Nov. 17, 1964 P. A. KLANN 3,157,753

ELECTRIC SWITCHING ASSEMBLY USEFUL AS A KEY ACTION FOR ORGANS

Filed Feb. 13, 1962 2 Sheets-Sheet 1

FIG. 1

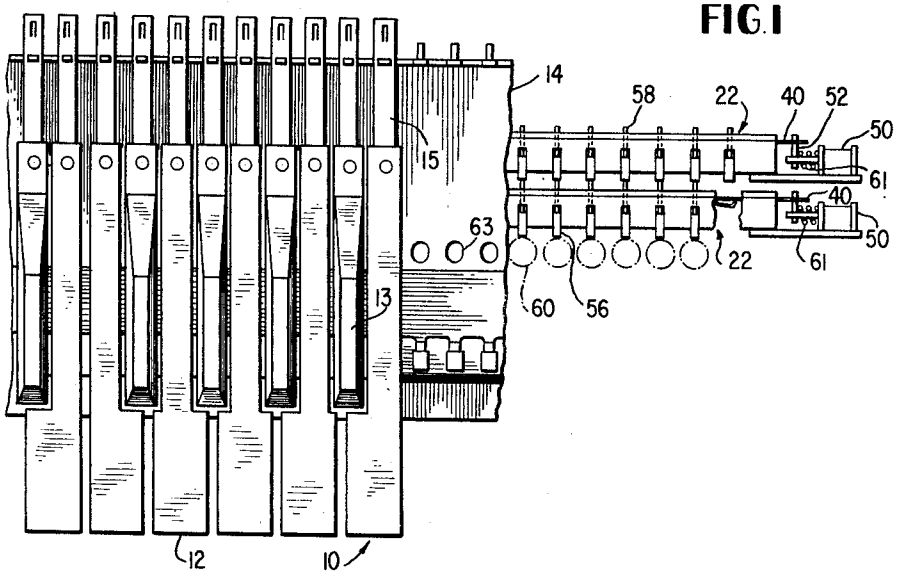


FIG. 2

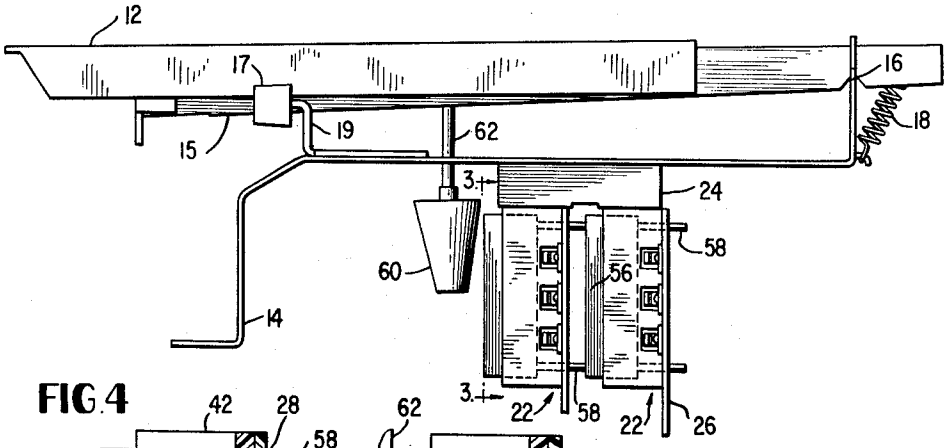
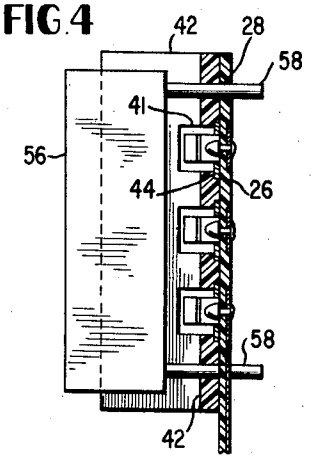


FIG. 4



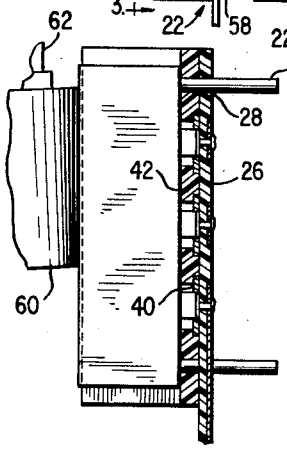


FIG. 5

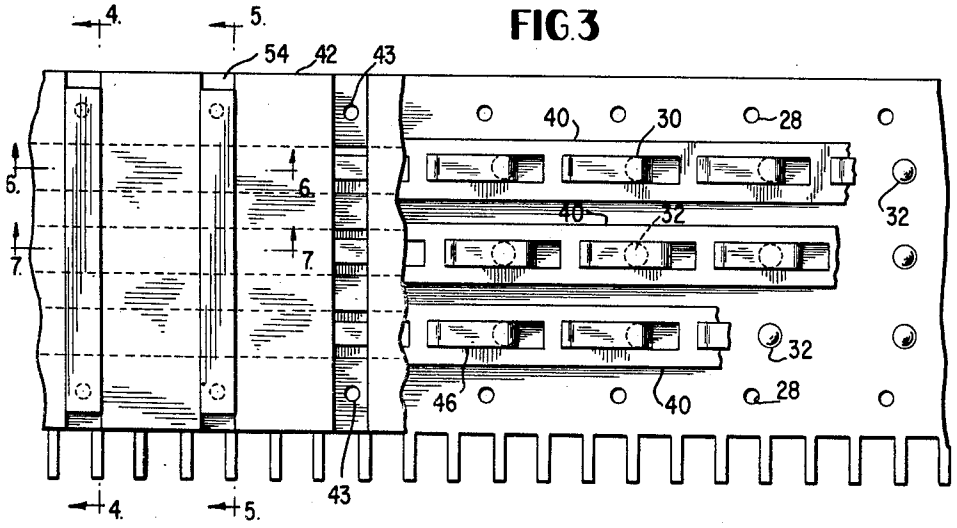
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ELECTRIC SWITCHING ASSEMBLY USEFUL AS A KEY ACTION FOR ORGANS

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FIG.3



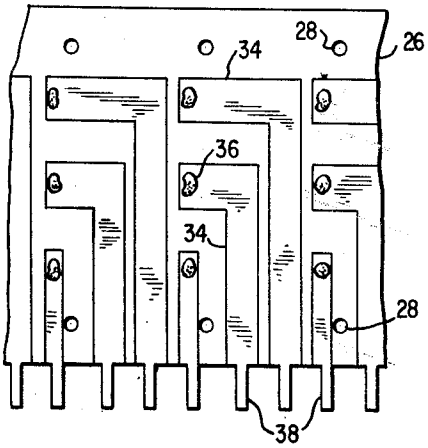


FIG.8

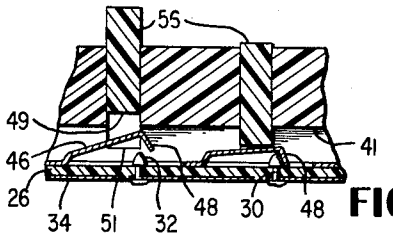


FIG.6

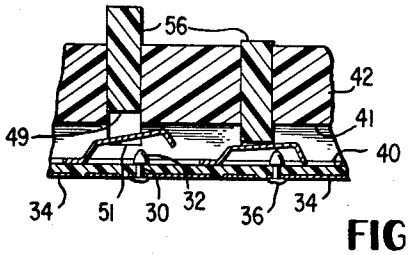


FIG.7

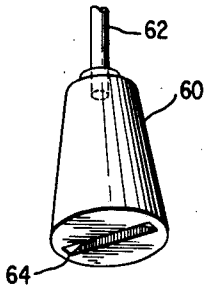


FIG.9

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ELECTRIC SWITCHING ASSEMBLY USEFUL AS A KEY ACTION FOR ORGANS

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Filed Feb. 13, 1962, Ser. No. 172,989
8 Claims. (Cl. 200—18)

This invention relates to improvements in electric key actions for organs.

In electric organs, and also in pipe organs, each of the keys on the various keyboards, pedals, stop knobs and other instrumentalities, are utilized to control a plurality of intermediate electrical switches which in turn control the ultimate sound producing mechanisms. These key or pedal and stop operated switches are often formed in a matrix arrangement so that one key and one stop may provide a plurality of different combination of switching and are commonly called key actions or couplers. Key actions can be coupled directly to manual keyboards or pedal keyboards and, in addition this key action can also be remotely controlled by mechanical actuators commonly known and used in the art. This invention relates to improvements in the construction of these key actions or couplers.

In key action switches for use in organs, it is common and conventional practice to utilize relatively light contact pressure for closing the contacts of the actuated switch or switches. After several days of inactivity, quite often an insulating oxide film will form on the switch contact which will not be broken when the organ is again used and the key is pressed to actuate the switches. Hence, the insulating film will prevent the switch contacts from making and no sounds will be produced by the organ unless this insulating oxide film is broken and conductive contacts can be made. One object of this invention is to overcome this difficulty by providing a unique construction of key action switch contacts utilizing increased contact pressure plus wiping action of the contacts of the switch; this wiping action together with the physical construction of the contacts functions to keep the contacts clean when the switch is used.

Key actions or couplers are sometimes rendered inoperative by the collection of dirt and dust which will accumulate on the action, particularly if the switches are exposed. The construction of this invention eliminates this deficiency by providing that the switch contacts of the key action are substantially enclosed from dirt and dust which, upon accumulation, would create switching difficulties.

In organs, the key pressures are commonly directly related to the contact pressure in the key action switches and it is usually desirable to keep the key pressure uniform and low. This invention provides a construction which allows light keying pressures and increased contact pressure of the switch contacts due to a unique leverage construction. Furthermore, the making of the contacts of the switch has little effect upon the keying pressure and therefore closing of the contacts of the switches has little effect upon the keying touch of the organist.

In key actions of known organs, there is need for adjustments due to the manufacturing process and these adjustments may be needed periodically. Due to the unique construction of the key action of this invention, such adjustments may be eliminated as the construction is as accurate as the tooling used in the manufacturing. The only adjustment which is provided is a desirable adjustment for adjusting the touch of the keyboard relative to the key action switches.

The construction of the key action of this invention provides for great flexibility in that it may be used with a number of known types of keyboards and other operators

including remote operators. Further, a number of the actions may be stacked or ganged together without any change in each single unit. Since the individual units are quite compact, even when ganged together, a great amount of space within the organ normally used for the key action may be saved.

Another feature of this invention is the unique construction which lends itself to mass production and is many times less expensive than known prior key actions or couplers. Furthermore, the key action is constructed of a number of slides which have very little motion during operation and therefore require very little power to operate. These slides are electrically insulated and include contacts formed therefrom which return to normal open positions after operation by the inherent resiliency thereof.

Other objects and advantages of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principles of the invention and the best mode which has been contemplated of applying those principles.

In the drawings:

FIG. 1 is a top plan view of a portion of an organ keyboard partially broken away to show the key action of this invention and its relation to the keyboard;

FIG. 2 is a side elevation view of a manual key in the keyboard and the key action together with the operator connecting the key for operating the key action;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2 with portions broken away for the sake of clarity in explanation;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 3 illustrating a portion of the key action when the switches for a particular key are not actuated;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 3 similar to FIG. 4, but illustrating the condition when the key is depressed and the operator of the key action is in contact therewith;

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 3 illustrating one contact being made and the other normally open;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 3 illustrating one contact not being made even though a corresponding key is actuated due to movement of the contact slide;

FIG. 8 is an elevational view showing a portion of the base for the key action from the reverse side; and

FIG. 9 is a perspective view of a key action operator.

In general, this invention contemplates a key action of the type having slides which may be operated, for example, by electromagnets in accordance with actuated stop tabs. Movements of these slides and corresponding movement of a selected key determines which sounds will be produced by the organ in known and conventional manner. The unique construction is of the key action switching in which the slides include one of the switch contacts formed therefrom in the form of a contact tongue bent out of the plane of the slide and having a downwardly extending end. The other contact is a stationary rivet with a conical head supported on an insulating base having a printed circuit on the rear side thereof. A plurality of contact slides are provided at right angles to a plurality of columns of the rivet head contacts. For each column of rivet head contacts, there is a corresponding key or similar operator and a push bar contacted by the operator. If a key is depressed, the operator contacts the push bar which forces the resilient tongues downwardly so that they selectively make a circuit with the rivet contact depending upon the position of the slide. The push bars are guided through the key action support

by slots therein and by extending guide rods. The guide rods are adapted to bear on the push bar of an identical key action which may be mounted behind a first key action and a number of key actions may be ganged together in this manner with no change in any of the individual switch units. Because of the unique construction the contacts accomplish a wiping action during making to keep them clean and are also substantially enclosed to keep out dirt and dust. Because of the leverage from the actuated key, the contacts will be made with sufficient pressure to always insure electrical connections while the resultant force on the touch of the key is negligible. Also, the actuator slides are returned by the normal resiliency of the contact tongues and the contacts will therefore be normally open.

Referring now to the drawings for a specific explanation of a preferred embodiment, in FIG. 1, there is shown a portion of a keyboard 10 having a plurality of keys 12. The keys may be formed in the usual manner by means of key caps 13 on metallic key stems 15. A key frame 14 is adapted to be secured to an organ frame (not shown) and the key frame includes an upstanding fulcrum support 16 for each key 12. A key stop 17 of rubber or the like is mounted on a bracket 19 and is secured to the key frame 14, there being a key stop 17 for each individual key. The keys 12 are normally biased in a clockwise direction as viewed in FIG. 2 to an uppermost position by means of a key tension spring 18 secured to the rear of the key 12 and to the frame 14. Upon touching the key 12, it may be forced downward until it contacts the key stop 17. The construction of the keys and the key frame is known in the art and is not in itself part of this invention. In fact, a number of other suitable types of keyboards could be used with the unique key action of this invention.

The key action or coupler assembly 22 may be secured to a mounting support 24 which in turn is secured to the key frame 14 as shown in FIG. 2. However, the mounting support 24 is not necessary as the key action assembly 22 can be secured by means of screws directly to the bed of key frame 14.

The key action construction includes an insulating baseboard 26 having a pair of guide holes 28 therein for each key position, see FIGS. 3 and 8. Also contained in rows on the baseboard 26 are contact rivets 30 having pointed heads 32 as shown in FIGS. 6 and 7. The reverse side of the baseboard 26 contains printed circuit connections 34 which are electrically connected by solder 36 to the rows of contacts 30, see FIG. 8. The baseboard 26 and printed circuit 34 may be a copper clad phenolic resin. As shown in FIGS. 3 and 8, the baseboard 26 includes a comb-like edge with projections 38 one for each of the printed circuit connections 34. The comb-like projections 38 are constructed to receive conventional mechanical connectors. Electrical wiring for connections within the organ are secured to the projections 38 and may pass through the spaces between the individual projections for suitably connecting the various keyboards and stops as is well known in the organ art.

A plurality of coupler contact slides 40 are adapted to be supported on the baseboard 26 and extend across individual contacts 30 in the rows of contacts to form a matrix like switching arrangement, see FIG. 3. A guide block 42 of an insulating material is mounted on the front side of baseboard 26 and is provided with longitudinally extending grooves 41, the grooves having widened portions 44 as shown in FIGS. 4 and 5 for providing a guide track for the contact slides 40. The guide block 42 also includes pairs of guide holes 43, FIG. 3, corresponding and mating with the alignment holes 28 in the baseboard 26. The guide holes 43 are provided at the bottom of guide slots 54 which extend parallel to each other in columnar fashion and are located above the contacts 30.

The coupler contact slides 40 may be fabricated from single strips of suitable conductive spring-like material and at spaced intervals in the strips spring-like tongues 46 are provided from the material of the strip. These tongues are formed upwardly of the plane of the strip as shown in FIG. 6 and include a downwardly extending contact end 48. The inherent resiliency of the tongues 46 causes them to assume a normal position as shown on the left hand side of FIGS. 6 and 7. However, upon being forced downwardly, the tongues 46 move against the inherent bias therein until the ends 49 of the bars 56 abut the bottom 51 of their guide slots 54 as shown in FIGS. 6 and 7. This is shown for example in the right hand side of FIG. 7. However, by suitable actuation of electromagnets 50, FIG. 1, the slides may be moved longitudinally so that when the tongues 48 are pushed down they will either contact a corresponding contact rivet 30 at the pointed head thereof with a wiping action, FIG. 6, or will straddle the contact rivet 30, FIG. 7. Whether or not a contact is made between the contact end 48 of tongue 46 and the pointed head 32 of rivet 30 depends upon the position of the slide 40 as controlled by electromagnet 50. As shown in FIG. 1, a suitable mechanical linkage 52 connects the electromagnet 50 to the slide 40. A spring return for the electromagnet 50 may be provided if required by a compression spring 61.

The pushing down of all of the tongues 46 in a row of contacts 30 is under the control of a push bar 56 slidably mounted in slots 54 in guide block 42, as shown in FIG. 3 for example. The slots 54 correspond to the rows of contacts 30 and also correspond to the particular keys of the keyboard.

For moving the push bar 56 against the resilient contact tongues 46, a frusto-conical operator 60 is provided. The frusto-conical operator 60 is secured to the key stem 15 by a threaded rod 62. The threaded rod 62 extends through a hole 63 in the key frame 14. Of course, there is an operator 60 for each of the keys 12. The operator 60 is eccentrically mounted with respect to its stem 62 and the eccentricity may be adjusted by screw adjustment between the connection of the rod 62 and the operator 60. This screw adjustment is accomplished by means of a suitable tool inserted into a screw slot 64 in the bottom of the frusto-conical operator. The operator is adjusted so that as the key is depressed, it will strike the push bar 56 and cause the push bar to move toward the contact slide 40 within slots 54 and while being guided by guide rods 58 secured to the push bar 56. The push bar is seated in the bottom of the slot 54 when the key 12 is fully actuated and when so seated will operate to depress all of the tongues 46 of the slides 40 which are under the particular push bar 56 being actuated. Thus, for any particular key which is struck all of the contacts tongues 46 in column of contacts corresponding to that key will be moved down. However, whether or not an electrical circuit is made between the contact end 48 and the head 32 of rivet 30 depends on the position of the slide 40 actuated by the electromagnet 50.

Because of the leverage obtained through the key 12 and actuator 60, the making of the contacts is at greater pressure than commonly used and furthermore, because of the relationship between the slide 40 and the contacts 30, when the contacts are made the end 48 of the tongue 46 wipes over the rivet head 32 to wipe off any oxide film as the contacts are made. The contact pressure can be largely controlled by the angle of the contact blade portions 46 and 48. It is further noted that with the push bars 56 assembled within the guide 42, the contact slides 40 and rivet contact heads 32 are substantially enclosed to keep out dirt and dust which could cause malfunctioning.

As shown in FIG. 2, two or more of the key action

or coupler assemblies **22** may be assembled on a suitable mounting **24** and the guide rods **58** of one assembly contact the push bars **56** of the next succeeding assembly so that actuation of one key may control in effect a very large matrix or possibility of combination of switch contacts. This arrangement results in flexibility in that modular units may be ganged together in any desired amount and the saving in space is quite pronounced. It should also be noted that movement of the slides **40** by the electromagnets **50** is only the very short distance between that shown in detailed sections, FIGS. 6 and 7. Therefore, and because of the unique slide track, the amount of power required to move slides **40** is quite small. The eccentric adjustment of operator **60** provides for adjusting of the touch of the key.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. An electric switching assembly useful as a key action for organs comprising, an insulating support base, a guide block covering the base including a plurality of rows of parallel guide tracks and guide slots positioned transversely to the rows of tracks in columnar fashion, stationary switch contacts secured to the base in columnar fashion beneath the guide slots, a printed circuit on the base electrically connecting the stationary switch contacts to an edge of the base, a plurality of planar coupler contact slides, each slide longitudinally slidably mounted in one of the parallel guide tracks and crossing the columns of switch contacts, resilient contact tongues integral with and struck from the contact slides and spaced therein equal to the spacing between the columns of stationary contacts, means to move the contact slides longitudinally a short distance, a push bar positioned transversely of the slides in each guide slot adjacent the resilient tongues for each column of switch contacts and movable to force the tongues of the contact slides toward the support base to selectively make contact with the stationary contacts depending upon the longitudinal position of the slide.

2. An electric switching assembly for an organ as defined in claim 1 further wherein: the contact tongues extend out of the plane of the slide and wherein the resilient contact tongues include a depending contact end positioned to selectively connect the stationary contact and to miss the stationary contact depending upon the longitudinal position of the contact slides.

3. An electric switching assembly for an organ comprising: an insulating support base, stationary switch contacts secured to the base in columns, a printed circuit on the base electrically connecting the contacts to an edge of the base, planar coupler contact slides longitudinally slidably mounted on the base and crossing the columns of switch contacts, resilient contact tongues integral with and struck from the contact slides and spaced therein equal to the spacing between columns of contacts, the contact tongues extending out of the plane of the slide and including a dependent contact end positioned to selectively connect the stationary contact and to miss the stationary contact depending upon the position of the contact slide, means to move the contact slides longitudinally a short distance, a push bar positioned transversely of the slides adjacent the resilient tongues for each column of switch contacts, the push bar being movable to force the tongues of the contact slides toward the support base so that the depending ends of the contacts selectively make contact with the stationary contacts depending upon the longitudinal position of the slide, a guide board secured to the insulating support base and having a plurality of parallel guide slots, one slot for each of said push bars, and guide rods secured to each of said push bars and extending outside of said switching assembly, said guide rods positioned to actuate push bars of a similar assembly to provide common actuation for ganged assembly units.

4. An electric switching assembly for an organ as defined in claim 3 further comprising: a plurality of comb-like projections on the baseboard connected to the printed circuit thereof.

5. An electric switching assembly for an organ as defined in claim 4 further comprising: an operator secured to and actuated by a key of a keyboard and including an eccentric conical contact portion contacing the push bar for each column of switch contacts, the eccentric conical contact portion being adjustable about its eccentric axis.

6. A key action for organs comprising: an insulating support including a base and a guide block covering the base and defining a plurality of rows of parallel tracks and parallel guide slots extending transversely to the tracks in columnar fashion, stationary switch contacts secured to the support base in columns, planar coupler contact slides longitudinally slidable in the parallel tracks, the coupler contact slides positioned in rows to cross the columns of switch contacts, resilient contact tongues integral with and struck from the contact slides and spaced equal to the spaces between the columns of contacts, means to move the contact slides longitudinally a short distance so that the contact tongues are correctly over and misaligned with respect to the stationary switch contacts depending upon the longitudinal position of the contact slides, and a movable push bar in each parallel guide slot for each column of switch contacts to force the tongues of the contact slides corresponding to the column of contacts toward the support base to selectively make contact with the stationary contacts depending upon the longitudinal position of the rows of slides for the particular column.

7. A key action for an organ comprising: an insulating support base, stationary switch contacts secured to the support base in columns, planar coupler contact slides longitudinally slidable and mounted on the support base, the coupler contact slides positioned in rows across the columns of switch contacts; resilient contact tongues integral with and struck from the contact slides and spaced equal to the spaces between columns of contacts, means to move the contact slides longitudinally a short distance so that the contact tongues are correctly over and misaligned with respect to the stationary switch contacts depending upon the position of the contact slides, and a movable push bar for each column of switch contacts to force the tongues of the contact slides corresponding to the column of contacts toward the support base to selectively make contact with stationary contacts depending upon the longitudinal position of the rows of slides for the particular column, and further comprising additional identical key actions positioned with the insulating base of one action adjacent the movable push bars of an adjacent action, and including extending means provided on the movable push bars for contacting movable push bars of an adjacent key action, and additionally including an operator connected to a keyboard for operating the push bars.

8. A key action for use in an organ comprising in combination an insulating support piece having comb-like edge projections, a plurality of stationary switch contacts having conical heads secured to the base in parallel columns, a printed circuit on the reverse side of the base connecting the contacts with the comb-like projections, coupler contact slides slidably mounted on the insulating base in parallel rows crossing the columns of stationary contacts, resilient contact tongues integral with the contact slides and formed out of the plane of the surface thereof, the space between tongues equal to the space between columns of contacts and the tongues including a depending contact end positioned to selectively contact

the stationary contacts, means for moving each of the contact slides individually and longitudinally a short distance, a push bar for each column of switch contacts movable to force the tongues of contact slides toward the support base to selectively make contact with the stationary contacts depending upon the longitudinal position of the slide, a guide board secured to the insulating support piece for the push bars, the guide board having guide slots therein, guide rods attached to each push bar and extending through the support base to actuate adjacent push bars to provide a gangable assembly, an operator for each push bar positioned adjacent thereto, the operator including a frustro-conical contact portion

secured to an organ key, eccentric mounting means for the frustro-conical contact portion of the operator so that the contact portion may be adjusted about its eccentric axis to contact the push bar at various times.

References Cited by the Examiner

UNITED STATES PATENTS

901,509	10/08	Wilson	200—5 X
1,085,433	1/14	Kepler	200—159 X
2,902,549	9/59	Bernstein	200—166 X
2,927,985	3/60	Rivers	200—16 X

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