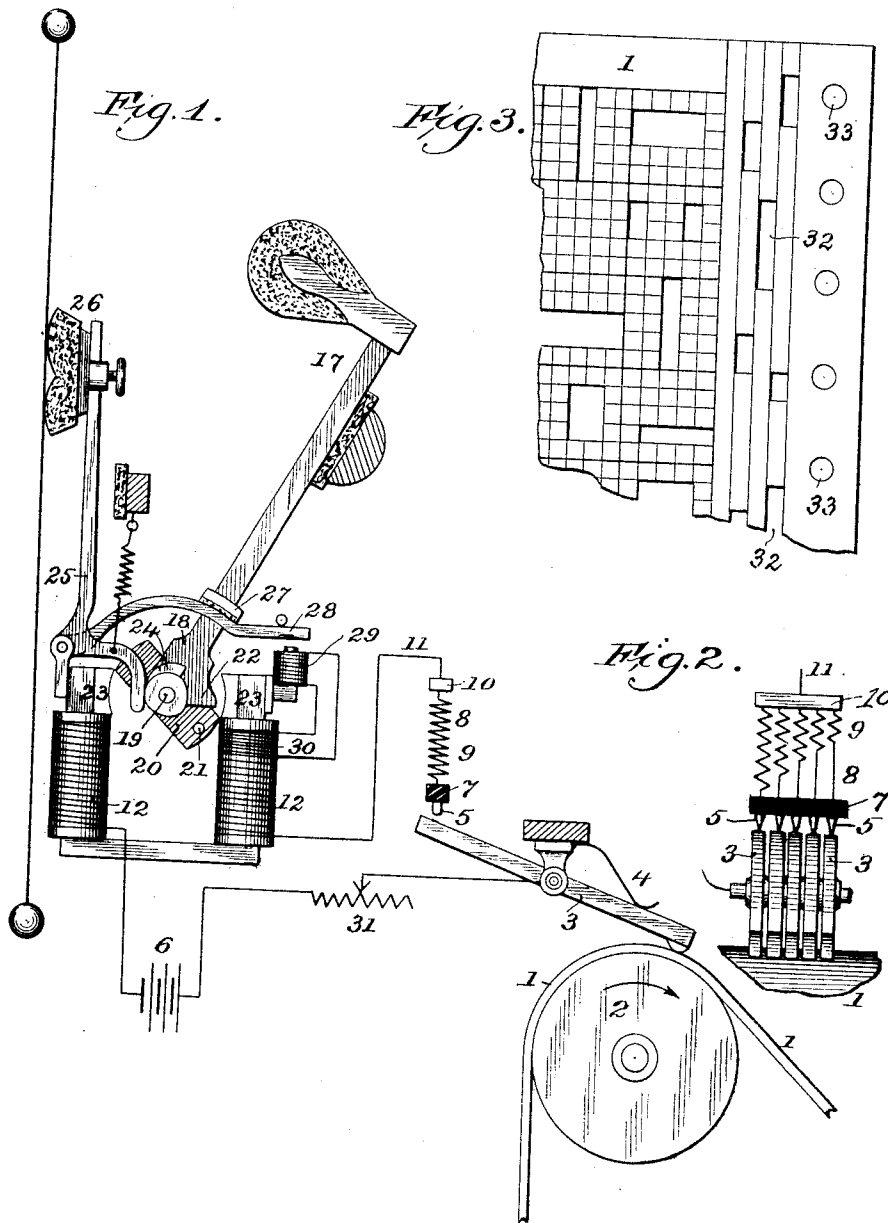


C. COLEMAN.
ELECTRICALLY OPERATED MUSICAL INSTRUMENT.
APPLICATION FILED AUG. 22, 1898.

1,107,495.

Patented Aug. 18, 1914.

2 SHEETS—SHEET 1.



Attest:
Harry B. White
W. B. Corlies

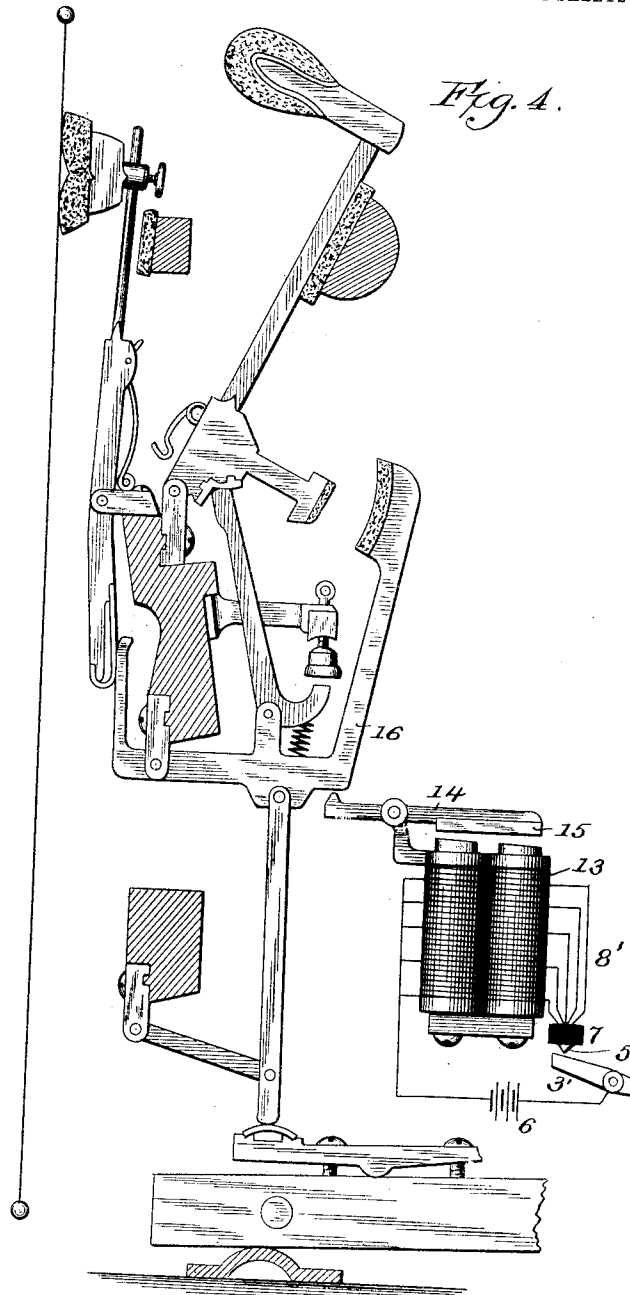
Inventor:
Clyde Coleman.
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UNITED STATES PATENT OFFICE.

CLYDE COLEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
GEORGE B. FRENCH, OF BOSTON, MASSACHUSETTS, AND FRANK L. HALL, OF NEW
YORK, N. Y.

ELECTRICALLY-OPERATED MUSICAL INSTRUMENT.

1,107,495.

Specification of Letters Patent.

Patented Aug. 18, 1914.

Application filed August 22, 1898. Serial No. 689,237.

To all whom it may concern:

Be it known that I, CLYDE COLEMAN, a citizen of the United States of America, and resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electrically-Operated Musical Instruments, of which the following is a specification.

My invention relates broadly to automatic musical instruments, and particularly to electrically-actuated automatic instruments such as pianos.

The prime object of my invention is to attain substantially perfect expression in so far as affected by intensity or modulation of notes. To this end I provide a separate hammer or note-producing means to sound each note, and for each note-producing means a separate actuative means independent of and not affected by the actuative means for the other notes, and adapted to actuate its respective note-producing means with two or more forces or force components, either separately or simultaneously, whereby each note may be produced with considerable variation in volume or intensity, and without affecting or being affected by the simultaneous similar control of the notes. Preferably the components of actuative force delivered to an individual note-producing means by its respective actuative means, will be all different in value or intensity, since this difference contributes greatly to the range of intensity variation attainable by applying these actuative components separately and jointly in various combinations. Let n equal the number of force components of different values derivable from the actuative means for one note, and let N equal the total number of effects attainable by separate and joint application of these components, and $N=2^n-1$. Hence it will be seen that by employing four different components of actuative force I can get fifteen different effects, and by using six different components I can get sixty-three different effects, and so on.

Since the means for controlling the volume of each note is a separate independent means for that note alone, and is unaffected by simultaneous action of the volume-controlling means for any other note, it is in this sense that I shall employ the words "independent" and "independently" in the claims hereinafter.

Since each volume-controlling means is arranged in control of one note only, I have deemed it sufficient for purposes of illustration to show, in the accompanying drawings, only one volume-controlling means with the note-producing mechanism which it controls. A representation of the other note-producing mechanisms with their respective independent volume-controlling means would be mere duplication of the single note-producing means and volume-controlling means shown in the drawings; but it must, of course, be understood that, in practice, my invention will be embodied in a number of note-producing means, each with its independent volume-controlling means.

My invention comprises other objects and features of importance, which will clearly appear in the accompanying description of the particular embodiment illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical elevation, partly diagrammatic, illustrating the present invention as applied to an upright piano; Fig. 2 is a detail elevation at right angles to Fig. 1, of multiple permutating circuit-controlling fingers, resistances, etc., of the present invention. Fig. 3 is a detail view of a perforated music sheet adapted for use in the automatic operation of my invention; and Fig. 4 is a vertical sectional elevation, partly diagrammatic, illustrating the application of the invention to an ordinary upright piano action, and also showing a modification of the means for effecting the volume-control in the present system.

Similar numerals of reference indicate like parts in the several views.

Here 1 represents the perforated music sheet or other equivalent device, by the movement of which the playing of the musical instrument is effected in an automatic manner as usual to the present type of electrically operated musical instruments; 2, a roller by which the music sheet 1 is supported in proper relation to the circuit-closing mechanism which is operated by said music sheet in its travel past the same; 3 are the circuit closers, of which there are two or more for each individual note. These circuit closers may be of any usual and suitable construction, preferably, however, of the form shown in Figs. 1 and 2, and each consisting of a centrally pivoted finger, one end

of which is adapted for yielding contact with the music sheet 1 through the instrumentality of the individual spring 4, while the other end is adapted to contact with one of the individual electrical contact points or anvils 5.

In the construction shown, the group of contact fingers 3 are permanently connected with one terminal of the source of electric current 6, and the group of individual contact points 5 are insulated in the fixed supporting rail 7, and arranged to lead current through different paths to produce different volume effects in the note-producing mechanism.

Fig. 2 represents five separate conductors having different resistances and each connected between the bus-bar 10 and one of the contact anvils 5. The operating and volume-controlling circuit leads from one terminal of the battery 6, to and through a variable resistance 31, and thence to the contact fingers 3, thence through one or more of the contact fingers which, by action of the music sheet 1, are brought into contact with the anvils 5, and thence through such anvils 5 and the resistances respectively connected therewith to the bus-bar 10, and thence through the conductor 11 and the magnet coils 12 back to the opposite terminal of the battery. It will be noted that the intensity of current in the magnet coils 12 will depend upon the resistance or joint resistance of the one or several resistance conductors included in the circuit by the action of the contact fingers 3 controlled by the music sheet 1. If the resistance conductors all have different resistances, five different values of current, and hence of tone volume, may be had by mere selection of one of the five resistance conductors; and, by combining the resistance conductors in groups of two or more, twenty-six different combinations may be had, giving twenty-six other different values of current and tone volume. Hence, the twenty-six combination values, added to the five unit values, make thirty-one different values of current and tone volume which may be had by the action of the five simple contact fingers 3 with their respective resistances. The same result is attained in the modified volume-controlling device of Fig. 4. Here, the circuit leads from one terminal of the battery 6 to the contact fingers 3', and thence to one or several of the contact anvils 5 with which the fingers coact, and from each contact anvil 5 the current flows through a separate conductor and through a separate coil of the magnet 13, and thence back to the opposite terminal of the battery. Fig. 4 represents conductors leading to five separate magnet coils, which will preferably be wound so as to produce five different magnetizing effects, whereby may be attained the same

thirty-one values of magnetizing current and tone-volume already pointed out in the construction of Figs. 1 and 2.

My invention for producing varied intensities in musical notes, in its broadest aspect, is adapted for use in connection with many types of musical instruments, particularly those operated by electro-magnetic action; and while, for sake of illustration, the drawings represent the invention applied to an upright piano mechanism, it is evident that the system can be readily modified in the minor details of construction for use in connection with many other types of musical instruments, and accordingly the expression, note-producing mechanism, is intended in the present description to set forth the mechanism by which the musical note is directly produced, regardless of the particular construction of such mechanism or whether it comprises a string and hammer as illustrated in the present drawings, or the equivalent thereto.

In Fig. 4, I illustrate the present system in connection with an ordinary upright piano action, and adapted to operate the same in such manner as not to interfere with the ordinary manual operation of the piano by the fingers of a player. To this end the lever 14, carrying the armature 15, of the operating electro-magnet 13, makes engagement with the bottom of the "jack lever" 16 of the piano action to impart movement to the same.

In the specific construction of Fig. 1, the action hammer 17 is loosely pivoted by means of its butt 18 on the supporting axis or shaft 19 of the semi-rotative armature 20, so that the hammer is capable of the usual free and unimpeded movement to a limited extent in striking the string or other equivalent note-producing device. Initial movement is imparted to the hammer 17 by a stud or projection 21 on the armature 20, which engages the under-side of a shoulder or offset 22 on the hammer butt 18, as shown. The semi-rotative armature 20, being pivoted between the poles 23 of the electro-magnet 12, affords a construction permitting an extended range in the movement of the armature, and affords, in connection with the above described means for varying the intensity of the magnetizing current, a very efficient apparatus for producing notes of the required degree of intensity.

The cam 24 is impelled by the armature 20, and engages the bell crank lever 25 carrying the damper 26 to cause a movement of the damper in unison with the movement of the hammer as usual in piano actions.

27 is a frictional shoe secured to the hammer stem or other portion of the action hammer 17.

28 is a pivoted arm constituting the hammer-check, the free end of which carries the

armature of the auxiliary electro-magnet 29. The central portion of said arm is curved concentrically with the pivotal axis of the action hammer, and is adapted to contact with the friction shoe 27 to set up frictional engagement between the parts and restrain the hammer against rebound. The curved arm is normally held in contact with the friction shoe of the hammer by a spring or other usual and equivalent means.

The auxiliary magnet coil 29 of Fig. 1 is connected in series with an extra winding upon the core of the magnet 12, so that the auxiliary magnet will be energized by induced or secondary current when the magnet 12 is energized by the battery 6. When thus energized, the auxiliary magnet 29 will attract the end 28 of the curved pivotal arm so as to withdraw the same from contact with the brake shoe 27, while the hammer makes its stroke under impulse of the magnet 12. After the hammer has completed its stroke, the secondary current in the auxiliary magnet 29 is discontinued and the curved arm again engages the brake shoe on the hammer. This means of disengaging the curved arm from the brake shoe obviates the necessity of an additional circuit contact for this purpose.

The variable resistance or rheostat 31 is provided as an additional regulating means to vary the amount of current available in the electro-magnet 12. Obviously, the resistance of this rheostat may be varied from maximum to zero, or the rheostat may be entirely omitted if desired.

The music sheet employed to automatically operate the mechanism is illustrated in detail in Fig. 3, and is preferably divided into parallel spaces, each slightly wider than one of the circuit-closing fingers 3 which bears on the space. These parallel divisions are preferably divided transversely of the sheet, as shown, to form small squares for the guidance and convenience of the composer in the production of a composition by the formation of suitable perforations. The music sheet will also be provided with the usual spaces for the perforations 32, by which the pedal actions are operated, and with the series of equi-distant perforations 33, which engage sprocket projections on the feeding drum.

As compared with the usual arrangement of feed drum and music sheet heretofore employed, in which the drum is conductive, and contact therewith is made by the points of the circuit closers projecting through perforations of the music sheet to establish a circuit, the relative arrangement of the music sheet 1, circuit-closing fingers 3 and contact points or anvils 5, illustrative in Fig. 1, possesses the following advantages: In the present construction the contact anvils 5, and the contact surfaces of the fingers 3, can

be economically formed of platinum, and in consequence will retain a bright and uncorroded condition during long use, while with the usual arrangement above described the drum surface is very liable to corrosion and to gather a coating of dirt, etc., either of which will seriously impair or entirely prevent the establishment of the desired electrical circuit. A further advantage of the present construction lies in the fact that the contact sparking occurs at a point removed from the edges of the perforations in the music sheet, which sparking would be apt to destroy a music sheet of paper or celluloid in the ordinary mechanism, wherein such sparking occurs in a place immediately adjacent to the edges of the music sheet perforations.

It is obvious that various modifications may be made in the construction shown and above particularly described within the principle and scope of my invention.

I claim:

1. An automatic musical instrument comprising a transmitter of power, and means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of three or more separate power-controlling devices each connected directly to said power transmitter, and means for causing each of said power controlling devices to separately transmit power or causing them to jointly transmit power in various combinations thereof to cause actuation of the note-producing means.

2. An automatic musical instrument comprising a transmitter of power, and means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of three or more separate and differential power-controlling devices each connected directly to said power transmitter, and means for causing each of said power controlling devices to separately transmit power or causing them to jointly transmit power in various combinations thereof to cause actuation of the note-producing means.

3. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of conductive power controlling devices arranged in parallel and means for leading electric current through said conductive devices separately or jointly.

4. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of differential and conductive power controlling devices arranged in parallel and

means for leading electric current through said conductive devices separately or jointly.

5. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of resistances arranged in parallel and means for leading electric current through said resistances separately or jointly.

6. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of conductors of different resistances arranged in parallel and means for leading electric current through said conductors separately or jointly.

7. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: a group of separate conductive power controlling devices arranged in parallel, and a plurality of circuit closers one for each such separate power controlling device; in combination with a conductor connected with all of said circuit closers, a conductor connected with all of said power controlling devices at the ends thereof opposite to that

at which the circuit closers are adapted to connect therewith, means for supplying electric current to said conductors, and a note sheet for actuating said circuit closers.

8. An electrically actuated automatic musical instrument comprising means for producing a single note independently of the individual means for producing any other note including the following parts, viz.: an electromagnet, a group of separate power-controlling conductors of different resistances arranged in parallel, and a plurality of circuit closers one for each such separate power controlling conductor; in combination with a common conductor connected with all of said circuit-closers, a common conductor connected with all of said power controlling conductors at the ends thereof opposite to that at which the circuit closers are adapted to connect therewith, the electro-magnet aforesaid being connected in one of said common conductors, means for supplying electric current to said common conductors, and a note sheet for actuating said circuit closers.

In testimony whereof witness my hand this 20th day of August 1898.

CLYDE COLEMAN.

In presence of—

ROBERT BURNS,
M. H. HOLMES.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."