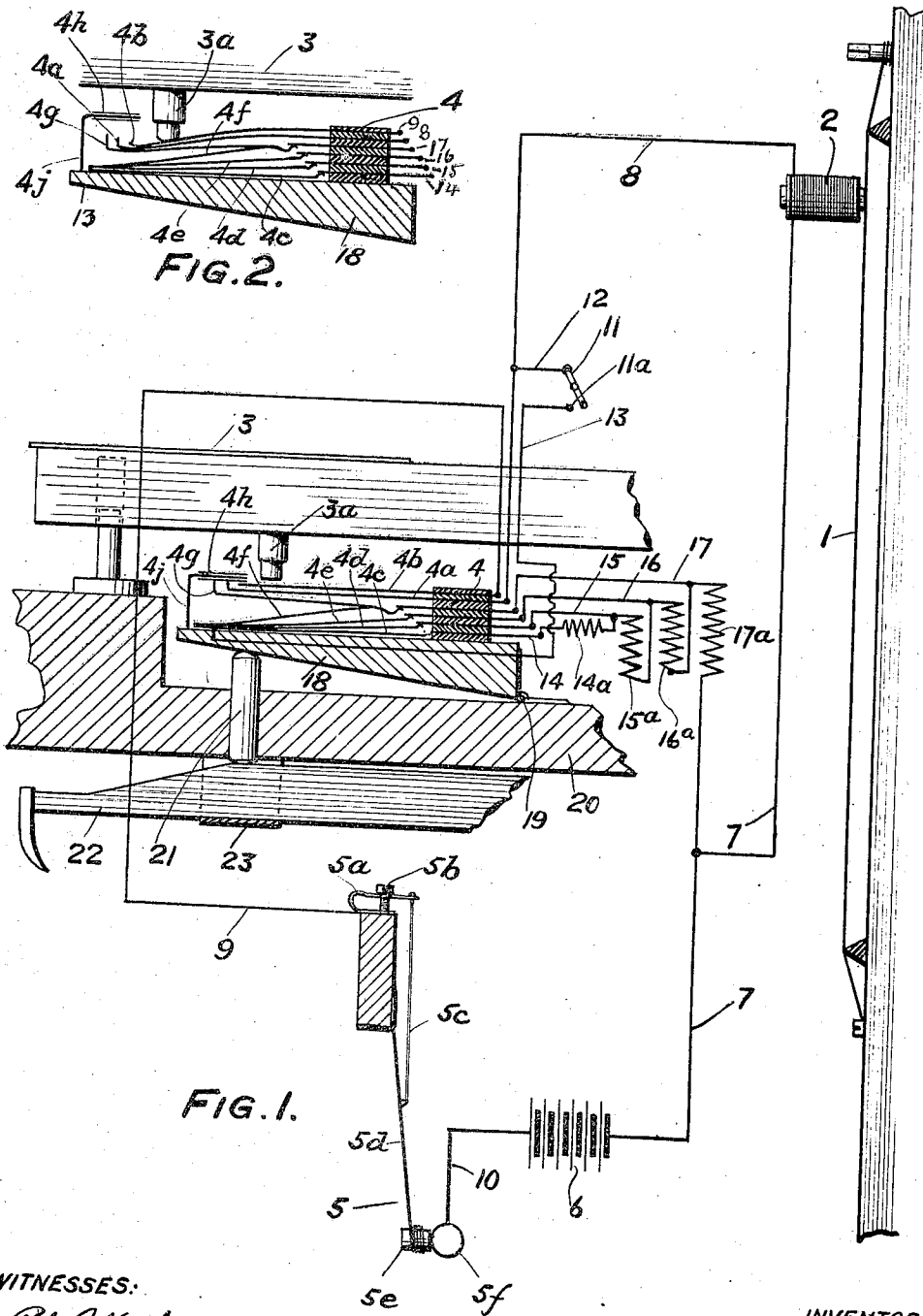
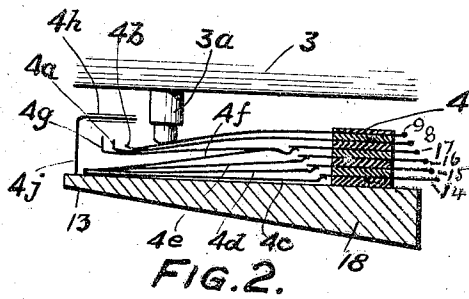


G. BREED.
METHOD AND MECHANISM FOR PRODUCING MUSICAL SOUNDS.
APPLICATION FILED SEPT. 23, 1909.

1,051,675.

Patented Jan. 28, 1913.



WITNESSES:

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METHOD AND MECHANISM FOR PRODUCING MUSICAL SOUNDS.

1,051,675.

Specification of Letters Patent.

Patented Jan. 28, 1913.

Application filed September 23, 1909. Serial No. 519,225.

To all whom it may concern:

Be it known that I, GEORGE BREED, a citizen of the United States, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a Method of and Mechanism for Producing Musical Sounds, of which the following is a specification.

My invention comprises a method of and mechanism for producing musical sounds whereby sonorous members are vibrated electro-magnetically by a pulsating current under control of the performer so that the electro-magnetic action and the volume of sound can be varied at will, the primary object effected being the provision of an instrument, and particularly a piano, in which the current is automatically regulated to a substantially constant effective value, any desired part of such current value utilized in effecting the electro-magnetic action, the tones sustained indefinitely, and their volumes varied (swelled or diminished) gradually or abruptly at the will of the performer by means of the usual keys.

In the accompanying drawings, Figure 1 is a diagrammatic view representing an application of my invention; and Fig. 2 is a sectional view representing a second position in the operation of the switch mechanism shown in Fig. 1.

The means embodying the invention, as shown in the drawings, comprise the piano string 1, the electro-magnet 2 disposed so that when excited it will attract the string, the piano key 3 having thereon the boss 3^a, the compound switch 4 disposed so that it can be operated by means of the boss, the pulsator 5 for regulating and pulsating the current which excites the electro-magnet, and the battery 6 which supplies the current. The current flows from the battery 6 through the conductor 10 to the pulsator 5, thence through the conductor 9 to the switch 4, thence through the conductor 8 to the electro-magnet 2 and thence by the conductor 7 back to the battery.

The pulsator consists of the contact members 5^c and 5^e, (preferably of carbon or graphite), the resilient wire 5^a carrying the contact 5^e, and the fine wire 5^e, held at the desired tension by the spring 5^a adjusted by the screw 5^b, the fine wire expanding when heated by current passing therethrough to permit the spring to separate the contacts

and contracting to close the contacts upon cooling due to the interruption of the current. The pulsator thus rapidly interrupts the current and provides resistance effecting a desired limitation of the effective value thereof, the mean effective current being preferably limited thereby to approximately $\frac{1}{2}$ ampere. The contact 5^e is duplicated for each key and 5^c may be so duplicated or may be common to several contacts 5^e.

The switch consists of the resilient contact 4^b connected with the conductor 9, the resilient contact 4^a connected with the conductor 8, and the connected resilient contacts 4^c, 4^d, 4^e, 4^f, and 4^g. The contacts or conductors 4^c, 4^d, 4^e, 4^f, have their outer ends fixed together and adapted to be connected with the conductor 8 through the conductor 12, the switch lever 11, the contact 11^a and the conductor 13. The inner ends of the contacts 4^c, 4^d, 4^e, and 4^f normally engage the conductors 14, 15, 16, and 17, while the inner end of the contact 4^g is fixed to the contact 4^f and its outer end is free. The outer ends of the contacts 4^a, 4^b, and 4^g are normally held, by their resiliency, against the underside of the insulation 4^b of a hook 4ⁱ, by which such contacts are kept from accidental engagement.

The conductor 14 contains the resistance coil 14^a and is connected with the conductor 15. The conductor 15 contains the resistance coil 15^a and is connected with the conductor 16. The conductor 16 contains the resistance coil 16^a and is connected with the conductor 17. The conductor 17 contains the resistance coil 17^a and is connected with the conductor 7.

The switch 4 is carried on a board 18 connected by the hinge 19 with the table 20 and the board is supported by a pin 21 movable vertically through the table. A wedge 22, movable in a way 23 beneath the table, carries the pin 21. When the wedge 22 is moved inwardly, the pin 21 drops and permits the board 18 to drop, whereby the switch 4 is withdrawn from the range of travel of the key boss 3^a, and the electro-magnetic mechanism is thrown out of action. When the wedge is drawn outwardly, the pin and the board are elevated, whereby the switch is held in position to be acted upon by the key.

When no current or little current is flow-

ing, the pulsator contact 5^e is held in engagement with the contact 5^f by the tension of the wire 5^c through its action upon the resilient wire or spring 5^d extending at an angle to the wire 5^c; when the wire 5^c is heated by substantial current flowing there-
 5 through, it elongates and permits the spring 5^d to withdraw the contact 5^e from the contact 5^f, whereby the circuit is broken; when
 10 the wire 5^c cools, the contacts reengage; whereby an automatic adjustment of the pulsator is provided to effect rapid pulsations in the current, the current is regulated, and sticking is prevented.

15 In operation, when the switch lever 11 is in the open position and the circuit there-through broken, if the performer presses down the key 3 until the contacts 4^a and 4^b engage, the full volume of current flows
 20 therethrough, from the battery by way of the pulsator, to the electro-magnet and thence back to the battery, and the full volume of sound is obtained due to the maximum amplitude of vibration of the string.
 25 the other switch contacts and the resistance coils being out of circuit. If the key be pressed down farther, until the contact 4^a engages the contact 4^s, the current is divided so that part of it will flow by way of the
 30 shunt circuit 17 and the resistance coil 17^a back to the battery, and only the remaining part will flow by way of the conductor 8 and the electro-magnet 2 back to the battery, hence the force exerted by the magnet, the
 35 amplitude of the vibrations of the string and the volume of sound are reduced. If the key be pressed down farther, until the member 4^d is disengaged from the conductor 17, a smaller portion of the current will be
 40 shunted through the conductors 4^f, 4^e and 16 by way of the coils 16^a and 17^a and a larger part of the current will flow through the conductor 8 and the electro-magnet 2, hence
 45 the vibrations of the string and the volume of sound will be increased. If the key be pressed down farther so that the member 4^e is disengaged from the conductor 16, a still smaller part of the current will be shunted
 50 by way of the coils 15^a, 15^b and 17^a, connected by the conductor 15 with the member 4^d which is connected by the members 4^f and 4^s with the member 4^a, and a larger part of the current will flow by way of the electro-
 55 magnet from the member 4^s, so that the volume of sound will be further increased. If the key be pressed down farther so that the member 4^d is disengaged from the conductor 15, a still smaller part of the current will
 60 flow by way of the coils 14^a, 15^a, 16^a, and 17^a, connected by the conductor 14 with the member 4^c, which is connected by the conductors 4^f and 4^s with the member 4^a, and a still larger amount of current will flow by
 65 way of the electro-magnet 2 connected by the conductor 8 with the member 4^s; hence

the volume of sound will be further increased. If the key be pressed down still farther, until the member 4^e is separated from the conductor 14, all of the current
 must flow through the electro-magnet and the initial full volume of sound will be produced. If now the switch lever 11 is
 70 brought into engagement with the point 11^a, upon depressing the key 3 and engaging the contact 4^b with the contact 4^a, part of the
 75 current will flow by way of the conductors 4^a, 8, 12, 11, 11^a, 13, 4^f, 17 and 17^a to the conductor 7 and back to the battery, while the remainder will flow by way of the conductor
 80 8 to the electro-magnet 2, hence the initial volume of sound is now less than the maximum. Upon further depressing the key 3 and engaging the contacts 4^b, 4^a and 4^s, with
 separation of the contact 4^f from the conductor 17, a smaller part of the current will
 85 flow from the conductor 8 by way of the conductors 12, 11, 13, 4^e, 16, 16^a, and 17^a back to the battery, while the remainder flows through the electro-magnet 2, hence the volume
 90 of sound has been increased by the further depression of the key. Upon still further depressing the key 3, the contact 4^e is separated from the conductor 16 and a
 smaller amount of current will flow from the conductor 8 by way of the conductors 12,
 95 11, 13, 4^d, 15, 15^a, 16^a and 17^a, while the remainder will flow through the electro-magnet 2; hence the volume of sound will have been increased further. Upon still
 further depressing the key 3, the contact 4^d is separated from the contact 15 and a
 100 smaller amount of current flows from the conductor 8 by way of the conductors 12, 11, 13, 4^c, 14, 14^a, 15^a, 16^a, and 17^a, while the larger remainder flows by way of the electro-
 105 magnet 2; hence the volume of sound will be still further increased. Upon still further depressing the key 3 and separating the contact 4^c from the conductor 14, the
 conductor 13 is cut out of circuit and all of the current will pass through the electro-
 110 magnet 2; hence the largest volume of sound will be produced in the lowermost position of the key. Consequently with the switch
 115 11 closed, the volume of sound is gradually increased from the minimum to the maximum as the key is gradually moved down.

It will be seen from the foregoing description that by the combination of a piano
 string and key with a circuit having con-
 120 tacts adapted to be controlled by the key and containing an electro-magnet and pulsator adapted for vibrating the string, the full
 volume of tone can be obtained when all of the current is passed through the electro-
 125 magnet, while by the use of the shunt circuits containing the resistance coils and the switching mechanism having the resilient
 members brought into operation successively by the key, the amount of current
 130

passing through the electro-magnet can be varied gradually and the desired change in the volume of sound obtained.

By the foregoing improvements there is provided a current of constant effective value with means for dividing such current so that the total or the desired division of the total current can be utilized, at the will of the performer, for exciting the electro-magnet as may be required for producing the desired volume of tone.

Having described my invention, I claim:

1. The method of producing musical sounds which consists in electro-magnetically actuating a sonorous member by a pulsating current and automatically regulating the exciting current to a substantially constant effective value.

2. The method of producing musical sounds which consists in electro-magnetically actuating a sonorous member by a pulsating current, automatically regulating the exciting current to a substantially constant effective value, and utilizing any desired portion of said current for producing the electro-magnetic action.

3. The mechanism for producing musical sounds which comprises a sonorous member, in combination with a circuit containing an electro-magnet in the field of which said sonorous member is disposed and self-adjusting means for pulsating the current and regulating the amount thereof supplied to said electro-magnet.

4. The mechanism for producing musical sounds which comprises a sonorous member, a circuit containing an electro-magnet in the field of which said sonorous member is disposed and a device for pulsating the current and automatically regulating the amount thereof supplied to said electro-magnet, and means whereby the current so regulated is divided and the desired portion thereof supplied to said electro-magnet.

5. The mechanism for producing musical sounds which comprises a sonorous member, in combination with a circuit containing means for effecting the vibration of said member and a pulsator having a pair of contacts and a conductor acting when cold to bring said contacts into engagement and expanded by current passing therethrough to permit said contacts to separate.

6. The mechanism for producing musical sounds which comprises a sonorous member, in combination with a circuit containing means for effecting the vibration of said member and a pulsator having a pair of contacts, a device acting to withdraw one of said contacts from the other, and a conductor acting when cold to effect the engagement of said contacts and expanded by current passing therethrough to permit the separation of said contacts.

7. The mechanism for producing musical

sounds which comprises a sonorous member, a main circuit containing an electro-magnet for effecting the operation of said member, means for pulsating and regulating the current in said circuit, a shunt circuit around said electro-magnet, and means whereby said current is divided and a part thereof passed through said electro-magnet and the remaining part through said shunt circuit.

8. The mechanism for producing musical sounds which comprises a sonorous member, a main circuit containing an electro-magnet for effecting the operation of said member, means for pulsating and regulating the current in said circuit, a shunt circuit, a key, and a set of contacts operated by said key whereby the performer can close said circuits in succession and vary the amount of current passing through said magnet.

9. The mechanism for producing musical sounds which comprises a sonorous member, a main circuit containing an electro-magnet for effecting the operation of said member, means for pulsating and regulating the current in said circuit, and means within the control of the performer for dividing said current and passing the desired portion thereof through said electro-magnet, said means last named comprising several shunt circuits having different resistances, resilient contacts whereby said shunt circuits are made and broken, and a key whereby said contacts are operated in succession to regulate the amount of current passing through said electro-magnet and the amplitude of vibration of said sonorous member.

10. The mechanism for producing musical sounds which comprises a sonorous member; a main circuit containing a pair of contacts for making and breaking it, an electro-magnet for actuating said sonorous member, and means for regulating and pulsating the current; several shunt circuits having different resistances and contacts whereby they are adapted to be connected in succession with said main circuit, and a key whereby said contacts are operated in succession for the purpose of varying the amount of current supplied to said electro-magnet and the amplitude of vibration of said sonorous member produced thereby.

11. The mechanism for producing musical sounds which comprises a sonorous member; a circuit containing a pair of normally open resilient contacts for making and breaking it, an electro-magnet for actuating said sonorous member, and means for regulating and pulsating the current; several shunt circuits having different resistances, resilient contacts normally closed, and a resilient contact connected with said contacts last named and normally separated from said contacts first named, and a key which is operable first to close said first named contacts, second, to connect said first

named contacts with said third named contacts, and then to open said second-named contacts in succession, whereby a gradually changing amount of current is passed to said electro-magnet, and a gradually changing volume of sound is produced by the sonorous member.

12. The mechanism for producing musical sounds which comprises a sonorous member; a main circuit containing a pair of normally open contacts for controlling it, an electro-magnet for effecting the vibration of said sonorous member, and means for pulsating and regulating the current; several shunt circuits containing different resistances, normally closed contacts, and means comprising a switch for connecting said last named contacts with said main circuit, a contact connected with one of said contacts last named and adapted to be connected with said contacts first named, and a key which when operated first closes said first named contacts, then engages said first named contacts with said contact, and then opens the contacts of said shunt circuits in succession.

13. The mechanism for producing musical sounds which comprises a sonorous member; a circuit containing an electro-

magnet for attracting said member and resilient contacts for controlling said circuit; mechanism comprising a key for operating said contacts; mechanism for supporting said contacts, and means for moving said last named mechanism whereby said contacts are withdrawn from said first named mechanism.

14. The mechanism for producing musical sounds which comprises a sonorous member; several circuits one of which contains an electro-magnet for actuating said sonorous member; resilient contacts for controlling said circuits so as to vary the amount of current passing through said electro-magnet; mechanism for operating said contacts, mechanism for supporting said contacts, and means for moving said last named mechanism whereby said contacts are withdrawn from position to be operated by said first named mechanism.

In witness whereof I have hereunto set my name this 22 day of September, A. D. 1909, in the presence of the subscribing witnesses.

GEORGE BREED.

Witnesses:

ROBERT JAMES EARLEY.

JOS. G. DENNY, Jr.