Aug. 7, 1928. 1,680,039

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PIPE ORGAN

Original Filed Feb. 16, 1921

Fig. 1.

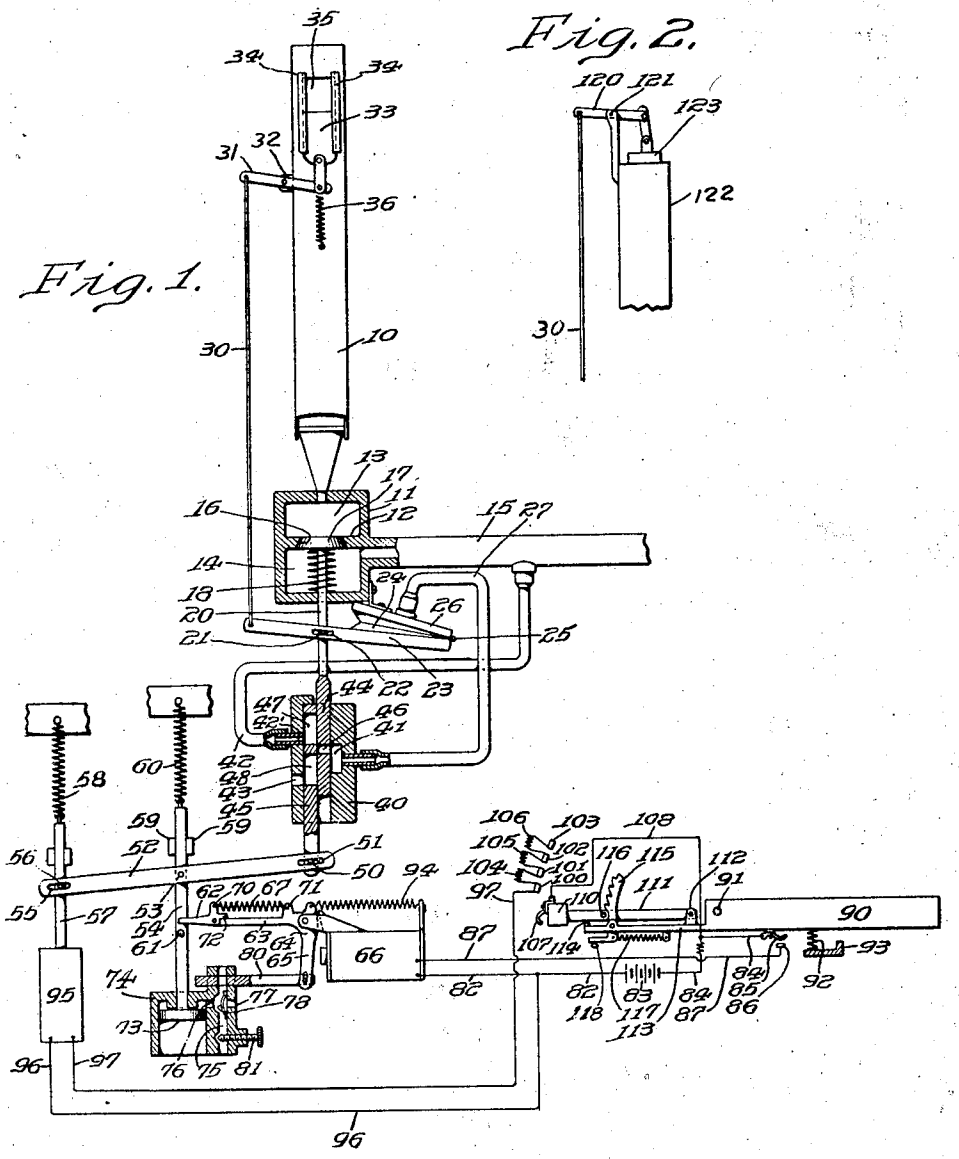


Fig. 2.

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Patented Aug. 7, 1928. 1,680,039

UNITED STATES PATENT OFFICE.

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PIPE ORGAN.

Application filed February 16, 1921. Serial No. 445,499. Renewed December 2, 1927.

Some of the objects of the present invention are to provide means for playing an organ with a touch simulating that of a piano touch; to provide means for varying the intensity of a note or notes from an organ; to provide means for causing the note of an organ to have an initial maximum intensity which will gradually diminish at a predetermined rate; to provide means whereby the initial intensity of an organ note may be varied in accordance with the striking force upon the key; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Fig. 1 is a diagrammatic view, partly in section, of one form of the present invention as applied to open end organ pipes; and Fig. 2 represents the end portion of a closed organ pipe showing the application of the system to that type of pipe.

Referring to Fig. 1 of the drawing, one form of the present invention comprises an organ pipe 10 of the open end type mounted upon a wind chamber in the form of a casing 11 having a transverse partition 12 arranged to provide a chamber 13 and a receiving chamber 14. The chamber 13 has free communication with the inlet end of the organ pipe 10 while the chamber 14 has free communication with an air pipe 15 leading to any suitable source of air supply not shown. Communication between the chambers 13 and 14 is established as desired by an opening 16 controlled by a valve 17 which seats therein and is normally held closed by a spring 18. In the present construction the opening 16 is below and in alignment with the inlet of the pipe 10, and the valve 17 is arranged to move vertically to open and close communication between the two chambers 13 and 14.

As a means for controlling the movement of the valve 17 and for controlling the variation in intensity of the sound produced by the pipe 10, the valve 17 has a stem 20 protruding from the casing 11 and carrying a rigid pin 21 intermediate its length which rides snugly in a slot 22 arranged longitudinally in an arm 23. This arm 23 forms the movable side of a bellows 24 and is hinged or pivoted at 25 to the fixed side 26 which is rigidly fastened to a fixed part such as the casing 11. Air under pressure is admitted to the bellows 24 by way of a pipe 27 in a manner to be hereinafter explained. The free end of the arm 23 is connected by a cable 30, or other means, to one end of a lever 31 which is pivoted at 32 to the pipe 10 and has its opposite end pivoted to a slide valve member 33 which slides in guides 34 to vary the size of an opening 35 in the side of the pipe 10. A spring 36 is arranged to assist in the return of the valve member 33 to its normal open position.

For controlling the supply of air to the pipe 27, a valve casing 40 is provided having a valve chest 41 formed therein and arranged to communicate with the pipe 27. At the other side of the casing 40 a pipe 42, which is in communication with the main air supply pipe 15, communicates with a port 42′. An exhaust port 43 is provided at a suitable point. Communication between the two pipes 27 and 42 is controlled by a primary slide valve 44 acting in conjunction with a secondary slide valve 45. The primary valve 44, in the present instance, is formed as an extension of the valve stem 20 and is provided with a through port 46 properly located for the required action. The secondary valve 45 projects from the opposite end of the casing 40 with respect to the valve 44 and has two through ports 47 and 48, the length of the former being sufficient to establish communication between the port 46 and the inlet port 42′ when the two valves 44 and 45 are arranged to allow air to enter the bellows 24, the length of the port 48 being sufficient to establish communication between the port 46 and the exhaust port 43 when the two valves 44 and 45 are arranged to relieve pressure in the bellows 24. In the present construction the two valves 44 and 45 slide snugly within the casing 40, one against the other, and in one operative position are arranged to establish communication between the pipes 42 and 27, and in another position to cut off such communication and establish communication between the pipe 27 and the exhaust 43. The primary valve 44 is operated by the movement of the arm 23 as heretofore explained.

In order to shift the secondary valve 45, so that it functions in the desired manner, it is provided with a rigid pin 50 arranged to ride in a slot 51 formed in a floating lever 52. This lever 52 is pivotally connected at 53 intermediate its length to a rod 54, while the end, opposite to the valve connection, is provided with a slot 55 arranged to receive a pin

56 fast to a solenoid core 57. The rod 54 is arranged for reciprocatory motion between guides 59, being actuated in one direction by a spring 60 which normally holds the parts in the position shown in Fig. 1. Movement of the rod 54 in the opposite direction is caused by a pin 61 fast to the rod 54 and in the path of movement of a finger 62 which is pivoted to one arm 63 of a bell crank 64, the other arm 65 of which forms the armature of an electromagnet 66. The bell crank 64 is pivoted to a fixed part. A spring 67 is interposed between a lug 70 of the finger 62 and a like lug 71 of the bell crank 64, thereby normally maintaining the finger 62 in the position shown. A stop member 72 formed as a part of the finger 62 is arranged to engage the arm 63 to form a rigid extension for moving the pin 61 and rod 54.

As a means for retarding the return of the rod 54 and causing it to move at a predetermined speed, after a working stroke, the rod 54 terminates in a piston 73 which is arranged to slide in a dash-pot casing 74, the cylinder of which is open at one end to allow unrestricted movement during the working stroke. The dash-pot casing 74 is provided with a through passage 75 having communication by way of a port 76 with the cylinder back of the piston 73. The casing 74 also has an air inlet port 77, to the passage 75, controlling which is an inwardly opening flap check valve 78. One end of the passage 75 is arranged to be opened and closed by a slide valve 80 connected to be operated by the movement of the armature 65. The opposite end of the passage 75 is controlled by an adjustable needle valve 81, the position of which with respect to the passage 75 determines the rate at which the air escapes from the cylinder of the dash-pot 74.

For the purpose of energizing the magnet 66, one side of its winding is connected by a conductor 82 to one pole of a battery 83, the other pole of which is connected by a conductor 84 to a brush contactor 85 arranged in juxtaposed relation to a contact 86 which is connected by a conductor 87 to the other side of the winding of the magnet 66. The brush contactor 85 is carried by an organ key 90, pivoted at 91 and held in the position shown by a spring 92 acting against a fixed part which serves as a stop 93 to limit the movement of the key 90. The arrangement is such that the depression of the key 90 causes the circuit to be closed between the contactor 85 and the contact 86 so that the magnet 66 is energized to swing the bell crank 64 as required. The bell crank 64 is returned to its normal position, as soon as the magnet 66 is deenergized, by a spring 94.

In order to limit the downward movement of the secondary valve 45 so that its stroke is varied in accordance with the speed at which the key 90 is depressed, the core 57 is arranged to be actuated by a solenoid 95, one side of the winding of which is connected by a conductor 96 to the conductor 82, and the other side of the winding is connected by a conductor 97 to a variable resistance comprising a plurality of contact segments 100, 101, 102 and 103 arranged in series with resistance coils 104, 105 and 106. The contact segments are located in the arc of travel of a brush contactor 107 which is connected by a conductor 108 to the conductor 84 and thus to the other pole of the battery 83. The brush contactor 107 is carried by a weight 110 fixed to one end of an arm 111 having its opposite end pivoted at 112 to an extension 113 of the key 90. This extension 113 serves as a support at 114 for the arm 111, and has a toothed member 115 pivoted thereon and projecting upwardly in the path of a pin 116 fast on the arm 111. A spring 117 tends to rotate the member 115 counter-clockwise and thus holds the toothed part in position to engage the pin 116 when the arm 111 is swung in a clockwise direction by the depression of the key 90. A pin 118 secured to a fixed part is provided which engages the toothed member 115 when the key 90 is in the position shown thus releasing the pin 116.

In the form of the invention shown in Fig. 2 the cable 30 is connected at its upper end to a lever 120 which is pivoted at 121 to the top of an organ pipe 122 of the closed type, the lever 120 being in such a position as to connect with and operate the sliding stop 123 of the organ pipe 122. Thus when the amount of air admitted to the pipe 122 varies, the position of the sliding stop 123 will be so varied as to keep the note of the pipe 122 constant. It will be understood that the construction and operation of the form is otherwise the same as in Fig. 1.

In the operation of the form of this invention shown in Fig. 1, and just described, when it is desired to blow the pipe 10 the key 90 is depressed and the force with which it is depressed determines the position which the weight 110 will assume. Thus, if the key 90 is depressed gently, the weight 110 will not change its position with respect to the key 90 and the contactor 107 will rest on the segment 100 when the key 90 is fully depressed. If, however, the key 90 is depressed with greater speed, the momentum of the weight 110 will cause it to over-run the position of the key 90, thus moving the contactor 107 into engagement with the segment 101. It will be held in this position by the pin 116 engaging one of the teeth of the member 115. If the key 90 is depressed with great speed, the weight 110, due to its momentum, will over-run the position of the key 90 by a large amount, thus moving the contactor 107 into engage-

ment with the segment 103 and holding it there by means of the member 115. It will thus be seen that the contactor 107 will engage one of the segments 100 to 103, depending upon how fast the key 90 is depressed. When the key 90 is released and assumes the position shown in Fig. 1 under the action of the spring 92, the pin 118 will engage the member 115 and thus cause it to release the pin 116 which will allow the arm 111 and the weight 110 to assume their initial positions, as shown in Fig. 1, under the action of gravity. Suppose, for example, that the key 90 has been depressed with sufficient speed to cause the contactor 107 to make contact with the segment 101. This will cause a current to flow from the battery 83 through the conductors 84 and 108, contactor 107, segment 101, resistance 104, segment 100, conductor 97 and solenoid 95, conductors 96 and 82, back to the battery 83. This causes a definite amount of current to pass through the solenoid 95 and causes the core 57 to assume a definite position dependent upon the strength of this current and upon the strength of the spring 58. The pin 56 and therefore the left-hand end of the lever 52 will be moved into and held in a definite position. When the key 90 is depressed, the contactor 85 engages the contact 86, thus closing the circuit through the magnet 66, which attracts the bell crank 64, rotating it about its pivot in a counter-clockwise direction. This causes the finger 62 to engage the pin 61, thus moving the rod 54 and the piston 73 downwardly. This motion is very rapid, as air enters the check valve 77. Before the bell crank 64 has reached the end of its motion, the finger 62 has slipped out of engagement with the pin 61, thus allowing the rod 54 to move upwardly under the action of the spring 60. This motion is retarded, however, as the air behind the piston 73 has to escape by the needle valve 81 as the valve 80 has closed the passage 75. It will thus be seen that the lever 52 is quickly rotated in a clockwise direction. This causes the secondary valve 45 to be quickly moved downwardly and then to gradually return to its initial position, the amount which it is moved down being dependent entirely upon the position of the pin 56 as the rod 54 is always moved the same amount and the speed of the return of the secondary valve 45 is dependent upon the adjustment of the needle valve 81. The primary valve member 44 follows closely the motion of the secondary valve member 45, for, when the secondary valve member 45 is moved downwardly, the opening 46 is in communication with the port 47 which allows air to pass from the pipe 42 to the pipe 27 and thus to the bellows 24 which moves the arm 23 downward thus carrying the valve stem 20, valve 17 and primary valve 44 with it. When the primary valve 44 has caught up with the secondary valve 45, this supply of air will be shut off. When the secondary valve 45 moves up, the port 46 is put into communication with the port 48 and this allows the air in the bellows 24 to pass from the pipe 27 and out the exhaust 43. The bellows will therefore be deflated under the action of the spring 18. It is therefore evident that the movement of the secondary valve 45 will be followed in like direction by the valve 17.

It is seen from the foregoing description that when the key is first depressed the weight 110 will assume a position relative to the key 90 depending upon the force with which the key 90 is depressed, and this will determine the amount of current passing through the solenoid 95 which in turn determines the position of the pin 56. At the same time the rod 54 is moved downwardly, thus moving the secondary valve 45 downwardly, the amount of motion being dependent on the position of the pin 56. This motion is closely followed by the valve 17 and thus a large volume of air will be admitted to the pipe 10, this volume and therefore the intensity of the note being dependent upon the strength with which the key 90 is depressed and then this volume of air is gradually decreased at a certain definite rate which is determined by the setting of the valve 81. thus gradually decreasing the intensity of the note from the pipe 10. As this rate of decrease is constant for any given adjustment of valve 81, the duration of the sound will be dependent upon how far the valve 45 is moved, which in turn is dependent upon the velocity with which the key 90 is depressed.

It will be noted that when the pressure on the key 90 is released the contactor 107 will move rapidly over the contacts 103 to 100, thus increasing the current through the solenoid 95 which will tend to move the rod downwardly thus tending to rotate the rod 52 in a counter-clockwise direction about the pin 53. This will have no effect on the valve 45, however, as it will be already in its uppermost position.

Although only a single form is shown in which this invention may be embodied, it is to be understood that the invention is not limited to any specific construction, but might be applied in various forms without departing from the spirit of the invention or the scope of the appended claims.

Having thus described my invention, I claim:

1. In an organ, a pipe, means for causing said pipe to sound a musical note, an organ key, electrical means actuated by the depression of said key for operating said note producing means, and means for sustaining

a note for a period whose duration depends upon the speed at which said key is depressed.

2. In an organ, a pipe, means for causing said pipe to sound a musical note, an organ key, electrical means actuated by the depression of said key for operating said note producing means, and means including a momentum actuated device for sustaining a note for an interval whose duration depends upon the speed at which said key is depressed.

3. In an organ, a pipe, means for causing said pipe to sound a musical note, an organ key, means actuated by the depression of said key for operating said note producing means, means for maintaining the pitch of said note constant, while varying the wind pressure and means for sustaining the note after the release of the key.

4. In an organ, a pipe, means for causing said pipe to sound a musical note, an organ key, means actuated by the depression of said key for operating said note producing means, means including a valve having a predetermined time lag for maintaining the pitch of said note constant, while varying the wind pressure and means for sustaining the note after the release of the key.

5. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key, electrical means controlled by said key arranged to open said valve to cause said means to operate, momentum controlled means actuated by said key for determining the amount of initial opening of said valve, a retarding device for controlling the closing of said valve at a rate to give a predetermined variation in intensity to said note, and means for maintaining the pitch of said note constant while varying the wind pressure.

6. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key for opening said valve to cause said means to operate, momentum controlled means actuated by said key for determining the amount of initial opening of said valve, a retarding device for controlling the closing of said valve at a rate to give a predetermined variation in intensity to said note, and means controlled by said retarding device for maintaining the pitch of said note constant while varying the wind pressure.

7. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key, electrical means controlled by said key for opening said valve to cause said valve means to operate, momentum operated means actuated by said key for determining the amount of initial opening of said valve, and a retarding device for controlling the closing of said valve at a rate to give a predetermined decrease in intensity to said note.

8. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key, electrical means actuated by the depression of said key for opening said valve to cause said note to be produced, and means for causing said valve to close at a rate different from its opening movement to decrease the intensity of said note.

9. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key, electrical means controlled by said key for opening said valve to cause said means to operate, momentum controlled means actuated by said key for determining the amount of initial opening of said valve, a retarding device for controlling the closing of said valve at a rate to give a predetermined decrease in intensity to said note, and means for maintaining the pitch of said note constant while varying the wind pressure.

10. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key for opening said valve to cause said means to operate, momentum controlled means actuated by said key for determining the amount of initial opening of said valve, a retarding device for controlling the closing of said valve at a rate to give a predetermined decrease in intensity to said note, and means controlled by said retarding device for maintaining the pitch of said note constant while varying the wind pressure.

11. In an organ, a key board for said organ comprising a pivoted lever, a second lever loosely mounted on a movable portion of the first named lever, a body having a relatively large mass secured to a free end of said second named lever, said second named lever and mass being movable independently of said first named lever, the extent of such movement varying according to the speed of movement of the first named lever, means for restoring the first named lever to normal, means for locking the second named lever in its displaced position relative to the first named lever arranged to be automatically released upon return of the first named lever to normal, and means controlled by the momentum of said mass for varying the intensity of the sound produced.

12. In an organ, a key board for said organ comprising a pivoted lever, a second lever loosely mounted on a movable portion of the first named lever, a body having a relatively large mass secured to a free end of said second named lever, said second named lever and mass being movable independently of said first named lever, the extent of such movement varying according to

the speed of movement of the first named lever, yielding means for restoring the first named lever to normal, means for automatically locking the second named lever in its displaced position relative to the first named lever arranged to be released upon return of the first named lever to normal, and means controlled by momentum of said mass for varying the intensity of the sound produced.

13. In an organ, resonant means for producing a musical note, means for causing said resonant means to produce sound waves including a control key, means movably suspended on said key and having its extent of movement determined by the momentum imparted thereto by movement of the key, a circuit controller having a plurality of stopping positions selected according to the extent of movement of said means, automatic means for maintaining said controller in a selected position while said key is displaced from normal, means variably controlled by said circuit controller to vary the pitch of the sound, and means having a predetermined time lag for sustaining the sound after said key is returned to its normal position.

14. In an organ, means for producing sound, a key spaced therefrom, electrical means controlled by said key for actuating said sound producing means comprising a circuit controller adapted to set up variable circuit combinations, momentum controlled mechanism operated by said key for selectively actuating said controller to set up one of said circuit combinations.

15. In an organ, a pipe, means including a valve for causing said pipe to sound a musical note, an organ key, electrical means controlled by said key for opening said valve, and means made effective upon the release of said key for closing said valve at a predetermined slow rate.

16. In an organ, a pipe, means including a plurality of electrical circuits for causing said pipe to sound a musical note of varying intensity, a body movable under its own momentum for controlling said circuits and a key for giving momentum to said body in accordance with the speed at which the key is depressed.

Signed at New York, in the county of New York, and State of New York, this 8th day of February, 1921.

JOHN HAYS HAMMOND, Jr.