Nov. 27, 1951 R. P. MORK 2,576,764

COMBINATION STOP MECHANISM

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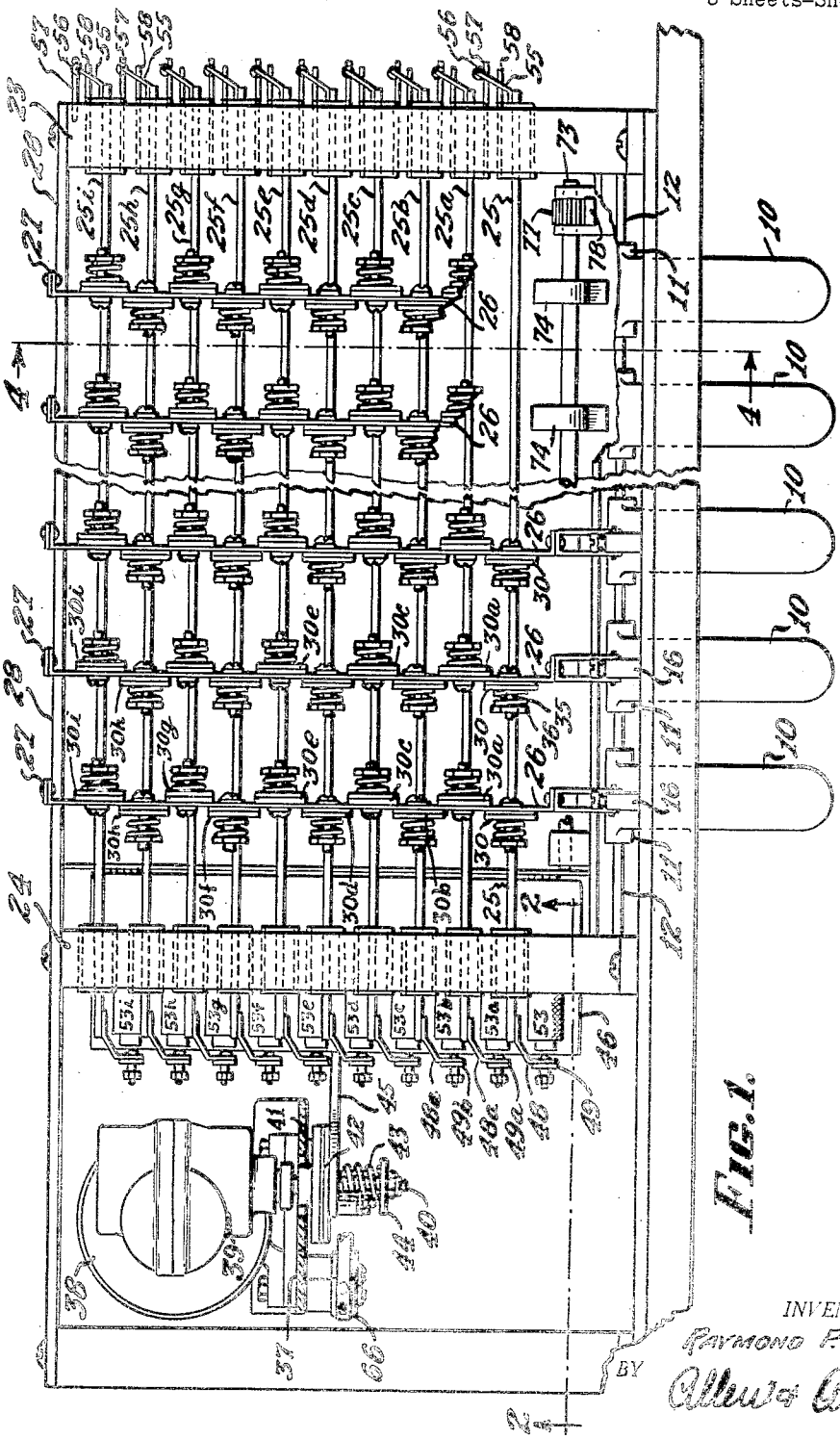


FIG. 1.

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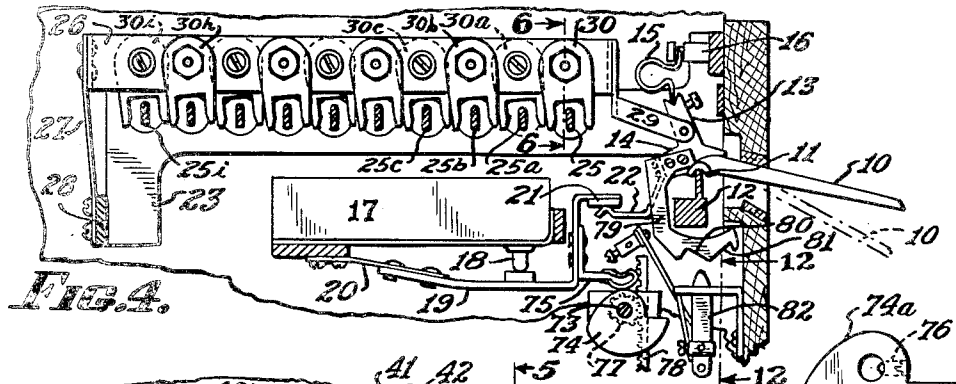


FIG. 4.

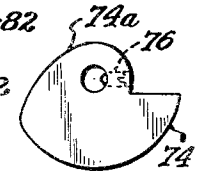


FIG. 7.

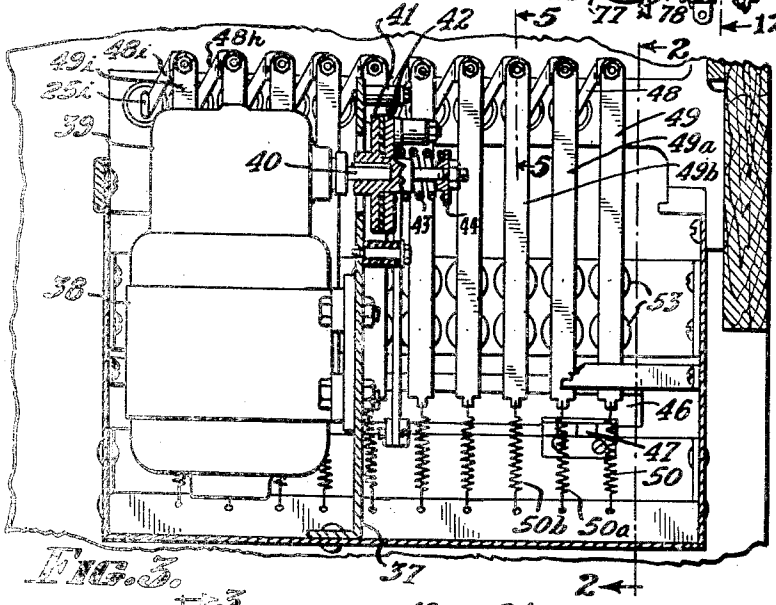


FIG. 3.

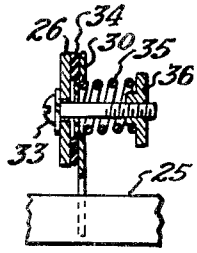


FIG. 6.

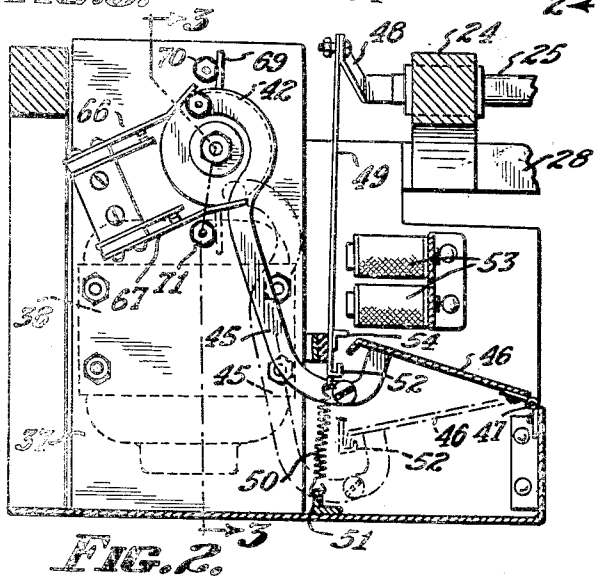


FIG. 2.

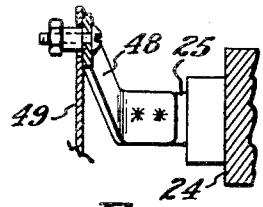


FIG. 5.

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COMBINATION STOP MECHANISM

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FIG. 8.

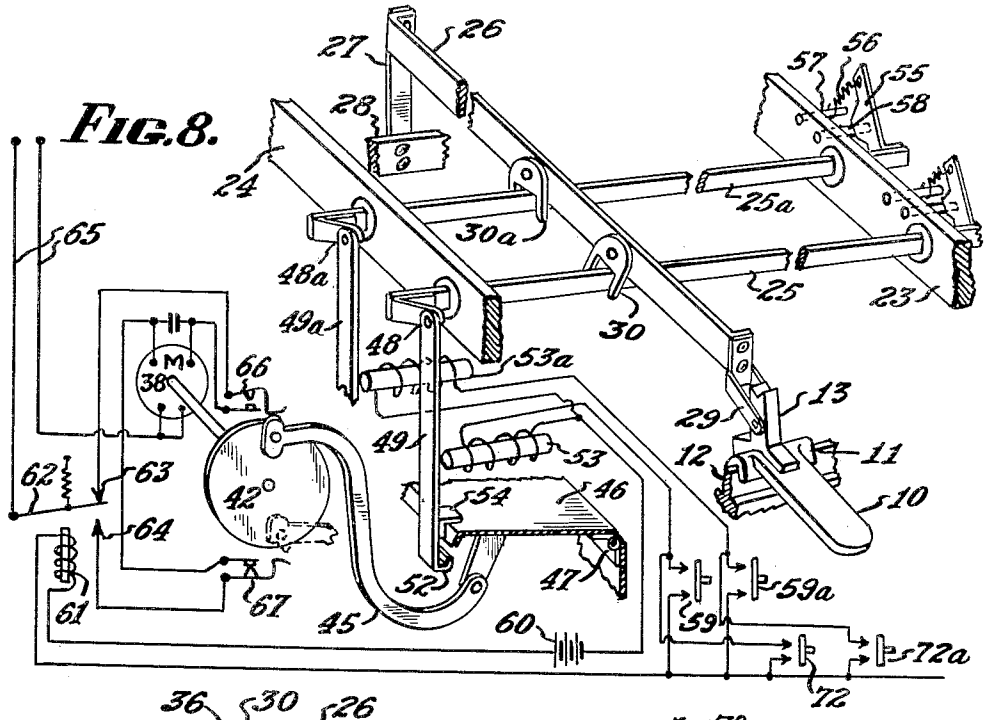


FIG. 9.

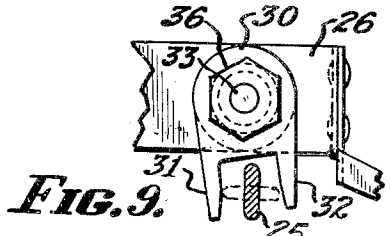


FIG. 12.

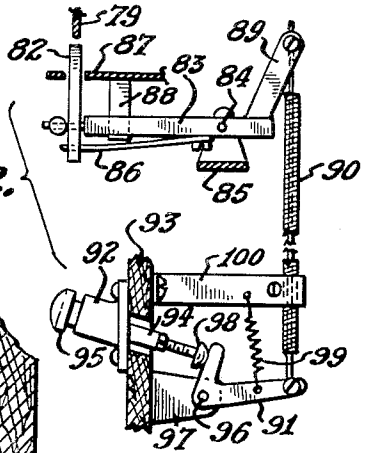


FIG. 10.

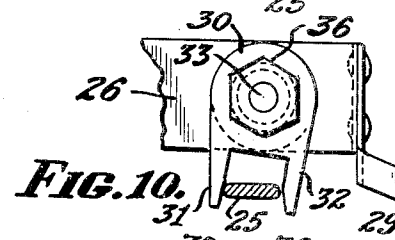
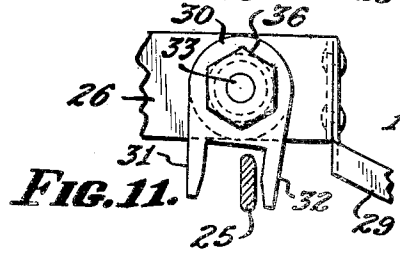
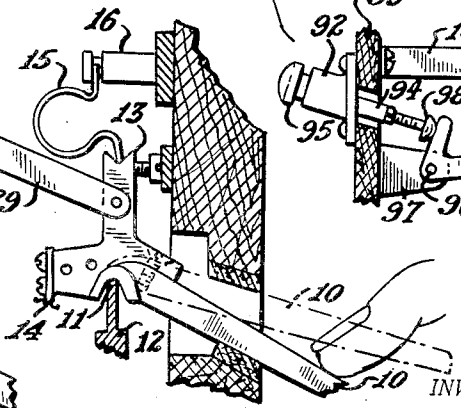


FIG. 11.





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Patented Nov. 27, 1951

2,576,764

UNITED STATES PATENT OFFICE

2,576,764

COMBINATION STOP MECHANISM

Raymond P. Mork, Cincinnati, Ohio, assignor to The Baldwin Company, Cincinnati, Ohio, a corporation of Ohio

Application November 26, 1948, Serial No. 62,180

21 Claims. (Cl. 84—1.19)

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My invention relates generally to means for opening or closing electric circuits individually or in selected combinations, manually or automatically. I shall describe my invention in connection with an exemplary embodiment which is a combination stop action employable in electrically controlled pipe organs, or in organs of the type wherein electrical pulsations are generated, combined, modified as to harmonic content, and converted into audible musical tones.

A primary object of my invention is the provision of a simple, inexpensive, but completely flexible organization whereby, by means of a single actuator, various preset combinations of electrical circuits may be energized.

It is an object of my invention to provide a simple and dependable mechanism by which an operator may, after depressing a selecting button or the like, set up desired electrical circuits for energization, and, releasing said button, obtain at a later time energization of the same combination of electrical circuits by pressing the same selecting button.

It is an object of my invention to provide a mechanism of this class which is economical, dependable, durable and easy to assemble and adjust.

It is an object of my invention to provide a mechanism of the character described well adapted for inclusion in a removable voice box in an electrical musical instrument, as hereinafter described.

Another object of the invention is to provide a mechanism of the class set forth by means of which an operator may quickly alter the combination of electrical circuits previously chosen, upon the actuation of a different selecting button.

Still another object of the invention is to provide a combination stop action for a musical instrument, by means of which electric stop switches may be actuated separately or in selected combination, manually or automatically.

Yet another object of the invention is the provision of a mechanism whereby a series of electrical circuits may be energized in predetermined sequence by an actuator for that purpose, as for example a pedal which gradually brings into play all stops of the full organ when depressed, without interfering either with the manual selection of stops, or with the operation of combination mechanism such as that referred to above.

These and other objects of the invention, which will be set forth hereinafter or will be apparent to one skilled in the art from the following description, I accomplish by that construction and

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arrangement of parts and in that mode of operation of which I shall now describe the aforesaid exemplary embodiment. Reference is made to the accompanying drawings wherein:

Figure 1 is a partial plan view of my combination stop mechanism.

Figure 2 is a partial vertical sectional view taken along the section line 2—2 of Figure 1.

Figure 3 is a transverse vertical section taken along the line 3—3 of Figure 2.

Figure 4 is a partial vertical transverse section taken along the line 4—4 in Figure 1.

Figure 5 is a partial elevation with portions in section taken along the line 5—5 of Figure 3.

Figure 6 is a partial sectional view taken along the line 6—6 of Figure 4.

Figure 7 is an enlarged elevational view of a cam which I may employ.

Figure 8 is a simplified and semi-diagrammatic perspective view, with parts in section, of the combination mechanism showing also circuit arrangements therefor.

Figures 9, 10 and 11 are respectively elevational views with parts in section showing the mode of operation of a portion of the combination mechanism.

Figure 12 is an elevational view with parts in section showing the organization of the combination modifying devices.

In a musical instrument of the organ type, the various voices and couplers are usually selected by means of stop tabs in the form of short levers projecting through an aperture in the top front board of the instrument above the playing keys, and having upper and lower positions in which appropriate electrical circuits are energized and de-energized. Various voices and/or couplers or combinations thereof are desired during the performance of most musical compositions, and the playing must be partially or wholly interrupted to permit the organist to depress or raise pluralities of the stop tabs. This operation is inconvenient and time-consuming. As a consequence, there has hitherto been recognized the need for the provision of combination stop mechanisms whereby a plurality of predetermined voice combinations could be set up on a program apparatus and then obtained instantly and selectively through the actuation of single buttons, stop tabs or the like. Mechanisms hitherto proposed for his purpose have, however, been cumbersome, expensive, and in most instances difficult to set up and adjust.

In a copending patent of John F. Jordan, No. 2,555,040, dated May 29, 1951, there is described

an assembly of parts in an electrical musical instrument in which complex electrical pulsations are generated for all of the notes within the range of the instrument, these pulsations being thereafter combined in accordance with the requirements of a musical composition by means of playing keys, the so-combined oscillations being finally modified selectively by voicing circuits, amplified and reproduced. In the construction of this organ, the stop tab mechanisms, the stop tab switches, the various voicing circuits, electronic out-phasing means, and a preamplifier are all assembled as a unit in a voice box structure. This unit is removable and replaceable in the organ as such, being located behind the upper front board of the instrument, with the stop tabs projecting through openings therein. The voice box has plug-in connections to a connector board wired to the key switches, and also plug-in connections to various other instrumentalities such as a distributor box for connection to the volume control and to the amplifier and reproducer mechanisms. The voice box may also contain switch mechanisms for tremolo, echo organ and the like additionally projecting through the upper front board of the instrument. The combination stop and other devices taught in the present application are well adapted for installation in a unitary voice box structure generally of the type described in said Patent No. 2,555,040, with such changes in dimensions of the voice box as may be required to accommodate the added apparatus.

Stop tab and switch mechanism

As most clearly shown in Figure 4 each stop tab **10** is provided with a hub **11** resting on an upwardly extending fin of a bar **12**, fixed in the organ, or forming a part of the voice box hereinabove referred to. Affixed to each stop tab there is an element providing an upwardly extending arm **13** notched at its upper end, and a rearwardly extending arm **14**. A compression spring **15** engages between the notch of the arm **13** and an overhead abutment **16** on the organ front board or voice box, forming a dead center mechanism, tending to hold the stop tab down upon the bar fin, and holding it either in the "off" position shown in solid lines in Figure 4 or in the "on" position shown in dotted lines in the same figure.

A stop switch is generally indicated at **17**, having an actuating plunger **18**. The stop switches are preferably, though not necessarily of the form described in Patent 2,215,124, dated September 17, 1940, in the names of Kock and Jordan. I have shown an operating lever **19** attached to the switch by a resilient member **20** and having an overhead abutment **21** to be engaged by a finger **22** attached to the rearwardly extending arm **14** on the stop tab. Thus it will be apparent that the manual rocking of the stop tab **10** will actuate the switch **17**.

It will be understood that the mechanism thus far described, or its equivalent, will be multiplied in the organ so that there will be one such assembly for each voice for each of the manuals of the organ. Preferably all of the stop tabs will be mounted in alignment in the organ or in the voice box, although the tabs may be separated into groups, one for each of the manuals involved.

Combination selector mechanism

Referring to Figures 4 and 8, in brackets **23** and **24**, I journal a plurality of rods **25**, **25***a*, etc., for rotation. The number of these rods may be widely varied, and there will be a rod for each preset stop combination desired. The rods preferably extend continuously across all stop-switch and stop-tab combinations in the organ, although it is within the scope of my invention, if desired, to provide separate groups of rods for the stop tab groups of the several manuals. The advantage of providing a single group of actuator rods **25**, **25***a*, etc. common to all of the stop tabs is that this enables me to set up concurrent combinations of voices for the swell, great and pedal manuals whenever desired, while, as respects any rod, a combination may still be set up pertaining only to a particular manual.

Above and transverse the groups of rods **25**, **25***a*, I provide an actuator bar **26** for each stop tab. This bar is shown mounted at its left-hand end (in Figure 4) by a resilient metal strap **27** to a support **28** extending across between the brackets **23** and **24**. At its right-hand end, the bar is connected by means of a forked member **29** to the upwardly extending arm **13** on the stop tab. This completes the support of the bar **26**; and it will be evident that if the bar be moved in the direction of its length either to the left or right in the figure, it will serve to move the stop tab **10** to its upper or lower position as the case may be, and consequently to actuate the stop switch **17**. The several actuator rods serve to move the actuator bars selectively as will presently be described, and hence to effect the movement of the several stop tabs to on and off position in accordance with prearranged patterns.

In connection with each of the actuator bars **26** I provide a series of means **30**, **30***a*, etc. capable of being engaged by the rods **25**, **25***a*, etc. These elements, as most clearly shown in Figures 9, 10 and 11, each comprise a body **30** and depending, spaced legs **31** and **32** adapted to lie on either side of a bar **25**. The bodies such as **30** are perforated; and are mounted upon the transverse actuator bars such as **26** frictionally, so that while the bodies **30**, **30***a*, etc. may be moved rotatively with respect to the bars, a greater force is required to accomplish this than to move the bars longitudinally for the actuation of the stop tabs **10**. A suitable mode of mounting the elements **30** is illustrated in Figure 6, where a bolt **33** is shown passing through the bar **26** and the body **30**, with the interposition of a washer of frictional material **34** therebetween. A compression spring **35** is engaged between a nut **36** on the end of the bolt **33** and the body **30**, the body having a central depression, as shown, serving to center both the spring and the frictional washer.

The bar **26** for each of the stop tabs **10** will carry as many of the bodies **30**, **30***a*, etc. as there are rods **25**, **25***a*, etc., by means of which the particular stop tab is to be actuated. I may provide each of the transverse actuator bars **26** for each of the stop tabs with one of the bodies for each of the longitudinal actuator rods. In usual practice however, I assign certain rods **25** to certain keyboards or combinations of keyboards, employing bodies **30**, **30***a*, etc. only on those actuator bars **26** connected to stop tabs of said certain keyboards or combinations thereof, and only in those locations on those bars **26** where they may engage the assigned rods **25**. In Figures 1 and 4 of this application, I have illustrated a system in which there are 10 of the rods **25**, **25***a* and in which each of the transverse actuator bars **26** carries 10 of the bodies **30**, **30***a*, etc.

The number of rods and bodies to be actuated thereby may, however, be varied in accordance with the individual requirements of any instrument. In order to save space, I have shown alternate ones of the bodies **30**, **30***a*, etc. mounted on opposite sides of the actuator bars **26**.

The rods **25**, **25***a*, etc., throughout their operative length, are flattened as indicated in the several figures. The distance between the spaced depending legs **31**, **32** of the bodies **30**, **30***a*, etc., may by slightly greater than the longer transverse dimension of the flattened rods; and the difference between the longer and shorter transverse dimensions of the actuator rods is such that when any rod is turned with its greater cross-sectional dimension vertical, as in Figure 9, and is in inoperative position, the actuator bar bearing the bodies may be moved in either direction to actuate its stop tab without interference from the rods.

When such a rod is turned so as to have its greater cross-sectional dimension horizontal, as in Figure 10, it is in actuating position, and may actuate the transverse bar **26** through the corresponding body **30** depending upon the position of that body. If the body at any time is positioned as indicated in Figure 9, a rotation of the rod **25** will produce no effect upon it since the rod will not contact either of the legs **31**, **32**. However, if the position of the body **30** at the time the rod **25** is rotated is such that the rod contacts the leg **31**, then the bar **26** will be moved to the left. Contrariwise, if the leg **32** is so positioned as to be contacted by the rod **25** when it is turned from the solid line to the dotted line position, the bar **26** will be moved to the right. The relationship of the body **30** to the rod **25** will depend not alone upon the rotative position of the body **30** on the bar **26** but on the longitudinal position of the bar **26**, i. e. on whether or not the particular stop to which the bar **26** is connected (as hereinabove described) is in the "off" or "on" position.

If I prefer to rotate the rods **25**, **25***a*, etc. through an angle less than 90°, I may make the longer transverse dimension of the rods greater than the distance between the legs of the bodies **30**, **30***a*, etc.

This series of relationships provides not only for the effecting of predetermined stop combinations upon the actuation, by turning, of any of the rods **25**, **25***a*, etc., but also permits the easy and convenient establishment of a combination with respect to each of the rods. This is illustrated in Figures 9, 10 and 11. Let it be supposed that it is desired to establish a combination with respect to the rod **25**. If that rod be now turned, as in Figure 10, to a position in which its longer cross sectional dimension is horizontal and is caused to remain in that position, depression of the stop tab **10** by the finger as shown will result in a movement of the transverse bar **26** to the right. This in turn will tilt the body **30** to the position shown in Figure 10. This establishes the particular stop as one to be turned on as part of the combination when the rod **25** is turned to actuating position. However, when the rod **25** is turned to non-actuating position the stop tab **10** may be lifted by the finger, thus moving the transverse bar **26** to the left as shown in Figure 11, without changing the position of the body **30** on the bar.

Similarly, in setting up a combination, if when the rod **25** is placed in actuating position as in Figure 10 and a stop tab is in the down or "on" position when the voice represented by that tab is not desired in the combination, it is only necessary to lift the tab by the finger to remove it from the combination by positioning the body as shown in Figure 9.

In other words, in setting up a combination it is only necessary to turn a particular rod to the actuating position, and then establish the combination by turning on or depressing those stop tabs which are desired as part of the combination, and turning off or raising those stop tabs which are not desired as part of the combination. When the rod thereafter is turned to non-actuating position, the stop tabs may be freely manipulated by the fingers in any way desired during the course of the playing of a musical composition. But if at any time thereafter the same rod is again turned to actuating position the preset combination will be established, i. e. those stops preselected as part of the combination will be turned on if off, or will remain on if already in that position, while those stops not preset as part of the combination will be turned off if they happen to be on, or will remain off if in that condition at the time of the actuation of the rod.

It will be understood that in the use of the device, after the various combinations have been preselected as described, all rods are turned to the non-actuating position, leaving all stop tabs free for manipulation by the fingers. In effecting a preset combination, the appropriate rod of the group **25**, **25***–a*, etc. is momentarily turned to actuating position and then is returned to non-actuating position. The preselected combination will be established by this momentary action, but the several voices can immediately be changed.

Selective and driving mechanism for the actuator rods

For rocking the actuator rods into and out of actuating position, I provide a mechanism which will now be described. On a partition or bracket **37** (see Figure 3) in the voice box, I mount an electric motor **38** having a gear box **39** with a shaft **40** extending through the partition. One of the face plates **41** of a friction clutch is mounted upon this shaft. The other plate or disc **42** of this clutch is pressed toward the first by a spring **43** engaging against an abutment **44** on the end of a stud mounted to the first plate. The purpose of the friction clutch is to permit the operating mechanism to be stopped accurately in its rotative movement, irrespective of any tendency of the motor and associated elements to over-run.

As most clearly shown in Figures 2 and 8, the disc **42** is connected by a curved link **45** to a platform element **46** pivoted as at **47** to a suitable support. The link **45** is pivoted to the disc **42** in an off center position. Rotation of the disc **42** will thus result in raising and lowering the platform **46**, the highest position of the platform being that shown in solid lines in both figures.

The several actuating rods **25**, **25***a* are provided at one end with crank arms **48**, **48***a* etc., and from the ends of these arms I loosely suspend (as most clearly shown in Figure 5) bar-like elements **49**, **49***a* etc. made of magnetic material. Coil springs **50** engage between the ends of these elements and brackets on the base of the voice box as shown at **51** in Figure 2, and serve to keep the elements **49**, **49***a*, etc. in general vertical alignment. At the lower ends of the elements **49**, **49***a*, etc. I provide hook-shaped configurations **52** adapted to be

engaged by a turned-over outer edge of the platform 46 if the elements are drawn toward the platform. Normally the springs 50 keep the elements 49, 49a, etc. sufficiently outwardly beyond the edge of the platform to avoid such engagement. The elements themselves may be drawn toward the platform into position for engagement, individually, by electromagnets 53, 53a, etc. It will be noted from the arrangement of parts most clearly illustrated in Figure 8 that if an element 49 be drawn toward the platform by its electromagnet 53 into a position of platform engagement, a lowering of the platform will result in a rotation of the actuating rod 25 through the crank arm 48, the element 49 acting as a link. To return the rods to non-operative position after they have been so actuated, I preferably provide a resilient return means stronger than the spring 50, as well as a suitable stop means. The elements 49, 49a, etc. may be provided with angles 54 to engage the platform to assist in the return of the actuating rods by overcoming the initial friction between the rods 25, 25a, etc., and the bodies 30, 30a, etc. In Figure 8, an arm 55 has been shown fastened to the opposite end of the actuating rod 25a. The outer end of this arm is connected by a spring 56 to a post 57 on the end support 23, and a stop 58 is provided for the arm 55 to fix the non-operative position of the rod.

In the circuit of each of the electromagnets 53, 53a, etc., I provide an individual push button 59, 59a, etc., a source of power 60 and the winding 61 of a relay switch for energizing the motor 38. Depression of any selected one of the series of push buttons 59, 59a, etc. will thus energize an appropriate one of the electromagnets 53, 53a, etc., and the relay switch. The relay switch has an armature 62 and opposed contacts 63 and 64, these elements being connected into the power circuit 65 of the motor 38. This power circuit also includes upper and lower limit switches 66 and 67 associated with the driven disc 42. The last mentioned switches are normally biased to closed position, but are adapted to be opened by an abutment on the disc 42 or on the link 45.

If now the push button 59 is depressed, the magnet 53 will be energized, drawing the element 49 into platform engaging position. At the same time the armature 62 of the relay switch will be drawn into contact with the contact element 64, energizing the motor 38 through the lower limit switch 67. The motor will begin to operate, and the platform 46 will be driven downwardly, pulling upon the element 49 and rotating the actuating rod 25 from inoperative to actuating position. The result will be the effecting of a preset stop combination as has been explained above. When, however, the platform 46 has been driven to its lowest position the abutment aforesaid will open the lower limit switch 67, thus de-energizing the motor 38, providing the armature 62 of the relay switch has remained in its lower position. It can be caused to do this indefinitely by continued depression of the push button 59. The method of preselecting a stop combination, which has been explained above, will thus be carried on by the operator while he holds depressed a push button appropriate to the particular actuating rod with respect to which the combination is being preset, thus maintaining the actuating rod in actuating position.

Upon release of the button the armature 62 of the relay switch will rise into contact with the contact element 63, thus re-energizing the motor 38 through the upper limit switch 66. The operation of the motor will continue until the abutment aforesaid opens the limit switch 66 at the completion of a full cycle, whereupon the motor will again be de-energized with the platform 46 in its upper position and the actuator rod returned to inoperative position. It will be evident that the depression and release of any one of the buttons 59, 59a, etc. will thus result in the rotation of an appropriate one of the actuator rods to actuating position, and its return to non-operating position. In order to prevent premature rise of the armature 62, if the push button switch is released immediately, I may provide the relay switch with a time relay device such as a closed ring of copper surrounding its magnetic core.

I prefer to employ a reversible motor 38 so connected into its power circuit that during the first half cycle of revolution of the disc 42 the motor will drive it in one direction, while during the second half cycle or return of the disc to starting position it will be driven in the opposite direction. This enables me to provide a stop means 69 (Figure 2) on the disc 42 and coacting abutments 70 and 71 on the supporting partition 37. This is a safety factor, fixing the full and half cycle positions of the disc 42 and hence the upper and lower positions of the platform 46, insuring that the elements 49 and 49a may be accurately brought into engaging relationship with the platform in its upper position, and providing against over-rotation of the actuator rods.

At 72, 72a, etc. in Figure 8 I have indicated a series of push buttons or other switches in parallelism respectively with the push buttons 59, 59a, etc. It is frequently desired by the operator of the instrument that the preset stop combinations be effectable from different positions on the organ console. The use of parallel push buttons or other switches thus enables me to provide duplicate sets for each manual, or a series of foot actuated switches adjacent the pedal manual, if this be desired.

Register crescendo mechanism

As a part of the general assembly described herein, and as part of the mechanism of the voice box, I provide a device whereby, upon the operation of a single control element in one direction, a preselected series or all of the available voices of the organ may be brought into effect, either successively, or simultaneously. To accomplish this, I journal in the voice box a shaft 73 shown in Figure 4, and extending generally parallel to the upper front board of the organ and beneath all or a selected number of the stop tab mechanisms. Upon this shaft I mount a series of cams 74, one for each of the stop switches to be actuated, each such cam coacting with a finger 75 on the actuating lever 19 of its particular stop switch. The cams may be shaped as shown in Figure 7 with an actuating surface 74a extending over a substantial arc. Each cam may be provided with a setscrew 76 by means of which its rotative position on the shaft 73 can be adjusted. It will be understood that as the shaft 73 is caused to rotate, any particular cam 74 will actuate its appropriate stop switch at a certain angular position of the shaft, depending upon the adjustment of the cam, and will maintain the switch closed during further rotation of the shaft, depending upon the extent of the surface 74a. By independent adjustments of the several cams on the shaft any number of stop switches in the

group in the voice box may be caused to be actuated in any desired sequence or simultaneously.

The shaft 73 may be rotated in any was desired. One way is to provide it with a pinion 77, meshing with a rack 78, which in turn is connected to any suitable actuator in the control of the operator, such as a foot pedal mounted in the lower front board of the organ. Since the cams on shaft 73 act directly on the stop switches 17, their action is independent of the other operating mechanisms heretofore described, so that my register crescendo mechanism does not affect the raised or lowered condition of any of the stop tabs, or any voice combination preselected through the operation of the combination stop devices.

Special voice selectors

Normally there are certain voices and/or couplers in an organ which bear a special relationship to the requirements of musical compositions. For example, the performer, even when employing a preset stop combination, may feel the need of adding to it or subtracting from it one of these special voices or couplers and without changing the preset combination as a whole or altering its reproducability. My mechanism as herein described makes provision for this need by arranging special actuators for such voices or couplers, which will be effective (in a single manipulation) in opening the switch for such a voice or coupler if closed, or in closing it if open. I have devised actuating means for this purpose which accomplishes the desired effect without interfering with the mechanisms thus far described, or with the preset or hand-set stop combinations in effect at the time of the actuation.

In Figure 4 I have shown an angular arm 79 attached to the rearwardly extending arm 14 of the stop tab mechanism. The angular arm has a pair of opposed angularly related cam surfaces 80 and 81 coming together in a point on its lower edge. Below the arm I have shown a finger 82, resiliently maintained in a centralized vertical position. If this finger be driven upwardly it will contact either the cam surface 80 or the cam surface 81 of the angular arm 79, depending upon the initial position of the stop tab 10, and, riding down the contacted cam surface it will engage a shoulder at the end thereof, moving the arm 79, and hence the stop tab and its associated parts either in one direction or the other. Thus if the finger 82 be actuated as described, it will raise the stop tab 10 if lowered and will lower it if raised.

Referring to Figure 12, it will be seen that the finger 82 is mounted on an axial pivot on the end of a lever 83. The lever is itself pivoted at 84 on a bracket 85. The finger 82 is resiliently centered by means of a spring 86 on the lever 83 which engages the lower end of the finger. The finger extends upwardly through a slot in a bracket element 87 on the voice box, which is also provided with a depending stop member 88 for the lever.

Beyond the pivot 84 the lever is provided with an angular arm 89, connected by flexible cable or bowden transmission element 90 to a bell crank 91. For the selection or elimination of special voices or couplers, a foot actuator is usually desired. I have shown such a foot actuator in Figure 12, comprising a body 92 mounted on the lower front board 93 of the organ and perforated to receive a sliding rod element 94 having a foot button 95. The bell crank 91 is pivoted as at 96 to a bracket 97 on the lower front board of the organ; and the inner end of the plunger 94 is provided with adjustable means 98 bearing against an arm of the bell crank 91. A spring 99 may be provided engaging between the bell crank and a bracket 100 on the lower front board of the organ to release the transmission 90 after the pressure of the foot is removed and to return the foot button 95 to its outward position.

It will be understood that a mechanism such as has just been described may be provided for any one or more stops in the instrument, or even for all of them, although this is not ordinarily desired.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in an exemplary embodiment, what I claim as new and desire to secure by Letters Patent is:

1. In a combination stop mechanism a stop tab movable to on and off positions, a stop switch, a connection between said stop tab and said switch, a bar mounted for longitudinal movement and having connection with said stop tab, a rod mounted for rotative movement transverse said bar, said rod having unequal transverse dimensions, and a member mounted on said bar and having spaced legs one lying on each side of the rod, said last mentioned member being positionable on said bar so as to be actuatable by said rod.

2. The structure claimed in claim 1 wherein said last-mentioned member is pivoted to said bar and wherein mechanical resistance means are provided between said member and said bar, said resistance means offering greater resistance to relative movement between said member and said bar than the normal resistance of said stop tab to movement in actuating said switch, whereby said member is positionable upon said bar by manual movement of said stop tab.

3. In a combination stop mechanism a series of stop tabs mounted for movement to on and off position, a stop switch for each such tab, a connection between each tab and its switch whereby the switches are actuated by movements of the tabs, a bar for each tab mounted for longitudinal movement and having connection with the stop tab to move it from one position to another, a series of rods common to the several stop tabs and extending transversely of said bars, said rods mounted for rotative movement, and having unequal transverse dimensions, and a series of members pivotally mounted on each bar through mechanical resistance means, said members having legs lying on either side of the respective rods, said members being positionable upon said bars by manual movement of the respective stop tabs when said rods are rotated to positions in which their longer transverse dimension extends in a direction transverse said legs, the shorter transverse dimension of said rods being such as to permit movement of said bars in either direction for the actuation of their respective stop tabs, and the relationship of parts being such that rotative movement of said rods to a position in which their longer transverse dimension is transverse the legs of said members, will produce movement of said bars in either direction depending upon the instant positions of said bars and the positions of said members thereon.

4. In a combination stop mechanism a series of stop tabs mounted for movement to on and off positions, a stop switch for each such tab, a connection between each tab and its switch whereby the switches are actuated by movements of the tabs, a bar for each tab mounted for longi-

tudinal movement and having connection with the stop tab to move it from one position to another, a series of rods common to the several stop tabs and extending transversely of said bars, said rods mounted for rotative movement, and having unequal transverse dimensions, and a series of members pivotally mounted on each bar through mechanical resistance means, said members having legs lying on either side of the respective rods, said members being positionable upon said bars by manual movement of the respective stop tabs when said rods are rotated to positions in which their longer transverse dimension extends in a direction transverse said legs, the shorter transverse dimension of said rods being such as to permit movement of said bars in either direction for the actuation of their respective stop tabs, and the relationship of parts being such that rotative movement of said rods to a position in which their longer transverse dimension is transverse the legs of said members, will produce movement of said bars in either direction depending upon the instant positions of said bars and the positions of said members thereon, and means for rotating said rods selectively from inoperative to operative position, together with means for returning said rods to inoperative position.

5. The structure claimed in claim 4 in which the means for rotating said rods selectively from inoperative to operative positions comprise crank arms on the ends of the rods, depending link elements on the ends of the crank arms, a pivoted platform common to all such link members and interengageable therewith, resilient means for holding said link members in positions of non-engagement with said platform, and magnetic means for bringing said link members selectively into engagement with said platform.

6. The structure claimed in claim 4 in which the means for rotating said rods selectively from inoperative to operative positions comprise crank arms on the ends of the rods, depending link elements on the ends of the crank arms, a pivoted platform common to all such link members and interengageable therewith, resilient means for holding said link members in positions of non-engagement with said platform, and magnetic means for bringing said link members selectively into engagement with said platform, and means for moving said platform comprising a motor, a crank, and a linkage connection between said crank and said platform, and cyclical control mechanism for said motor for causing it to move said platform in one direction and return said platform to starting position.

7. The structure claimed in claim 4 in which the means for rotating said rods selectively from inoperative to operative positions comprise crank arms on the ends of the rods, depending link elements on the ends of the crank arms, a pivoted platform common to all such link members and interengageable therewith, resilient means for holding said link members in positions of non-engagement with said platform, and magnetic means for bringing said link members selectively into engagement with said platform, and means for moving said platform comprising a motor, a crank, and a linkage connection between said crank and said platform, and cyclical control mechanism for said motor for causing it to move said platform in one direction and return said platform to starting position, an operating circuit for said motor and an inter-connection between said operating circuit, said magnetic means and selective switch devices individually connected to the separate magnetic means whereby operation of said motor can be caused to rotate any one of said rods selectively.

8. The structure claimed in claim 7 including a friction clutch having an element driven by said motor, said crank being connected to said element, wherein said operating circuit causes operation of said motor for a half cycle in one direction and for the remaining half cycle in the opposite direction, and including stop means located on said friction clutch element and arranged to coact with an abutment provided on a support to determine the upper and lower positions of said platform.

9. The structure claimed in claim 7 including a friction clutch having an element driven by said motor, said crank being connected to said element, wherein said operating circuit causes operation of said motor for a half cycle in one direction and for the remaining half cycle in the opposite direction, and including stop means located on said friction clutch element and arranged to coact with an abutment provided on a support to determine the upper and lower positions of said platform, and wherein said control circuit includes opposed limit switches and a relay for completing forward and reverse connections to said motor respectively through said limit switches, wherein said limit switches are respectively actuated by an abutment means in connection with said friction clutch member, and wherein said circuits connecting said electromagnetic means are connected in common to said relay switch.

10. The structure claimed in claim 7 including a friction clutch having an element driven by said motor, said crank being connected to said element, wherein said operating circuit causes operation of said motor for a half cycle in one direction and for the remaining half cycle in the opposite direction, and including stop means located on said friction clutch element and arranged to coact with an abutment provided on a support to determine the upper and lower positions of said platform, and wherein said control circuit includes opposed limit switches and a relay for completing forward and reverse connections to said motor respectively through said limit switches, wherein said limit switches are respectively actuated by an abutment means in connection with said friction clutch member, and wherein said circuits connecting said electromagnetic means are connected in common to said relay switch, and wherein said relay switch includes time delay mechanism.

11. The structure claimed in claim 7 including a friction clutch having an element driven by said motor, said crank being connected to said element, wherein said operating circuit causes operation of said motor for a half cycle in one direction and for the remaining half cycle in the opposite direction, and including stop means located on said friction clutch element and arranged to coact with an abutment provided on a support to determine the upper and lower positions of said platform, and wherein said control circuit includes opposed limit switches and a relay for completing forward and reverse connections to said motor respectively through said limit switches, wherein said limit switches are respectively actuated by an abutment means in connection with said friction clutch member, and wherein said circuits connecting said electromagnetic means are connected in common to said

relay switch, and wherein said relay switch includes time delay mechanism, and wherein selectively operable switches in addition to the first mentioned switches are connected respectively in parallel therewith so that the stop selector mechanism can be operated from a plurality of positions.

12. The structure claimed in claim 11 wherein the connection between the stop tabs and their respective switches is a loose connection permitting operation of the switches with the stop tabs in the off position, and including a shaft common to a plurality of said switches mounted for rotation in proximity thereto, said shaft being provided with adjustable cams for operating said switches, and including a foot pedal connected with said shaft to rotate it whereby to actuate a varying number of said switches in accordance with the angular amount of such rotation.

13. The structure claimed in claim 11 wherein the connection between the stop tabs and their respective switches is a loose connection permitting operation of the switches with the stop tabs in the off position, and including a shaft common to a plurality of said switches mounted for rotation in proximity thereto, said shaft being provided with adjustable cams for operating said switches, and including a foot pedal connected with said shaft to rotate it whereby to actuate a varying number of said switches in accordance with the angular amount of such rotation, certain of said stop tabs at least having double-faced cam elements in connection therewith, actuators for said cam elements serving upon actuation in one direction to move said stop tabs from either position to the other, and connections between said actuator elements and foot actuated operating elements.

14. In a musical instrument of the type wherein the timbre of the tones produced is selected by means of electric circuits, the combination of a plurality of electric switches respectively connected in said circuits, stop tabs manually movable between a timbre-selecting position and a timbre-rejecting position with respect to said switches, cam mounting strips located behind said tabs and respectively movable longitudinally thereby, a rotatable cam bar mounted adjacently and perpendicularly to said strips, cam members each comprising a base portion rotatably engaging one of said strips through mechanical resistance means and two leg portions straddling said cam bar, means for rotating said bar about its longitudinal axis from a substantially parallel position with respect to said legs to a substantially perpendicular position with respect to said legs, each said cam, for a given position of its respective strip and tab, having a first position, wherein neither of its legs is engageable by said cam bar upon rotation thereof and a second position wherein one of said legs is engageable by said bar upon rotation thereof to force said strip to shift said tab to its other position, said positions of said cam being changeable by the manual movement of a respective tab while said bar is in said perpendicular position with respect to said legs.

15. Mechanism comprising parallelly arranged elongated members longitudinally movable between two extreme positions, a rotatable bar mounted adjacent to and transverse said members, cams each comprising a base portion rotatably engaging one of said elongated members through mechanical resistance means and two leg portions straddling said bar, said bar being of round-edged substantially rectangular cross-section where straddled by said legs, means for rotating said bar about its longitudinal axis between a position wherein the long axis of said rectangular section is substantially parallel to said legs and a position wherein said axis is substantially perpendicular to said legs, each said cam for a given position of its respective elongated member having one position wherein neither of its legs is engageable by said bar upon rotation thereof and another position wherein one of said legs is engageable by said bar upon rotation thereof to force said elongated member to shift from one of said two positions to the other, the position of a cam with respect to its elongated member being changeable by forcing said elongated member from one of said two positions to the other while the rectangular section of the bar straddled thereby is in said perpendicular position with respect to said legs.

16. Mechanism as claimed in claim 14 including manually movable actuating means in connection with said elongated members and movable thereby during the movement of said elongated member from one of said two positions to the other.

17. Mechanism as claimed in claim 15, including resilient means in connection with said actuating means operative to assist in said movements as said elongated members approach either of said two positions.

18. In a combination stop mechanism, a series of stop tabs mounted for movement to on and off positions, a stop switch for each tab, and a connection between each tab and its switch whereby the switches are actuated by movements of the tabs, the connections between the stop tabs and their respective switches being a loose connection permitting operation of the switches with the stop tabs in the off position, a shaft common to a plurality of said switches mounted for rotation in proximity thereto, said shaft bearing cams for operating said switches, and a foot pedal connected with said shaft to rotate it whereby to actuate a varying number of said switches in accordance with the angular amount of such rotation.

19. In a combination stop mechanism, a series of stop tabs mounted for movement to on and off positions, a stop switch for each such tab, a connection between each tab and its switch whereby the switches are actuated by movements of the tabs, a bar for each tab mounted for longitudinal movement and having a connection with the stop tab to move it from one position to another, a series of rods common to the several stop tabs and extending transversely of said bars, said rods mounted for rotative movement and having unequal transverse dimension, and a series of members pivotally mounted on each bar through mechanical resistance means, said members having legs lying on either side of respective rods, said members being positionable upon said bars for manual movement of the respective stop tabs so as to be actuable by said rod upon rotation thereof.

20. The structure claimed in claim 19 wherein the connection between the stop tabs and their respective switches is a loose connection permitting operation of the switches, with the stop tabs in the off position, and including a shaft common to a plurality of said switches mounted for rotation in proximity thereto, said shaft being pro-

vided with adjustable cams for operating said switches, and including a foot pedal connected with said shaft to rotate it whereby to actuate a varying number of said switches in accordance with the angular amount of such rotation.

21. The structure in claim 19 in which certain of said stop tabs at least have double-faced cam elements in connection therewith, actuators for said cam elements serving upon actuation in one direction to move said stop tabs from either position to the other, and connections between said actuator elements and foot actuated operating elements provided therefor.

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The following references are of record in the file of this patent:

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