United States Patent

Thompson

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[54] COAXIAL SWITCH

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[52] **U.S. Cl.** .....**200/153 S,** 200/67 A, 200/72, 333/97

[51] **Int. Cl.** **H01p 1/10**

[58] **Field of Search**.....260/153 S, 67 B, 69, 71, 72, 260/75, 50.3; 333/97 S, 7, 32; 336/105

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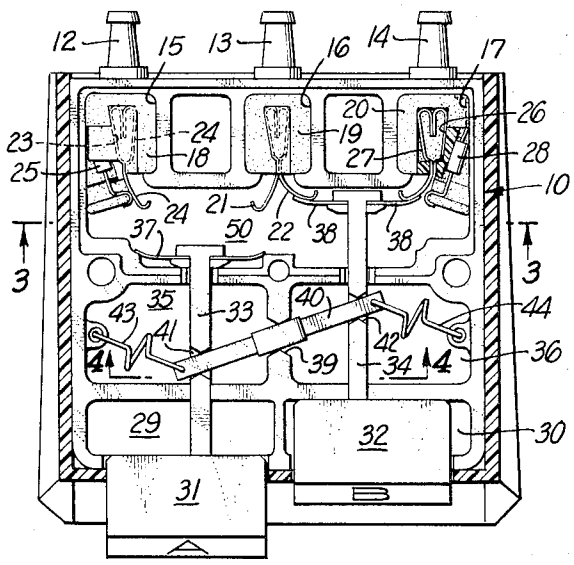
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[57] **ABSTRACT**

A switch adapted for as an A–B coaxial cable switch for CATV systems. The switch includes a pair of depressible pushbuttons, one for each cable. The buttons always move oppositely to each other. The crossbar extends diagonally within the switch and pivots at its center on a stationary slot in the switch housing. The ends of the crossbar pivot on slots in longitudinally reciprocable bars connected to the pushbuttons. A pair of coil springs are connected between the ends of the crossbar and the housing. Movable contact members carried by the bars make or break brushing contact with stationary spring contacts each time the pushbuttons are switched. When either button is depressed to move the crossbar past center or lateral position, the coil springs urge the crossbar toward the reverse position.

8 Claims, 6 Drawing Figures



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2 Sheets-Sheet 1

FIG. 1.

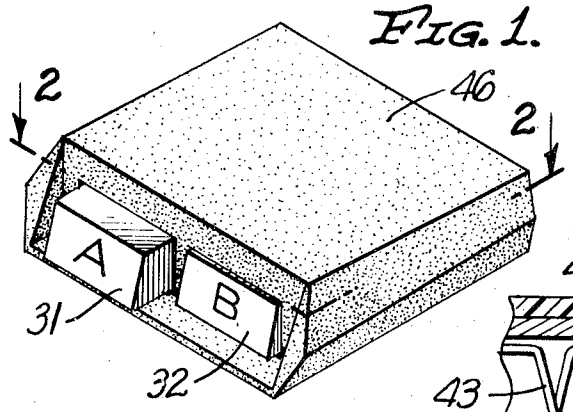


FIG. 4.

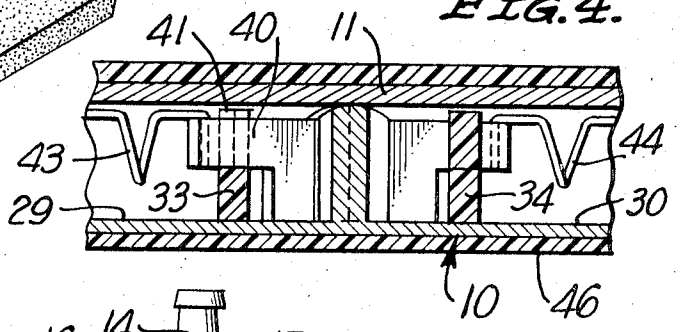


FIG. 2.

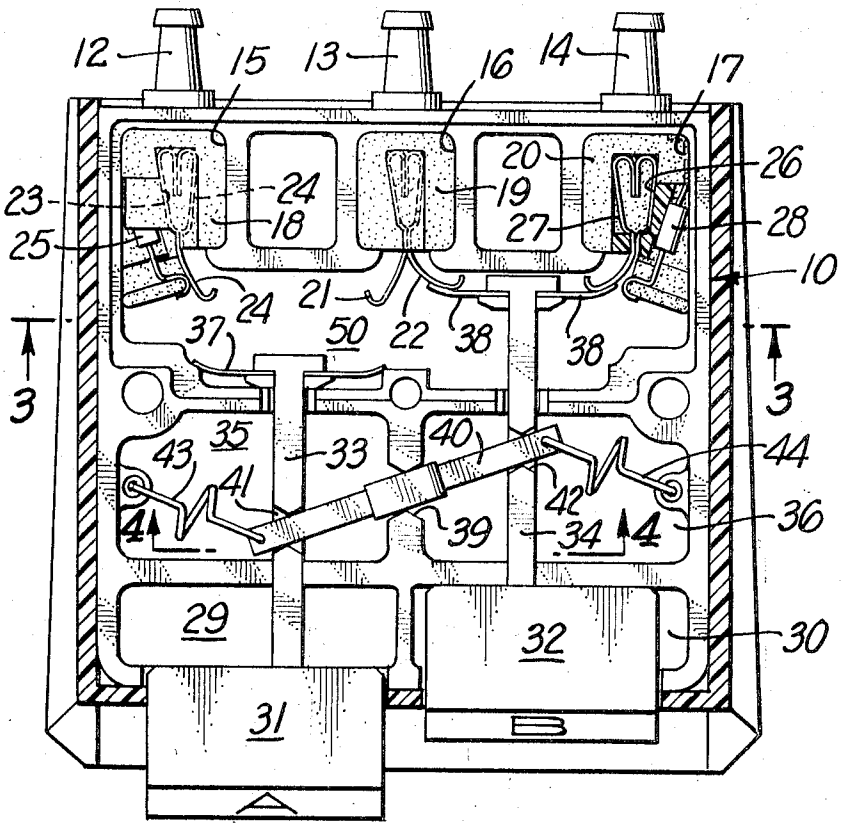
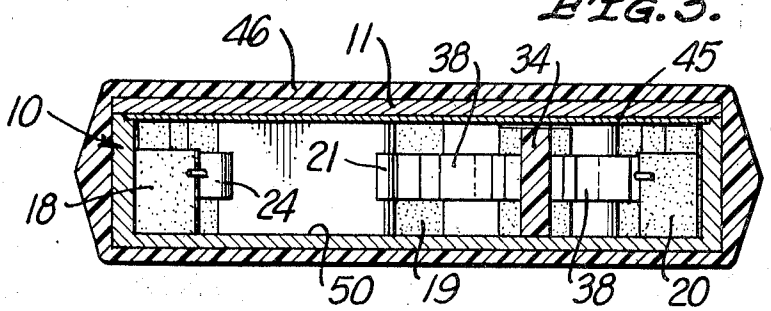


FIG. 3.



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FIG. 5.

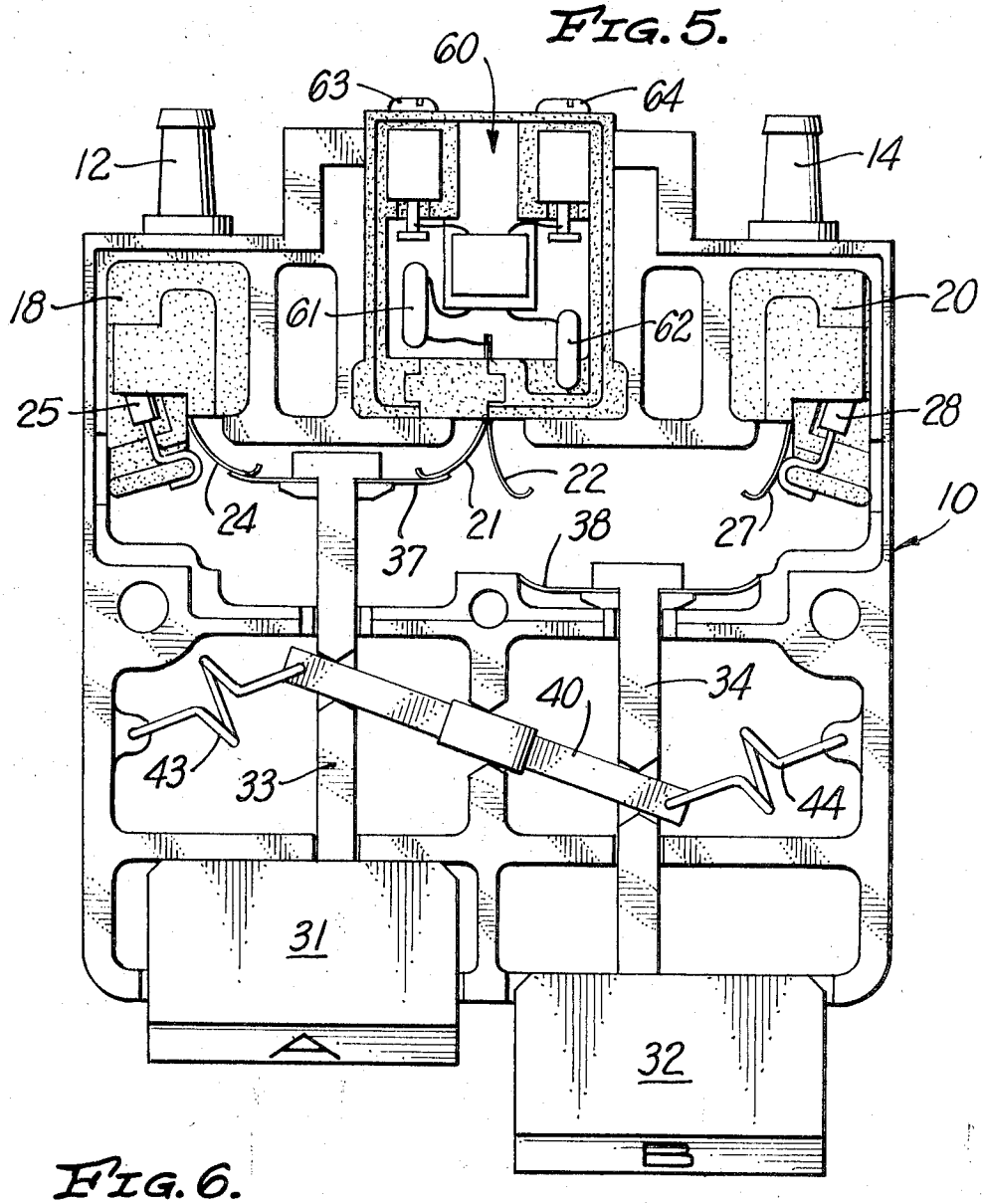
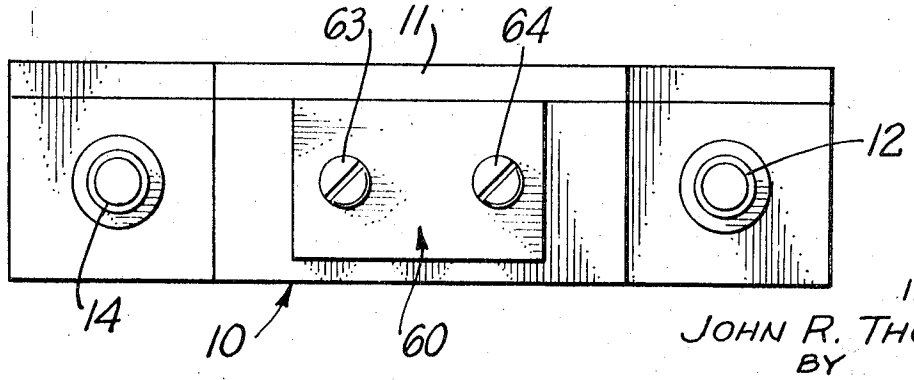


FIG. 6.



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COAXIAL SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a coaxial switch which is particularly designed and adapted for use as an A–B cable switch in CATV cable systems.

2. Description of the Prior Art

Switches of the type now in use are believed to be inferior in that they do not sufficiently isolate or shield one cable from the other. They also are not sufficiently economical and foolproof in their construction and operation.

SUMMARY OF THE INVENTION

The invention comprises a switch of the type described which is an improvement over the prior art because it provides increased isolation of the respective cables. The switch is guaranteed to provide a minimum of 75 db. isolation and is believed in fact to provide substantially more.

Another advantage of the switch is that it is extremely rugged in its structure and operation, is substantially foolproof and will last for an extremely long time. It is substantially impossible to damage or break the switch, even by pushing both buttons at the same time. The switch is also more economical to manufacture because of its simplicity in parts and assembly.

The contact elements make a brushing engagement with each other over an extremely large surface area each time they make or break contact, so that clean and secure contacts are achieved.

In an alternative embodiment, the switch incorporates a transformer within the switch housing, eliminating the necessity of a separate output transformer.

It is accordingly among the objects of the invention to provide a switch having all of the advantages and benefits set forth above. The invention also comprises such other objects, advantages and capabilities as will later more fully appear and which are inherently possessed by the invention.

While I have shown in the accompanying drawings a preferred embodiment of the invention, it should be understood that the same is susceptible of modification and change without departing from the spirit of the invention.

REFERRING TO THE DRAWINGS

FIG. **1** is an isometric view of the switch on a reduced scale;

FIG. **2** is a sectional view taken on line **2**—**2** of FIG. **1**;

FIG. **3** is a sectional view taken on line **3**—**3** of FIG. **2**;

FIG. **4** is a sectional view taken on line **4**—**4** of FIG. **2**;

FIG. **5** is a sectional view similar to FIG. **2** of an alternative embodiment;

FIG. **6** is an end view of the switch of FIG. **5**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment which has been selected to illustrate my invention comprises a substantially square housing **10**, which may conveniently be formed of cast metal. The top of the housing is provided with a cover **11**. The interior of the housing is divided into a plurality of small compartments which house the various component parts of the switch.

Extending outwardly from the backwall of the housing **10** are three cable ferrules **12**, **13** and **14**, the outside of which is electrically grounded to the housing **10**. The ferrules have hollow interiors for receiving the center conductors of the cable, which is not shown in the drawings.

The rear portion of the housing **10** is divided into five adjacent compartments. The hollow interiors of the ferrules **12**, **13** and **14** are aligned with openings leading into the two corner compartments **15** and **16** and the center compartment **17**. Mounted within the compartments **15–17** are substantially square plugs **18–20** respectively, each of which comprises a plurality of pieces of relatively hard electrically nonconductive material such as plastic.

The plug **19** in the center compartment **17** holds in place a pair of elongated spring contacts **21** and **22**, the outer ends of which form reversely bent loops having straight parallel portions which are adapted to resiliently receive and make secure electrical contact with a cable inserted into the center ferrule **13**. The inner ends of the spring contacts **21** and **22** are free and extend inwardly adjacent to each other into an open area **50** of the housing **10** which is disposed forwardly from the compartments **15** and **17**. The tips of the inner ends of the contacts **21** and **22** are bent both reversely and in opposite directions away from each other.

The plug **18** in the corner compartment **15** holds in place a pair of elongated spring contacts **23** and **24**, the outer ends of which form reversely bent loops having straight parallel portions which are adapted to removably receive and make secure electrical contact with a cable inserted into the end ferrule **12**. Only the contact **24** has a free inner end which extends inwardly into the free area **50** of the housing. The tip of the free inner end of the contact **24** is reversely bent.

The plug **18** also holds in place a 75 ohm resistor **25**, the rear lead of which is bent around the back of the plug **18** to make electrical contact with the adjacent inner wall of the housing **10**. The other lead of the resistor **25** extends into the free area **50** and is bent around the edge of a portion of the plug **18** which also protrudes inwardly into the free area **50**. The contact **24** is resiliently biased so that it is normally urged into physical and electrical contact with the adjacent lead of the resistor **25**.

The plug **20** in the other corner compartment **17** holds in place a pair of identical spring contacts **26** and **27**, which are adapted to make contact with a cable inserted into the other ferrule **14**. An identical 75 ohm resistor **28** is held in an identical manner and the contact **27** is resiliently biased into contact with the adjacent lead of the resistor **28**.

The forward end of the housing **10** is divided into a pair of open compartments **29** and **30**. These compartments are adapted to receive a pair of pushbuttons **31** and **32**, which are mounted for reciprocal movement toward and away from the housing **10**. The pushbuttons **31** and **32** move alternately to each other. When the pushbuttons **31** and **32** are in inward closed position, they are disposed substantially entirely within the compartments **29** and **30**. When they are in their outward open positions, they protrude forwardly substantially entirely beyond the forward wall of the housing **10**.

Extending rearwardly into the housing **10** from the pushbuttons **31** and **32** are a pair of vertically directed bars **33** and **34** respectively, which extend through a pair of compartments **35** and **36** disposed directly behind the compartments **29** and **30** and into the open area **50**. The bars **33** and **34** slidably extend through slots cut in the laterally directed walls of the compartments **35** and **36**.

The inner ends of the bars **33** and **34** which are disposed within the open area **50** carry a pair of elongated leaf spring contact members **37** and **38** respectively. Each of these contact members includes a pair of laterally directed wings, which are gradually bent inwardly at their outer ends.

The wall which divides the compartments **35** and **36** is provided with a central slot **39**, the opposite edges of which are V-shaped to form a pair of oppositely facing fulcrums for a crossbar **40**, which pivotally extends through the slots **39**. The crossbar **40** also pivotally extends through a pair of slots **41** and **42**, which extend downwardly into the upper part of the bars **33** and **34**. The opposite edges of the slots **41** and **42** are also V-shaped to form a pair of oppositely facing fulcrums for pivotal movement of the crossbar **40**.

Connected to the opposite ends of the crossbar **40** are the inner ends of a pair of coil springs **43** and **44**, the outer ends of which are attached to the housing **10** adjacent to the center of the sidewalls of the compartments **35** and **36**.

It will be seen that the switch is in a stable condition only when one of the pushbuttons **31** and **32** is in closed position and the other is in open position.

When the pushbutton 31 is in closed position, its contact member 37 engages the spring contacts 21 and 24. In doing so, it holds the contact member 24 away from contact with the adjacent lead of the resistor 25.

The pushbutton 32 is then in open position, with the wings of its contact member 38 engaging and making electrical contact with the forward wall of the open area 50. This grounds the contact member 38 and prevents it from acting as an antenna or radiator of signals. This accordingly adds to the isolation of the cables. The contact member 27 is at this time in engagement and electrical contact with the adjacent lead to the resistor 28.

When manual pressure is exerted upon the pushbutton 32 to move it inwardly toward closed position, such movement is resisted by both of the coil springs 43 and 44. As the pushbutton 32 and its bar 34 move inwardly, the crossbar 40 is pivoted from an angular to a lateral position, causing both of the coil springs 43 and 44 to become compressed. As soon as the crossbar 40 moves past the center or lateral position, both of the coil springs 43 and 44 urge the crossbar 40 onwardly to the opposite angular position. They quickly move the pushbuttons 31 and 32 on to opposite positions without further manual pressure.

It will be seen that as the contact member 38 of the bar 34 moves rearwardly across the open area 50, it engages the contacts 22 and 27 and bends them with what may be termed a brushing action in which the gradually curved outer ends of the contact member 38 brush across and then form a large contact area with the bent ends of the contacts 22 and 27. There is a similar brushing action in reverse when the contact member 38 moves back toward open position. There is identical brushing action of the other contact member 37 as it moves into and out of engagement with the contacts 21 and 24.

When the contact member 27 is bent by its engagement with the contact member 38, it moves inwardly away from contact with the adjacent lead of the resistor 28. On the other side of the housing, the opposite movement takes place. As the contact member 37 moves outwardly, the contact 24 by its own resilience moves back into engagement with the adjacent lead of the resistor 25.

The switch is particularly adapted for use as an A–B coaxial switch in CATV systems. It is capable of other uses as well, such as television station switching. The functional structure of the switch is also capable of being used for substantially any electrical switching application.

When the switch is used as an A–B coaxial switch, the pushbuttons 31 and 32 are marked "A" and "B" respectively. The ferrules 14 and 15 are marked "Cable A" and "Cable B" respectively. The center ferrule is marked "TV." The cables A and B are connected to their respective ferrules and the TV set is connected to the center ferrule 13.

The TV set can then be switched from either cable to the other by merely pushing one or the other of the push buttons 31 and 32. This doubles the number of channels available to the TV set user on a CATV system.

The interior of the switch is preferably provided with a thin substantially flat copper shield 45, which covers the switch contact area and which acts as an electrostatic shield. The switch may be removably mounted in a plastic outer cover 46, which is preferably somewhat resilient. The cover 46 protects the switch from possible physical damage and also provides shock hazard protection.

It will be noted that the resistors 25 and 28 provide a 75 ohm termination for the unused input cable.

In use, the switch is preferably mounted on or near the television set either through adhesive or with fastening members such as screws or the like.

The ferrules 12, 13 and 14 may be replaced by any type of commonly used coaxial cable connector, such as a female "F" connector common to CATV systems, or any other suitable connector.

FIGS. 5 and 6 of the drawings show an alternative embodiment of the invention in which a balun transformer is physically integrated within the housing of the switch. This eliminates the necessity of providing a separate output transformer between the switch and the television set. Such a transformer is required because the coaxial cable is an unbalanced 75 ohm system and the television set requires a 300 ohm balance input. The transformer accordingly serves as an impedance matching device and converts an unbalanced system to a balanced system.

The structure and operation of the switch itself is identical with that of the embodiment previously described. The same reference numerals are accordingly used for identical parts. In this embodiment, however, the contact elements 21 and 22 are connected to one of the loads of the primary side of a balun transformer 60 through a first DC blocking capacitor 61. The opposite primary lead of the transformer is connected to one lead of a second DC balancing capacitor 62. the opposite end of which is grounded to the housing.

The secondary of the transformer 61 is connected to a pair of screws 63 and 64, which are adapted to be connected to the antenna input of the television set. The center lead of the transformer secondary is electrically grounded by means not shown in the drawings.

It may be noted that in both embodiments of the invention the housing and all of its component walls are preferably made of metal or other electrically conductive material. All of the switch elements within the housing except the contact members, leads and springs are preferably made of hard plastic or other electrically nonconductive material. The springs are isolated in separate compartments to minimize any deleterious effect which they might have in preventing isolation.

I claim:

1. A switch comprising a housing, first and second pushbuttons mounted for alternating manual reciprocal movement between inward and outward positions with respect to said housing, an elongated bar attachment to each of said pushbuttons, said bars extending inwardly into said housing from said pushbuttons, a crossbar having its center pivotally mounted on a stationary part of said housing, the ends of said crossbar being pivotally connected to said bars, a contact member carried by the inner end of each of said bars, at least one substantially stationary contact adapted to be engaged by each of said contact members when the pushbutton to which it is attached is in inward position, said crossbar being movable upon the inward movement of either of said pushbuttons between two stable diagonal positions, in one of which said first pushbutton is in inward position and its contact member is in engagement with its stationary contact and said second pushbutton is in outward position and its contact member is out of engagement with its stationary contact, and in the other of which said second pushbutton is in inward position and the engagement of said contact members are reversed, resilient means urging said crossbar toward the opposite diagonal position when either of said push buttons is pressed toward inward position and moves said crossbar past a lateral position with respect to its center pivot point, said resilient means comprising a coil spring extending between each end of said crossbar and an adjacent portion of said housing disposed transversely from the center pivot point of said crossbar.

2. The structure described in claim 1, the center of said crossbar being pivotally mounted in a slot formed in said housing adjacent the center thereof and the ends of said crossbar being pivotally mounted in slots formed adjacent the midportion of said bars.

3. The structure described in claim 2, the opposite sides of each of said slots being V-shaped to form oppositely facing fulcrums for said crossbar.

4. The structure described in claim 3, each of said contact members comprising a leaf spring having a pair of laterally directed resilient wings, and a resilient stationary contact engageable with each of said wings, said wings and stationary contacts making resilient brushing engagement with each

other when said pushbuttons and contact members are moved between inward and outward positions.

5. The structure described in claim 4, each of said stationary contacts comprising an elongated curved resilient member having a free end disposed within said housing, said free ends being movable both longitudinally and transversely upon engagement thereof with the wings of said contact members.

6. The structure described in claim 5, and a resistor mounted adjacent one of the stationary contacts engaged by each of said contact members, said resistor having one lead thereof disposed directly adjacent to said stationary contact, the resilience of said stationary contact normally urging it into engagement with said lead whenever its contact member is in outward position, said contact member being adapted to move said stationary contact out of engagement with said lead when said contact member is in inward position.

7. The structure described in claim 6, and means for connecting one of said stationary contacts engageable by each of said contact members with one of a pair of television cable connections and means for connecting the other of said stationary contacts engageable by each of said contact members with a television set, said pushbuttons being operable to selectively connect said television set to either of said cables, the unused cable being automatically connected through one of said resistors to electrical ground.

8. The structure described in claim 1, and means for connecting one of said stationary contacts engageable by each of said contact members with one of a pair of television cable connections, a balun transformer disposed in said housing, means connecting the other of said stationary contacts engageable by each of said contact members to the input of said transformer, and means for connecting the output of said transformer to a television set, said pushbuttons being operable to selectively connect said television set to either of said cables through said transformer.

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