United States Patent

[11] **3,553,411**

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[21] Appl. No. **678,658**
[22] Filed **Oct. 27, 1967**
[45] Patented **Jan. 5, 1971**

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[54] **AUTOMATIC SWITCHING DEVICE**
4 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **200/176,** 200/179
[51] **Int. Cl.** **H01h 67/14**
[50] **Field of Search** ..... 200/175-—180, 1(cursory), 1A; 335/110, 111, 112, 113; 340/365, 166(cursory); 178/17C, 17A; 179/16(Inquired)

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ABSTRACT: An automatic switching device has cooperating groups of selector and switch elements, each element being capable of being placed in either of two positions. The selector elements are individually positioned by means of input information signals to establish a selection condition. The switch elements are provided with stops, so arranged relative the selector elements that, when a particular selection condition has been established, only one switch element can be moved to its other position; equal forces are, therefore, applied to all the switch elements, after a selection condition has been established, to cause the device to switch a corresponding one of output circuits associated with the switch elements, to provide output signals corresponding to the selection condition. The input and output signals can be any combination of known kinds of signals, such as electric, pneumatic or hydraulic.

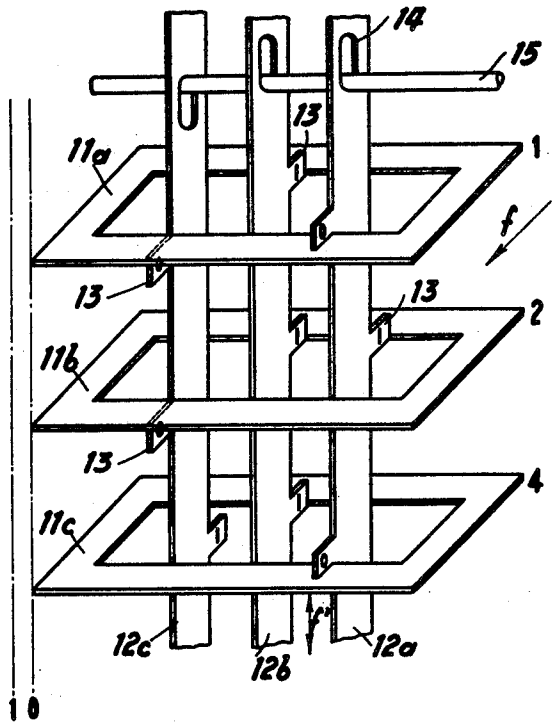

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Fig. 1

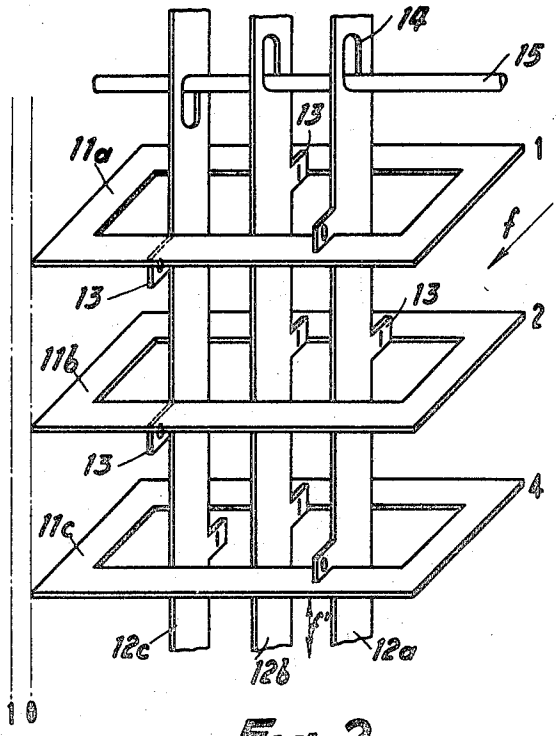

Fig. 2

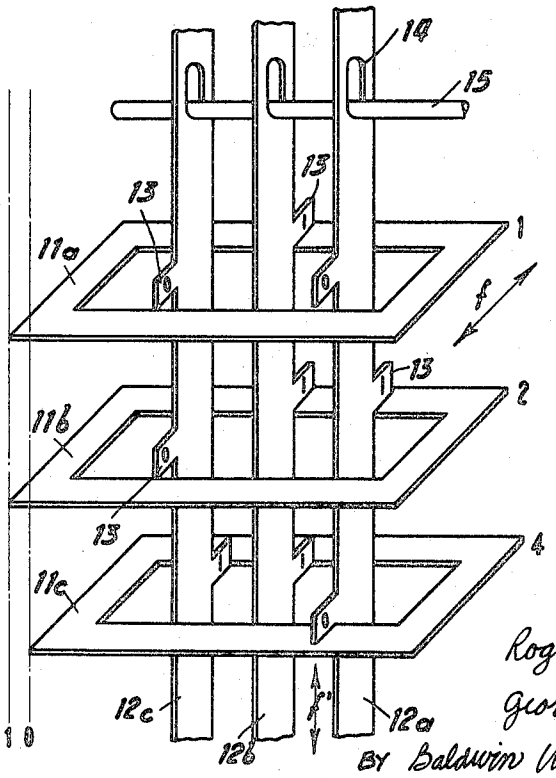

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Fig. 3

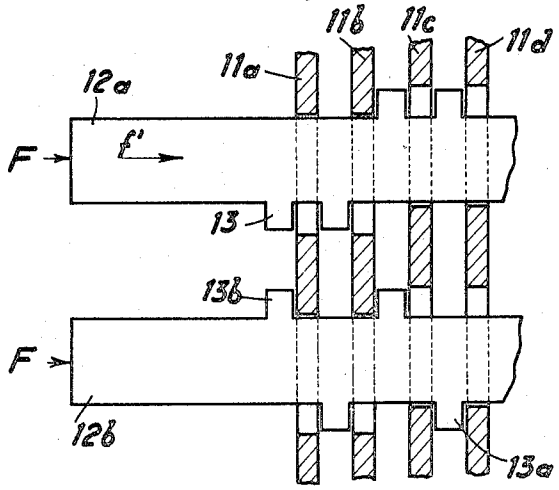

Fig. 4

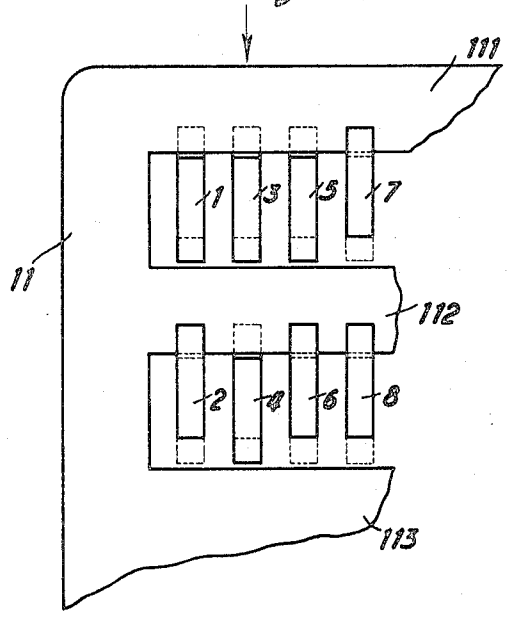

Fig. 5

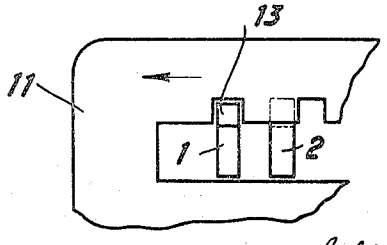

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Fig. 6

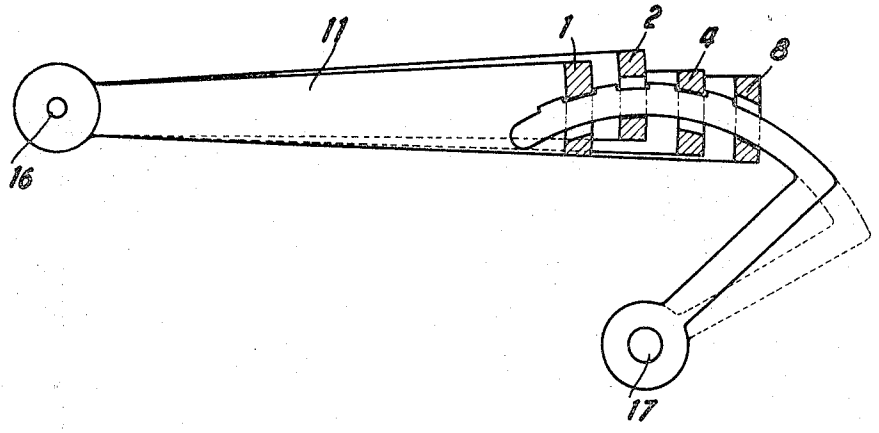
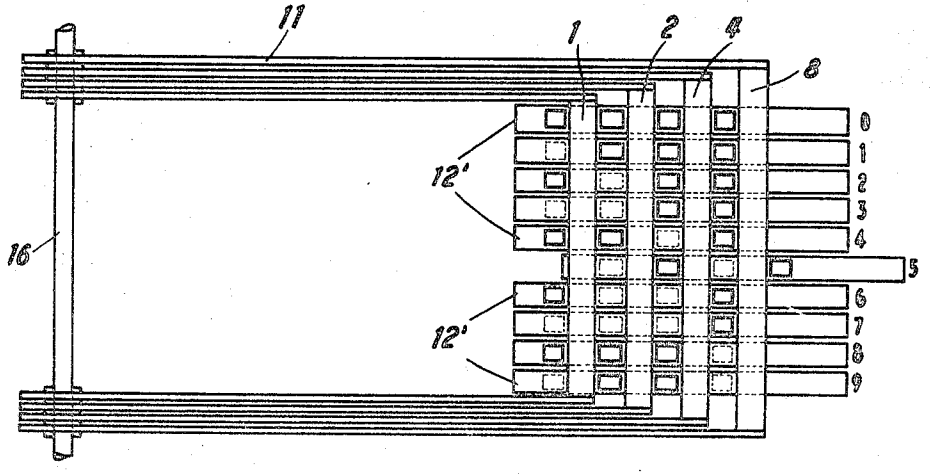


Fig. 7



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AUTOMATIC SWITCHING DEVICE

The present invention relates to an automatic switching device for remote control.

It refers more particularly to an automatic switching device intended to receive signals in an "all-or-nothing" code comprising any number of units.

In known devices, information selection is effected through a plurality of selector device stages and the train of signals intended for the automatic switch requires spatial transformation for each switching stage. In addition, the formation of a connection representing a first information prevents the reception of a second information as long as this connection is maintained, so that it is usually necessary to transfer to a relay the duty of maintaining the connection in order to free the automatic switch.

One aim of the invention is to permit the making of connections without having to use holding relays or other auxiliary means.

Another aim of the invention is to permit the construction of automatic switches of reduced dimensions, in which the reception of a series of signals representing the information directly effects the desired switching, which is maintained as long as the device does not receive a new cancelling information, the automatic switching device being available as soon as the switching operation has been effected.

The present invention provides in an automatic switching device comprising a group of selector elements for receiving information signals and assuming a position characteristic of the value attached to the information signals to define a corresponding selection position, and a group of switch elements for controlling circuits associated therewith according to the said selection position, all the elements being adapted for individual movement by operating means, the improvement wherein: the selector and switch elements comprise rigid members cooperatively mounted and capable of occupying either of two predetermined positions under the movement action of their operating means, the direction of movement of the switch elements being parallel one to another and transverse to that of the selector elements; the selector elements each have certain edges capable of preventing the passage, in a direction transverse to the edges, of stop means engaging the edges, corresponding edges of individual selector elements being parallel to one another and uniformly spaced apart; the switch elements have distributed along them in a direction transverse to the edges of the selector elements the said stop means for engaging corresponding edges of the selector elements, the number of stop means of each switch element being equal to the number of selector elements; and wherein the stop means are so distributed over each selector element, in a plane transverse to the direction of movement of the switch element, that, when the selector and switch elements are in either of the said predetermined positions, only one of the switch elements can be moved, the other being locked in position by the interaction of the stop means and the selector elements.

The selector elements may all be identical, the switch elements differing one from another in the distribution of the stop means thereon; or all the switch elements may be identical, the selector elements differing one from another in the distribution of the said edges.

Such an automatic switching device, capable of being controlled by the reception of N different items of information r presenting for the entire automatic switching device 2^N possible switching states, comprises N switching elements, all of which differ by virtue of the distribution of their stop means, which may be disposed in two parallel series on each of said elements.

Each switching element has as many stop means as there are selection elements, each of the uneven portions of a switching element being adapted to cooperate with a selection element only in one of the two positions of said selection element.

The automatic switching device is provided with control means effecting the positioning of the selection elements.

The number of selection elements is equal to the number of signals capable of representing an item of information.

The automatic switching device contains an operating means for applying an identical force to all the switching elements, the direction of which is defined by an input signal, and for displacing only one of them, this force being applied to said elements only after the selection has been effected.

Various forms of construction of the automatic switching device are described hereinbelow simply by way of example and without limitation, with reference to the accompanying drawings, in which:

FIG. 1 illustrates diagrammatically a form of construction of the device in which all the selector elements are in one of the two positions which are permitted to it;

FIG. 2 is a similar view, in which two of the selector elements have assumed the other position which was permissible to them;

FIG. 3 illustrates diagrammatically another form of construction of the automatic switching device, in elevational view;

FIG. 4 illustrates an alternative form of the same device, in plan view;

FIG. 5 illustrates another alternative, in plan view;

FIG. 6 illustrates another embodiment, in elevational view; and

FIG. 7 illustrates this alternative in plan view.

In the embodiment illustrated diagrammatically in FIG. 1, the automatic switching device forming the subject of the invention comprises a selection group composed of selector elements **11***a*, **11***b*, **11***c*.... and a switching group comprising switching elements **12***a*, **12***b*, **12***c*...

The selector elements are each constituted by a plate cut out so as to form a frame.

The switching elements **12** are constituted by blades having on their edges projecting portions **13** forming stop means and disposed differently so that each element has a profile which is specifically characteristic thereto.

The switch elements are disposed parallel and cross the selector elements, which are likewise parallel to one another and equidistant.

The width of the opening of the frame is slightly larger than the width of a blade **12** plus the distance to which a stop means **13** projects beyond the blade.

The stop means are distributed over each blade or switching element in such a manner that each corresponds to the plane of a selector element. A switch element must comprise as many stop means **13** as the automatic switching device has selector elements.

The selector elements **11***a*, **11***b*, **11***c*... and the switch elements **12***a*, **12***b*, **12***c*... are sufficient in number to comply with the conditions required in the automatic switching device in question.

The selector elements **11***a*, **11***b*, **11***c*.... can be displaced individually in accordance with the arrows f in order to assume two stable positions by an operating means (not illustrated) of any known type.

The switch elements **12***a*, **12***b*, **12***c*.... can likewise be displaced in accordance with the arrows f', so as to assume two stable positions, by another operating means which at a determined moment as specified hereinbelow applies a thrust in one direction or the other to all the switch elements.

It will be understood that depending on the position occupied by the frames formed by the selector elements **11** the switch elements **12** will be able to move only provided that no stop means **13** is engaging an edge of the opening of a frame. The distribution of the stop means **13** over all the elements must be such that freedom to move is given only to a single switch element in all the positions assumed by all of the selector elements.

The rule to be observed in the arrangement of the device is therefore as follows:

An automatic switching device capable of being controlled by the reception of N different items of information acting on

the selector elements **11** and representing for the device as a whole 2^N possible switching states must comprise N switching elements, all of which are different through the distribution of their stop means **13**, which are disposed in two parallel series on each of said elements, one uneven portion or stop means per selection element, so that the number thereof on said element is equal to the number of selection elements.

To sum up, each of the stop means **13** of a switch element **12** can cooperate with a selector element **11** only in one of the two positions of the latter.

The number of selection elements is consequently equal to the number of signals representing a complete item of information in accordance with the system adopted.

FIG. **1** illustrates only three selector elements and three switch elements, in order to make it possible to understand more easily the principle of the automatic switching device forming the subject of the invention.

In FIG. **1** the selector elements **11** are in their conventional on broken line position **0** determined by a retaining means (not illustrated) and they can be displaced only in the direction of the arrow *f* until another retaining means holds them in the on broken line position **1** FIG. **2**.

The switch elements have apertures **14** through which passes a horizontal bar **15** which limits their movement in both directions in accordance with the arrow *f'*.

In the respective positions occupied by all the elements illustrated in FIG. **1**, the switch element **12***a* cannot be lowered because two stop means **13** marked **0** bear against the selector elements **11***a* and **11***c*. Similarly, the switch element **12***c* cannot be raised to its top position because the stop means **13** marked **0** engage with the selector elements **11***a* and **11***b*.

Only the switch element **12***b* is free to descend, because the stop means marked **1** can pass inside the three selector elements **11***a*, **11***b*, **11***c* without engaging therewith.

In the binary system the number registered in the automatic switch for the switch element **12***b* is thus one one one. If the selector element **11***a* is in position one in the binary system, the selector element **11***b* in position two, and the selector element **11***c* in position four, the decimal number represented by one one one is seven.

FIG. **2** illustrates the same device, but after reception of signals which have had the effect of bringing the selector elements **11***a* and **11***b* into their on broken line position **1**.

It is then seen that all the stop means **13** marked **0** have been released from the selector elements **11***a* and **11***b*, but that the bottom stop means marked **0** on the switch element **12***a* is stopped by the selector element **11***c*. The switch element **12***b* is stopped by its stop means marked **1** engaging with the selector elements **11***a* and **11***b*.

Only the switch element **12***c* was free to move upwards under the thrust applied simultaneously to all the switch elements by a device (not illustrated) of any known type.

The number registered is then zero zero one in the binary system which is complementary to input information one one zero.

FIG. **3** is a partial diagrammatical illustration of two switch elements **12***a* and **12***b* cooperating with four selector elements **11***a*, **11***b*, **11***c*, **11***d*.

In the situation illustrated in that FIG., the selection is effected and the switch element **12***a* has been selected, all the selector elements being in a position determined by the signal received by each of them. As can be seen in the FIG., this element is free to move in the direction of the arrow *f'*, the two stop means **13** with which it is provided at its bottom part not encountering any obstacle, which is also true of its two bottom stop means. The same is not true of the switch element **12***b* which is stopped both by its upper stop means **13***b* bearing against the selector element **11***a* and by its stop means **13***a* which is arrested by the solid portion of the selector element **11***d*.

If we call zero the position of the selector elements **11***a* and **11***b* and **1** the position of the selector elements **11***c* and **11***d* as shown in FIG. **3**, the switch element **12***a*, which by its double series of stop means represents the information zero zero one one, is the only element capable of moving when the same information is communicated to the selector elements.

The switch element **12***b* representing the information one zero one zero is immobilized by its stop means **13***a* and **13***b*.

The selection elements being thus positioned, a force F is applied to each of the switch elements and the only element selected changes its position to operate the circuit or circuits which it controls.

The automatic switching device is thereafter available to receive other information.

The switch element **12***a* will be held in its new position as long as no new identical information, in this example zero zero one one as stated above, is imparted to the selection elements, and this selection will be followed by the application of a force F identically applied to all the switch elements, by this time in the opposite direction to that of the arrow F.

FIG. **4** illustrates a selection element in plan view instead of the edge view shown in FIG. **3**, that is to say the element **11** in the example selected; in this selection element there are provided two apertures, which are advantageously identical the first aperture being in the edge of one one one opposite one one two (see FIG. **4**) and the other on the edge of one one two opposite one one three and through which switch elements **1**, **3**, **5**, **7** in the case of the first aperture and **2**, **4**, **6**, **8** in the case of the second are disposed perpendicularly.

The advantage of an arrangement of this type resides in the fact that the switch elements may be distributed differently without in any way changing the operation, thus making it possible to modify the addresses at the will of the user; thus for example in telecommunication the exchange of two numbers would be made by simply exchanging the two respective switch elements.

It may sometimes be more advantageous to make all the switch elements identical, in which case the apertures and obstacles provided on the selection elements will be different, as is shown for example in FIG. **5**.

FIGS. **6** and **7** illustrate an automatic switch in which the selection elements **11'** and the switch elements **12'** are subjected to an angular rotation about axes **16** and **17** respectively instead of performing a movement of translation.

As can be seen from the above description, the selection elements are operated by input signals and the configuration of these elements always represents the last input information received. The switch elements are the output elements and can control output signals of any known kind (for example electric, hydraulic, etc. signals).

The displacement controls relate alternatively to the selection elements and to the switch elements.

The displacement of the switch elements is controlled by a force applied to said elements by, for example pneumatic, magnetic or hydraulic means. This force is applied for the displacements in the opposite direction to that used for activation and for the interruption of the circuits.

Modifications of form and of detail may be made to the devices described above simply by way of example without limitation, without thereby departing from the spirit of the invention.

We claim:

1. A switching device of the character described comprising:

a. a first plurality of rigid selector elements, each selector element being independently movable to either of two positions;

b. a second plurality of rigid switch elements, each switch element being independently movable between either of two positions;

c. said selector elements and switch elements being arranged for movements in intersecting paths; and

d. cooperating stop means comprising stops carried on each of one plurality of elements and equal in number to the other plurality of elements for engaging the other plurality of elements upon movement of the switch and selector

elements in an intersecting path to restrain movement of all switch elements, but one, in any position of the selector elements.

2. The switch defined in claim 1 wherein: the cooperating stop means comprise stops carried on each of one plurality of elements and movable into apertures in each of the other plurality of elements.

3. A switching device of the character described comprising:

a. a first plurality of rigid selector elements, each selector element being independently movable to either of two positions;

b. a second plurality of rigid switch elements, each switch element being independently movable between either of two positions;

c. said selector elements and switch elements being arranged for movements in intersecting paths;

d. cooperating stop means comprising stops carried on each of one plurality of elements and equal in number to the other plurality of elements;

e. said stop means being so positioned that upon movement of the switch and selector element in an intersecting path, as to restrain movement of all switch elements, but one, in any position of the selector elements;

f. said first plurality of selector elements being spaced parallel rectangular frame members; and

g. said second plurality of switch elements being spaced parallel blade members positioned within said frame members.

4. The switch defined in claim 3 wherein: the cooperating stop means comprise stops carried by the blade members and movable into stop position relative to the frame members.