

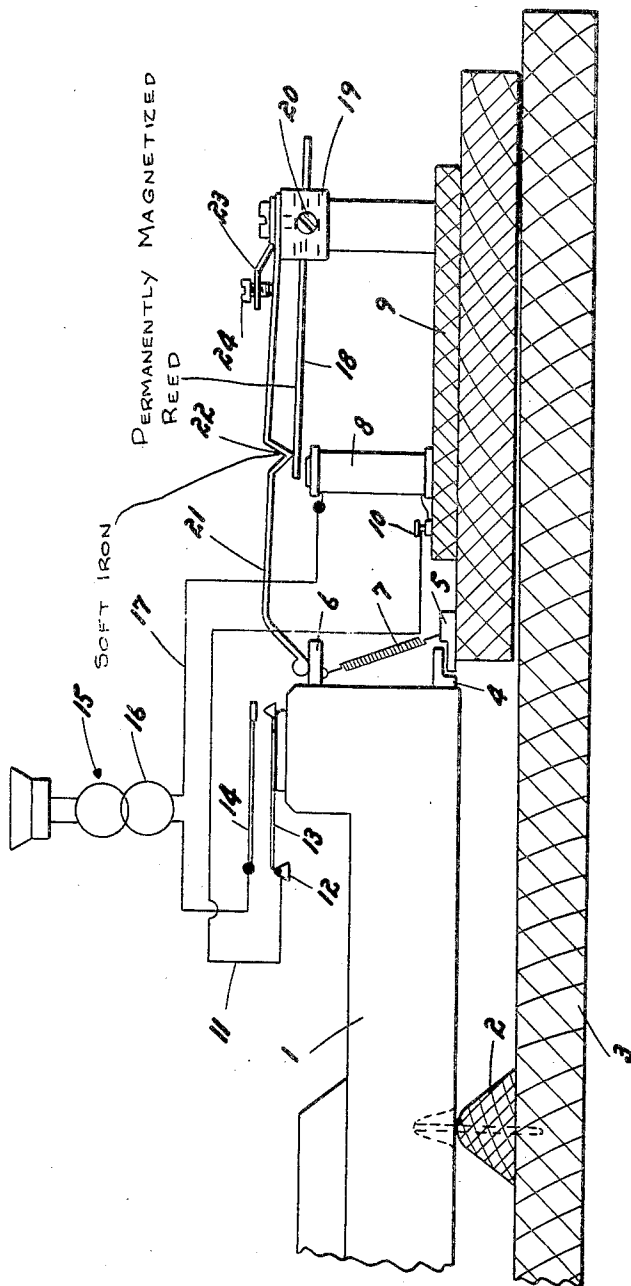
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MUSICAL INSTRUMENT

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This invention relates to musical instruments of the type including a number of vibratory elements of ferromagnetic metal tuned to different notes in a musical scale and arranged to be caused to vibrate at low intensity and while so doing induce a low-frequency alternating electric current in the coil of a corresponding electro-magnet, said current being, through a transformer, led to the input of an amplifier to be reproduced in the form of an amplified low-frequency signal in a loudspeaker connected to the output of said amplifier.

Musical instruments of this kind are previously known, in which an instrument in the shape of a piano is disclosed including a number of vibratory elements each one of which is caused to vibrate by an instantaneous connection of a corresponding electro-magnet into an electric circuit causing the vibratory element to be attracted and then immediately released, after which the same electro-magnet is connected into the transformer circuit, so that the low-frequency alternating currents induced in the coil of said electro-magnet due to the vibrations will be introduced into said last-named circuit. To obtain this result, a changeover switch is used for each key of the key-board of the instrument, said changeover switches being adapted to be operated through the actuation of the corresponding one of said keys.

The present invention has for its object to enable the large manifold of change-over switches as well as said circuit and connecting elements belonging thereto to be omitted and thereby attain a substantial simplification of instruments of the type described.

For the object stated, a musical instrument according to this invention is mainly characterized by the fact that to each vibratory element, which is magnetic, being suitably a permanent magnet, there is provided a movable armature, preferably made of soft iron or the like and arranged normally to retain the vibrating portion of said vibratory element attracted in its inactive position and to be lifted through the actuation of a key or the like until the attractive force is overcome by the counter-acting resilient force then produced in said vibratory element, so that the latter will be released and begin to vibrate in the field of the corresponding electro-magnet to be caught up again when the key or the like is released.

An embodiment of the invention will now be described by way of example, reference being had to the accompanying diagrammatic drawing the single figure of which illustrates a side-view of the mechanism belonging to one of the operating keys of the instrument.

In the drawing, a key of the key-board of the instrument is designated by numeral 1. The keys 1 are, as usual, rockably mounted on a felt-covered supporting pad 2 disposed on a base plate or board 3. The inner end of key 1 is provided with a shoulder 4 cooperating with a fixed stop member 5 in order to limit the rocking movement of the key 1. A tension coil-spring 7 inserted between stop member 5 and an upper shoulder 6 on the inner end of key 1 urges the key towards its position of rest.

The electro-magnets 8 belonging to the keys 1 are disposed as a bank on a special, longitudinally extending plate 9, and they are at one terminal connected in common to a bus bar 10 which latter is connected through a conductor 11 and connected to a second bus bar 12 which carries movable contact springs 13 of normally open switches, one such switch being provided for and corresponding to each key 1. The corresponding fixed contacts 14 of said switches are connected to one terminal of the primary winding 16 of the transformer 15. The other terminal of said primary winding 16 is connected by a conductor 17 to the second terminal of electro-magnet 8.

Provision is made to enable up to ten electro-magnets 8 simultaneously to be switched to the transformer 15 (at most ten keys can be operated simultaneously). In order not to cause the output to be attenuated too much, provision is made to compensate out the increased resistance of the coils of the electro-magnets as compared with the arrangement when the number of keys operated simultaneously is lower than ten.

The vibratory elements 18, in a manner known per se, are in the form of a rod mounted at one end in a support 19 and preferably consisting of a short length of piano wire which has been permanently magnetized and whose free length from the point of attachment has been so chosen that the rod will vibrate at the intended pitch frequency of the corresponding note. The rod 18 is longitudinally adjustable in its support 19 whereby it is possible to tune the same when necessary. A set screw 20 is provided for this purpose. Rod 18 extends substantially longitudinally relative to key 1 with its free end directed towards the key, and the electro-magnet 8 is disposed between the inner end of key 1 and support 19. Electro-magnet 8 should preferably be secured to plate 9 in such a manner as to be adjustable as to position both in parallel and perpendicular relation to the vibratory element 18.

Each vibratory element 18 has connected thereto a movable armature 21, preferably made of soft-iron. This armature is in the form of a resilient arm secured at one of its ends to support 19 above the vibratory element 18 and in parallel relation to the latter, said arm being arranged to be actuated at its opposite end by the key 1 when the latter is operated, the arm 21 being then lifted by the upper shoulder 6 of key 1.

Armature or arm 21 is formed opposite the free extreme end portion of rod 18 with a downwardly directed bend 22 serving as a pole-piece cooperating with the vibratory element 18 which is normally held attracted to the soft-iron arm 21 by the magnetically attractive force acting between the said two members. Upon operation of key 1 the arm 21 is lifted carrying with it rod 18 until the said attractive force is overcome by the oppositely acting resiliency which is then produced in the rod, whereby the latter will be released and begin to vibrate in the field of the electro-magnet 8, to be caught up again by arm 21 when key 1 is released and urged into its position of rest by its restoring spring 7.

The resiliency of armature or arm 21 is adjustable by means of a leaf-spring 23 secured to support 19 and having at its free end a set screw 24 which abuts the upper surface of armature 21 in spaced relation to the point of attachment of said armature to support 19.

Upon operation of key 1, switch 13, 14 is closed by the inner end of said key to transfer the low-frequency alternating current induced in electro-magnet 8 by the physical vibration of rod 18 in the field thereof. The gap between the contact elements 13 and 14 of the switch should be so dimensioned that the switch 13, 14 will be closed immediately after the release of the vibratory element 18 from armature 21.

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It should be understood that the invention is not to be considered to be restricted to the embodiment described in the foregoing and illustrated in the accompanying drawing since the same is susceptible of various modifications without departing from the scope of the invention as defined in and by the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In a musical instrument including a number of vibratory elements of ferro-magnetic metal tuned to different notes in a musical scale and adapted to vibrate at low intensity and to induce a low-frequency alternating electric current in the coil of a corresponding electro-magnet, a transformer connected to said electro-magnet and an amplifier connected to said transformer, said current from said electro-magnet passing through said transformer and the input of said amplifier for reproduction as an amplified low-frequency signal in a loudspeaker connected to the output of said amplifier, that improvement comprising a permanent magnet element connected to each of said vibratory elements, a movable armature formed of soft iron operatively connected to said vibrating element in its vibrating portion so that it vibrates in the same manner as said vibrating portion, a key means actuating said movable armature and said vibratory element, said armature when actuated by said key having an attractive force which is overcome by the counteracting resilient force in said vibratory element to produce a release of said vibratory element which vibrates in the field of said electro magnet.

2. A musical instrument according to claim 1 in which each vibratory element is in the form of a rod attached at one end to a support and in which said rod is longitudinally adjustably mounted in said support.

3. A musical instrument according to claim 2 in which said electro-magnet is mounted so as to be adjustable in its position both parallelly and perpendicularly relative

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to said vibratory element and in which said vibratory elements consist of relatively short magnetized lengths of piano wire.

4. A musical instrument according to claim 3 in which said armature is in the form of a resilient arm secured at one end to said support and extending in parallel relation to said vibratory element, said arm being adapted to be actuated at its opposite end by said key and in which said armature is formed with a bend serving as a pole-piece for cooperation with said vibratory element.

5. A musical instrument according to claim 4 in which the resiliency of said armature is adjustable by means of a leaf-spring secured to said support and provided at its free end with a set-screw engaging said armature in spaced relation to its point of attachment to said support.

6. A musical instrument according to claim 1 comprising, for each key, a normally open switch in the primary circuit of said transformer and arranged to be closed upon operation of the corresponding key in order to transfer the low-frequency alternating current induced in the coil of the corresponding electro-magnet by the vibration of said vibratory element.

7. A musical instrument according to claim 6 in which the gap between the contacts of said switch is so adjusted that said switch will be closed immediately after the release of said vibratory element from said armature.

8. A musical instrument according to claim 7 in which said switch is arranged to be closed by direct actuation from said key.

References Cited in the file of this patent

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