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MUTUALLY EXCLUSIVE STOP SWITCH MECHANISM

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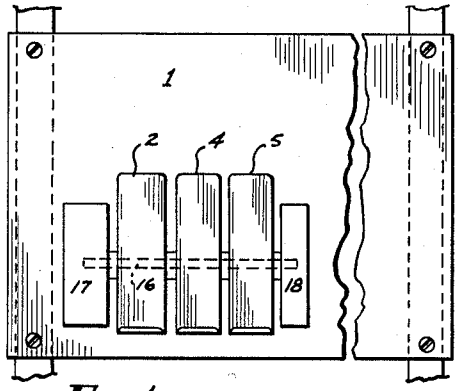


FIG. 1.

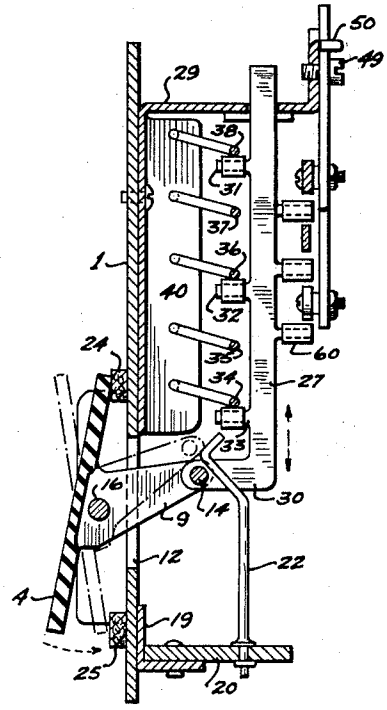


FIG. 3.

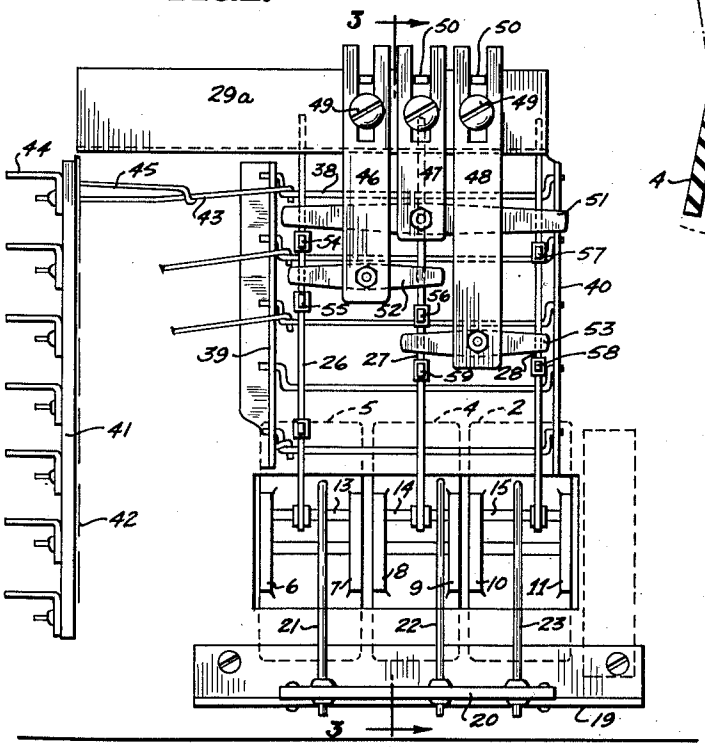


FIG. 2.

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MUTUALLY EXCLUSIVE STOP SWITCH MECHANISM

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This invention has to do with switch mechanisms employing a plurality of means to be selectively actuated by an operator, where the arrangement is such that the movement of any one of the means, say, to the "on" position will result in a return of the other means in the group to the "off" position, i.e., a multiple switch device in which the manually actuated elements are mutually exclusive in their operation.

Mutually exclusive switch mechanisms have heretofore been employed in various electric fields, such as the field of telephony where in general the manually actuable means are plungers, and where the actuation of any one plunger in a group results in the release of all of the other plungers, which are then returned to non-actuated position by springs or the like. The devices heretofore produced are not, however, applicable to the present problem; and in most instances they suffer from the additional defect of being impositive in action so that an inadvertent simultaneous actuation of two or more plungers may result in the simultaneous actuation of a plurality of switch mechanisms with which they are connected.

In electrical musical instruments the control of voices is usually accomplished by the actuation of tabs or tablets which are pivoted with respect to a voicing panel, and are actuated by rocking them about their pivots alternately to off and on positions, there being some type of dead-center mechanism to maintain the positions of the tablets so rocked. In the circuitry of electric organs many of the stop tabs are arranged to control voicing circuits which are additive with respect to the output of the instrument, so that the stop tabs are for the most part made to be independent of each other. Thus the operator may employ a plurality of voices simultaneously in the output of the instrument. Nevertheless, there are instances in which it is advantageous to provide for the mutually exclusive operation of small groups of stop tablets, or where such provision would permit the use of simplified circuitry. One instance may be the provision of stop tabs to effect a combination of particular voices, where, as to each such combination, the desired effect is obtained only if other stop tabs in the same group are not actuated. Again, in an instrument provided with means for the obtaining of so called "percussive effects," a small number of stop tabs may be arranged to control the rate of tonal decay. Yet another instance may involve the provision of a small number of mutually exclusive tabs to control the rate or amplitude of a vibrato effect.

It is a general object of the invention to provide mutually exclusive mechanism well adapted for use with rocking stop tabs.

It is an object of the invention to provide a mutually exclusive mechanism operated by rocking stop tabs, wherein the movement of one tab to the on position will positively move the other tabs in the group to the off position.

It is an object of the invention to provide mutually exclusive means arranged for operation by stop tabs which means is flexible and essentially unlimited as to the number of electrical switch mechanisms which may be actuated by the depression of any one tab.

It is an object of the invention to provide mutually exclusive means for actuation by stop tabs, which means do not preclude the operation of the same switch by more than one of the stop tabs in the group. This provision makes possible the securing of the effects of different arrangements of circuit elements, some of which may be the same for two or more of the arrangements.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, are accomplished by that structure and arrangement of parts of which an exemplary embodiment will hereinafter be described. While the description will relate to the stop tabs and associated mechanism in an electrical musical instrument, it will be understood that the principles of the invention are applicable to any circuitry which may to advantage be operated by rocking members or tablets. Reference is made to the accompanying drawings wherein:

FIG. 1 is a face view of a portion of the voicing panel of an electrical musical instrument, showing a series of stop tabs the action of which is to be made mutually exclusive.

FIG. 2 is a rear view of the apparatus.

FIG. 3 is a vertical sectional view taken along the section line 3—3 of FIG. 2.

Referring first to FIG. 1, the index numeral **1** indicates the face of a voicing panel which may be of wood, metal, plastic or other substance in keeping with the style of the console of the musical instrument. Three stop tabs, marked respectively **2**, **4** and **5** are shown as mounted on the panel so as to have a rocking motion. In ordinary practice, the stop tabs will have spaced legs extending through a perforation in the panel. Thus, as shown in FIG. 2 the tab **5** will have legs **6** and **7**, the tab **4** will have legs **8** and **9**, and the tab **2** will have legs **10** and **11**. In FIG. 3, the tab **4** is shown in section, with the leg **9** extending through the perforation **12** in the voicing panel. The inner ends of the legs of each of the stop tabs are connected together by rods shown at **13**, **14**, and **15**. In the particular construction, the tabs are mounted on a common pivoting rod **16** which passes through perforations in the legs near the stop tab body, and engages at its ends in supports **17** and **18** on the face of the voicing panel.

The voicing panel is provided on its rear side with an angle member **19** which bears a plate **20** lying at an angle to the voicing panel. Spring wire members **21**, **22** and **23** are attached to the panel **20** as shown. Their free ends are bent to form humps which bear respectively against the rods **13**, **14** and **15** of the stop tabs. It will be evident from the dotted line showing in FIG. 3 that as any stop tab moves from one position to the other, its rod **13**, **14** or **15** will depress one of the spring elements **21**, **22** or **23**, riding past dead-center to a biased position on the opposite side of the hump thereof. Felt strips **24** and **25** or pieces of other suitable deadening material may be cemented to the voicing panel **1** in the positions shown in FIG. 3 so that the operation of the several stop tabs will be noiseless.

The voicing panel **1** will, in usual constructions, extend across the front of the instrument console, and may bear numerous independently operable stop tabs for individual voices, as well as other control mechanism including an off-on switch for the power supply to the instrument, and any graduated control devices which may be provided. In elaborated instruments there may be sets of independently operable stop tabs for the great organ manual, for the swell organ manual, and for the pedal clavier. It goes without saying that the voicing panel, if desired, may support two or more of the mutually exclusive assemblies described herein.

In order to accomplish the purposes of this invention, each of the stop tabs in the mutually exclusive assembly is arranged to operate a bar having a reciprocatory motion in a direction generally parallel to the plane of the voicing panel **1**. These reciprocatory bars are indicated at **26**, **27** and **28**, and as most clearly shown in FIG. 3, the upper ends of the bars are journaled in holes in an angle bracket **29** attached to the voicing panel, while the lower ends of the bars are provided with angular extensions **30**, the free ends of which have a pivotal connection respectively with the rods **13**, **14** and **15**. Thus a rocking of the stop tabs will cause a reciprocation of the bars in the direction shown by arrows in FIG. 3.

The bars are provided selectively with certain extensions on the side toward the voicing panel. In FIG. 3 such extensions are shown at **31**, **32** and **33**. A series of bail-like members, formed of wire or rod stock, have their out-turned ends journaled in bracket members **39** and **40** on the voicing panel. The bail-like members are indicated respectively at **34**, **35**, **36**, **37** and **38**. Any number of these bail-like elements may be provided in any given assembly, the length of the bars **26**, **27** and **28** being increased or diminished as may be required. It will be noted in FIG. 3 that the extensions **31**, **32** and **33** are arranged to rock respectively the bail-like members **38**, **36** and **34**. Movement of the bar **27** in FIG. 3 will not result in any rocking of the bail-like elements **37** and **35**. The other bars, **26** and **28** in the assembly, will have other projections extending toward the voicing panel and arranged to rock one or more of the bail-like elements. Although two or more of the bars **26**, **27** or **28** may be arranged to rock one or more of the same bail-like elements, the total arrangement as respects each such bar will be different. Thus, the actuation of any one stop tab will result in the rocking of a different arrangement and usually, though not necessarily, a different number of the bail-like elements.

The bail-like elements are each arranged to operate one or more switch mechanisms. These switch mechanisms may take various forms within the spirit of the invention. Preferably the switches are of the jack-switch type in the sense that they embody members extending in the same general direction, having a mounting at one end in which the several members are insulated from each other and are provided with means whereby electrical connections may be made to them, the members at their outer or free ends being so arranged that the movement of one of them will bring two or more into or out of electrical contact. By way of an exemplary showing, reference is made to FIG. 2 wherein an insulative panel **41** is shown mounted on a bracket **42**. A wire member **43** is mounted at one end on the panel, and, passing through the panel is provided with means for making an electrical connection thereto as at **44**. The wire **43** is elongated so as to reach to the bail-like member **38**, and has a bent end which is hooked over that member. A second wire member **45** is also mounted with respect to the panel and provided with means (not shown) for effecting an electrical connection to a suitable circuit. The outer end of the wire **45** is shown in this particular instance as bent in such a way as to have a portion lying beneath the wire **43** and making electrical contact with the wire **43** when it is in the position shown. It will be evident from FIG. 2 that if the bail **38** is rocked upwardly, the wire **43** will be brought out of contact with the wire **45** and the electrical connection broken between them. It will be evident to that skilled worker in the art that other arrangements may be effected in which a similar movement of the wire **43** may be caused to make one or more circuits instead of break a circuit, and that in still other arrangements one circuit may be made as another circuit is broken. Very satisfactory switches may be made by the use of spring wire which has been plated with some highly conductive metal that is strongly resistant to oxidation.

It will also be evident that wherever desired the bail-like elements such as **38** may be caused to operate more than one switch each.

To the bracket **29** there are attached certain depending supports **46**, **47**, **48**, preferably in an adjustable fashion. To this end, the supports are slotted as shown and held to an upturned portion **29***a* of the bracket **29** by means of screws **49**. Bosses **50** also formed on the part **29***a* also engage in the slots of the supports **46**, **47** and **48** so that these supports are kept in vertical alignment although adjustable as to effective height. Rocker arm members **51**, **52** and **53**, pivoted to the lower ends of the supports as shown may also be of flexible construction, so that actuation of two stop tabs simultaneously will not cause excessive stresses therein. The bars **26**, **27** and **28** are formed on their rear edges with protuberances adapted to contact and rock the arms or to be moved by the arms as will be hereinafter explained. In FIG. 2 the bar **26** is shown as having protuberances **54** and **55** related respectively to the rocker arms **51** and **52**. If the bar **26** is moved vertically as by actuation of its stop tab, it will be evident that the protuberances **54** and **55** will swing the arms **51** and **52** in a clockwise direction as viewed in FIG. 2. Should the bar **27** be in the upper position at the time of the aforesaid upward movement of the bar **26** it will be moved downwardly because the right-hand end of the swinging arm **52** will engage the protuberance **56** on the bar **27**. Similarly if the bar **28** were in an upper position when bar **26** is moved upwardly as described, a protuberance **57** on bar **28** will be engaged by the rocker arm **51**, and the bar **28** will be moved downwardly. The arrangement is such that only one of the bars **26**, **27** or **28** can occupy the upper or "on" position at any one time, and that movement of any one of the bars (by means of its stop tab) to the upper position will result in a movement of either of the other bars to the lower position if they are not already occupying that position. For example if the bar **28** were moved upwardly to rock arm **51** in a counterclockwise direction by means of the protuberance **57**, the bar **26** would be swung to the lower position, if it had previously been occupying the higher position, by means of the protuberance **54**. Similarly the protuberance **58** on bar **28** will swing the arm **53** in a counterclockwise direction, lowering bar **27** by means of protuberance **59** if that bar happened to be in the upper position. However, the arrangement is such that while only one bar may occupy the "on" position at any one time, all three bars may occupy the "off" position at the same time if their respective stop tabs are moved to the "off" position.

As more clearly shown in FIG. 3 the protuberances on the rear sides of the bars **26**, **27** and **28**, as well as the forward projections on the front edge of the bars are preferably provided with tubular elements **60** of some effective sound deadening material such as rubber or felt, so that the operation of the structure becomes noiseless.

It will be evident to the skilled worker in the art that the structure disclosed herein may be modified to take care of a greater number of stop tabs and a correspondingly greater number of the bars such as **26**, **27** and **28**. In order to make the operation of the several bars mutually exclusive as hereinabove described, a greater number of swinging arms will have to be provided if a greater number of bars is employed; but it is necessary only to provide such a number and disposition of swinging arms as to move all other bars to the "off" position when one bar is moved to the "on" position. Likewise the number of bail-like elements **34–38** may be increased as may be found desirable with an appropriate enlargement of the dimensions of the apparatus behind the panel **1**.

However, three stop tabs are usually sufficient to provide pre-set voice combinations for an electric organ. In a copending application of Donald J. Campbell, Serial No. 4,294 filed January 25, 1960, now Patent No. 3,063,324

and entitled Pre-Set Combination Stop Means for Electric Organs, there are described certain circuit combinations to which the means of this invention are excellently adapted. A commonly desired pre-set arrangement would include a flute combination, a string combination and a full-organ combination although other combinations may be added or substituted if desired. The combinations may be restricted to a single manual or a different means for setting up pre-selected combinations of voices may be provided for each manual and the pedal clavier; but it is more usual to provide a single arrangement of stop tabs for combination voices, which arrangement will serve to vary the tonal effect throughout the entire organ.

In any event, the normal method of arranging for pre-selected voices, as generally set forth in the said copending application, will be to provide in addition to a normal header in which electric oscillations may be collected from various sources or through various filters upon the actuation of single-voice stop tabs, a plurality of additional headers having fixed, high impedance connections to groups of sources or voicing circuits. The last mentioned header may be referred to as pre-set headers, and the several headers including the normal header may be so connected through the apparatus of this invention to one or more output systems that, when a pre-set stop tab is actuated the normal header will be disconnected from the output system and the appropriate pre-set header or headers connected thereto and vice versa. In some instances it is desirable to ground headers when they are disconnected from the output system. This may be readily arranged in the use of the apparatus of this invention by the employment of single pole, double-throw switches to be operated by the bail-like elements **34–38**.

Modifications may be made in this invention without departing from the spirit of it. The invention having been described in certain exemplary embodiments, what is claimed as new and desired to be secured by Letters Patent is:

1. In a mutually exclusive stop switch mechanism a panel, stop tabs pivoted for swinging motion with respect to said panel, operating means in connection with said stop tabs extending through said panel, and bars on the opposite side of said panel from said stop tabs, said bars being arranged to be moved longitudinally by said operating means, means for operating switches attached to said bars, rocker arms extending transversely of said bars and means on said bars for swinging said rocker arms, there being with respect to each bar at least a rocker arm connecting it with the first one of the other bars and at least a rocker arm connecting it with a second one of said other bars, each bar in the structure having connection by means of a separate rocker arm with each other bar so that the movement of a bar in one longitudinal direction will result in a movement of all other bars in the opposite direction if such other bars have previously been moved in the first mentioned direction.

2. The structure claimed in claim 1 wherein said rocker arms are capable of moving said bars in but one direction so that all of said bars may simultaneously occupy positions which are the result of movement of any one of said bars in a direction opposite to said last mentioned direction as determined by the positions of said stop tabs.

3. In a mutually exclusive stop switch mechanism a panel, stop tabs pivoted for rocking movement with respect to said panel, operating means attached to said stop tabs and extending through said panel, a bracket on the side of said panel opposite said stop tabs, said bracket having a portion extending away from said panel, bars attached respectively to said operating means at one end, journaled for sliding movement adjacent their other ends in the said bracket portion, means in connection with said bars for the selective operation of switches, supports attached to said bracket portion and extending in general parallelism with said bars, rocker arms pivoted to said supports, and means on said bars for contacting and swinging said arms and for producing movement of said bars when said arms are swung by another bar the interaction between said arms and said means on said bars being such that only one of said bars may occupy a position which is the result of a longitudinal movement of said bar in one direction as produced by its respective stop tab, but all bars may occupy simultaneously an opposite position.

4. The structure claimed in claim 3 including spring means engaging the operating means on said stop tabs and acting as a dead center mechanism to maintain positions of said stop tabs as determined by their rocking movement.

5. The structure claimed in claim 4 including bail-like switch actuating means having end portions pivoted in extensions on said bracket, the switch actuating means on said bars comprising projections differing in position as to each of said bars and serving to rock said bail-like members selectively when said bars are moved.

6. In a mutually exclusive stop switch mechanism a series of at least three bars mounted for longitudinal movement under the influence of manually actuable stop devices, and a series of rocker arms extending transversely of said bars, there being with respect to each bar at least a rocker arm connecting it with a first one of the other bars and at least a rocker arm connecting it with a second one of said other bars, each bar in the structure having connection by means of a separate rocker arm with each other bar, said bars having means for engaging said rocker arms whereby movement of said rocker arms will move said bars in one direction and movement of said bars in the opposite direction will move said rocker arms, whereby only one of said bars may occupy one longitudinal position at any one time, there being another longitudinal position which all bars may occupy at the same time, and means in connection with said bars operating switch means.

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