Sept. 29, 1959 J. W. McBRIDE 2,906,158

STRINGED MUSICAL INSTRUMENT OF THE PERCUSSION TYPE

Filed July 27, 1953

3 Sheets-Sheet 1

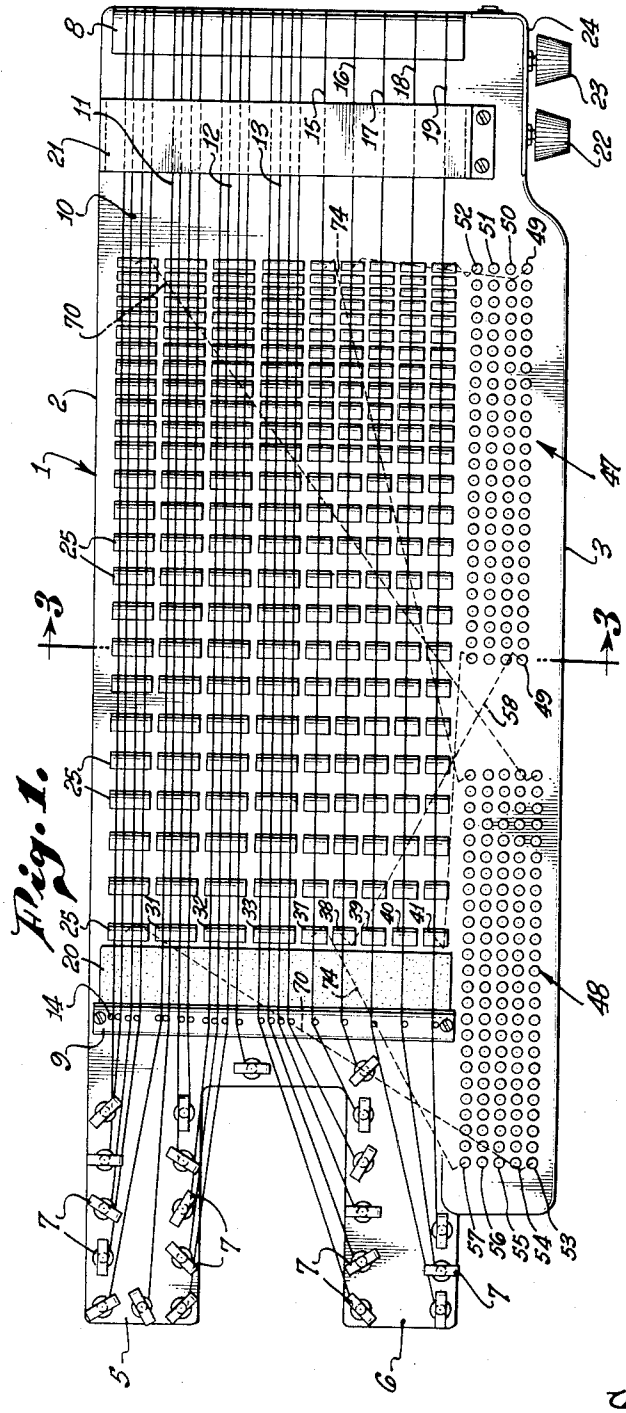


Fig. 1.

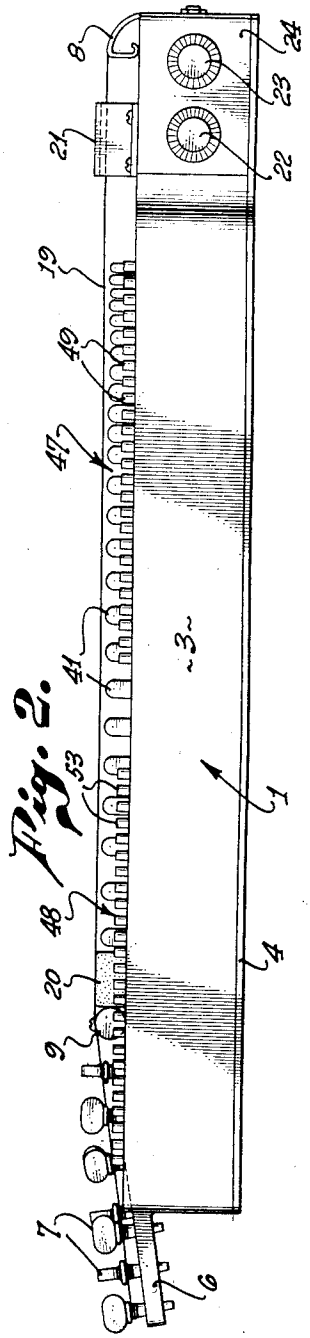


Fig. 2.

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Fig. 3.

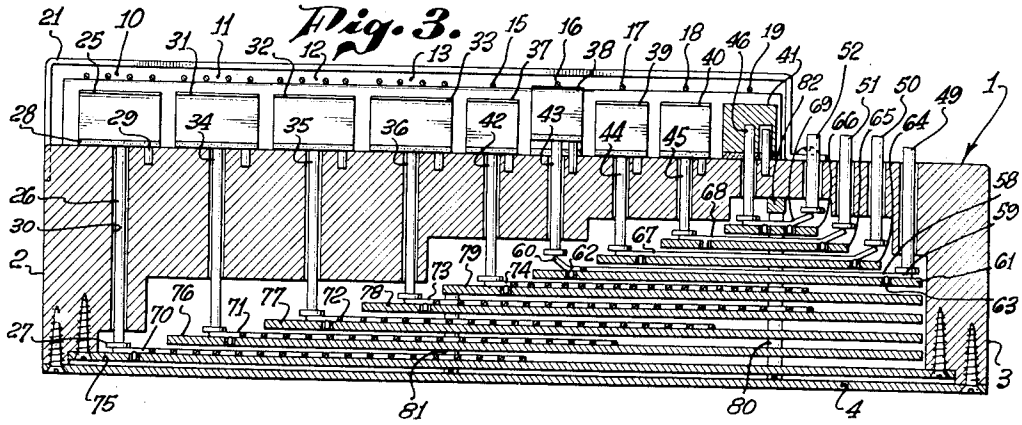
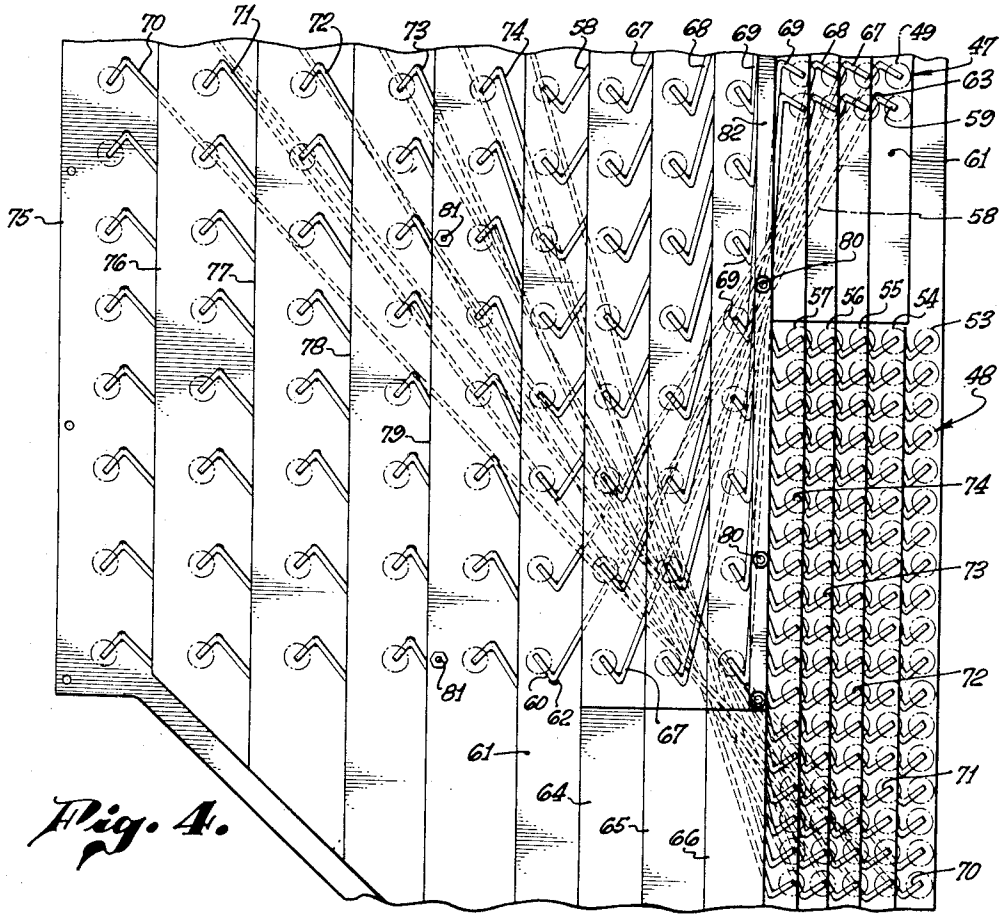


Fig. 4.



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Fig. 5.

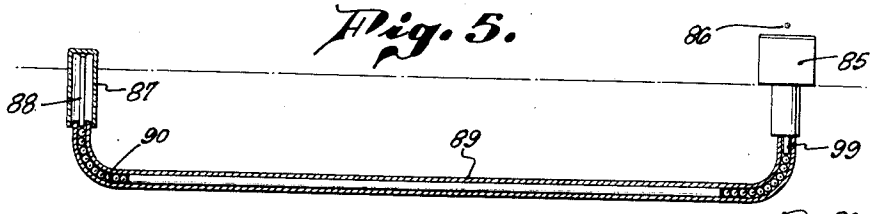


Fig. 6.

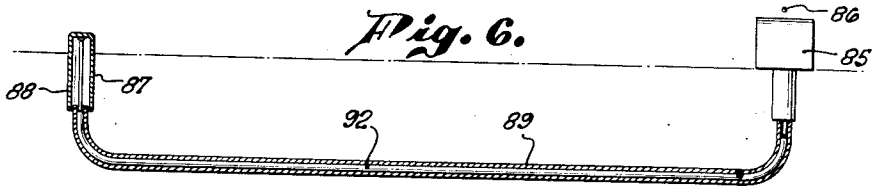


Fig. 7.

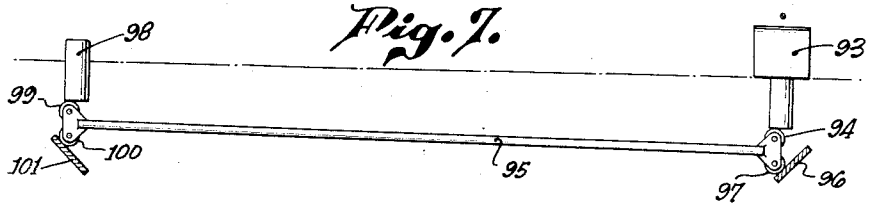


Fig. 8.

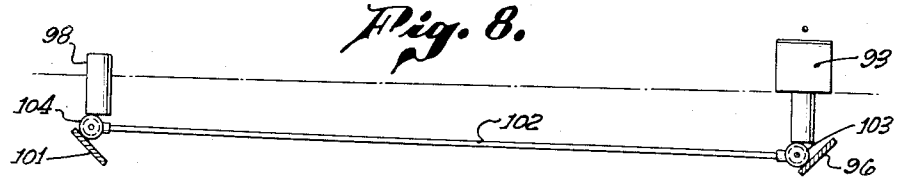


Fig. 9.

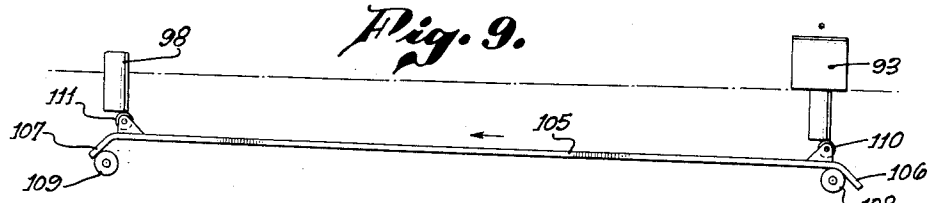


Fig. 10.

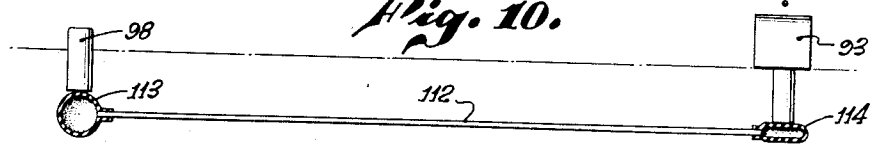
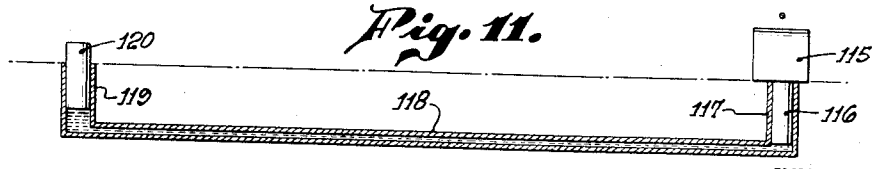


Fig. 11.



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2,906,158

STRINGED MUSICAL INSTRUMENT OF THE PERCUSSION TYPE

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Application July 27, 1953, Serial No. 370,491

5 Claims. (Cl. 84—315)

This invention relates to stringed musical instruments, and more particularly of the type that can be played by percussion or plucking.

When a tensioned string is struck intermediate its length, the string provides two vibrating portions so long as contact is maintained between the string and the fret or other device that struck the string. The ancient clavicord operated on this principle; and by this means desired musical intervals or chords can be produced by appropriate choice of the place where the string is struck.

It is one of the objects of this invention to improve in general, instruments of this character.

It is another object of this invention to make it possible to provide a compact instrument of this character that is readily portable, and yet provides numerous strings and movable frets.

This result is accomplished by the aid of a series of closely nested operators for the frets, these operators being selectively actuated from any of a number of manually operable push buttons. These push buttons are arranged on a keyboard, or the like, that is conveniently located for operation by the artist.

In order further to reduce the size of the instrument, the operators are preferably arranged in a plurality of parallel layers, incapable of interfering with each other.

Accordingly, it is another object of this invention to provide such a multi-layer arrangement for the bank of operators.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a plan view of an instrument incorporating the invention, several of the fret actuating levers being indicated diagrammatically in dotted lines;

Fig. 2 is a side elevation thereof;

Fig. 3 is an enlarged sectional view taken along a plane corresponding to line 3—3 of Fig. 1;

Fig. 4 is a fragmentary top view of the mechanism; and

Figs. 5 to 11, inclusive, are diagrammatic illustrations showing modifications of the means for operating the frets.

The body 1 (Figs. 1 and 3) of the instrument is shown in hollow form; it may be made of any appropriate material, such as plastic or metal. This body 1 has side walls 2 and 3 and is provided with a cover member 4 enclosing the mechanism located within the body 1.

The body 1 has the integral neck portions 5 and 6 (Figs. 1 and 2). These neck portions are shown as slanting and accommodating the tuning mechanism, such as the pegs 7.

At the right-hand end of the body 1, there is located a birdge 8 over which are stretched a series of tensioned strings. At the left-hand end of the body another transverse bridge member 9 is provided.

Four of the sets of strings 10, 11, 12 and 13 are shown, in this instance, as each comprising four individual strings. These strings are stretched by the aid of the pegs 7 located in the extension 5. They are maintained in parallel relation by the aid of pins 14, attached to bridge 9. At the right-hand end the strings may be appropriately anchored in apertures in the bridge member 8.

Five additional strings 15, 16, 17, 18 and 19 are similarly tensioned across the bridge members 8 and 9.

A pad 20 of felt is placed adjacent the bridge 9 in order to provide a damping effect on the strings. Furthermore, a pick-up structure is disposed in operative relationship to the strings, which are of magnetic material. A cover 21 (Figs. 1 and 3) is appropriately disposed over the pick-up mechanism which is merely diagrammatically indicated in these figures.

Control knobs 22 and 23 serve as adjustments for the amplitude or intensity of the amplifiers connected to the pick-up device. These knobs may be appropriately supported on a bracket 24 (Figs. 1 and 2) appropriately attached to the exterior of wall 2.

The set of strings 10 is arranged to be struck by any one or more of the frets 25, comprising a set. The longitudinal spacing of these frets is arranged so that chords of the desired type are obtained by the vibration of any desired number of string sections defined by contact of any number of frets with the string. Each of the frets 25 is movable upwardly, as viewed in Fig. 3, so as to strike all of the strings 10 simultaneously. Thus each fret 25 is of substantial width, and its upper end may be rounded. Thus by appropriate operation of frets along one or more strings, definite harmonic chords can be produced by plucking or by percussion.

Each of the frets 25 is carried on the end of a push rod 26 (Fig. 3), guided by aperture 30 in body 1. The push rod has an enlarged head 27 at its lower end. Furthermore, a felt pad 28 is attached to the bottom of each fret 25. It is also provided with a recess for the reception of a guide pin 29, attached to body 1. This guide pin 29 prevents rotation of the fret 25 about the axis of the push rod 26.

Each of the sets of strings 11, 12 and 13 is similarly provided with its own set of frets 31, 32 and 33, respectively, conforming in spacing with frets 25. The frets 31 are also provided with the push rods 34 which are somewhat shorter than the push rods 26. Similarly, the sets of frets 32 and 33 are provided with push rods 35 and 36, respectively, each progressively shorter.

Strings 16, 17, 18 and 19 have their sets of frets numbered respectively 37, 38, 39, 40 and 41. They are of similar construction as the frets heretofore described, except that they are narrower since they cooperate with only one string. The push rods 42, 43, 44, 45 and 46 are joined to these frets respectively and are progressively shorter, as indicated most clearly in Fig. 3.

Operation of the sets of push rods 26, 34, 35, 36, 42, 43, 44, 45 and 46 is effected by the aid of groups of push buttons arranged in rows, and in a convenient place for operation by a player. Thus, there is a right-hand group 47 and a left-hand group 48 (Fig. 1) arranged along one edge of the body 1. The lowermost row 49 of group 47 constitutes a set of push buttons for operating the frets 38.

The succeeding rows 50, 51 and 52 operate frets 39, 40 and 41 respectively.

Similarly, the rows of push buttons 53, 54, 55, 56 and 57 cooperate with the sets of frets 25, 31, 32, 33 and 37, respectively. Those in both groups 47 and 49, corresponding to sharp notes may be black, or the body 1 may have black stripes extending across these buttons. Accordingly, the appearance of the groups of buttons may be similar to that of a piano keyboard.

In the form shown in Figs. 1 to 4, inclusive, bell crank levers are used, coupling the respective push buttons with the push rods for operating the frets. For example, the lowermost row of push buttons 49 in the group 47 operates the set of levers 58. These levers are shown diagrammatically in Fig. 1 by single dotted lines. They are shown to best advantage in Figs. 3 and 4.

Each lever 58 is in the form of a bar or rod, bent at one end to form an operating crank 59 engageable by the lower end of the push button. The lever is also bent at its opposite end to form a crank 60 operating the lower end of the corresponding push rod 43. The main portion of the rod intermediate the cranks serves as a pivoting means for the lever. These levers lie upon a flat support 61 and are appropriately confined against substantial movement away from this flat support. Furthermore, the flat support 61 is provided with clearance apertures for the projections 62 and 63 attached to the lever 58. These projections thus maintain the levers 58 in nested relationship.

In Fig. 3, one of the push buttons 49 is shown as depressed so that it operates one of the frets 38.

Located immediately above the flat support 61 are similar flat supports 64, 65 and 66. These supports 64, 65, and 66 are progressively narrower so that the portions adjacent the edges of these supports are left uncovered. In this way, access to the push rods 42, 43, 44, 45 and 46, and the buttons 49, 50, 51 and 52, by the cranks 59 and 60 is permitted. Furthermore, the flat supports 61, 64, 65 and 66 are quite closely spaced so as to provide the function of confining the levers against substantial movement away from the supports. Thus the levers 58 are located between the lower support 61 and the immediately adjacent upper support 64.

Similarly, a group of levers 67 lies between the supports 64 and 65. These levers serve to operate the push rods 44 associated with frets 39. These levers are also nested in side by side relation and are similarly provided with projections cooperating with apertures in the support 64, for maintaining them in this nested relationship.

Another set of levers 68 serves similarly to couple the push buttons 51 to the push rods 45. Still another set of levers 69 couples the push buttons 52 to the push rods 46. All the levers of one set or group, except levers 69, lie in nested relationship between the supports 61, 64, 65 and 66. Levers 69 are confined by a strip 82 adjacent to the bottom surface of body 1.

As shown most clearly in Fig. 3, the sets of push buttons 49, 50, 51 and 52 are slidable in appropriate guide apertures in the body 1. Furthermore, the right-hand edges of the series of supports 61, 64, 65 and 66 form a stepped relationship to permit operation of the push buttons without interference with the supports.

The sets of push rods 26, 34, 35, 36 and 42 are similarly actuated by the sets of levers 70, 71, 72, 73 and 74. These levers are constructed in substantially the same manner as the levers heretofore described, and they are nested and are operated respectively by the sets of push buttons 53, 54, 55, 56 and 57. These levers are confined against substantial movement away from the respective supports 75, 76, 77, 78 and 79 by the aid of the adjacent supports.

Each lever in a set has slightly different configuration in order to extend between the respective push button and the push rod which it is intended to operate. This is indicated in Figs. 1 and 4. Nevertheless, as heretofore stated, the arrangement is such that the levers do not interfere with each other as in each layer the levers can be appropriately nested side by side.

In order to attach the supports 61, 64, 65, 66, 70, 71, 72, 73 and 74 in proper spaced relationship, use is made of spacer posts 80 and 81 (Figs. 3 and 4). Spacer post 80 extends through all of the supports and appropriate means are provided for spacing the supports apart as by collars, or the like. The post 80 is accommodated in the strip 82.

Furthermore, the supports 75, 76, 77, 78 and 79 are held in spaced relationship by the supplemental spacer post 81.

Ordinarily, when the instrument is played the body 1 is held in a horizontal position. In this way the weight of the frets is sufficient to cause the group of push buttons 47 and 48 to be urged upwardly. However, by depressing any one push button a corresponding string or set of strings is struck by the fret associated with the push button.

The group of push buttons 47 and 48 are conveniently located at a place where they may be most readily reached by the operator.

Although simple bell crank levers are utilized in the form of the invention shown in Figs. 1 to 4 inclusive, other forms of mechanisms may be utilized.

For example, in Fig. 5, the movable fret 85, which cooperates with the string 86, may be moved by the aid of the push button 87. This push button 87 is hollow and has a central rod 88. A tube 89, having curved upturned ends, is filled with balls 90. The left-hand terminal ball may be urged inwardly of the tube by the rod or plunger 88.

A thrust is imparted to the right-hand terminal ball by the intermediate balls. This right-hand ball is moved upwardly, to operate the push rod 91 connected to the fret 85.

In place of the balls for transmitting the thrust from the push button 87 to the fret 85, a flexible shaft structure 92 may be utilized, as indicated in Fig. 6.

In Fig. 7, the fret 93 is urged upwardly by a roller 94 which is supported in the end of a rod 95. This roller 94 is caused to move upwardly by virtue of the provision of an inclined plate 96. With the inclined surface of this plate cooperates a roller 97 also supported in the right-hand end of the rod 95. As rod 95 moves to the right the roller 97 moves up on plate 96. To move the rod 95 toward the right, use is made of a push button 98 which may urge a roller 99 downwardly. This roller 99 is mounted upon the left-hand end of the rod 95. The roller 100, also mounted on the left-hand end of rod 95, cooperates with the inclined surface of a plate 101.

Accordingly, a downward thrust on a push button 98 causes the rod 95 to move toward the right. The roller 100 moves downwardly on plate 101, while roller 97 rides upwardly on plate 96. Accordingly, the roller 94 moves upwardly to operate the fret 93.

A simplified form of this type of mechanism is illustrated in Fig. 8. In this instance the rod 102 carries single rollers 103 and 104 respectively, at its opposite ends. These rollers cooperate with the plates 96 and 101 in the same manner as in Fig. 7.

In the form shown in Figs. 7 and 8, the rods 95 and 102 are urged toward the right when the push button 98 is operated. In the form shown in Fig. 9, the arrangement is such that the rod 105 is moved toward the left. For this purpose the rod 105 has oppositely inclined ends 106 and 107. These ride respectively on the rollers 108 and 109 mounted on stationary axes. Roller 110 is mounted on rod 105 underneath the fret 93 and roller 111 is mounted underneath the push button 98. These rollers are carried by the rod 105.

Operation of a push button 98 causes the inclined end 107 of rod 105 to move toward the left and over the roller 109. At the same time, the end 106 moves up-

wardly with respect to roller **108** and the fret **93** is operated.

In the form shown in Fig. 10, fluid pressure is utilized to effect operation. This fluid pressure may be either liquid or gas pressure. Thus, a hollow tube **112** is appropriately supported and has a compressible bulb **113** of thin rubber at its left-hand end, and an expansible bulb **114** of thin rubber at its right-hand end. In this instance the tube **112** is stationary. The bulbs **113** and **114**, together with the tube **112**, form a hollow sealed space. Accordingly, movement of the plunger **98** to compress the bulb **113** results in a corresponding expansion of the bulb **114**. The expansion of this bulb then causes upward movement of the fret **93**.

In Fig. 11, a cylinder and piston arrangement are provided for hydraulic actuation. In this instance the fret **115** is provided with an integral piston **116** operating in a cylinder **117**. This cylinder **117** is connected as by a conduit **118** to a cylinder **119**. A push button **120** serves as a piston for this cylinder **119**. Accordingly, operation of the push button **120** causes fluid pressure to be exerted on the piston **116**, and the fret **115** is correspondingly moved.

The inventor claims:

1. In a musical instrument: a body having a surface; a pair of substantially parallel string structures supported by the body and extending along said surface; a set of movable fret structures for each string structure and supported by the body beneath the string structures for engagement with spaced portions of the respective string structures; a pair of substantially parallel rows of buttons depressibly carried by the body, the rows being disposed on one side of both of the string structures; a first set of rods interconnecting the buttons of one row with the fret structures of one of the fret sets, a second set of rods interconnecting the buttons of the other row with the fret structures of the other of the fret sets; all of the rods being confined for rotation about their longitudinal axes; the rods of the first set all lying in one common plane substantially parallel to said surface; the rods of the second set all lying in another common plane parallel to and spaced from said one common plane to avoid interference between the rods of the two sets; the rods having means at corresponding ends respectively engageable with the corresponding buttons for rotation of the rods in one direction upon depression of the buttons; the rods having means at their other corresponding ends engageable with the corresponding fret structures for moving the fret structures into engagement with the string structures upon rotation of the rods by said buttons.

2. In a musical instrument: a body having a surface; a pair of substantially parallel string structures supported by the body and extending along said surface; a set of movable fret structures for each string structure and supported by the body beneath the string structures for engagement with spaced portions of the respective string structures; a pair of substantially parallel rows of buttons depressibly carried by the body, the rows being disposed on one side of both of the string structures; a first set of rods interconnecting the buttons of one row with the fret structures of one of the fret sets, a second set of rods interconnecting the buttons of the other row with the fret structures of the other of the fret sets; all of the rods being confined for rotation about their longitudinal axes; the rods of the first set all lying in one common plane substantially parallel to said surface; the rods of the second set all lying in another common plane parallel to and spaced from said one common plane to avoid interference between the rods of the two sets; each rod having a projection extending transversely at one end and engageable with the corresponding button for rotation of the rod by depression of the button; each rod having a projection extending transversely at the other end and engageable with the corresponding fret structure for moving the fret structure into engagement with the string structure upon rotation of the rod.

3. In a musical instrument: a body having a surface; a pair of substantially parallel string structures supported by the body and extending along said surface; a set of movable fret structures for each string structure and supported by the body beneath the string structures for engagement with spaced portions of the respective string structures; a pair of substantially parallel rows of buttons depressibly carried by the body, the rows being disposed on one side of both of the string structures; a first set of rods interconnecting the buttons of one row with the fret structures of one of the fret sets, a second set of rods interconnecting the buttons of the other row with the fret structures of the other fret sets; all of the rods being confined for rotation about their longitudinal axes; the rods of the first set all lying in one common plane substantially parallel to said surface; the rods of the second set all lying in another common plane parallel to and spaced from said one common plane to avoid interference between the rods of the two sets; each rod having a projection extending transversely at one end and engageable with the corresponding button for rotation of the rod by depression of the button; each rod having a projection extending transversely at the other end and engageable with the corresponding fret structure for moving the fret structure into engagement with the string structure upon rotation of the rod; the weight of the fret structures biasing the projections at said one ends into engagement with the buttons for normally positioning the buttons upwardly.

4. In a musical instrument: a body having a surface; a pair of substantially parallel string structures supported by the body and extending along said surface; a set of movable fret structures for each string structure and supported by the body beneath the string structures for engagement with spaced portions of the respective string structures; a pair of spaced substantially parallel rows of buttons depressibly carried by the body, the rows being disposed on one side of both of the string sections; one of the rows of buttons and one of the string structures both being located between the other row of buttons and the other string structure; a first set of rods interconnecting the buttons of said one row with the fret structures for said one string structure, a second set of rods interconnecting the buttons of said other row with the fret structures for said other string structure; all of the rods being confined for rotation about their longitudinal axes; the rods of the first set all lying in one common plane substantially parallel to said surface; the rods of the second set all lying in another common plane parallel to and spaced beneath said one common plane to avoid interference between the rods of the two sets; the rods having means at corresponding ends respectively engageable with the corresponding buttons for rotation of the rods in one direction upon depression of the buttons; the rods having means at their other corresponding ends engageable with the corresponding fret structures for moving the fret structures into engagement with the string structures upon rotation of the rods by said buttons.

5. In a musical instrument: a body; sets of strings supported by the body; sets of movable fret structures, respectively cooperating with the sets of strings, and movably supported by the body beneath the string for determining different modes of vibration of the respective strings; rows of buttons movably supported by the body, each row corresponding respectively to the sets of frets; sets of rods rotatable about their longitudinal axes, and corresponding respectively to the sets of frets and the sets of buttons, and each rod having end portions respectively engageable with the cooperating frets and buttons; the sets of rods being arranged in strata within the body; and means carried by the body for rotatably supporting the rods, including means defining pairs of spaced surfaces between which the strata of rods can extend, one of

said surfaces of each pair providing a supporting surface for the corresponding set of rods, so that the strata do not interfere wtih each other, and so arranged that the button-operated ends of each set of rods be in spaced linear arrangement to cooperate with the cooresponding push button ends.

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