KEYBOARD FOR MUSICAL INSTRUMENTS
Ricardo Hocheltein, Jr., 19 E. Greenleaf St., Emmaus, Pa. 18049
Filed Oct. 22, 1969, Ser. No. 868,361
Int. Cl. G10c 3/12

ABSTRACT OF THE DISCLOSURE
A keyboard for musical instruments includes a pair of springs affixed to a key bed and supportably engaging a key. The springs form a flexural pivot and are aligned in planar relation to permit movement of the key in a single plane only. The spring rate is modified by providing a toggle spring affixed at its ends to the key bed and key, respectively.

BACKGROUND OF THE INVENTION
This invention relates to an improved keyboard which simplifies the manufacture and maintenance of musical instruments and which eliminates the need for sliding surfaces to guide the keys when an instrument is played. In the type of keyboard presently widely used in pianos, organs, accordions and like instruments, sliding friction surfaces are utilized in an effort to maintain the keys in a desired parallel alignment. In order to achieve this proper alignment, the keys are individually adjusted in the keyboards by skilled craftsmen when the instruments are assembled. This leads to substantial additional manufacturing costs. Moreover, the use of friction surfaces leads to excessive wear, noise, and interference with key movement, especially when a key is depressed with a certain lateral thrust to thus increase the pressure between the sliding surfaces.

Other known assemblies employ flat springs but rely on guide slots, pins, and similar expedients to assist in efforts to obtain desired key alignment. These additional elements add to the cost of manufacture and assembly and are subject to failure. Past attempts to utilize flat spring arrangements without such guide devices have resulted in keyboards in which the keys do not remain properly aligned during operation.

It is therefore the primary object of the present invention to provide an improved keyboard which avoids the shortcomings of existing keyboards.

It is another object of this invention to provide a simply constructed keyboard which eliminates the need for manual alignment and adjustment of individual keys during manufacture.

It is a further object of this invention to provide a keyboard which eliminates the need for sliding surfaces to maintain the keys in proper alignment.

SUMMARY OF THE INVENTION
These and other objects of the invention are attained by providing a keyboard in which springs form a support pivot for the keys. In the preferred embodiment, a pair of flat springs is attached to a key bed member extending along the length of the keyboard. The springs supportably engage a key to permit movement in only the plane of the springs and key. A toggle spring extending between the key and a second key bed member assists in obtaining a desired spring rate for the flexural pivot.

DESCRIPTION OF THE DRAWINGS
For a better understanding of the invention, reference may be made to the following description of an exemplary embodiment, taken in conjunction with the accompanying drawings, in which:
FIG. 1 is a partial pictorial view of a keyboard in accordance with the invention;
FIG. 2 is an elevational view of the keyboard of FIG. 1; and
FIG. 3 is a schematic representation showing a principle of operation of the invention.

DESCRIPTION OF THE EXEMPLARY EMBODIMENT
FIGS. 1 and 2 illustrate a keyboard 10 embodying the invention and including a key 12 which is generally of channel shape and which receives a key cap 14, preferably of plastic or ivory. The key 12 operatively connects to a piano action, electric switch, or similar device (not shown). Each such key is supported in a key bed 15 on a balance rail 16 extending along the length of the keyboard 10 by a pair of springs 18 and 20 which together form a flexure pivot about which the key moves in an arcuate path when downward pressure is applied to the key cap 14. While the springs 18 and 20 shown are of rectangular cross section, any spring exhibiting substantially different degrees of flexibility on two planes of right angles to each other can be used. The springs 18 and 20 are attached to the rail 16 and to the key 12 by spot welding or similar fastening means. The flat spring 18 extends generally vertically from the rail 16 through an aperture 22 in the key 12, and it is welded to an upright member 24 formed in the key so as to provide rigidity in a plane CBA as illustrated in FIG. 3. The flat spring 20 extends generally horizontally from the rail 16, and is welded to an under surface 26 of the key 12 so as to provide rigidity in a plane GHI. Alternatively, the springs can be molded in plastic as an integral part of the key. In addition, both springs can be at 45 degrees from a horizontal plane without impairing their function, and substantial departures from the ideal 90 degrees angle between the springs can be tolerated. Both of the springs 18 and 20 allow freedom of movement on a plane DEF which is the plane in which the key 12 moves when in operation.

A keyboard is thus provided in which each key need not be manually aligned. Instead, the structure of this invention can be assembled on automatic or semi-automatic machinery by positioning the keys in an aligning fixture to obtain proper spacing and parallelism. Once fastened to their respective springs, the keys remain in the desired alignment following removal of the fixture. This alignment is maintained with rigidity in all but one plane with a minimum number of keyboard parts. In addition, the keyboard of the invention is characterized by the absence of friction between sliding surfaces even when the force applied to depress the key is not parallel to the plane DEF of the arcuate path.

The shape of the springs 18 and 20 can be varied to comply with different manufacturing methods. For example, springs 18 or 20 for several keys can be provided from a single flat metal sheet extending along the length of the keyboard and notched to provide individual leaves for each of the keys.

The keyboard 10 can include a toggle spring 28 of generally arcuate shape which connects at opposite ends to the key 12 and a front key bed rail 30, respectively, and modifies the keyboard spring rate to prevent it from becoming too steep when a compact design is desired for flat springs 18 and 20. In addition the spring 28 or similar means can be utilized to provide a special spring rate for tracker touch, characterized by a force greater at the beginning of a stroke than at the end. The key bed rail 30 extends generally parallel to the back rail 16 along the
3,616,722

keyboard 10 and has a pair of stop pads 32 and 34, preferably of felt material, attached to its upper surface and undersurface, respectively, serving to limit the vertical movement or depth of touch of the key 12.

The embodiment of the invention described herein is illustrative only. Many variations and modifications may be made by one skilled in the art without departing from the spirit of the invention. For example, the flexural pivot of the invention can be used in pedalboards of electronic or pipe organs. All such variations and modifications, therefore, are intended to be included within the scope of the appended claims.

I claim:

1. A keyboard for a musical instrument, comprising:
   a back key bed member extending generally parallel to the front key bed member and for supporting at least one pair of flat springs;
   a first flat spring attached to the back key bed member and extending in a generally vertical direction to supportably engage the key; and
   a second flat spring attached to the back key bed member and extending in a generally horizontal direction to supportably engage the key and to form with the first flat spring a flexure pivot about which the key can turn in a single plane only.

2. A keyboard according to claim 1, further comprising:
   a toggle spring of generally arcuate shape affixed at one end to the front key bed member and affixed at the other end to the key so as to modify the spring rate of the keyboard.

3. A keyboard according to claim 1, further comprising:
   a plurality of pairs of such first and second flat springs, each pair of springs supporting a key of the keyboard.

4. A keyboard for a musical instrument, comprising a plurality of keys, a back key bed member extending along the length of the keyboard, a pair of flat springs attached to each key, each spring being attached at one end to a key and at the other end to the key bed member so that the keys are supported on the key bed member, and the first and second flat springs in each pair extending within the same plane in different directions from the key bed member and being attached to the same key at different portions along the length thereof, so that each pair of flat springs form a flexure pivot about which the key can move in a generally arcuate path in a single plane.

5. A keyboard in accordance with claim 4, wherein the first flat spring in each pair extends in a direction generally perpendicular to the longitudinal axis of the keys and the second flat spring extends in a direction generally parallel to the longitudinal axis of the keys.

6. A keyboard in accordance with claim 4, wherein a front key bed member is provided which extends generally parallel to the back key bed member and in the path of movement of the keys for limiting the depth of movement of the keys.

7. A keyboard according to claim 6, further comprising:
   a toggle spring of generally arcuate shape affixed at one end to the front key bed member and affixed at another end to the key so as to modify the spring rate of the keyboard.

References Cited

UNITED STATES PATENTS
3,480,744 11/1969 Yamada 84—433

RICHARD B. WILKINSON, Primary Examiner
L. R. FRANKLIN, Assistant Examiner