufficient to cause discharge across said working gaps, two pairs of A. C. terminals, two transmission bridges which are each connected between a corresponding pair of A. C. terminals, and respectively the anodes and the cathodes of a pair of working gaps of said tube, and D. C. discharge maintenance current terminals connected to said transmission bridges whereby D. C. discharge maintaining potential is connected across said gaps in parallel while A. C. currents are passed via said gaps in series.

4. A switching device as claimed in claim 3 and comprising a plurality of said gas discharge tubes, and pairs of working gaps of all said tubes connected at one side in multiple to a single transmission bridge and at the other side to individual transmission bridges, a single multipled connection to said one side of the priming gaps of all said tubes, and individual connections to said other sides of said priming gaps.

5. A switching device as claimed in claim 4 and comprising a plurality of groups of gas discharge tubes, each group comprising the same number of tubes, a first set of transmission bridges equal in number to the number of tubes in each group, and each connected in multiple to the anode (or cathode) pairs of a set of tubes comprising a single tube per group having the same positions in the groups, e. g. all the first tubes of the groups, a single multipled priming connection to the anodes (or cathodes) of the priming gaps of each of the said sets of tubes, a second set of transmission bridges equal in number to the number of groups and each connected in multiple to the cathode (or anode) pairs of all the tubes of the one group, and a single multipled priming connection to the cathodes (or anodes) of the priming gaps of each of said groups of tubes.

6. A switching device as claimed in claim 3, and comprising two pairs of working gaps per tube and corresponding provision of transmission bridges and connections whereby four-wire transmission is provided.

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No references cited.