

July 7, 1936.

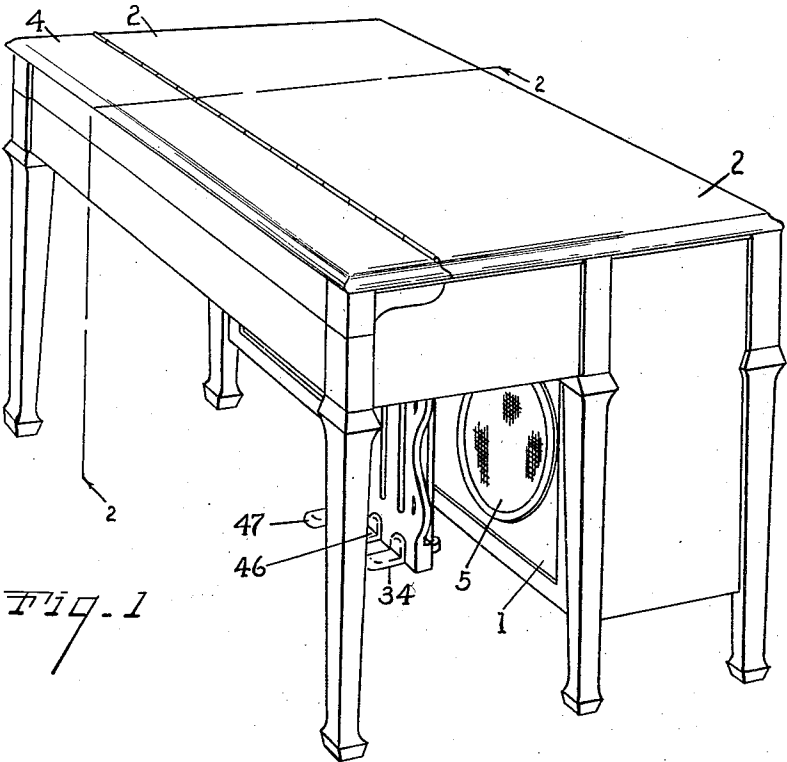
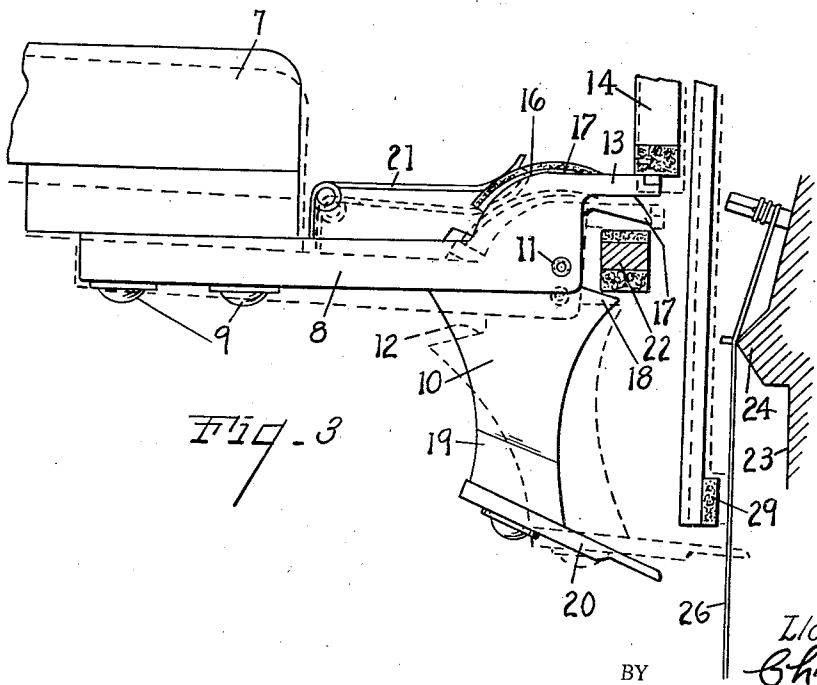
L. A. LOAR

2,046,333

MUSICAL INSTRUMENT

Original Filed Jan. 27, 1934

3 Sheets-Sheet 1



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July 7, 1936.

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MUSICAL INSTRUMENT

Original Filed Jan. 27, 1934 3 Sheets-Sheet 2

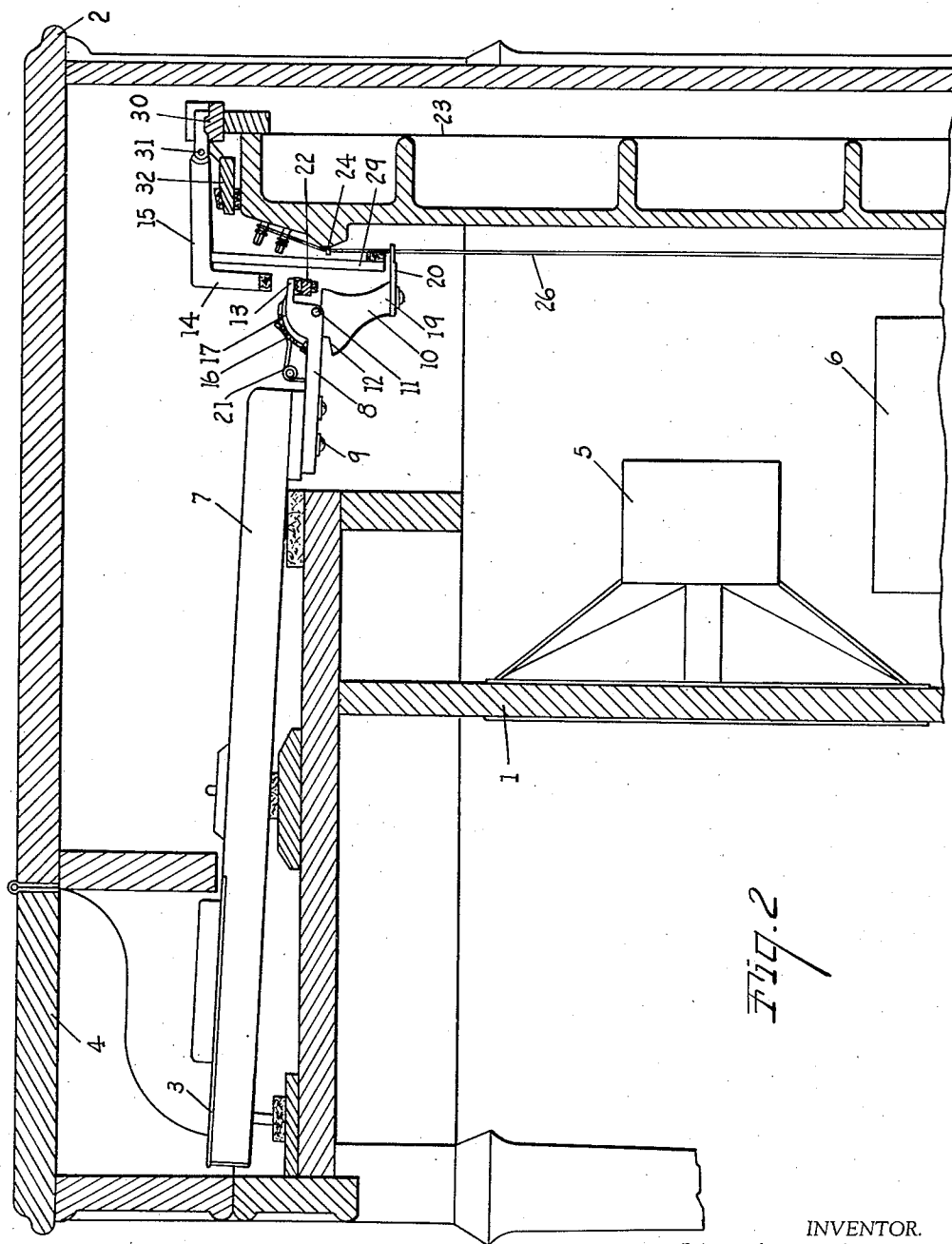


Fig. 2

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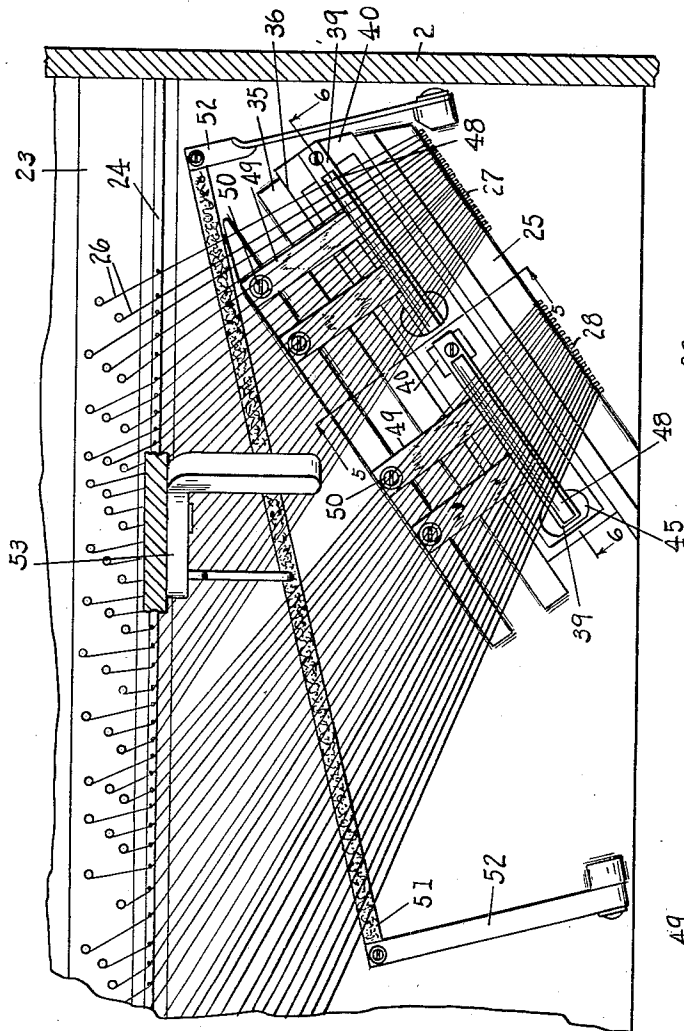
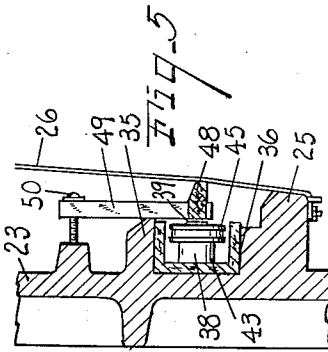
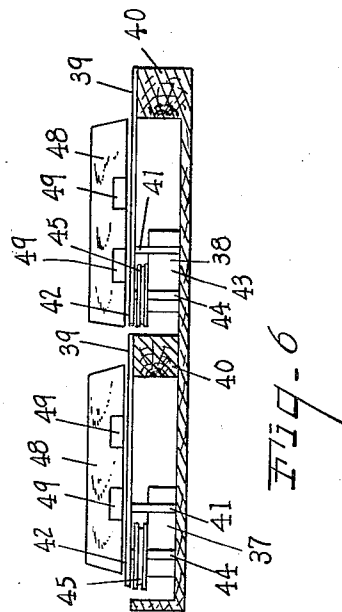
L. A. LOAR

2,046,333

MUSICAL INSTRUMENT

Original Filed Jan. 27, 1934

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,046,333

MUSICAL INSTRUMENT

Lloyd A. Loar, Kalamazoo, Mich., assignor to
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Original application January 27, 1934, Serial No.
708,568. Divided and this application March
16, 1935, Serial No. 11,468

8 Claims. (Cl. 84—1)

This is a division of my copending application, Serial No. 708,568, filed January 27, 1934, for Musical instruments, now Patent No. 1,995,317, granted March 26, 1935.

My invention relates to musical instruments and more particularly to clavier or keyboard instruments of the string or harpsichord type.

The main objects of the invention are:

First, to provide an instrument of this character having improved means for plucking the strings to initiate the vibration thereof without mechanical interference.

Second, to provide improved adjustable means for electrically amplifying the vibration of the strings.

Third, to provide a musical instrument having the above desirable features and characteristics and which is compact and simple and economical in its parts and which produces a very beautiful tone.

Objects relating to details and economies of my invention will appear from the description to follow. The invention is defined and pointed out in the claims.

A structure which is a preferred embodiment of my invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of a musical instrument embodying the features of my invention.

Fig. 2 is an enlarged fragmentary transverse vertical section taken on a line corresponding to line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail view similar to Fig. 2, showing the parts in actuated position after a string has been vibrated.

Fig. 4 is a fragmentary interior view showing the string arrangement.

Fig. 5 is a detail section on line 5—5 of Fig. 4.

Fig. 6 is a detail section on line 6—6 of Fig. 4.

In the embodiment of my invention illustrated by the drawings, the amplifier-loud speaker unit 1 is built in the cabinet 2 of the instrument. The keyboard 3 is substantially horizontal as shown and is provided with a cover 4 hinged to swing back over the top of the cabinet to expose the keyboard. The keyboard and the loud speaker 5 and audio-frequency amplifier 6 may be of conventional design.

As illustrated by Figs. 2 and 3, the inner end 7 of each key is provided with a wippen 8 mounted thereon by means of screws 9. The outer end of the wippen is forked to receive the striker jack 10 which is pivoted thereto at 11. The striker jack is free to oscillate in the wippen between the stops provided by the ends of the

recess 12 and the base of the fork, such stops being felted to obviate noise. The extreme outer end 13 of the wippen is adapted to engage the depending portion 14 of the damper arm 15 when the wippen is elevated. The lower end of the depending portion 14 of the damper arm is felted as shown.

The striker jack 10 is provided with a curved back surface 16 provided with a groove, upper and lower jaws 17 and 18, and a depending picker support portion 19. A picker 20 is carried by such depending portion 19, the picker or striker being hereinafter referred to as a pick. The pick is made of leather, fiber, celluloid, wood covered with buckskin or any suitable material.

The curved back 16 of the striker jack is felted as shown for coaction with the wire spring 21 which is mounted at its inner end on the wippen 8. The resilient outer end of the spring engages the groove in the back of the striker jack and acts to provide a slight frictional resistance to the movement of the jack. Between the upper and lower jaws of the striker jack, I arrange the stop rail 22 for coaction with the jaws to move the jack to retracted position when the wippen is elevated and to return the jack to its normal rest position when the wippen is lowered. The upper and lower surfaces of the stop rail 22 are provided with facings of felt or other sound absorbent material. The stop rail 22 is vertically adjustable with respect to the upper and lower jaws of the jacks, the stop rail being rigidly secured in position at its ends after adjustment. The preferred adjustment of the stop rail is such that the lower jaw of the jack contacts the rail just after the pick has slipped off of the string.

Near the back of the cabinet, I arrange a vertical metal string plate 23 having a horizontal upper pin bridge or string bearing 24 and an inclined lower pin bridge or string bearing 25. The tuned strings 26 occupy a substantially common vertical plane between the upper and lower bearings with the strings inclined as shown and divided into a treble group 27 and a bass group 28.

The striker jacks are made long so that their picks will pluck the tensioned strings as far from the upper bearing 24 as desirable. The pick is made long enough to reach the string and leave room between the stop rail and the string for the damper 29 which is connected to the damper arm 15, the operative surface of the damper being provided with a felted pad for contact with the string. The damper arm is

pivoted to the rail 30 at 31, the arrangement being such that when the wippen is elevated its extreme outer end 13 engages the depending portion 14 of the damper and swings the damper 29 out of contact with the string 26. When the wippen is lowered, gravity returns the damper to its normal position in contact with the string unless the damper lift rail 32 is held in elevated position by means of the foot pedal 34 commonly called the sustaining pedal. The damper lift rail 32 extends under all of the damper arms 15 for holding them in elevated position simultaneously.

The string plate 23 is provided with a lever bridge 35 arranged in spaced parallel relation to the string bearing 25 to provide an inclined channel 36 in which is disposed bass and treble magnetic pick-ups 37 and 38. Each magnetic pick-up or generator is provided with a magnetic armature 39 mounted on an end support 40 and an intermediate support 41. The intermediate support 41 is spaced from the vibratory end 42 of the armature so as to break up the natural vibratory period of the armature. The intermediate support 41 is formed of magnetic material and constitutes a part of the magnetic circuit the flux of which is supplied by the permanent magnet 43 having a pole piece 44 constituting a core for the coil winding 45, the upper end of the pole piece being spaced from the vibratory end of the armature to provide an air gap variable with the vibration of such end. The terminals of the coil winding 45 are connected to the audio-frequency amplifier 6 through a potentiometer (not shown) which is adapted to be controlled by the loud pedal 46 and the soft pedal 47. The electrical amplification of the output of the generators 37 and 38 is thus under the direct control of the player.

String bridges 48 are disposed on the armatures 39 and under the strings 26 as shown for the purpose of vibrating the armatures in accordance with the vibration of the strings. On the lever bridge 35, I mount a pair of levers 49 for each string bridge 48, one end of the levers being rigidly connected to the string bridge and the other end being adjustably connected to the string plate 23 by means of screws 50. The arrangement is such that when the screws 50 are tightened, the levers 49 lift the string bridge 48. The total pressure of the strings on the string bridge may be too great on the armature for the most effective operation of the magnetic pick-up or generator. My adjustable supports for the string bridges provide means to adjust this pressure on the armature bar to the correct amount without changing the angle of the string bearing on the bridge. The armature sustains the direct string pressure at an angle of substantially 180° or normal to the direction of vibration of the armature.

An octave bar 51 is pivotally connected to the string plate 23 by means of arms 52, 52 at its ends. Through the operation of a foot pedal or knee pedal 53, the felt edge of the bar is brought lightly against the center of all of the strings 26, causing them to sound their first harmonic or octave higher than the fundamental frequency of each string. This increases the range of the keyboard one octave without extending the length of the keyboard.

The picks 20 are arranged to be normally below the strings, there being a pick for each string, so that when its key is struck the pick is elevated into engagement with its string and is then moved with a cam-like action by the in-

clined string to swing the pick clear of the string, the pick leaving the string with a wiping action which leaves the string vibrating. The damper 29 is swung out of contact with the string by the lifting of the wippen prior to the vibration of the string by the pick. As the wippen continues its upward movement, its lower jaw 18 engages the stop rail 22 and swings the striker jack 10 to fully retract the pick 20 as illustrated by Fig. 3. The spring 21 holds the striker jack in this position when the key is released until the upper jaw 17 engages the stop rail 22 on the return stroke and swings the striker jack back to its normal position with the pick 20 under its string 26. Inasmuch as the striker jack is free to oscillate, a hard stroke on the key will vibrate the string vigorously and give a loud tone, whereas a gentle stroke on the key will give a soft tone. The degree of tone intensity is thus under the direct control of the player at the keyboard.

The action of the pick on the string as it slips therefrom is a sort of wiping or brushing. The operation of the pick and jack is exactly the same as that described and shown in my application, Serial No. 708,570, filed January 27, 1934, for Musical instruments, except that the plucking action in the present case is adapted to vibrate tensioned strings. In my other application referred to above, the plucking action is used to vibrate relatively short metal tongues or reeds which lift farther than tensioned strings. To make up for this, the pick 20 is longer, requires less pressure from the string 26 to cause the pick and jack to oscillate away from the string, and when this oscillation starts, the pick falls away from the string much faster than when the pick is used to vibrate a reed, as in my other application.

The operation of the action in providing key touch control over dynamics is substantially the same as that described in the action of my application, Serial No. 708,570. However, the spring 21 in the present case does not change its contact in relation to the hinge 11 as it does in my other application. In this case, the slight friction of spring 21 on the jack serves the same purpose and repetition is less rapid, but the dynamics touch control is the same.

The vibration of the string is transmitted through its string bridge 48 to the armature 39 the vibratory end 42 of which vibrates in unison with the string. This causes a corresponding variation in the air gap of the magnetic circuit which induces an alternating current in the coil winding 45, this alternating current being amplified by the audio-frequency amplifier 6 and finally heard as a tone emanating from the loud speaker 5. This tone is very sonorous and beautiful and is substantially free from objectionable overtones and partials.

I have illustrated and described my improvements in an embodiment which I have found very practical. I have not attempted to illustrate or describe other embodiments or adaptations, as it is believed this disclosure will enable those skilled in the art to embody or adapt my improvements as may be desired.

Although I have shown and described a certain specific embodiment of my invention, I am fully aware that many modifications thereof are possible. My invention is therefore not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A musical instrument comprising a vertical metal plate having a horizontal upper pin bridge and an inclined lower pin bridge, a series of tuned strings arranged in inclined relation between the upper and lower pin bridges, a lever bridge arranged on said plate in spaced parallel relation to said lower pin bridge, bass and treble magnetic pick-ups disposed in the space between said lever bridge and lower pin bridge and each comprising a magnetic armature supported at one end and at a point spaced from its other end to provide a vibratory portion having a frequency differing from the natural frequency of the armature, bass and treble string bridges arranged on the armatures of said pick-ups, and spaced levers arranged on said lever bridge and connected fixedly at one end to said string bridges and adjustably at the other end to said plate for raising and lowering the string bridges relative to their pick-up armatures.

2. A musical instrument comprising a vertical plate having a horizontal upper pin bridge and an inclined lower pin bridge, a series of tuned strings arranged in inclined relation between said upper and lower pin bridges, a lever bridge arranged on said plate in spaced parallel relation to said lower pin bridge, bass and treble magnetic pick-ups disposed in the space between said lever bridge and lower pin bridge and each comprising a magnetic armature, bass and treble string bridges arranged on the armatures of said pick-ups, and spaced levers arranged on said lever bridge for raising and lowering the string bridges relative to their pick-up armatures.

3. A musical instrument comprising a plate having an upper string bearing and an inclined lower string bearing, a series of tuned strings arranged in inclined relation between said upper and lower string bearings, manually operated string picking means for each string, a magnetic pick-up arranged adjacent said lower string bearing and comprising a magnetic armature supported at one end and at a point spaced from its other end to provide a vibratory portion having a frequency differing from the natural frequency of the armature, a string bridge arranged on the armature of the pick-up, and means for raising and lowering the string bridge relative to the pick-up armature.

4. A musical instrument comprising a plate having an upper string bearing and an inclined lower string bearing, a series of tuned strings arranged in inclined relation between said upper and lower string bearings, manually operated string picking means for each string, a pick-up arranged adjacent said lower string bearing and

comprising an armature supported at one end and at a point spaced from its other end to provide a vibratory portion having a frequency differing from the natural frequency of the armature, and a string bridge arranged on the armature of the pick-up. 5

5. A musical instrument comprising a plate having an upper string bearing and an inclined lower string bearing, a series of tuned strings arranged in inclined relation between said upper and lower string bearings, manually operated string picking means for each string, a magnetic pick-up arranged adjacent said lower string bearing and comprising a magnetic armature, a string bridge arranged on the armature of the pick-up, and means for raising and lowering the string bridge relative to the pick-up armature. 15

6. A musical instrument comprising a plate, a series of tuned strings, mechanical string picking means for each string, and a lever bridge, a pick-up comprising an armature, a string bridge arranged on the armature, and lever means arranged on said lever bridge and connected at one end to said string bridge and at the other end to said plate for raising and lowering the string bridge relative to the armature. 20

7. A musical instrument comprising a vertical plate having a horizontal upper string bearing and an inclined lower string bearing, a series of tuned strings arranged between said bearings in inclined relation, a series of dampers associated with the upper ends of the strings below said upper bearing, a series of wippens adapted to retract said dampers when elevated, a series of striker jacks pivoted to said wippens and carrying picks adapted to pluck said strings on the elevation of the wippens and be swung thereby clear of the strings, a string bridge disposed adjacent the lower bearing, a magnetic pick-up operated by said string bridge, means for varying the operative relation between said pick-up and string bridge, and an octave bar pivotally connected to said plate for coaction with said strings at substantially the centers thereof. 30

8. A musical instrument comprising a vertical plate having a horizontal upper string bearing and an inclined lower string bearing, a series of tuned strings arranged between said bearings in inclined relation, a series of wippens, a series of striker jacks pivoted to said wippens and carrying picks adapted to pluck said strings on the elevation of the wippens and be swung thereby clear of the strings, a string bridge disposed adjacent the lower bearing, a pick-up operated by said string bridge, means for varying the operative relation between said pick-up and string bridge, and an octave bar pivotally connected to said plate for coaction with said strings. 45 50 55

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