March 26, 1935. L. A. LOAR 1,995,316

MUSICAL INSTRUMENT

Filed Jan. 27, 1934 4 Sheets-Sheet 1

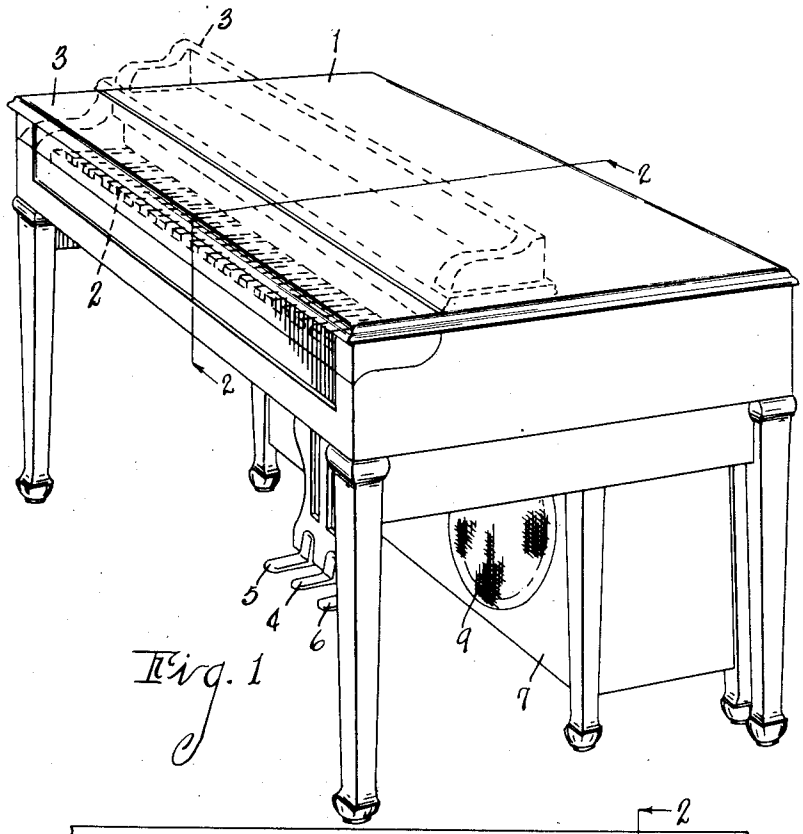


Fig. 1

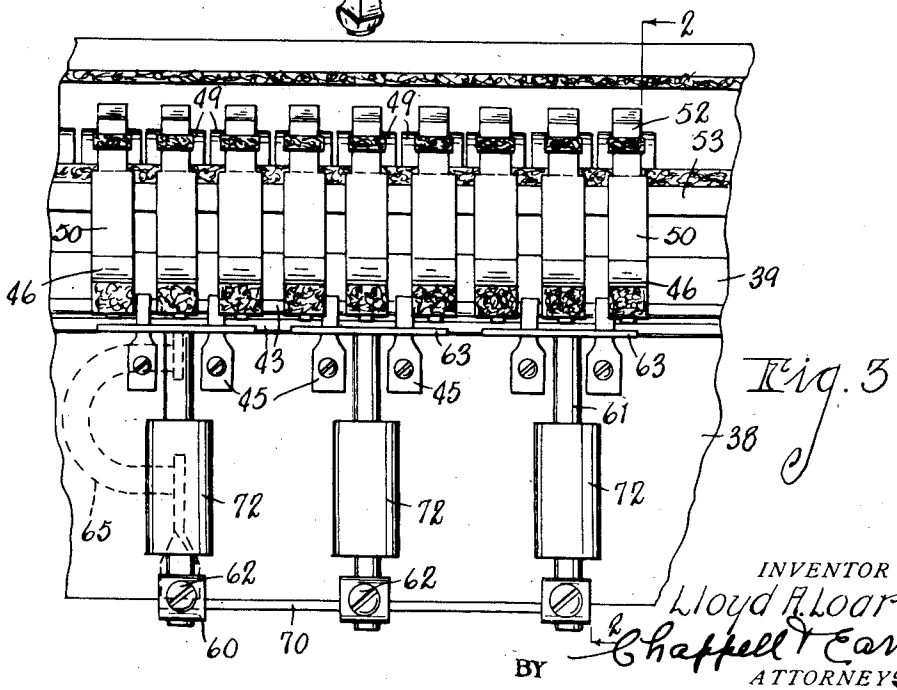


Fig. 3

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MUSICAL INSTRUMENT

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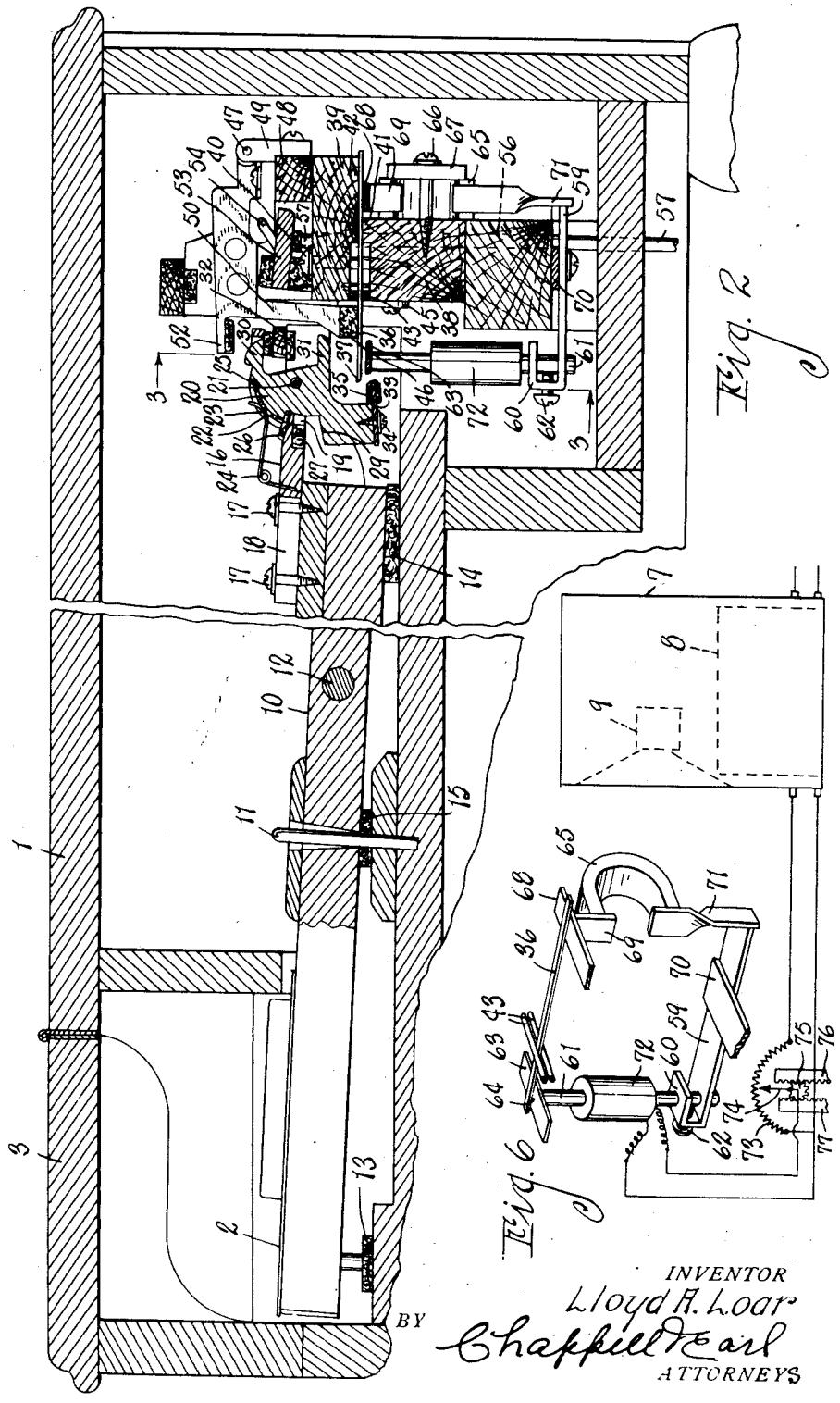


Fig. 2

Fig. 6

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MUSICAL INSTRUMENT

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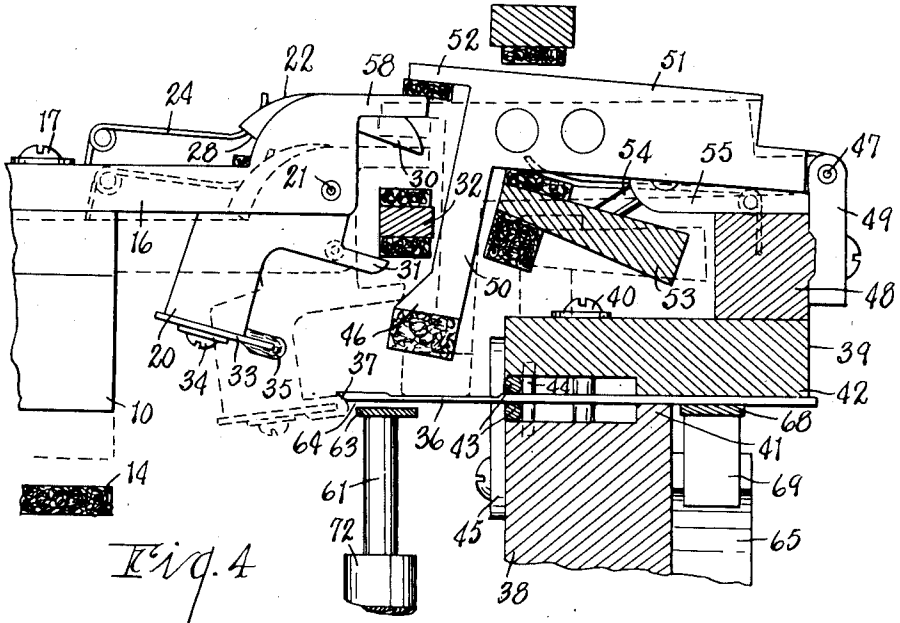


Fig. 4

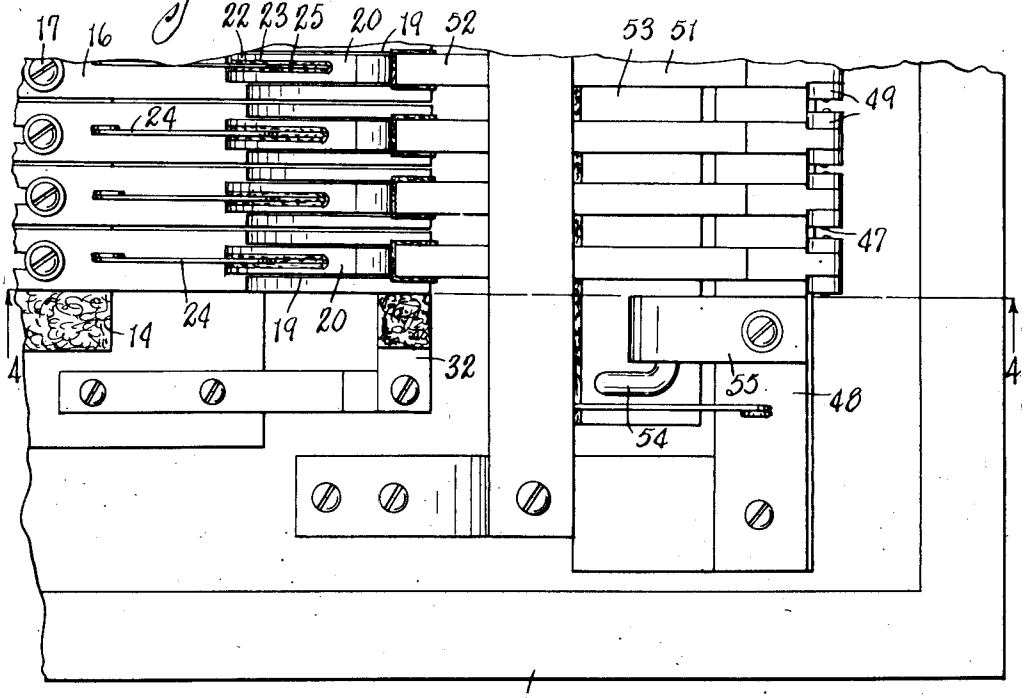


Fig. 5

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MUSICAL INSTRUMENT

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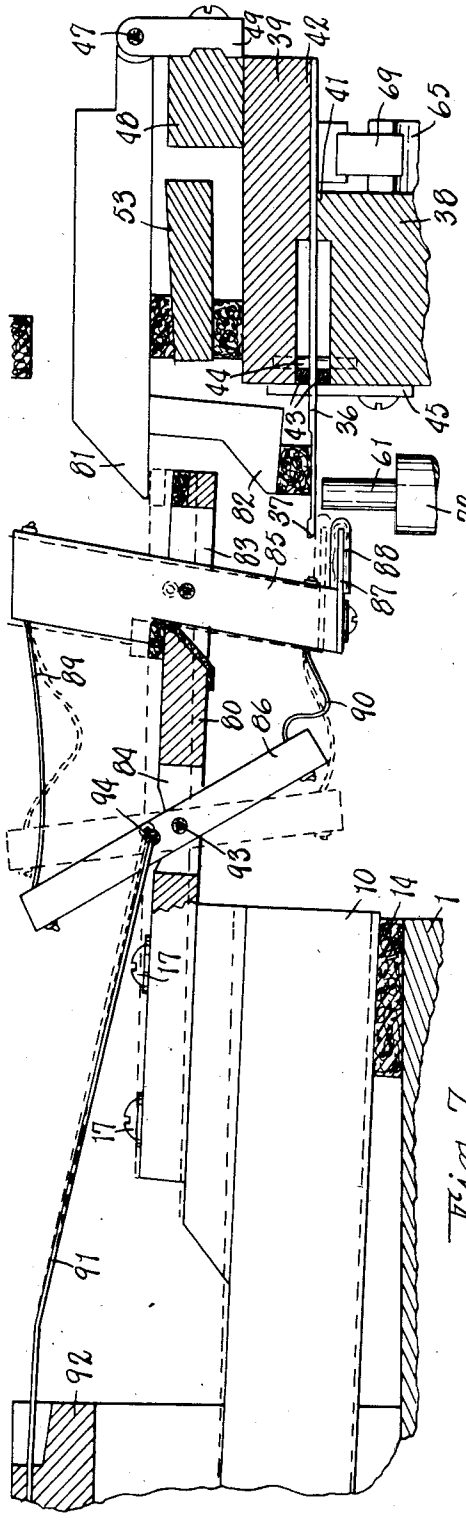


Fig. 7

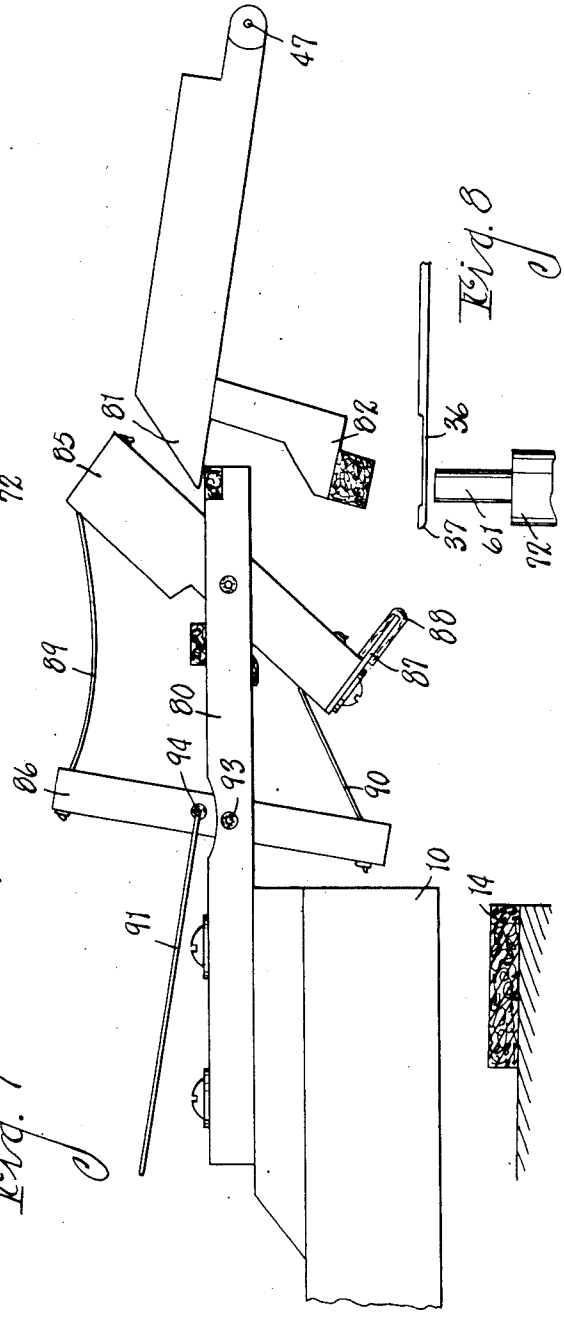


Fig. 8

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Patented Mar. 26, 1935

1,995,316

UNITED STATES PATENT OFFICE

1,995,316

MUSICAL INSTRUMENT

Lloyd A. Loar, Kalamazoo, Mich., assignor, by mesne assignments, to Acousti-Lectric Company, Kalamazoo, Mich., a corporation of Michigan

Application January 27, 1934, Serial No. 708,567

22 Claims. (Cl. 84—1)

My invention relates to musical instruments and more particularly to an electrical instrument of the reed-clavier or keyboard type.

The main objects of my invention are:

First, to provide a musical instrument capable of tone production in which the note produced is approximately 90% fundamental and only 10% overtones and having a perfectly even scale with every tone developed to its maximum of quality.

Second, to provide an instrument of this character which produces a pure tone with substantially no mechanical dilution regardless of its volume.

Third, to provide improved means for initiating the vibration of vibratory reed-like armatures without interfering with their natural vibration.

Fourth, to provide an improved magnetic pick-up or generator having an armature consisting of a magnetic reed which is adapted to vary the length of an air gap in the magnetic circuit in accordance with its vibration.

Fifth, to provide a pedal controlled potentiometer in the generator-amplifier circuit for controlling the output volume of the instrument.

Sixth, to provide improved key operated reed picking means whereby the intensity of the tone is controlled directly by the force with which the keys are struck.

Seventh, to provide a musical instrument having the above desirable features and advantages and which is compact and light in weight, simple and economical in construction and which is provided with a conventional piano keyboard and pedals adapted to be operated like those of a conventional piano.

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, the amplifier-speaker unit being shown under the instrument, the key-board cover being shown in open position by dotted lines.

Fig. 2 is an enlarged fragmentary transverse section on a line corresponding to line 2—2 of Figs. 1 and 3.

Fig. 3 is an enlarged fragmentary vertical section on a line corresponding to line 3—3 of Fig. 2.

Fig. 4 is a detail section on a line corresponding to line 4—4 of Fig. 5 and showing the parts in actuated position.

Fig. 5 is a fragmentary plan view of the instrument with the casing cover removed.

Fig. 6 is a fragmentary diagrammatic representation of the pick-up or generator and amplifier-speaker assembly.

Fig. 7 is an enlarged fragmentary detail section of a modification of the reed picking means, the parts being shown in normal position by the full lines and in partially actuated position by the dotted lines.

Fig. 8 is a view similar to Fig. 7 showing the parts in their fully actuated position.

In the embodiment of my invention illustrated by Figs. 1 to 6, inclusive, of the drawings, numeral 1 in general indicates the cabinet of the instrument which is provided with a clavier or keyboard 2 like that of a piano, the keyboard having a hinged cover 3. The instrument is also provided with a loud pedal 4, a soft pedal 5, and a sustaining pedal 6 similar to those of a piano. The cabinet 7 contains an audio-frequency amplifier 8 and a loud speaker 9 of suitable design, the cabinet being preferably portable and preferably adapted to be positioned under the main instrument if desired, as illustrated by Fig. 1.

Without the audio-frequency amplifier-loud speaker unit, the operation of my musical instrument is practically inaudible. Head phones can therefore be substituted for the loud speaker and in this way the instrument can be used for practice with only the player hearing it through the head phones. Thus, any number of instruments can be used simultaneously in the same room without interference. For radio broadcasting, the amplifier-speaking unit can be dispensed with entirely and the output circuit of the instrument connected directly to the radio transmitter, the usual microphone being entirely dispensed with.

Briefly, I pick or pluck a tuned reed of suitable metal to produce an almost inaudible tone. The reed being of magnetic material constitutes the armature of a pick-up or generator, the output of which is amplified by the audio-frequency amplifier and then heard through the loud speaker. For this reason, my instrument may be said to be wholly electrical depending as it does upon the electrical amplification of the reed vibrations. My all-electrical musical instrument has a deeply resonant, sonorous, and organ-like tone which is peculiarly moving and beautiful.

As shown in Fig. 2, the keys 10 of the keyboard 2 are arranged to teeter about pins 11, the nor-

mal position of the keys being shown with the exposed finger part elevated. The inner ends of the keys are held down in their normal position by means of lead weights 12. Outer cushions or buffers 13, inner cushions 14 and central cushions 15 are provided as usual for rendering the operation of the keys noiseless.

On the inner end of each key, I mount a wiper 16, or wippen as usually designated, by means of screws 17, 17, the wippen having a longitudinal slot 18 for the screws and by means of which the wippen can be adjusted longitudinally of the key. The outer end of the wippen is slotted or forked at 19 to loosely receive the picker head or jack 20 which is pivoted thereto at 21.

The jack 20 has a curved or cammed back 22 provided with a groove 23 for receiving the wire spring 24 mounted on the wippen as illustrated. The bottom of the groove 23 is covered with a layer 25 of felt or other similar material for coaction with the upturned resilient end of the wire spring. The resilient end of the spring slidably engages the felt in the bottom of the groove and imparts a slight friction to the movement of the jack for steadying the same. The spring also coacts with the cammed back of the jack to assist the oscillatory movement thereof by gently urging the jack toward its proper direction of movement from its normal and retracted position.

The wippen 16 is provided with felted upper and lower recesses 26 and 27 at the base of the slot 19 for coaction with abutments 28 and 29, respectively, in the rear of the jack. The oscillatory movement of the jack is thus limited in its normal and retracted position by the wippen.

I shape the jack 20 so as to provide an upper jaw 30 and a lower jaw 31 for coaction with the felted upper and lower surfaces, respectively, of the stop rail 32. At the bottom of the jack, I mount a reed striker or picker 33, hereinafter referred to for convenience as a pick, by means of the screw 34. The pick is made of some relatively stiff material such as leather, fiber, celluloid, or wood and covered with a cover 35 of soft material such as buckskin or the like. Fig. 2 shows the parts in normal position with the pick 33 spaced below the reed or armature 36 to be vibrated. The stop rail 32 coacts with the upper jaw 30 to hold the jack 20 with the pick in its normal position. The vibratory end of the reed 36 is preferably beveled or inclined at 37 as best illustrated by Fig. 4.

When the wippen 16 is elevated by the operation of the key, the pick 33 first strikes the vibratory end of the reed and causes the latter to vibrate as the pick slips off with a wiping action. Due to the turning force imparted to the jack by the wiping contact between the pick cover 35 and the beveled reed end 37, the pick is thrown clear of the reed which is thereby left free to vibrate. As the wippen continues to carry the jack upwardly, the lower jaw 31 coacts with the stop rail 32 to swing the jack 20 to its fully retracted position as illustrated by Fig. 4. Thus, when the key is released, the jack is allowed to drop with the wippen to its normal position, the pick clearing the end of the reed. At a point below the level of the reed, the pick is moved to its position under the end of the reed by the engagement of the upper jaw 30 with the stop rail 32.

The reeds 36 are arranged in spaced parallel relation between the bridge 38 and the bridge cap 39 mounted thereon by means of the screws 40. The bridge has an upstanding rear reed support 41 which coacts with the depending reed support 42 of the bridge cap to clamp the stationary ends of the reeds in fixed position. The reeds are supported at the front by means of bearing rods 43, 43, such rods being held in place by means of rear pins 44 and front lugs 45.

A series of reed dampers 46 are pivotally connected at 47 to the upper rear edge of the bridge cap 39 by means of the rail 48 and pivot bracket 49. Each damper has a substantially vertical arm portion 50 depending in front of the bridge cap and provided with a front extension 52. The under surfaces of the extension 52 and vertical portion 50 are provided with felt pads as illustrated.

A damper lift rail 53 is disposed to rest on the bridge cap 39 under the horizontal arms 51 of the dampers, the damper lift rail being pivotally connected by means of rocker arms 54, 54 to the end blocks 55, 55 on the rail 48. The bridge and bridge cap have vertically aligned holes 56 below the damper lift rail for the tappet or rod 57 which is connected to the sustaining pedal 6 for elevating the damper lift rail into engagement with the damper arms when the sustaining pedal is depressed.

The end 58 of each wippen 16 projects under the front projection 52 of the individual damper arm so as to engage the same and raise the damper 46 from the vibratory end of the reed 36 prior to the release of the reed by the pick 33. When the key is released, the end 58 of the wippen ceases to support the front projection 52 of the damper which thereupon engages the reed and stops its vibration.

A series of magnetic pole piece brackets or holders 59 are secured to the bottom of the bridge 38, each holder being provided with an inwardly facing U-shaped front extension 60 provided with vertically aligned openings in which the pole piece 61 is disposed for vertical adjustment. A screw 62 is threaded in the web of the U-shaped front extension for securing the pole piece in adjusted position. On the upper end of the pole piece 61, I mount a face plate 63, the face plate being spaced below the vibratory ends of a plurality or battery of the reeds to provide with each an air gap 64 variable with the vibration of the reed.

To supply magnetic flux to the air gap 64, I use the U-shaped permanent magnet 65 which I mount on the back of the bridge by means of a screw 66 and clamp 67. The stationary ends of the battery of magnetic reeds are connected to one pole of the magnet 65 by means of the upper bus bar 68 and pole piece 69, the upper bus bar being arranged under the bridge cap 39 as illustrated. The pole piece holder 59 or a battery of them is connected to the other pole of the magnet 65 by means of the lower bus bar 70 and pole piece 71. With this arrangement, one magnet serves to supply flux to a battery of pole faces 63.

As illustrated by Fig. 6, the magnetic circuit of the pick-up or generator is substantially closed except for the air gap 64 between the vibratory ends of the reeds and the pole face 63. If desired, a circuit of this character can include all of the reeds on the bridge. The number of magnets used depends on the strength of each magnet and the saturation point of each reed. A convenient and efficient arrangement is one pole piece 61 and face plate 63 for each three reeds, and three pole pieces 61 for each magnet 65. The magnets are mounted so that the positive and negative poles thereof are in parallel. By means of the upper

and lower bus bars 68 and 70, any desired number of magnets can be included in the magnetic circuit.

On each pole piece 61, I provide a coil winding 72, the pole piece in this case serving as a core for the winding. The terminals of the coil winding 72 are connected to the audio-frequency amplifier 8 through a potentiometer 73 having a variable contact 74, the normal position of the variable contact being in substantially the center of the potentiometer. Thus, when the vibratory end of the reed vibrates, the air gap 64 is correspondingly varied or vibrated, causing the flux passing through the core 61 of the coil winding 72 to increase and decrease rapidly. This generates a current in the coil winding 72 which is amplified by the audio-frequency amplifier 8, the tone being subsequently heard emanating from the loud speaker 9.

To control the volume of the tone, I provide the variable contact 74 of the potentiometer 73 with a pinion gear 75 and racks 76 and 77 meshing with the gear teeth on opposite sides thereof. The rack 76 is connected to the loud pedal 4, while the rack 77 is connected to the soft pedal 5. With the parts arranged in this manner, when the soft pedal 5 is depressed, the variable contact 74 of the potentiometer is turned to gradually increase the resistance of the potentiometer in accordance with the extent to which the pedal is depressed. In a similar manner, when the loud pedal 4 is depressed, the resistance of the potentiometer is decreased. Thus, the output volume of my musical instrument is under the direct control of the player.

The operation of my musical instrument may be summarized as follows: When a key 10 is struck by the player, the inner end of the key rises. The wippen 16 rises with the key and carries the pick 33 into contact with the vibratory end of the reed and the outer end of the wippen into contact with the front projection 52 of the damper. The damper releases the reed and the pick 33 causes the reed to vibrate as it slips off of its inclined end 37 traveling upward and backward. Because at the instant of contact of the pick 33 with the reed end 37 the striker jack 20 is free to oscillate, a hard stroke on the key 10 which throws the picker assembly upward with great speed will vibrate the reed vigorously and give a loud tone. A gentle stroke on the key will throw the picker assembly upward with less speed and a weaker vibration of the reed results with a consequently weaker tone. Thus, by varying the force with which the key is struck by the player, any desired degree of tone intensity can be obtained.

Inasmuch as the operation of my action mechanism is an important feature of the present invention, it is described in detail as follows. Referring to Fig. 2, when the key 10 lifts the wippen 16, the jack 20 is lifted far enough so that the pick 33 is in contact with the inner end of reed 36, neither the upper jaw 30 nor the lower jaw 31 of the jack is in contact with the stop rail 32. Thus, the jack 20 is free to oscillate in either direction. Since the end of the pick is either under the pivot 21 of the jack or in front of it, the pressure of the extreme end of the reed on the pick causes the jack to oscillate to move the pick out from under the end of the reed. It will also be observed that as the jack oscillates in such direction, the pick drops farther below the end of the reed. The extent of this drop is slight and the speed with which it develops is not materially affected by the speed with which the pick engages the reed.

However, at the instant of contact between the pick and the end of the reed, a slight amount of friction is developed between these parts, which is sufficient to tend to hold them together. If the jack and wippen are elevated rapidly by a hard blow on the key, the pick is forced against the reed before the oscillation of the jack draws the pick down and out from under the end of the reed. The friction between the pick and reed increases more rapidly than the rapidity with which the pick falls away from the reed and so assists the pick to lift the reed higher and vibrate it through a wider arc before the pick can slip out from under the end of the reed.

On the other hand, if the key 10 is struck gently, the wippen 16 and the jack 20 are elevated more slowly and the speed with which the pick falls away from the reed and oscillates back away from the same is also less because the pick does not come against the reed with so much force, but the speed of the pick falling away from the reed and out from under the same decreases much less than the speed with which the jack lifts and the pick travels upwardly past the line of the reed. The friction between the pick and reed consequently develops more slowly and does not tend to hold the pick against the reed and prevent it from oscillating back therefrom. On the contrary, the pressure of the reed against the pick causes the pick to move away from the end of the reed and at the same time oscillate out from under the same before the pick has lifted past the end of the reed. Consequently, the pick does not lift the end of the reed so far out of line to get by and the reed is not vibrated as widely.

The above action is so definite that with full amplification of the vibration pattern of the reed turned on, a gentle stroke of the key will cause the pick to brush the reed so lightly that the amplified tone is barely audible. A vigorous stroke of the key causes the pick to vibrate the reed so widely that the resultant audibility of the tone can be up to the capacity of the amplification-speaker system. A very gradual press of the key will brush the pick past the end of the reed without vibrating the latter at all. This is because the jack is free to oscillate the pick away from the reed when the pick touches the end of the reed. The only resistance to this movement is the inertia of the jack itself, and as it is pivoted in the middle such inertia is so slight that the jack can be moved with the breath after the wippen has lifted the upper jaw of the jack off of the stop rail. The friction between the spring 24 and the groove 23 in the back of the jack is also very slight. At the time the pick contacts the end of the reed, the spring 24 has traveled forwardly and is over the pivot 21 so that it has no tendency to urge the pick either forwardly or backwardly, the slight friction between the spring and groove tending to hold the pick in place.

When the reed has forced the pick and jack to oscillate clear of the end of the reed, the spring presses slightly on the jack ahead of its pivot and tends to hold it there. At the same time, the lower jaw 31 engages the stop rail 32 and holds the jack in fixed position with the pick clear of the reed. When the key is released, the wippen drops with the jack until the pick is below the line of the reed, whereupon the upper jaw 30 engages the rail 32 and oscillates the jack

to its normal position with the pick under the end of the reed. The edges of both the pick and reed are beveled so that when the pick starts to slip off the end of the reed it does so freely and without interference. Further, the reed cannot start to vibrate without its end lifting and making it easier for the pick to slip off.

The pick and its jack are thrown backward, see Fig. 4, by the pressure of the reed end 37 on the pick. Continued movement of the key brings the lower jaw 31 of the jack into engagement with the stop rail 32. The spring 24 by slight pressure in the groove 23 on the back of the jack assists in holding the jack in position with the pick well away from the reed and also prevents any dancing back and forth of the jack when the key is struck vigorously. As long as the lower jaw 31 is in contact with the stop rail 32, the pick cannot move toward the reed and get on top of it or strike the end of it. The pressure of the lower jaw against the stop rail holds the jack in this position as long as the key is held down. When the key is released and the inner end thereof drops back on the felt pad 14, the wippen 16 drops with it. When the wippen drops far enough so that the pick is below the level of the reed, the upper jaw 30 engages the stop rail 32 which oscillates the jack 20 so that the pick is returned to its normal position under the vibratory end of the reed ready for another stroke.

The key must return substantially to the position of rest before the pick returns to its normal place under the reed end. The damper 46 is held free of the reed as long as the key is depressed. All of the dampers can be lifted from all of the reeds by the sustaining pedal 6 through tappet 57 and damper lift rail 53 so that the reed will vibrate for its natural period after the key is released, the effect musically being the same as the usual sustaining pedal used with the conventional piano.

Referring to Figs. 7 and 8, there is illustrated a modification of my means for initiating the vibration of the reeds. In the modification, the wippen 80 is mounted on the inner end of the key 10 to project under the front projection 81 of the damper 82 so that when the key is operated the damper is lifted from the vibratory end of the reed. The wippen is provided with spaced front and rear slots 83 and 84 in which are mounted the picker jack 85 and the control jack 86, respectively. A reed pick 87 having a soft cover 88 is mounted on the lower end of the picker jack 85 to strike the vibratory end of the reed when the key is operated. The control jack and picker jack are connected by means of upper and lower cords or straps 89 and 90, the straps being of any suitable flexible material. I connect a wire spring 91 to the control jack 86 above its pivot and to the stationary support 92 for actuating the control jack to retract the picker jack and move the pick back and out of contact with the reed end when the key is operated to cause the pick to strike the reed end.

The oscillation of the picker jack 85 is controlled by the straps or cords 89 and 90. The control jack 86 is controlled so that its upper end oscillates forward rapidly through the action of the wire spring 91 as the key 10 is elevated. The speed of such oscillation is determined by the distance of the control jack pivot 93 to the point 94 of connection between the spring 91 and control jack. As the upper end of the control jack is pushed forward, its lower end is swung back. The length of the lower cord or strap 90 is such that just after the pick 87 has vibrated the end of the reed 36 the slack is taken up and the picker jack and pick are held away from the reed until the key is released.

As the key drops, the wire spring 91 pulls the control jack 86 back at the top, returning the slack to cord 90 and taking it up in cord 89. The picker jack is so balanced that it stays in the position illustrated by Fig. 8 until the pick has dropped beneath the level of the reed, whereupon the slack in the upper cord 89 is taken up and pulls the upper end of the picker jack back and the pick is returned to its normal position under the vibratory end of the reed 36.

At the instant the pick engages the reed and until the pressure of the reed on the pick has oscillated the picker jack so that the pick is out of contact with the reed and the latter has been vibrated, there is no tension on cords 89 and 90. Thus, a hard blow on the key vibrates the reed vigorously and a gentle blow vibrates it almost imperceptibly, with any desired graduation in between. The pick and picker jack are free of any control except the force of pressure against the reed at the instant the pick engages it. Intensity control is thus obtained through touch variation. Otherwise, the modification is similar to my preferred construction.

My new musical instrument produces a perfectly pure tone with substantially no mechanical dilution regardless of the volume of the tone. The result is a deeply resonant tone capable of perfect blending because of its freedom from overtones and partials. A perfectly even scale is obtained with every tone developed to its maximum quality.

The loud speaker cabinet need not be used or positioned under the instrument as shown by Fig. 1. When so placed, however, it appears to be a part of the instrument. If the acoustics of the room make it necessary or desirable, the loud speaker cabinet can be placed at a distance from the instrument. The loud speaker cabinet is finished so that it may be used as a bench table.

The advantages of my improved mechanical movement for vibrating the reeds may be summarized as follows: My mechanical movement is (1) economical in cost, (2) light in weight, (3) simple in construction, (4) of the same touch as a piano, (5) readily adjustable, (6) positively capable of furnishing the player means to control the intensity of the tone by the force with which the key is struck, and (7) capable of initiating the reed vibration with substantially no mechanical interference. The vibration of the reeds practically inaudible unless amplified, but when so amplified the volume of the tone can be nicely controlled.

I have illustrated and described my improvements in embodiments 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.

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

1. A musical instrument comprising a series of reeds having projecting vibratable end portions terminating in beveled ends, a series of keys for operating said reeds, wippens mounted on the inner ends of said keys and having forked outer ends, jacks pivoted to said wippens between said

forked ends and having a cammed back and spaced upper and lower jaws, picks mounted on said jacks below said jaws and in operative relation to the ends of said reeds, covers of soft material on said picks for contact with the reed ends, the picks acting on the raising of the wippens to first strike and then slide off of the beveled reed ends due to the turning force imparted to the jacks by wiping contact between the pick covers and the beveled reed ends, a stop rail extending between the jaws of said jacks and coacting with the upper jaws to hold the jacks in normal position with the picks below the reed ends and coacting with the lower jaws on the raising of the wippens to hold the jacks with the picks in retracted position beyond the reed ends, and wire springs mounted on said wippens and slidably engaging the cammed backs of said jacks for imparting friction to the movement of the jacks and for gently urging the jacks toward their proper direction of movement from both normal and retracted positions.

2. A musical instrument comprising a series of reeds having projecting vibratable end portions, a series of keys for operating said reeds, wippens mounted on the inner ends of said keys, jacks pivoted to said wippens and having a cammed back and spaced upper and lower jaws, picks mounted on said jacks below said jaws and in operative relation to the ends of said reeds, the picks acting on the raising of the wippens to first strike and then slide off of the reed ends due to the turning force imparted to the jacks by the wiping contact between the picks and the reed ends, a stop rail extending between the jaws of said jacks and coacting with the upper jaws to hold the jacks in normal position with the picks below the reed ends and coacting with the lower jaws on the raising of the wippens to hold the jacks with the picks in retracted position beyond the reed ends, and springs mounted on said wippens and slidably engaging the cammed backs of said jacks for imparting friction to the movement of the jacks.

3. A musical instrument comprising a series of reeds having vibratable end portions terminating in beveled ends, a series of keys for operating said reeds, wippens mounted on the inner ends of said keys, jacks pivoted to said wippens, picks mounted on said jacks below said jaws and in operative relation to the ends of said reeds, covers of soft material on said picks for contact with the reed ends, the picks acting on the raising of the wippens to first strike and then slide off of the beveled reed ends due to the turning force imparted to the jacks by the wiping contact between the pick covers and the beveled reed ends, means acting to hold the jacks in normal position with the picks below the armature ends and on the raising of the wippens to hold the jacks with the picks in retracted position beyond the reed ends, and means for frictionally retarding the movement of said jacks.

4. A musical instrument comprising a series of reeds having vibratable end portions, a series of keys for operating said reeds, wippens mounted on the inner ends of said keys, jacks pivoted to said wippens, picks mounted on said jacks below said jaws and in operative relation to the ends of said reeds, the picks acting on the raising of the wippens to first strike and then slide off of the reed ends due to the turning force imparted to the jacks by the wiping contact between the covers and the reed ends, and means acting to hold the jacks in normal position with the picks below the reed ends and on the raising of the wippens to hold the jacks with the picks in retracted position beyond the reed ends.

5. A musical instrument comprising a series of substantially inaudible vibratory reed-like electrical generator armatures, and means for operating said armatures including for each a key, a pivoted jack carried by said key and having a pair of forwardly facing open upper and lower jaws, an armature pick carried by said jack below the vibratory end of the armature in normal position, a stop between said jaws for coaction with the upper jaw to control the normal position of the pick and for coaction with the lower jaw to turn said jack to swing the pick out of armature engaging position when the key is elevated, means acting to hold said jack so that the pick clears the armature when the wippen is lowered, and a damper normally resting on said armature, the key acting to lift said damper from the armature when it is elevated.

6. A musical instrument comprising a series of vibratory electrical generator armatures, and means for operating said armatures including for each a key, a pivoted jack carried by said key, an armature pick carried by said jack below the vibratory end of the armature in normal position and adapted to engage the same with a retracting wiping movement on the elevation of the jack so that the amplitude of the resulting vibration of the reed is responsive to the rapidity of operation of said key, means acting to control the normal position of the pick and to positively swing the pick back out of engagement with the armature when the wippen is elevated above a certain point, and means acting to hold said jack with said pick in front of the armature so that the pick clears the armature when the key is lowered.

7. A musical instrument comprising a bridge having an upstanding reed support, a bridge-cap having its face in the vertical plane of the face of said bridge and its back projecting rearwardly of the bridge and a depending reed support opposed to the reed support of the bridge, a series of pick-up magnetic reeds disposed between said supports and having free vibratory ends projecting beyond the faces of said bridge and cap, a series of reed dampers pivotally connected to the upper rear edge of said bridge-cap and each having a substantially vertical portion depending in front of the bridge-cap and normally resting on its reed and a substantially horizontal arm spaced above the bridge-cap and provided with a front extension, a damper lift rail disposed to normally rest on said bridge-cap under the horizontal arms of said dampers and pivotally connected to the bridge-cap to be rocked upwardly into engagement with the damper arms, said bridge and cap having vertically aligned holes below said damper lift rail, and a pedal elevated tappet extending through said holes for actuating said damper lift rail to lift all of the dampers, and a series of reed picks having damper lifts associated therewith for engaging the front extensions of said damper arms and lifting the dampers from their reeds prior to the release of the reeds by the picks.

8. A musical instrument comprising a bridge, a bridge-cap, a series of reeds disposed between and having free vibratory ends projecting beyond the faces of said bridge and cap, a series of reed dampers pivotally connected to the upper rear edge of said bridge-cap and each having a substantially vertical portion depending in front of the bridge-cap and normally resting on its reed

and a substantially horizontal arm spaced above the bridge-cap and provided with a front extension, a damper lift rail disposed to normally rest on said bridge-cap under the horizontal arms of said dampers and pivotally connected to the bridge-cap to be rocked upwardly into engagement with the damper arms, said bridge and cap having vertically aligned holes below said damper lift rail, and a pedal elevated tappet extending through said holes for actuating said damper lift rail to lift all of the dampers, and a series of reed picks having damper lifts associated therewith for engaging the front extensions of said damper arms and lifting the dampers from their reeds prior to the release of the reeds by the picks.

9. A musical instrument comprising a bridge, a bridge-cap, a series of reeds disposed between and having free vibratory ends projecting beyond the faces of said bridge and cap, a series of reed dampers pivotally connected to the upper rear edge of said bridge-cap and each having a substantially vertical portion depending in front of the bridge-cap and normally resting on its reed and a substantially horizontal arm spaced above the bridge-cap and provided with a front extension, and a series of reed picks having damper lifts associated therewith for engaging the front extensions of said damper arms and lifting the dampers from their reeds prior to the release of the reeds by the picks.

10. A musical instrument comprising a tuned reed, a damper resting on said vibratory end and having a front projection, a key for operating said reed, a wippen mounted on the inner end of said key to project under said front projection and having spaced front and rear slots therein, a picker jack pivotally disposed in the front slot, a reed pick mounted on the lower end of said picker jack to strike the vibratory end of the reed when elevated, a control jack pivotally disposed in the rear slot, upper and lower straps connecting said picker jack and said control jack, and a spring connected to said control jack and to a stationary support for turning said control jack to retract said picker jack and move the pick back and out of contact with the reed end when the key is operated to cause the pick to strike the reed end.

11. A musical instrument comprising a series of reeds, means for individually operating said reeds including for each a key, a pivoted jack carried by said key and provided with spaced stops, a pick carried by said jack, a stop with which said stops on said jack alternately coact to positively swing the jack on its pivot and so that when the key is in its normal position of rest, the pick lies below its coacting reed, the jack being free to swing on its pivot when the pick is in peck-engaging position, a damper normally resting on said reed, and means carried by the key acting to disengage the damper prior to the engagement of the pick with the reed.

12. A musical instrument comprising a series of reeds, means for individually operating said reeds including for each a key, a pivoted jack carried by said key and provided with spaced stops, a pick carried by said jack, and a stop with which said stops on said jack alternately coact to positively swing the jack on its pivot and so that when the key is in its normal position of rest, the pick lies below its coacting reed, the jack being free to swing on its pivot when the pick is in peck-engaging position.

13. A musical instrument comprising a series of reeds, means for individually operating said reeds including for each a key, a pivoted jack carried by said key and provided with spaced stops, a pick carried by said jack, a stop with which said stops on said jack alternately coact to positively swing the jack on its pivot and so that when the key is in its normal position of rest, the pick lies below its coacting reed, the jack being free to swing on its pivot when the pick is in peck-engaging position, and means acting to frictionally resist the swinging of the jack on its pivot.

14. A musical instrument comprising a series of reeds, means for individually operating said reeds including for each a key, a pivoted jack carried by said key, a pick carried by said jack, means operative at the ends of the stroke of the jack to positively swing the jack on its pivot and so that when the key is in its normal position, of rest, the pick lies below its coacting reed, the jack being free to swing on its pivot when in pick-engaging position, a damper for and normally resting on each armature and a tappet carried by the key acting to disengage the damper prior to the engagement of the pick with the reed.

15. A musical instrument comprising a series of electrical generator armatures, means for individually operating said armatures including for each a key, a pivoted jack carried by said key, an armature pick carried by said jack, and means operative at the ends of the stroke of the jack to positively swing the jack on its pivot and so that when the key is in its normal position of rest, the pick lies below its coacting armature, the jack being free to swing on its pivot when in armature-engaging position.

16. A musical instrument comprising a series of electrical generator armatures, means for individually operating said armatures including for each a key, a pivoted jack carried by said key, an armature pick carried by said jack, means operative at the ends of the stroke of the jack to positively swing the jack on its pivot and so that when the key is in its normal position of rest, the pick lies below its coacting armature, the jack being free to swing on its pivot when in armature-engaging position, and friction means acting to resist the swinging of the jack on its pivot.

17. A musical instrument comprising a series of vibratory electrical generator armatures, a corresponding series of keys, a pivoted jack carried by each key, an armature pick carried by each jack, a stop rail common to all of the jacks, spaced stops on said jack, one of which coacts with said stop rail when the jack is in its elevated position and the other when the jack is in its lowered position to swing the jack on its pivot, a damper for each generator armature, a tappet carried by the key acting to release the damper, and a damper disengaging means common to all of the dampers.

18. A musical instrument comprising a series of vibratory electrical generator armatures, a corresponding series of keys, a pivoted jack carried by each key, an armature pick carried by each jack, a stop rail common to all of the jacks, and spaced stops on said jack, one of which coacts with said stop rail when the jack is in its elevated position and the other when the jack is in its lowered position to swing the jack on its pivot.

19. A musical instrument comprising a series of reeds, a corresponding series of keys, a pivoted jack carried by each key, a reed pick carried by

each jack, a stop rail common to all of the jacks, spaced stops on said jack, one of which coacts with said stop rail when the jack is in its elevated position and the other when the jack is in its lowered position to swing the jack on its pivot, and a friction means acting to yieldingly hold the jack in both of its said positions.

20. A musical instrument comprising a series of reeds, a corresponding series of keys, pivoted jacks carried by said keys and provided with spaced stops, picks mounted on said jacks in operative relation to said armatures, the picks acting on the raising of the jacks to first strike and then slide from the armatures due to turning force imparted to the jacks by the wiping contact between the picks and the reeds, means alternately coacting with the stops on said jacks as the jacks are raised and lowered to position the picks below the reeds when the keys are in normal position and to swing the jacks so that the picks clear the reeds on the return movement of the jacks, and friction means for the jacks acting to frictionally hold them in their adjusted positions.

21. A musical instrument comprising a series of reeds, a corresponding series of keys, pivoted jacks carried by said keys and provided with spaced stops, picks mounted on said jacks in operative relation to said reeds, the picks acting on the raising of the jacks to the first strike and then slide from the reeds due to turning force imparted to the jacks by the wiping contact between the picks and the reeds, and means alternately coacting with the stops on said jacks as the jacks are raised and lowered to position the picks below the reeds when the keys are in normal position and to swing the jacks so that the picks clear the reeds on the return movement of the jacks.

22. A musical instrument comprising a series of vibratable reed-like pick-up armatures, a corresponding series of keys, pivoted jacks carried by said keys, picks mounted on said jacks in operative relation to said armatures, the picks acting on the raising of the jacks to first strike and then slide from the armatures due to turning force imparted to the jacks by the wiping contact between the picks and the armatures, and means coacting with said jack as the jack is raised and lowered to position the picks below the armature when the keys are in normal position and to swing the jacks so that the picks clear the armatures on the return movement of the jacks.

LLOYD A. LOAR.