

Nov. 7, 1950

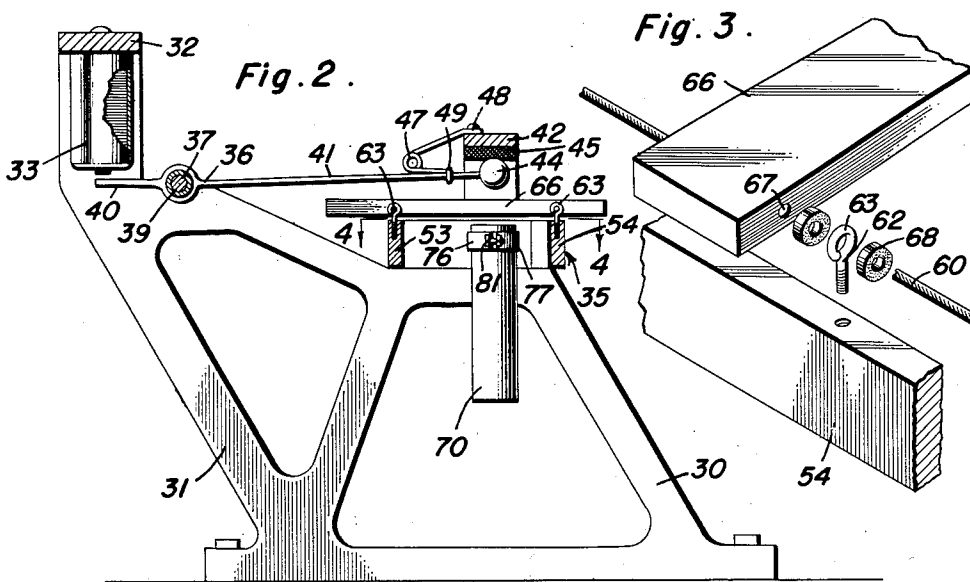
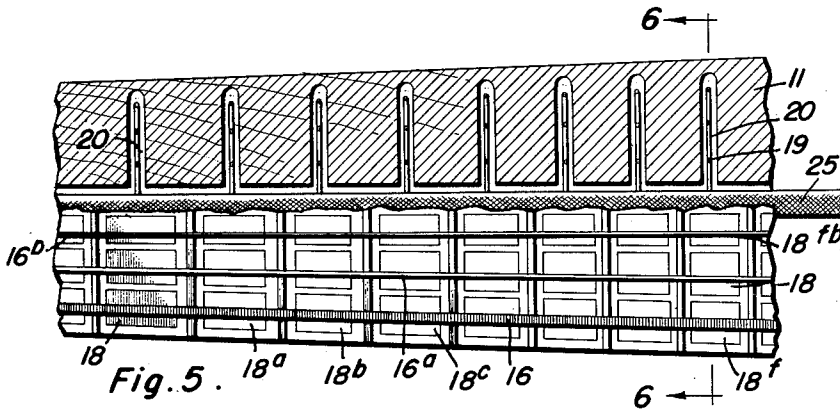
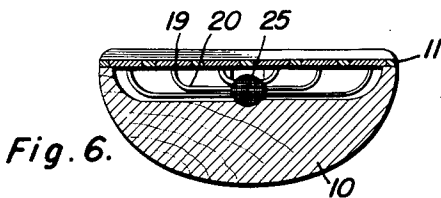
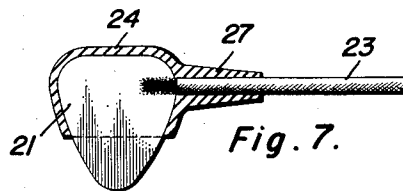
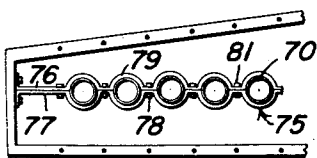
T. W. MITCHELL

2,528,663

STRING OPERATED MAGNETOELECTRIC MUSICAL INSTRUMENT

Filed Jan. 31, 1949

2 Sheets-Sheet 2



Thomas W. Mitchell
INVENTOR.

BY *Chance W. Dixon*
and *Harvey B. Jackson*
Attorneys

UNITED STATES PATENT OFFICE

2,528,663

STRING OPERATED MAGNETOELECTRIC
MUSICAL INSTRUMENTThomas W. Mitchell, St. Louis, Mo., assignor of
forty-nine per cent to R. C. Marrs, St. Louis,
Mo.

Application January 31, 1949, Serial No. 73,683

7 Claims. (Cl. 84-1.16)

1

This invention relates to magneto-electric musical instruments and it has for its main object to provide a musical instrument of this type which is operated by means of a string instrument played in the conventional manner.

String instruments, such as guitars, mandolins and the like are played by pressing down the strings against the neck of the instrument, thus determining an active or free length of the oscillating string which corresponds to the tone to be produced, while at the same time the string is picked or made to vibrate. As string instruments practically merely consist of the body which forms the resonance box and which holds the strings on one side and of the neck portion which carries the tuning keys, holding the strings on the other side, it is difficult to combine with a string instrument amplifying or tone reproducing or producing means. All appliances for picking up tones, produced on the string instrument for amplifying it, or for producing tones of another character when actuated by the playing of the string instrument, must be carried by or in the resonance box, thus affecting the tone production or amplification and increasing the weight of the instrument. As will be clear, these changes will greatly effect the handling of the instrument and its output.

It is an object of the present invention to provide a method and means for producing musical tones of a character different from the tone produced by the string instrument, along with the production of the same tone or note on the string instrument, without substantially affecting the playing method or the weight of the instrument and without materially affecting the tone production of the string instrument itself.

It is a further object of the invention to provide magneto-electric means for producing musical tones, actuated by the playing of a string instrument, said magneto-electric means being arranged at a distance and being operated by electric currents.

It is a further object of the invention to provide a magneto-electric musical instrument with a plurality of hammers or mallets striking against a tone producing member, such as a tuned block or rod, the means corresponding to a certain note or tone being actuated by the player pressing the strings against the neck of the instrument and picking the strings while playing the same.

It is a further object of the invention to provide means for energizing the electro-magnetic means of the musical instrument which include

2

contacts provided on the string instrument, preferably on the neck of the same, and which further include circuits associated with said contacts, each of which includes one of the said electro-magnetic actuating means.

It is a further object of the invention to provide means for closing individual energizing circuits on a string instrument upon the striking of a definite note or tone, said means including series of contacts aligned along the strings on the neck of the instrument, each contact being arranged at the place against which the string is pressed when a definite tone or note is produced by the player and said means further including conductive strings and a pick associated with a source of current.

Further and more specific objects will be apparent in the following detailed specification.

The invention is illustrated diagrammatically in the accompanying drawing but it is to be understood that the drawing shows one modification of the invention only by way of example in order to be able to explain the principle on which the invention is based and the best mode to apply this principle. It will be clear that the principle of the invention may also be carried into effect by using other modes of applying said principle. Modifications of the example shown are not, therefore, necessarily a departure from the essence of the invention.

In the drawing:

Figure 1 illustrates diagrammatically a plan view of the magneto-electric instrument and also shows the circuits for operating the said magneto-electric instrument.

Figure 2 shows an elevational view partly in section of the magneto-electric musical instrument.

Figure 3 is a perspective view illustrating the suspension of the tone blocks.

Figure 4 is a plan view of the end of the frame illustrating the means for holding the resonators.

Figure 5 is a plan view partly in section of the neck of a guitar provided with the controlling means according to the invention.

Figure 6 is an elevational sectional view of the neck of a guitar the section being taken along line 6-6 of Figure 5.

Figure 7 is an elevational view partly in section of the pick of the guitar.

As above explained the invention consists in producing musical tones, corresponding exactly to those produced on a string instrument, such as a guitar, by playing the said string instrument in the customary manner, the musical tones being

produced on a special musical instrument having its own characteristics and, if necessary, an amplifying or reinforcing equipment.

In the example illustrated in the drawing a guitar 10 may be used which is played in the usual manner by means of a pick 15. The guitar is of the conventional shape and is provided with the usual number of metallic strings 16, 16a, 16b

The conventional shape of the guitar is preferably selected in order to produce the impression that an instrument with which the player and his audience are familiar is played. Moreover the playing of the instrument is greatly facilitated when the familiar shape is used. However, the special shape of the guitar has no influence on the tone produced according to the present invention and it may therefore be changed if this appears to be desirable.

The guitar 10 is provided with the customary neck portion carrying the fingerboard 11. The fingerboard is a wooden structure which is subdivided in order to indicate and to produce various tones or half tones by pressing the string against the board with the finger of one hand, so as to determine the active or free oscillating length of the string which is picked. It will be clear that for each tone or half tone to be produced a definite place on the fingerboard has to be selected. At these places metal contact plates 18 are inserted into the fingerboard, a series of such contact plates 18, 18a, 18b, 18c, . . . being arranged along each of the strings 16, 16a, 16b

In this way, if the finger of the player presses a string down against the fingerboard at the proper place to produce a desired tone, a contact will be made between the metal strings and the metal plate corresponding to this tone.

Each metal plate 18, 18a, 18b, . . . is wired at 19 to a transversely arranged strand 20 of a multi-conductor cable 25 which runs along the neck of the guitar below the fingerboard and which is of sufficient length to be connected with a terminal box 22 (Figure 1) while allowing free movement of the guitar to the desired extent.

The pick 15 with which the guitar is played and which is shown in detail in Figure 7 consists of a wedge-shaped metal core 21 which is soldered or otherwise connected to an insulated wire strand or cable 23. Preferably the wire strand or cable strand enters a cavity in the core which is afterwards filled with solder metal. An insulating cap or shell of plastic or other material covers the metal core of the pick, the latter protruding from said insulating cap at the tip of the wedge. The portion covered by the insulating cap serves as a handle and is held by the player. The cap may be provided with a tubular extension 27 in order to protect the cable 23 and its connection with a pick.

The musical tones which have been selected by the player by placing his finger on the fingerboard and by pressing the string towards it while striking the string with a pick by means of his other hand are actually produced on the guitar. But it is to be understood that the construction of the guitar may be such that these tones may not be heard by the audience, if this appears to be desirable.

The tone producing musical instrument or attachment in this case which is operated in a magneto-electric way consists of a framework 30 which comprises two or more standards or supports 31 carrying two longitudinal bars 32, 42 and

a tone block carrier frame 35 to be described below.

On the longitudinal bar 32 a series of electro-magnets 33 is mounted which magnets may be polarized, if an A. C. current is used for energizing them. As many electro-magnets are arranged as tones or half tones are to be produced and are played on the guitar or other string instrument.

The armature of each electro-magnet 40 consists of or is attached to the pivoted lever 36 which is rockable around a rocker shaft 37 held in bearings 38. Each lever 36 is provided with a hub member 39 which supports it on the shaft 37.

The armature 40 may form part of or may be supported by the lever 36 and forms the shorter arm of said lever while the longer arm 41 carries a hammer or mallet 44. The mallets are all arranged below the longitudinal bar member 42 which forms a mallet stop and which as seen in Figure 1 is a stepped member the sections of which are arranged at increasing distances from the rocker shaft. The stepping of the mallet stop has the purpose to place the sections of the mallet stop bar 42 more or less centrally above the mallets 44 which are divided into groups arranged at different distances from the rocker shaft for a purpose which will be apparent.

The mallet stop bar 42 is lined with heavy felt 45 at its underside to prevent any noise, should the mallet strike against it in the course of its return movement.

The mallet stop bar 42 is moreover carrying a series of coil springs 47 with projecting ends or arms. One end 48 is fixed to the mallet stop bar 42 while the second end 49 is bent at right angles provided with an eye, encircling and firmly holding the mallet arm 41. The spring 47 is tensioned when the mallet is moved away from the stop bar 42 and it has therefore the tendency to return the mallet into its original position.

Below the mallets 44 the tone block carrier frame 35 is arranged. It consists of the two transverse or end pieces 52 and of the longitudinal members 53 and 54. These longitudinal members are arranged at an angle with respect to each other so that the transverse distance between them increases from one end to the other. The two end pieces or transverse heads 52 are therefore also of different length.

These longitudinal portions 53, 54 of the frame are of a smaller height than the end pieces so that a step results near the point where they join the end pieces 52 which are on a somewhat higher level than the upper edges of the longitudinal members. A heavy cord, rope or string 60 is extended above the upper edge of said longitudinal frame portions 53, 54 and is held in the eyes 55 of screws 56 fixed in said transverse heads 52 near the step of the longitudinal portion. The cord or string 60 is thus held in a tensioned condition above the frame between the screws 56 and it is stretched and tensioned in such a way that it runs in a straight line along the longitudinal portions 53 and 54 from one transverse head 52 to the other transverse head.

At regular intervals screws 62, provided with eyes 63 are projecting upwardly from the longitudinal frame which eyes are all aligned so that the tension cord or string 60 passes through them. The cord or string is therefore firmly held against vibration.

The cord supports tone blocks 65 or bars which are metal blocks tuned to a certain musical tone, and which are adapted to produce such a tone when supported at definite points and when

5

struck by a mallet. The tuned tone blocks 66 are provided with bores 67 running transversely with respect to their own longitudinal extension. One of the bores 67 is somewhat inclined towards the axis of the tone blocks in accordance with the angle at which the two cords 60 are mounted above the two frame members 53 and 54 which are also inclined towards each other. The tuned blocks are placed transversely on the frame and the cords or strings 60 are threaded through the bores 67. Felt washers 68 are used to space the tuned blocks correctly between adjacent screws 62 and eyes 63 projecting from the longitudinal members 53, 54.

The blocks are therefore not only supported at the correct distance between selected supporting points, a distance which is defined by the bores 67, but their vibrations cannot be transmitted to the frame 35 by virtue of their suspension on the cords, nor can any vibration which may have been set up in the frame be transmitted to the tone blocks.

The cords or strings 60 may of course be provided with tightening clamps (not shown) at one end in order to tension them properly.

As seen in Figure 1 the length of the tuned tone blocks 66 increases steadily from one end to the other in accordance with the variation of the musical tone which has to be produced. Therefore, in order to strike the tuned blocks approximately in the middle, the length of the mallet arm 41 is also increasing steadily. The mallet stop bar 42 is therefore stepped as above explained in order to be placed centrally above the mallets.

Below each tuned tone block 66 a resonator 70 is arranged. It consists of a cylindrical resonator body of the required length which is open at its end, said open end being located directly beneath the tuned tone block 66. The resonator which is tuned to the same tone to which the tone block is tuned is therefore adapted to reinforce by resonance the tone produced by the tuned block 66.

The resonators 70 are supported by a frame structure 75 shown in Figure 4 which consists of two members, each composed of a series of semi-circular clamp sections joined by straight sections 78. Screws 81 may be used to hold the two members 76 and 77 together so as to clamp the resonators firmly between the semi-circular clamp sections 79 which will hold the resonators suspended with their upper edge below the tone blocks 66.

The electrical connections are clearly shown in Figure 1. The source of current may be the usual network 80 which by means of a transformer 82 steps down the voltage to a safe value. A reduced and safe voltage is necessary as the player may accidentally touch current carrying parts. The A. C. may be rectified and the rectified D. C. may be used as indicated at 84 in the drawing, Figure 1. The rectifier box may also contain the main switch of the arrangement. Rectification of the A. C. can be dispensed with if the electro-magnets are polarized and are therefore operable by A. C. In this case the box 84 merely contains a circuit breaker which permits to cut out the current from the arrangement.

The rectifier 84 or the transformer 82 as the case may be, forms the source of current for the arrangement. With this source the pick 15 is connected by means of conductor 84 leading to the cable 23. The other side of the source of

6

current is connected with the conductor 87 which is a common energizing conductor for all the electro-magnets 33. Each electro-magnet 33 however has an individual conductor 88 branching off from the common conductor and leading to a terminal box 19. In this box each conductor 88 is wired to a strand of the multi-conductor cable 25 which leads to the guitar 10 or other string instrument. The strands of the multi-conductor cable are connected as has been described.

When the player presses down a string 16, 16a, 16b, . . . with the finger of his left hand and with his right hand, holding the pick 15, strikes the string, a tone is produced in the guitar in the customary manner but also a circuit is closed, energizing the electro-magnet corresponding to the musical tone which has been produced in the guitar by the player. This circuit runs from 82 over 84 and 87 to the electro-magnet 33f, assumed to correspond to the tone produced on the guitar by a player and over conductor 88f to the terminal box 22 and over the cable strands of cable 25 with which the conductor 88f is connected to the metal plate in the series 18f which the player used when playing. Assuming that the player pressed string 16b against contact 18fb while striking the string 16b with the pick 15 the circuit is closed over the said plate 18fb, the string 16b, the pick 15 and the cable 23 which leads to conductor 86 connected with the source of current.

The magnet 33f is therefore energized and attracts armature 40 which moves the mallet 41, 44 and strikes against the tuned tone block 66 thus producing the tone which corresponds to the note played on the guitar.

The tones played on the guitar are therefore not only produced on the instrument but are also produced on the tone blocks. The tune played on the guitar is therefore played on the blocks simultaneously with the playing on the string instrument.

It will be understood that the system which has been explained above may be used to produce a remote reproduction or to produce desired musical effects by using means imparting a distinctive coloring to the tone produced.

Obviously the means for producing tones simultaneously with the tones produced on the guitar or controlled by the player may be somewhat different from those shown in the drawings, and moreover other unessential changes may be made without departing from the essence of the invention.

Having described the invention, what is claimed as new is:

1. A magneto-electric musical instrument comprising a portable string instrument, having a conventional instrument body and neck, a plurality of conductive strings stretched over said body and neck, contacts arranged in longitudinal and transverse series along said neck, the contacts forming a longitudinal series being arranged on the neck along a single string of the instrument, each contact of the series corresponding to the portion of the neck against which a string is pressed to produce a definite tone, the transverse series, arranged along a transverse line, corresponding to tones produced on different strings, a pick provided with a conductive picking member, for picking said strings, an assembly of stationary vibratory sound producing elements, arranged at a distance from the string instrument, each vibratory sound producing ele-

ment being provided with a striking vibrator for producing sound vibrations, electro-magnetic means actuating each of said striking vibrators, a source of current, a circuit connected with each of said neck contacts, a circuit connected with the pick, each of said circuits comprising conductors leading from the string instrument to the said assembly of vibratory sound producing elements, and each electro-magnetic means being included in the circuit of one of the neck contacts and in the circuit of the pick, the tone produced by a vibratory sound producing element corresponding to the tone produced by the string, when pressed against the contact and picked by the player.

2. A magneto-electric musical instrument comprising a string instrument, having a conventional instrument body and neck, conductive strings stretched over said body and neck, contacts on said neck, each contact being located at a place at which a string is depressed by the player to produce definite musical tone, a pick provided with a conductive picking member, for picking said strings, a source of current, a circuit connected with each of said neck contacts, a circuit connected with the pick, a series of electro-magnets for producing tones, mallets operated by said electro-magnets, and tone blocks struck by said mallets when operated, each electro-magnet being included in the circuit of one of the contacts and in the circuit of the pick, the tone produced by the tone block when struck corresponding to the tone produced by the string when pressed against the contact in the circuit of which the electro-magnet is included.

3. A magneto-electric musical instrument comprising a string instrument, having a conventional instrument body and neck, conductive strings stretched over said body and neck, contacts arranged in longitudinal and transverse series along said neck, contacts forming a longitudinal series being arranged on the neck along a single string of the instrument, each contact of the series corresponding to the portion of the neck against which a string is pressed to produce a definite tone, the transverse series arranged along a transverse line, corresponding to tones produced on different strings, a pick provided with a conductive picking member, for picking said strings, a source of current, a circuit connected with each of said neck contacts, a circuit connected with the pick, a series of electro-magnets for producing tones, mallets operated by said electro-magnets, and tone blocks struck by said mallets when operated, open resonators arranged in front of said tone blocks to reinforce by

resonance the tone produced in said tone blocks, each electro-magnet being included in the circuit of one of the contacts and in the circuit of the pick, the tone produced by the tone block when struck corresponding to the tone produced by the string when pressed against the contact in the circuit of which the electro-magnet is included.

4. In a magneto-electrical musical instrument as claimed in claim 2, suspension means for the tone blocks including supports, and of a cord tensioned between and supports for holding said tone blocks.

5. In an electrical musical instrument as claimed in claim 2, in which the tone blocks are provided with bores, supports arranged at a distance, and cords tensioned between said supports, and passing through the bores of the tone blocks.

6. In a magneto-electrical musical instrument as claimed in claim 2 with tone blocks provided with transverse bores, suspension means for said tone blocks comprising a frame with longitudinal and transverse members, cords tensioned between said transverse members and running above and along said longitudinal frame members, spaced members provided with eyes carried by and projecting from said longitudinal frame members, with the eyes aligned along a straight line, the tensioned cord passing through said eyes and through said bores in the tone blocks and spacing members for holding said tone blocks between the eyes of said spaced members.

7. In a magneto-electric musical instrument as claimed in claim 2, a mallet stop member facing the tone blocks, a mallet carrying arm for each mallet, spring means attached to said mallet stop member and to said mallet carrying arm to hold the mallet against the mallet stop in its position of rest.

THOMAS W. MITCHELL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,978,583	Kentner	Oct. 30, 1934
2,070,344	Waters	Feb. 9, 1937
2,352,438	Hruby	June 27, 1944

FOREIGN PATENTS

Number	Country	Date
459,675	Great Britain	Jan. 13, 1937