

Jan. 5, 1960

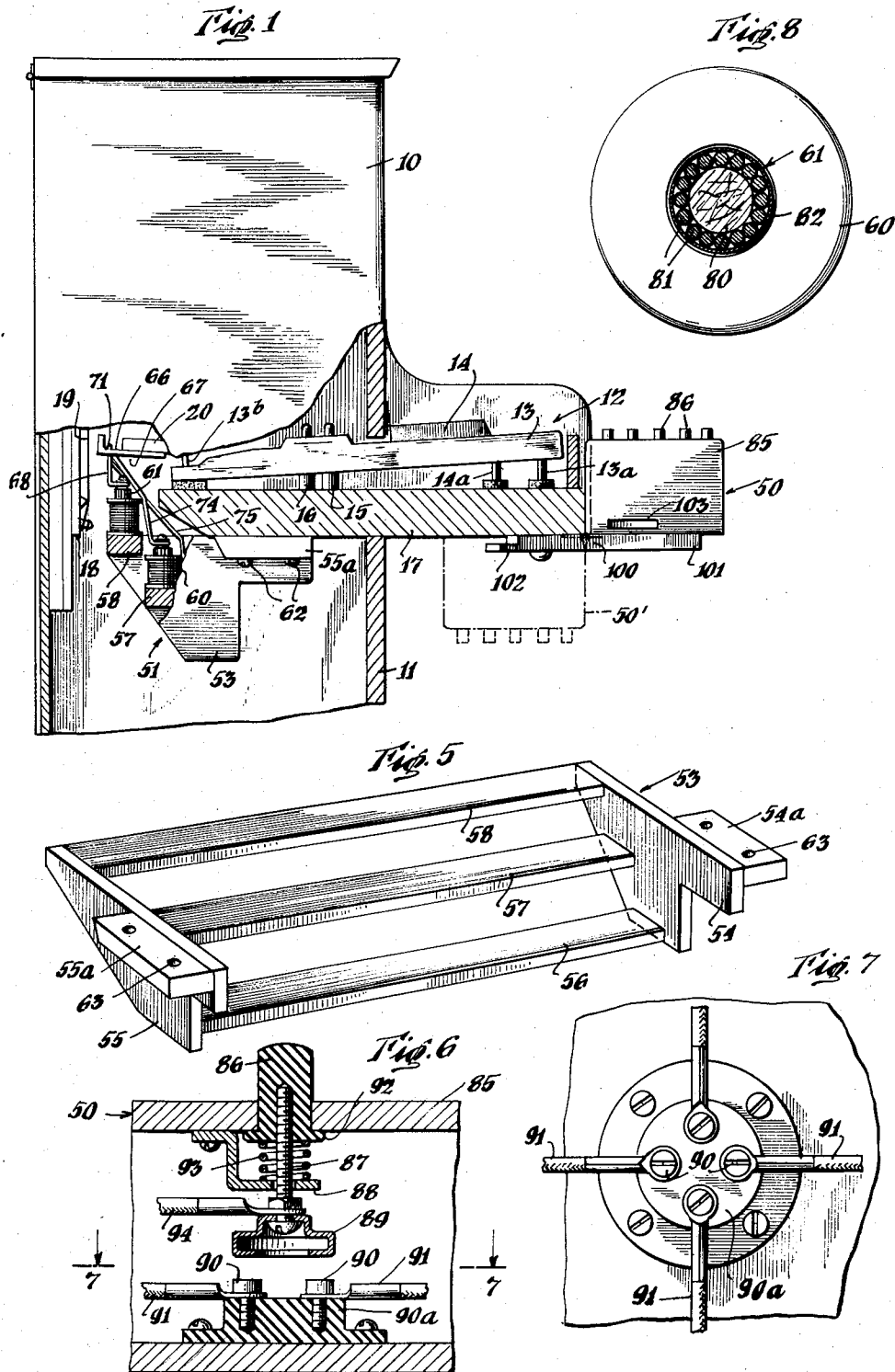
K. H. MUNZFELD

2,919,619

CHORD PLAYER ATTACHMENT FOR MUSICAL INSTRUMENTS

Filed May 7, 1956

3 Sheets-Sheet 1



K. H. MUNZFELD

CHORD PLAYER ATTACHMENT FOR MUSICAL INSTRUMENTS

3 Sheets-Sheet 2



1

2,919,619

CHORD PLAYER ATTACHMENT FOR MUSICAL INSTRUMENTS

Karl Heinz Munzfeld, Granite Falls, N.C.

Application May 7, 1956, Serial No. 583,272

4 Claims. (Cl. 84-443)

The invention is concerned with chord playing mechanism for installation in musical instruments. It is particularly directed to such a mechanism or attachment embodying key controlled electrically operated means that may be easily and conveniently installed in presently existing conventional upright pianos and adapted to operate through the normal mechanical action. As installed in a pre-existing or in a new piano it comprises an auxiliary mechanism selectively usable at will.

Various chord players in the form of attachments or built-in mechanisms intended to operate the normal mechanical action mechanism of the piano have been proposed heretofore but have had little or no success because of certain inherent disadvantages rendering their adoption for the purpose impractical.

In accordance with the general characteristics and principles of the present invention the major elements of the mechanism are preassembled as two units, one comprising a key assembly including electrical switch means and the other an assembly of electromagnet operators mounted on a common frame. The chord key unit is adapted to be applied to the piano in a convenient position preferably one adjacent the normal keyboard. It is small and compact and capable of being so mounted and positioned as not to interfere with the position or freedom of the person playing the instrument. In the specific embodiment disclosed the key unit is hingedly mounted in a manner such as to enable it to be swung into an operative position with the chord keys closely adjacent to and at approximately the horizontal level of the standard original keys or swung into a retracted position substantially out of sight.

The electromagnet unit embodies a considerable number of electromagnet operators mounted on a common frame the unit being preassembled and capable of insertion and being easily secured in position in open space commonly available such as exists in the bottom portion of a conventional upright piano below the normal keyboard. The electromagnets are arranged on the frame in a plurality of rows the rows being vertically spaced and the electromagnets in one row are bodily offset from the electromagnets in the other rows. By such compact arrangement solenoids of adequate size may be employed but direct mechanical connections made to successive normal key action mechanisms which in a normal piano must be closely spaced side by side in the direction of the standard keyboard.

The armature of each electromagnet is connected to a lever of the action mechanism for a predetermined one of the keys by a simple pull rod or wire which may be easily shaped to compensate for the position of the arma-

2

tures in different rows of the unit and the pull rod has a lost motion connection for the lever whereby the pull of the armature rocks the lever in a manner similar to the action of the corresponding normal key but the normal key may be operated free of any retarding inertia of the magnet armature. The electrical connections are through flexible wires and cables and may be readily made.

The mechanism includes a special type of armature particularly adapted for the purpose which is lightweight, results in a minimum of noise or hum and is free of any tendency to rotate.

Various other features and advantages will be described or indicated hereinafter or made apparent from a consideration of the specific embodiment of the invention illustrated in the drawings and which will be more fully described. The invention accordingly comprises features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims. Reference should be had to the accompanying drawings in which:

Fig. 1 is an end view in elevation of a portion of a generally conventional upright piano with the casing broken away over the middle area to show part of the mechanism with the auxiliary chord player applied;

Fig. 2 is a vertical sectional view on a larger scale showing the standard action of the piano with the electromagnet operating means of the present invention incorporated therein;

Fig. 3 is a plan view of the keyboard showing the electromagnet unit and the auxiliary chord key unit applied;

Fig. 4 is a fragmentary view in perspective showing the key unit applied;

Fig. 5 is a perspective view of the frame upon which the electromagnets are mounted;

Fig. 6 is a cross-sectional view on an enlarged scale showing one of the electrical switch means embodied in the chord playing key unit;

Fig. 7 is a view taken on the line 7-7 of Fig. 6;

Fig. 8 is a top view of one of the electromagnets with the armature shown in cross section, the view being taken on the line 8-8 of Fig. 2; and

Fig. 9 is a wiring diagram illustrating the electrical connections controlled by one of the keys.

The present invention is particularly advantageous in connection with a piano of the conventional upright type and Fig. 1 shows a portion of a piano of that general type having a casing 10 with a removable lower front panel 11 and a standard keyboard 12. The keyboard has the usual arrangement of white keys 13 and black keys 14 each supported by pivot means 15 and 16 respectively and each having conventional front guides as indicated at 13a and 14a respectively. The keys are mounted on a common base or board 17. As indicated particularly in Fig. 2, located at the rear is the string board 18 carrying the bank of strings 19 in the usual manner.

The chord player attachment is adapted to be associated with a standard piano action such as the typical form disclosed in Fig. 2. Each key of the main keyboard such as the key 13 shown in Fig. 2 carries an adjustable pin 13b adapted to engage under one end of a lever 20 commonly called a wippen pivoted at 21. The lever 20 carries a jack 22 pivoted thereon at 23, urged in a counter clockwise direction by spring 24. The nose of jack 22 normally engages under the hammer body 25 pivoted at

3

26. Extending from the body 25 is a shank 27 which carries a hammer 28 normally urged by spring 29 to a retracted position, as shown, with shank 27 engaged against a pad 30 on the hammer rail 31.

Lever 20 also carries a rigid finger 35 which upon rocking of lever 20 counter clockwise swings damper lever 36 clockwise about its pivot 37 against the pressure of spring 38. The upper end of lever 36 has a shank extension 38 on which is mounted a head 39 carrying a damper pad 40 normally resting against its string.

The mechanism includes various other elements common in piano actions the functions of which are well known such as the check 42 carried on the lever 20 for the backstop 43 extending from hammer block 25, and the bridle tape 44 secured at one end to the block 25 and at the other end to a wire finger 45 mounted on wippen lever 20. Suffice it to point out for the present purposes that operation of the key racks lever 20 counter clockwise causing the upper end or nose of jack 23 to engage under and rotate hammer block 25 counter clockwise and hammer 28 to strike its string 19. The rocking of lever 20 simultaneously lifts damper pad 40 from the string as heretofore described.

The auxiliary chord player attachment embodies two main preassembled units comprising a chord key unit indicated generally at 50 and an electromagnet operator unit indicated generally at 51. The individual keys of the chord player can be arranged and appropriately connected to operate any combination of notes over the entire scale if desired. Normally, however, the chords will be limited to the base notes or notes commonly played by the left hand and in the use of the attachment the melody may be played by the right hand and the chords by manipulation of the chord keys by the left hand. Accordingly in the present embodiment the electromagnet unit is located toward the base end of the instrument and may be a relatively short compact unit as indicated for example in plan in Fig. 3.

The unit includes an electromagnet for each note contemplated to be embodied in or used in the chord player. The number of chord player keys, however, may be less than the number of electromagnets since some or all of the electromagnets may be connected by electrical circuits to more than one chord key and used in more than one combination of keys or chords.

The electromagnets are mounted on the common frame 53 shown unassembled in Fig. 5. The frame comprises two end sections 54 and 55 between which extend in the present embodiment of the invention three parallel bars 56, 57 and 58 arranged in the form of successive steps. The electromagnets are mounted on the respective steps as indicated particularly in Fig. 2.

Each electromagnet includes a solenoid 60 in the usual form of a spool with many turns of fine wire and having an armature 61 axially movable therethrough. For the installation of the chord player a suitable mechanical connection is made from each armature to the particular piano action of a particular note. It may be noted first, however, that the electromagnets are all preassembled on the frame 53 and the frame is adapted to be mounted as a unit with the electromagnets in appropriate position. A very simple arrangement is provided in this respect. The frame 53 which may be made of wood is provided with a pair of ears 54a and 55a extending laterally and horizontally from the respective end pieces 54 and 55 as indicated particularly in Fig. 5. The unit is easily installed by temporary removal of the panel 11 and securing the unit in the position shown by screws 62 inserted through the openings 63 in ears 54a and 55a and extending into the base or board 17 of the keyboard assembly.

Each armature is connected to its respective piano action by simple mechanical means comprising as shown in Fig. 2 a small plate 66 secured by screws 67 to the under surface of the action lever 20, and a pull rod or wire extending from the armature to the plate 66. For

4

the particular action and key shown in Fig. 2 the pull wire 68 extends from an armature 61 in the back row, the wire having a loop at its lower end secured to the upper end of the core of the armature by a screw 69 and preferably an intervening washer 70. The upper end of the rod 63 extends through a hole in the plate 66 which is oversize to permit free movement of the wire in the hole. The upper end of the wire 68 has a portion 71 bent over at right angles to cause the left end of the lever 20 to be rocked downwardly when the respective solenoid is energized and the armature 61 is drawn downwardly. It will be apparent that the energizing of the solenoid operates the action and the rendition of the corresponding note in substantially the same manner as by the operation of the standard key 13 or 14. It will also be noted that by reason of the lost motion connection between the rod 63 and the lever plate 66 the action may be operated by the key 13 independently of and without necessarily moving the armature 69 and its wire 68. Upon operation by the normal key 13 the downward movement of the left end of the lever 20 may be accompanied or followed by the dropping of the armature 69 and its rod 63 under the force of gravity, but the key 13 is not required to overcome any inertia of the armature to effect the prompt rendition of the note.

The armatures of the electromagnets in the middle row are similarly connected to their respective piano actions by a wire or rod 74 corresponding to the wire 68 but appropriately bent to allow for the position of the electromagnets in the middle row further to the front. The same is true as to the electromagnets in the front or bottom row and their respective connecting wires 75. In accordance with common design in pianos, the successive actions are arranged closely adjacent to each other from end to end of the piano, the distance center to center of such actions commonly being less than $\frac{3}{4}$ inch for example. An electromagnet which is adequate and efficient for the purpose and economical of manufacture would normally have a diameter substantially more than the distance apart center to center of the piano actions. Accordingly where successive keys are operated by electromagnets it would be impossible to arrange the magnets in a single row. The present arrangement with the magnets on three levels and with the electromagnets in one row offset from those in another as indicated for example in Fig. 3 enables, however, the connection of electromagnets to successive actions by a compact unit arrangement and with simple and effective mechanical operating connections.

The present invention embodies electromagnets and particularly an armature construction which are particularly effective and advantageous for the purpose. As shown in Fig. 8 each armature embodies a core 80 of relatively lightweight non-magnetic material such as, for example, wood or suitable plastic composition. The magnetic portion comprises a ring of comparatively large diameter made up of a series of longitudinally extending wires or rods 81 of magnetic material such as iron, the individual wires being coated with a non-magnetic material which may be zinc. The core and surrounding row of magnetic wires are bound together by an enclosing cylinder 82 of non-magnetic and electrically non-conducting material which may be a fibrous sheet material such as paper. With the proper winding on the spool the present electromagnet is especially adapted for the purpose, and in particular it has a lightweight armature of therefore low inertia, and there is no tendency of the armature to rotate and disturb the mechanical connections to the lever 20. Furthermore the electromagnet is relatively free of hum or noise.

As has been heretofore noted the chord key unit is likewise preassembled and compact in its arrangement. It comprises an outer casing 85 having a series of keys 86 projecting upwardly therefrom when the unit is in the position shown in Fig. 4, for example. Each key 86 is

adapted to close a switch upon depression thereof. The details of the particular arrangement employed in the present embodiment are shown in Fig. 6. The keys 86 which are of electrically insulating material have secured therein a stem 87 axially movable through a guide 88 of preferably insulating material. The lower end of stem 87 carries an electrical contact button 89 adapted to engage the contact elements 90 which have individual wire connections 91 leading in each case to one of the solenoids. The contact elements are mounted in a flanged body 90a of electrically insulating material. The key 86 has a lower flange 92 which normally is held upwardly in engagement with the under surface of the top wall of the casing 85 by compression spring 93. The contact button 89 is connected to the lead-in wire 94 comprising one side of the electrical circuit. The electrical circuit may be varied as to particular design but a suitable arrangement thereof may be as just described and shown in Fig. 6 and more completely in diagrammatic form in Fig. 9, which latter includes the solenoids 60 and a source of electrical power indicated generally at 95. Also it is to be understood that the form and mechanical features of the key may be varied and when the term "key" is employed in the claims it is intended to embrace any manually operable device adapted to serve the purpose described.

As indicated in Figs. 6, 7 and 9 the particular button or key 86 is adapted to energize four of the solenoids but it will be understood that the number of solenoids energized from a particular button will vary in accordance with the chord desired to be rendered by that key. Also most of the solenoids will have a wire connection to more than one key such as indicated by the wire 91a in Fig. 9.

The chord key unit may be mounted in any desired position appropriate to its function and accessibility for operation. A particularly practical means is embodied in the present example of the invention. As shown in Fig. 1 the unit is secured to the under surface of the board 17 by a hinge 100 whereby it may be swung to the position shown in full line or to a retracted position indicated in broken lines at 50' in Fig. 1. A latch means is provided for holding the unit in the selected position comprising a pivoted lever 101 which is adapted to be swung underneath the bottom surface of the unit to hold it in the position shown in Figs. 1, 3 and 4. To move the unit to the position shown at 50' in Fig. 1 the lever 101 is rotated temporarily out of the path of the unit 50 and when the unit is swung to the position 50' the opposite end of the lever 101 is rotated to position the tongue 102 on the opposite end of lever 101 in the slot 103 in the end surface of the unit 50. The electrical connections from the unit 50 leading to the solenoids and to the source of electrical power are conveniently embodied in a flexible cable 104 enabling the unit 50 to be swung freely on its hinge and affording easy assembly of the attachment in a standard existing piano.

The keys have associated therewith indicia appropriate to the chords controlled by the respective buttons which may be applied to the upper end of the keys or on the upper surface of the casing 85 adjacent the keys for example. The indicia may be, for example, numbers to be associated with music or charts embodying successive numbers in association with notes or numbers comprising the melody designed for the use, and if appropriately made up, for the instruction of persons unfamiliar with written music. In other words, the attachment lends itself very readily to the playing of music including full chord arrangements by a person not capable of reading notes or normal sheet music.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown

in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A chord player attachment for upright pianos having a normal keyboard and an actuating mechanism associated with each key for rendering the respective musical notes, said attachment comprising a key unit embodying a plurality of chord keys and electrical switch means for each chord key, a hinge mounting means securing said unit to the piano and arranged to enable the unit to be swung to a position underneath the said normal keyboard or to a position outward therefrom with the chord keys located adjacent the keys of the normal keyboard and on substantially the same horizontal level for convenient operation of the individual chord keys, a plurality of electromagnet units mounted in the piano below said actuating mechanism, an operating connection from each electromagnet to one of said actuating mechanisms, and electrical connections for energizing predetermined ones of said electromagnets from the respective said electrical switch means.

2. A chord player for a piano having a normal keyboard and an actuating mechanism associated with each key for rendering the respective musical notes, each said mechanism including a pivoted lever connected to be operated by the corresponding normal key, said chord player comprising an auxiliary assembly of manually operable chord keys attached to the piano, an assembly of electromagnets mounted in the piano adjacent said mechanisms, an operating connection from each electromagnet to the said lever of a separate one of said actuating mechanisms, and electrical connections for energizing said electromagnets from said chord keys, each chord key and its electrical connection being arranged to energize the connected magnets to effect a separate predetermined chord, said operating connections including a lost motion device to enable free operation of the keys of the normal keyboard without operating the corresponding electromagnet connection.

3. A chord player attachment for a piano having a normal keyboard and an actuating mechanism associated with each key for rendering the respective musical notes, each said mechanism including a pivoted lever connected to be operated by the corresponding normal key, said chord player attachment comprising an auxiliary assembly of manually operable chord keys attached to the piano, an assembly of electromagnets each including an armature mounted in the piano adjacent said mechanisms, an operating connection from each electromagnet to the said lever of a separate one of said actuating mechanisms, and electrical connections for energizing said electromagnets from said chord keys, each chord key and its electrical connection being arranged to energize the connected magnets to effect a separate predetermined chord, said operating connections each embodying a pull rod connected at one end to the respective armature and at the other end having a lost motion connection to the respective said lever to enable free operation of the keys of the normal keyboard without operating the corresponding electromagnet connection.

4. A chord player attachment for upright pianos having a normal arrangement of keys mounted on a supporting board and an actuating mechanism associated with each key for rendering the respective musical notes each said actuating mechanism including a pivoted lever connected to be rocked by the corresponding normal key, said attachment comprising an auxiliary assembly of manually operable chord keys secured to the piano in convenient position for operation of the individual chord keys, a preassembled electromagnet unit embodying a frame and a plurality of electromagnets mounted thereon each including an armature, said frame being mounted and secured as a unit to the underside of said board, an operating rod extending from each electromagnet

armature to the lever of a different one of said actuating mechanisms including a lost motion connection to the lever, and electrical circuit and switch means for energizing predetermined ones of said electromagnets from the respective said chord keys, said electromagnets being arranged on said frame in a plurality of rows with the rows vertically spaced, the electromagnets in one row being offset in the direction of the row from those in an adjacent row thereby effecting a compact arrangement permitting direct connections from the respective electromagnets to successive normally closely spaced said actuating mechanisms.

5

10

References Cited in the file of this patent

UNITED STATES PATENTS

488,482	Pain	Dec. 20, 1892
730,098	Davis	June 2, 1903
784,508	Weber	Mar. 7, 1905
1,300,878	Reynolds	Apr. 15, 1919
1,603,871	Sandell	Oct. 19, 1926
2,243,834	Bonilla	June 3, 1941
2,422,260	Ray	June 17, 1947
2,569,525	Hill	Oct. 2, 1951
2,635,138	Reisner, Jr.	Apr. 14, 1953