June 9, 1953 J. D. ENOCHS ET AL 2,641,153

HAMMER ACTION FOR MUSICAL INSTRUMENTS

Filed Oct. 26, 1948 2 Sheets-Sheet 1

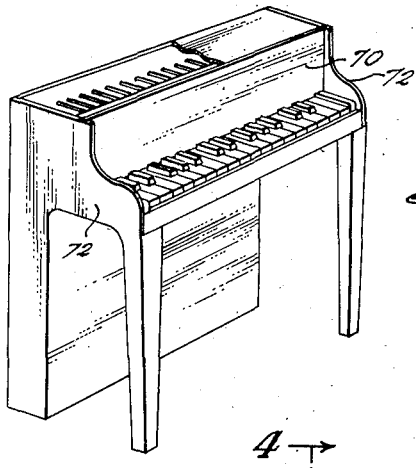

Fig. 1

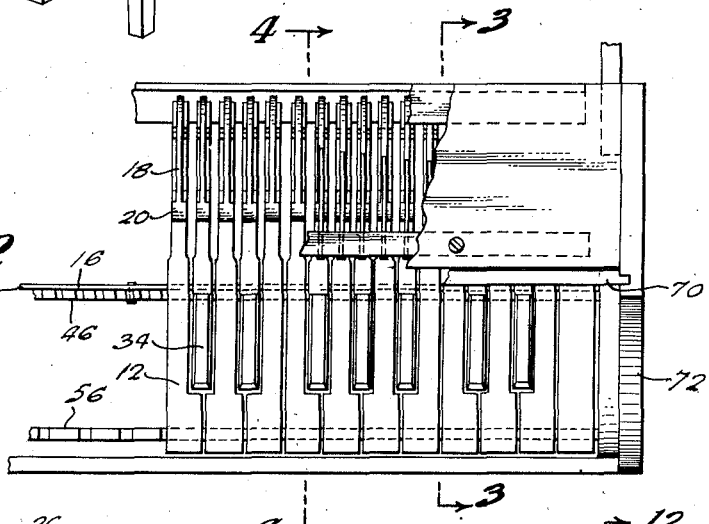

Fig. 2

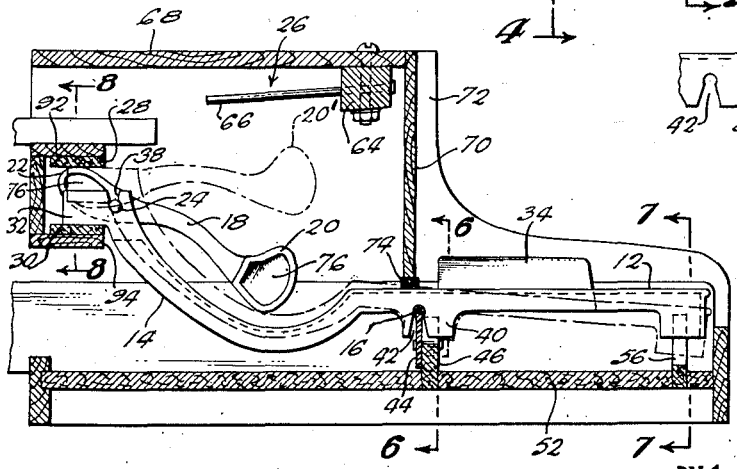

Fig. 3

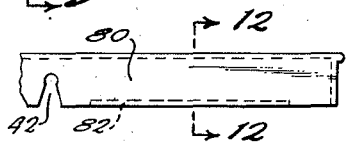

Fig. 11

Fig. 12

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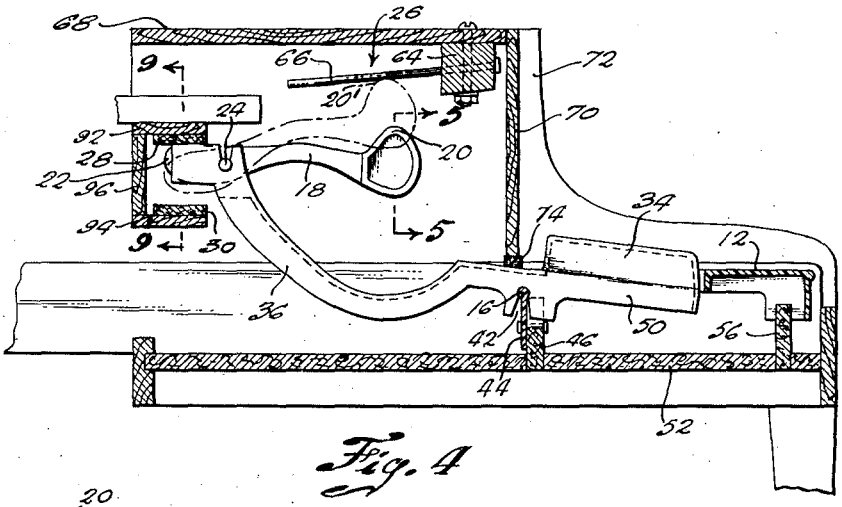

Fig. 4

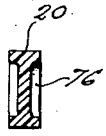

Fig. 5

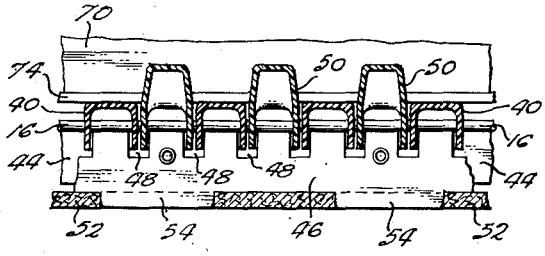

Fig. 6

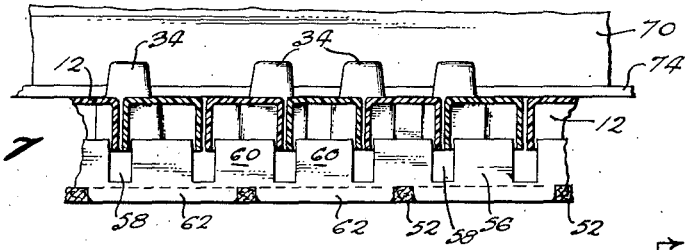

Fig. 7

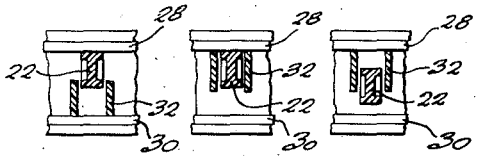

Fig. 8 Fig. 9 Fig. 10

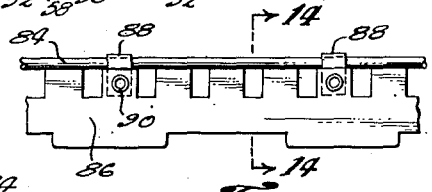

Fig. 13

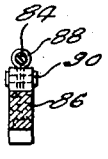

Fig. 14

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HAMMER ACTION FOR MUSICAL INSTRUMENTS

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Application October 26, 1948, Serial No. 56,532

16 Claims. (Cl. 84—403)

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This invention relates to musical instruments, and more particularly to a toy piano.

The primary object of the present invention is to generally improve toy pianos. A more particular object is to provide a simplified key and hammer action. Another object is to design the parts for ease of assembly, thereby decreasing labor cost in manufacture of the instrument. More specific objects are to improve the pivoting of the hammer on the key, and the pivoting of the key in the instrument. Further objects are to improve the means for guiding and locating the keys, and for limiting the motion thereof.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, our invention resides in the toy piano elements and their relation one to another as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

Fig. 1 is a perspective view showing a toy piano embodying features of the present invention;

Fig. 2 is a fragmentary plan view with a part of the case broken away;

Fig. 3 is a section taken approximately in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a section taken approximately in the plane of the line 4—4 of Fig. 2, with a black key depressed;

Fig. 5 is a section through the hammer taken approximately in the plane of the line 5—5 of Fig. 4;

Fig. 6 is a fragmentary section taken approximately in the plane of the line 6—6 of Fig. 3;

Fig. 7 is a section taken approximately in the plane of the line 7—7 of Fig. 3;

Figs. 8, 9 and 10 are schematic sections taken approximately in the plane of the line 8—8 of Fig. 3 and are explanatory of the key action.

Fig. 11 is a side elevation of a modified key;

Fig. 12 is a section taken approximately in the plane of the line 12—12 of Fig. 11;

Fig. 13 is a fragmentary elevational view of a modified fulcrum; and

Fig. 14 is a section through the same taken in the plane of the line 14—14.

Referring to the drawing, and more particularly to Fig. 1, the musical instrument is here illustrated as a toy piano of the spinet type. It will be understood that the key and hammer action may be applied to other musical instruments having sound-producing means different from that here shown, or located in cases of different configuration. However, the compactness of the hammer action, making it suitable for a spinet case, is one of its advantages. It should also be understood that the individual keys need not be miniature in dimension, and in fact in the particular toy here shown the white and black keys are each of standard size, although the keyboard has only two and a half octaves.

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Referring now to Fig. 3, the key 12 has a rearward extension 14, and is pivoted at 16 intermediate the key and extension. The free end of the extension 14 carries a hammer 18, the head end 20 of which extends towards the forward end of the key, and the tail end 22 of which extends beyond the pivot 24 of the hammer. The sound producing means 26 is disposed over the hammer, and a stop bar 28 is disposed above the tail 22 of the hammer. It will be evident that when the key is depressed the pivot 24 is raised, thus raising the hammer head 20 to strike the sound producing means 26.

Considering the arrangement in greater detail, another stop bar 30 is preferably disposed below the rear end 32 of key extension 14. The proportioning and disposition of the parts is such that when the key 12 is in raised position, the part 32 rests on bar 30, and the tail 22 rests (bearing upwardly) on bar 28. The latter contact limits the downward movement of the head 20, but is not essential because other motion limiting means might be employed, in which case the tail 22 might be spaced downwardly from the bar 28 when the key is in rest position. The advantage of the present arrangement is that cushioning material, specifically, strips of felt at 28 and 30, act as silencing means for the different movements. The head 20 does not hit or rest on the extension 14. This relationship or rest position is shown in solid lines in Fig. 3. When the key is depressed, as indicated in broken lines in Fig. 3, the pivot 24 is raised, thus raising the hammer 20, and the parts momentarily take a new position, shown in broken lines. This relation of the parts is also shown in Fig. 9 of the drawing. However, the hammer head 20 continues its upward movement under inertia and so strikes the sound producing means 26, as is best shown by the broken line position in Fig. 4. The relation of the tail parts at this time is also shown in Fig. 10. After striking the sound producing means and setting the same into vibration, the hammer immediately falls back out of the way to its rest position, this being shown in solid lines in Figs. 4 and 9, and in broken lines in Fig. 3.

Thus the proportioning of the parts is preferably such that when the key is depressed the extension 32 bears against the upper stop bar 28, and the tail 22 bears against the top bar 28, at which time, however, the head 20 has not risen sufficiently to reach the sound producing means. When the head continues rising by inertia until it strikes the sound producing means, the tail 22 moves downwardly toward but does not reach the bottom stop bar 30. For this reason, and also because of the immediate drop of the hammer, there is no damping of the vibration at 26.

The keys and hammers are preferably molded out of a suitable plastic. For ease in molding it is preferably a thermoplastic material, although a thermosetting material could be employed. The key 12 and extension 14 are preferably molded out of a single piece of white plastic. Referring to Fig. 4, the black key 34 and its extension 36 are preferably molded out of a single piece of black plastic. However, we have also made keys in which the key portion is molded separately from the extension, the two being subsequently overlapped and cemented together. In that case the extensions may all be of one color. The hammer with its head and tail is also preferably molded in one piece, and in this case the color is, of course, immaterial.

The key extension as molded is preferably bifurcated at its rear end, thus providing the spaced walls 32 best shown in Fig. 8. These walls are provided with bearings to receive trunnions 24, which are preferably molded integrally with the hammer. The walls 32 are preferably notched from one edge to the bearings, as is indicated by the notch 38 in Fig. 3. The notches converge toward the bearings to a size smaller than the diameter of the trunnions and bearings, but not much smaller, so that the trunnions may be pressed into the bearings with a snap fit. Thus the parts are readily assembled together and remain in assembled relation.

The keys also are preferably pivoted in the piano with a detachable or snap fit. Thus in Fig. 3 it will be seen that the side walls 40 of the key are provided with bearings and with notches 42 leading upwardly from the bottom of the walls to the bearings, said notches converging toward the bearing holes to a dimension somewhat smaller than the diameter of the holes. The pivot or fulcrum may be a rod, but in the present case is a round bead 16 at the upper edge of a flat strip 44. To mount the keys on the strip 44 they are simply pressed downwardly over the beaded edge 16. This does not limit the keys against sideward movement, but that is taken care of by additional means next described.

In Figs. 2 through 6 it will be seen that the strip 44 is riveted or eyeletted to a strip 46 which is preferably made of a suitable fibre board or thick, heavyweight cardboard or paperboard. The latter is secured edgewise beneath the keyboard, and in effect the assembly of two strips comprises an edgewise strip with a fulcrum rod at the top. The upper edge of the strip 46 is recessed to form projections which fit between the side walls of the keys, thus locating the keys against sideward movement. This is best shown in Fig. 6, in which it will be seen that strip 46 is notched or castellated along its upper edge, thus forming recesses 48 which receive the side walls 40 of the white keys and the side walls 50 of the immediately adjacent black keys. Of course, there is adequate clearance for free action of the keys, and as is shown, the side walls of the keys are made smooth and straight, such that the keys may bear against one another without appreciable friction. However, the locating notches avoid the possibility of all of the keys throughout the keyboard being moved wholly in one direction or the other, with excess cumulative clearance space at one end or the other of the keyboard.

The paperboard strip 46 may be secured in position in a number of ways. As here illustrated it is strongly secured by mounting it with a mortise and tenon connection on a thick paperboard or fibre board bottom wall 52 forming a part of the instrument case and located beneath the keyboard. As is best shown in Fig. 6, the strip 46 is recessed to provide tongues or tenons 54, and the bottom wall 52 is slotted or mortised to tightly receive the tenons 54. The parts are glued together, thus forming a sturdy, rigid structure.

The white keys are guided by additional guide means located near their forward ends. This is done by means of a guide strip shown at 56 in Figs. 3, 4 and 7. The strip 56 is notched or castellated on top, thus forming recesses 58 which receive the adjacent side walls of the white keys. The tops of the projections 60 between the recesses 58 are preferably made of suitable height to limit downward movement of the keys when depressed. It was previously mentioned that the ends of the key extensions bear against top stop 28 when the key is depressed, and that limitation is preferred in order to provide maximum movement of the pivot 24 of the hammer. Nevertheless the stops 60 at the forward ends of the keys are useful in protecting the key against excessive downward pressure. Thus a slight clearance may be left between the keys and the stops 60 when the key is depressed gently, but on increased pressure the key yields slightly and then rests on the stops 60. The guide strip 56 thus acts also as a stop strip.

The guide strip 56 is secured in position much as was described for the fulcrum strip 46, it being shaped on bottom to provide tenons 62 which are received in mating slots or mortises in the bottom wall 52 of the instrument. Here again the strip and bottom wall are glued together.

The sound producing means is preferably stringless, and various known constructions may be employed, such as those using plates, tubes, forks, etc. In the present case the sound producing means consists of a metal bar 64 having a series of spring steel rods 66 mounted therein. The rods may be simple round rods and, of course, vary in length along the keyboard to produce the desired tones or vibration frequencies. To secure the rods in bar 64 the bar may be provided with a series of holes fitting the rods, and if desired the stationary ends of the rods may be flattened somewhat before driving the rods through the holes, thus insuring a force fit.

Other details of construction will probably be apparent from study of the drawing. However, it may be pointed out that bar 64 is preferably secured to the top wall 68 (Fig. 3) of the piano case, the latter preferably being made of wood. The front wall 70 (Fig. 1) is slid downwardly into position from above, with its ends received in grooves formed in the end walls 72. The lower edge of wall 70 is preferably provided with a heavy sponge rubber strip 74 (Fig. 3) which rests against the white keys just back of the raised portions of the black keys, and which seals the

tops of the keys without inhibiting movement thereof. Of course, the movement at this point is slight because the wall 70 is located substantially over the pivot bar of the keys.

The hammers 18 are broadened at the head 20, as is best shown in Fig. 2. The ends may be recessed as shown at 76 in Figs. 3 and 5 to lighten the same and to lessen the amount of plastic material needed.

The keys 12 and extensions 14 are preferably hollow. As here illustrated the keys comprise top and side walls, and the same applies to the extensions 14. At the rear end 32, however, there is neither a top wall nor a bottom wall, the side walls 32 being left to receive the tail 22 of the hammer. In Fig. 3 it will be seen that the side walls of the white keys are recessed upwardly somewhat, thus conserving material. From inspection of Fig. 2 it will be appreciated that the white keys are of four types which differ when viewed in plan, thus providing the necessary room to receive the black keys. This, of course, is conventional.

In one specific case the bearing hole for the key was 0.133" in diameter and the slot leading to the same had an entrant width of 0.1875" and a minimum width at the bearing hole of 0.118". In the case of the bearing for the hammer trunnion, the bearing hole had a diameter of 0.129", and the minimum width of the entrant slot was 0.121", the initial or entrant width being 0.156". The initial width is, of course, not at all critical, and even the difference in width at the bearing hole is not wholly critical, but the dimensions mentioned above provide a desired snap fit. It must be understood that these dimensions are given solely by way of illustration, and not in limitation of the invention.

A modified construction for the key is shown in Figs. 11 and 12. In this case the side walls 80 are maintained at full height, and most of the bottom of the key is closed by means of a bottom wall 82, this consisting of a rectangular piece of plastic which is secured in position, as by means of a cement or solvent. The bottom edges of the side walls 80 may be stepped to receive the edges of the bottom wall.

A modified form of fulcrum strip is shown in Figs. 13 and 14. In this case the fulcrum rod 84 is a cylindrical rod which is set directly above the heavy paperboard strip 86. The latter is provided with recesses or castellations on top, and with tenons on bottom, just as was previously described. However, to secure the rod 84 to the strip 86 thin bands of metal 88 are bent around the rod at intervals, the lower ends being received in a cut or split in the top of the strip 86, and being secured in position by appropriate eyelets 90. The rod 84 may be made of metal or of a plastic. In the case of the instrument here shown in Figs. 3, 4 and 6, in which the rod is a bead formed integrally with a web, the beaded strip is preferably made of a plastic.

The top and bottom stop bars 28 and 30 previously referred to are preferably made by forming a channel of strips of wood, there being a top strip 92 (Fig. 4), a bottom strip 94, and a connecting or spacer strip 96. Layers of felt 28 and 30 are cemented to the top and bottom strips 92 and 94. The felt is preferably of substantial thickness, say ⅛", and in that sense it may be said that the complete stop bars are composite bars consisting of felt or silencing material combined with rigid backing material.

It is believed that the construction, method of assembly, and advantages of our improved musical instrument will be apparent from the foregoing detailed description. It will also be apparent that while we have shown and described our invention in a preferred form, changes may be made without departing from the spirit of the invention, as sought to be defined in the following claims.

We claim:

1. A key and hammer action for a toy piano, said action comprising a key with a rearward extension, means pivoting the same intermediate the extension and key, the free end of the extension extending upward and being bifurcated and pivotally carrying between the bifurcations thereof a hammer the head end of which extends toward the key and above the extension, and the tail end of which extends beyond the pivot of the hammer between the bifurcations of the extension, sound producing means disposed over said hammer, a first felted stop bar disposed below the rear end of the extension, and a second felted stop bar disposed above the rear end of the extension and hammer in such a position as to act as a stop for both, said latter stop bar being fixed at such height as to prevent the bottom end of the hammer head from striking the extension even when the key is in its raised or rest position.

2. A key and hammer action for a musical instrument, said action comprising a key with a rearward extension, means pivoting the same intermediate the extension and key, the free end of the extension pivotally carrying a hammer the head end of which extends towards the key, and the tail end of which extends beyond the pivot of the hammer, sound producing means disposed over said hammer, and stop bars disposed below and above the rear end of the extension and hammer, whereby when the key is in raised or rest position the extension rests on the lower stop bar, and when the key is in depressed position the tail bears against the top stop bar, the proportioning and disposition of the parts being such that at the latter time the hammer head is not raised sufficiently to reach the sound producing means, and when the hammer head continues rising by inertia it strikes the sound producing means and the tail moves downwardly toward but does not reach the bottom stop bar.

3. A key and hammer action for a toy piano, said action comprising a key with a rearward extension, means pivoting the same intermediate the extension and key, the free end of the extension being bifurcated and pivotally carrying between the extension thereof a hammer the head end of which extends toward the key, and the tail end of which extends beyond the pivot of the hammer between the bifurcations of the extension, sound producing means disposed over said hammer, and felted stop bars disposed below and above the rear end of the extension and hammer, whereby when the key is in raised position the extension rests on the lower stop bar and the tail bears against the upper stop bar, and when the key is in depressed position the extension bears against the top stop bar and the tail bears against the top stop bar, the proportioning and disposition of the parts being such that at the latter time the hammer head is not raised sufficiently to reach the sound producing means, and when the hammer head continues rising by inertia it strikes the sound producing means and the tail moves downwardly toward but does not reach the bottom stop bar.

4. A key and hammer combination as defined in claim 2, in which the key and extension are molded integrally out of a plastic, and in which the entire hammer is molded integrally out of a plastic.

5. A key and hammer combination as defined in claim 2, in which the sound producing means is stringless and comprises a bar carrying a series of spring steel rods of varying length, the rods being disposed over the hammers.

6. A key and hammer combination as defined in claim 1, in which the key and extension are molded integrally out of a plastic, and are hollow, and in which the entire hammer is molded integrally out of a plastic, and is solid, and in which the sound producing means is stringless and comprises a bar carrying a series of spring steel rods of varying length, the rods being disposed over the hammers.

7. A musical instrument comprising a keyboard made up of collaterally disposed horizontal hollow keys each having vertical side walls, a stationary fulcrum strip mounted edgewise beneath said keyboard and extending transversely of the keys, the upper edge of said fulcrum strip being notched or castellated to form projections which fit between the side walls of the keys in order to locate the keys against sideward movement, said fulcrum strip having a continuous stationary fulcrum rod secured along its upper edge, and the side walls of said keys being notched upwardly from the bottom edges to form bearings to receive said fulcrum rod, whereby the keys may be placed downward from above into position on the fulcrum rod.

8. A musical instrument comprising a keyboard made up of collaterally disposed horizontal hollow keys each having vertical side walls, a stationary fulcrum strip mounted edgewise beneath said keyboard and extending transversely of the keys, the upper edge of said fulcrum strip being notched or castellated to form projections which fit between the side walls of the keys in order to locate the keys against sideward movement, said fulcrum strip having a continuous stationary fulcrum rod secured along its upper edge, the side walls of said keys being notched upwardly from the bottom edges to form bearings which fit over said fulcrum rod, whereby the keys may be placed downward from above into position on the fulcrum rod, and said strip having a thickness much greater than the diameter of said rod, and thereby bearing against the inside of the side walls of the keys despite said notches in said side walls.

9. A toy piano comprising a case, and a keyboard made up of collaterally disposed hollow keys each having top, front and side walls, said case having a bottom wall disposed beneath said entire keyboard, a key guide strip mounted edgewise on said bottom wall beneath the forward ends of the keys, the lower edge of said guide strip being recessed to form tenons, and said bottom wall being slotted to receive said tenons, the upper edge of said guide strip being castellated to form projections which fit between the side walls of the keys in order to locate the keys against sideward movement, and the tops of the projections of said strip being of suitable height to limit the maximum downward movement of the keys when fully depressed.

10. A musical instrument comprising a keyboard made up of collaterally disposed hollow keys each having top and side walls, a stationary fulcrum strip and a stationary key guide strip each mounted edgewise beneath said keyboard in collateral spaced relation, the key guide strip being located near the ends of the keys, the upper edges of both of said strips being castellated to form projections which fit between the side walls of the keys in order to locate the keys against sideward movement, said fulcrum strip having a continuous stationary fulcrum rod secured along its upper edge, and the side walls of said keys being notched upwardly from the bottom edges to form bearings which receive said fulcrum rod.

11. A musical instrument comprising a keyboard made up of collaterally disposed hollow keys each having top and side walls, a stationary fulcrum strip and a stationary key guide strip each mounted edgewise beneath said keyboard in collateral spaced relation, the key guide strip being located near the ends of the keys, the upper edges of said strips being castellated to form projections which fit between the side walls of the keys in order to locate the keys against sideward movement, said fulcrum strip having a continuous stationary fulcrum rod secured along its upper edge, the side walls of said keys being notched upwardly from the bottom edges to form bearings which receive said fulcrum rod, said fulcrum strip having a thickness much greater than the diameter of said fulcrum rod and thereby bearing against the inside of the side walls of the keys despite said notches in said side walls, and the tops of the projections of said key guide strip being of suitable height to limit the maximum downward movement of the keys when fully depressed.

12. A key and hammer action for a toy piano, said action comprising a key with a rearward extension, means pivoting the same intermediate the extension and key, the free end of the extension extending upward and pivotally carrying a hammer the head end of which extends toward the key and above the extension, and the tail end of which extends beyond the pivot of the hammer, sound producing means disposed over said hammer, stop means disposed above the rear end of the extension and hammer, one of said extension and hammer having relatively rigid bearings and the other having a rigid pivot, said bearings being open at one side with a dimension slightly smaller than the diameter of the pivot, whereby the hammer and extension may be pressed into assembled relation with a snap fit.

13. A key and hammer action for a musical instrument, said action comprising a key with a rearward extension, fulcrum means pivoting the same intermediate the extension and key, the free end of the extension pivotally carrying a hammer the head end of which extends towards the key, and the tail end of which extends beyond the pivot of the hammer, sound producing means disposed over said hammer, and a stop bar disposed above the rear end of the extension and hammer, whereby when the key is in depressed position the tail bears against the stop bar, the proportioning and disposition of the parts being such that at the latter time the hammer head is not raised sufficiently to reach the sound producing means, and when the hammer head continues rising by inertia it strikes the sound producing means, one of said extension and hammer having a rigid pivot and the other of said extension and hammer having a relatively rigid bearing receiving said pivot, said bearing being open at one side with a dimension slightly smaller than the diameter of the pivot, whereby

the hammer and extension may be pressed into assembled relation with a snap fit.

14. A key and hammer action for a musical instrument, said action comprising a key with a rearward extension, fulcrum means pivoting the same intermediate the extension and key, the free end of the extension pivotally carrying a hammer the head end of which extends towards the key, and the tail end of which extends beyond the pivot of the hammer, sound producing means disposed over said hammer, and a stop bar disposed above the rear end of the extension and hammer, whereby when the key is in depressed position the tail bears against the stop bar, the proportioning and disposition of the parts being such that at the latter time the hammer head is not raised sufficiently to reach the sound producing means, and when the hammer head continues rising by inertia it strikes the sound producing means, one of said extension and hammer having a rigid pivot and the other of said extension and hammer having a relatively rigid bearing receiving said pivot, said bearing being open at one side with a dimension slightly smaller than the diameter of the pivot, whereby the hammer and extension may be pressed into assembled relation with a snap fit, said key having side walls with fulcrum holes and notches leading convergently upwardly from the bottom of said walls to said holes whereby the key may be pressed downwardly over said fulcrum means with a snap fit.

15. A key and hammer action for a toy piano, said action comprising a key with a rearward extension, rounded fulcrum means pivoting the same intermediate the extension and key, the free end of the extension being bifurcated and pivotally carrying between the extensions thereof a hammer the head end of which extends toward the key, and the tail end of which extends beyond the pivot of the hammer between the bifurcations of the extension, sound producing means disposed over said hammer, a stop bar disposed above the rear end of the extension and hammer, whereby when the key is in depressed position the extension and the tail bear against the stop bar, the proportioning and disposition of the parts being such that at the latter time the hammer

head is not raised sufficiently to reach the sound producing means, and when the hammer head continues rising by inertia it strikes the sound producing means, and the bifurcations of said extension having rigid bearings which are opened with the opening converging toward said bearings to a reduced dimension so slightly smaller than the bearing that the pivot may be pressed into the bearing with a snap fit.

16. In a toy piano, a slender generally cylindrical fulcrum or pivot having a horizontal axis and extending for the length of the key board, an upright support member disposed beneath said fulcrum for supporting the same along its length, and a plurality of hollow molded plastic piano keys each having a main horizontal top wall, a front wall, and side walls, all of said walls being integrally molded out of a suitable molding plastic in a single molding operation, said side walls having circular fulcrum holes dimensioned to fit said fulcrum, and upright notches in said side walls leading upwardly from the bottom edges of said side walls to said holes, said notches converging toward the holes to a size somewhat smaller than the diameter of the fulcrum, whereby said key may be pressed downwardly over said fulcrum with a snap fit, the snap fit resulting solely from the resilience of the material of the side walls themselves.

JEROME D. ENOCHS.
ROY M. BROWN.

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