J. A. WESER.

MECHANICAL MUSICAL INSTRUMENT.

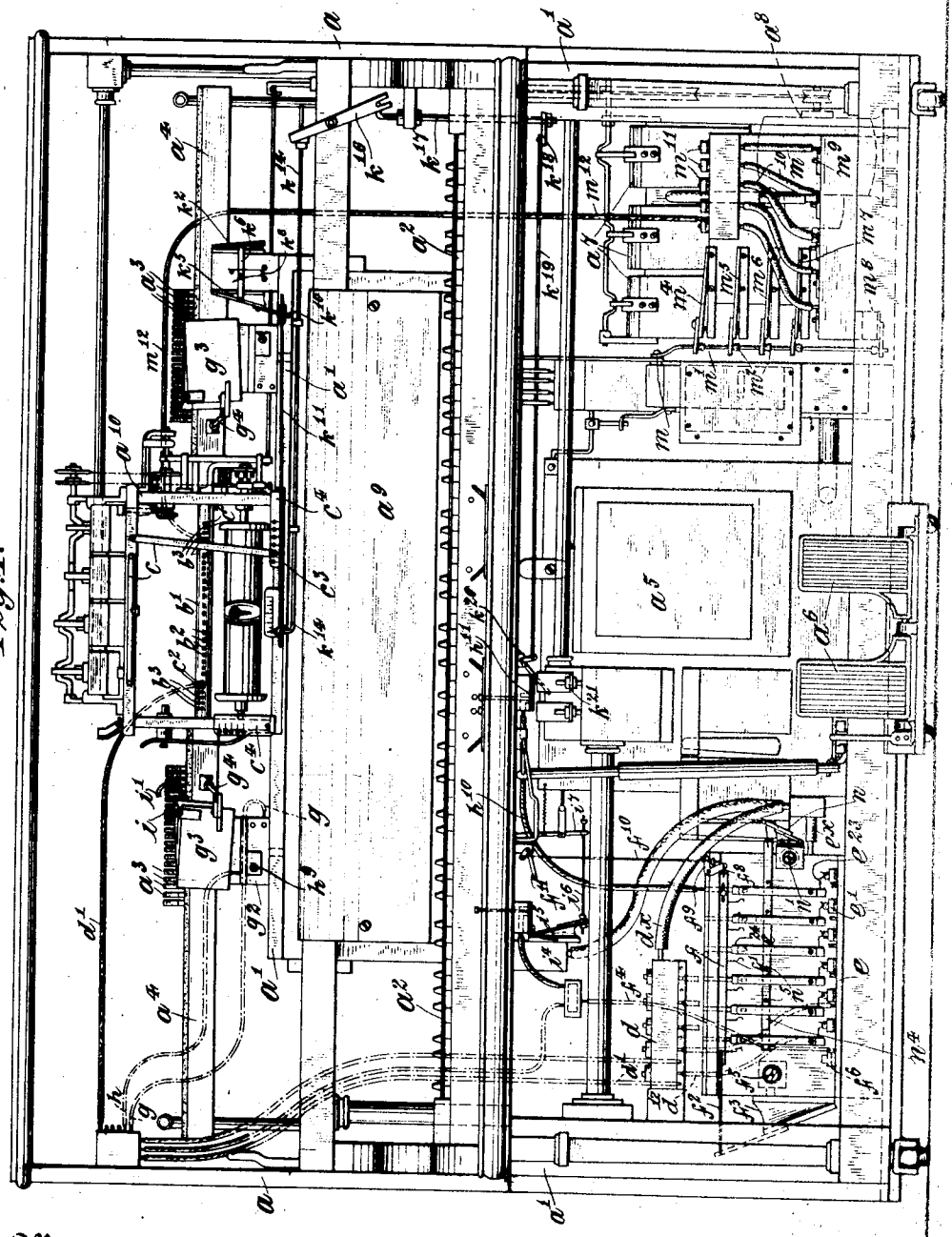
APPLICATION FILED MAR. 22, 1910.

1,088,000.

Patented Feb. 24, 1914.

7 SHEETS—SHEET 1.

Fig. 1.



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7 SHEETS—SHEET 2.

Fig. 2.

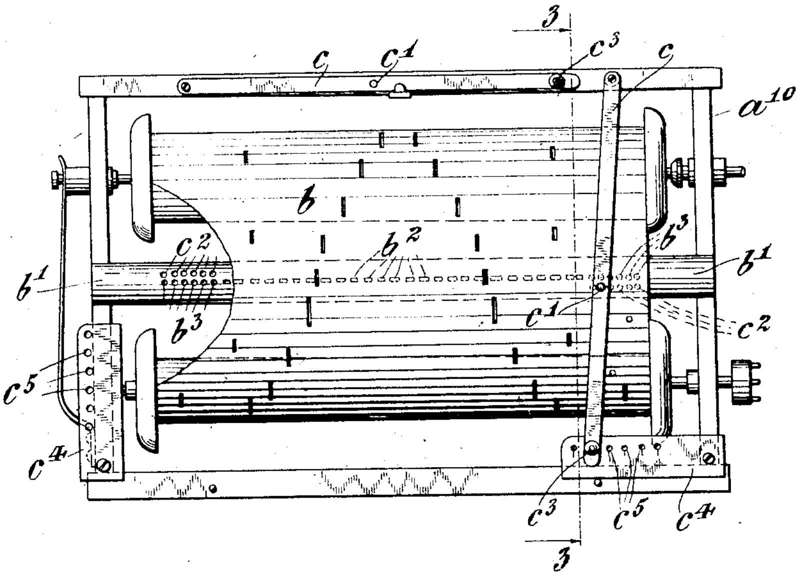
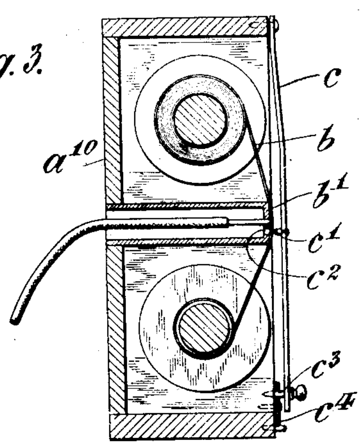


Fig. 3.



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7 SHEETS—SHEET 3.

Fig. 4.

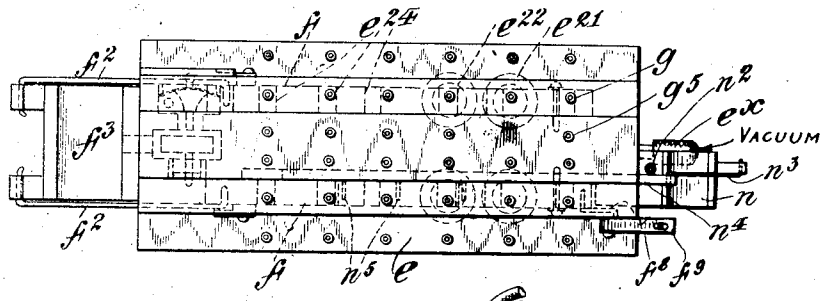


Fig. 5.

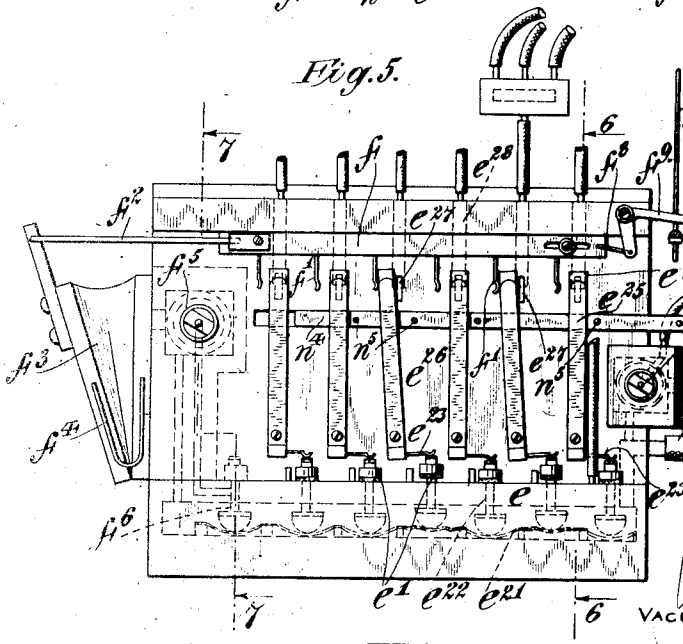


Fig. 6.

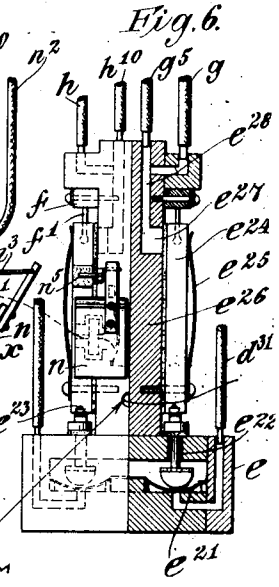
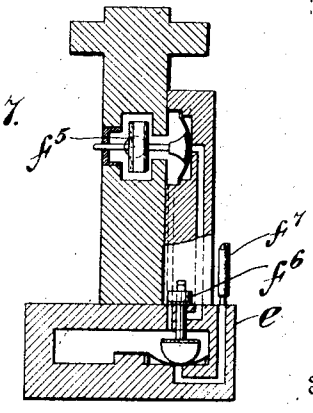


Fig. 7.



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7 SHEETS—SHEET 4.

Fig. 8.

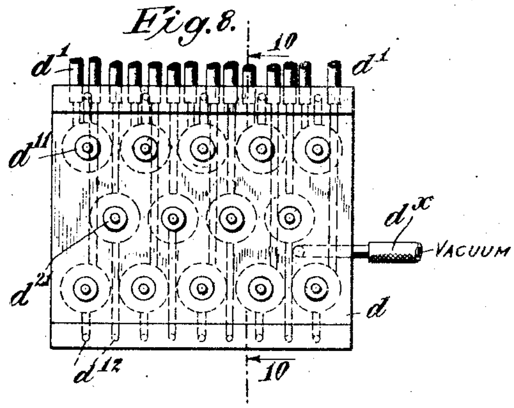

Fig. 9.

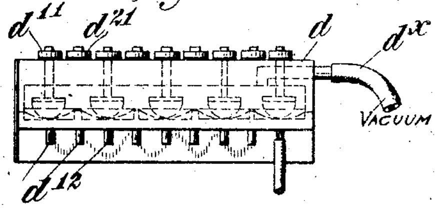

Fig. 10.

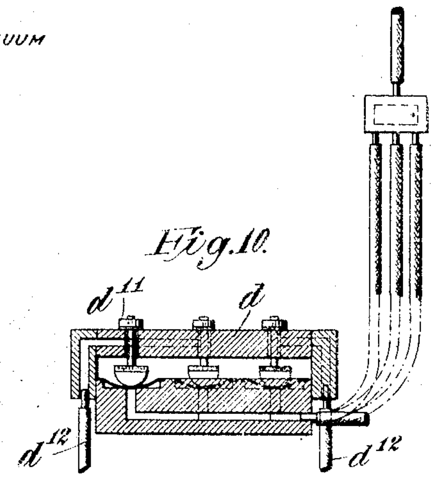

Fig. 11.

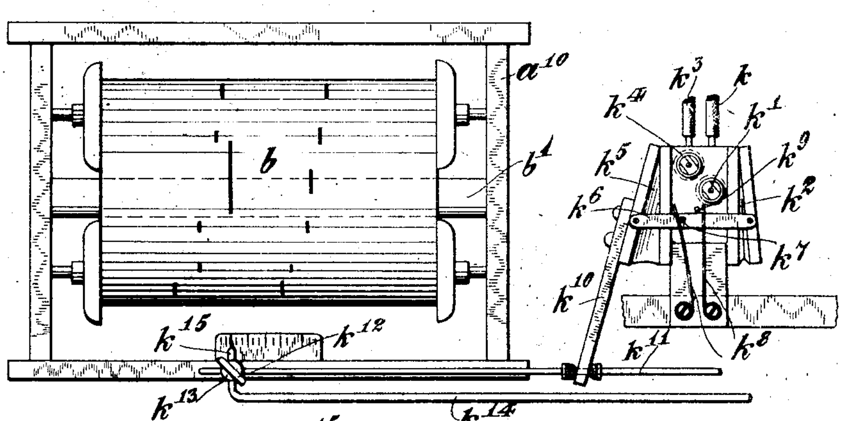

Fig. 12.

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7 SHEETS—SHEET 5.

Fig. 13.

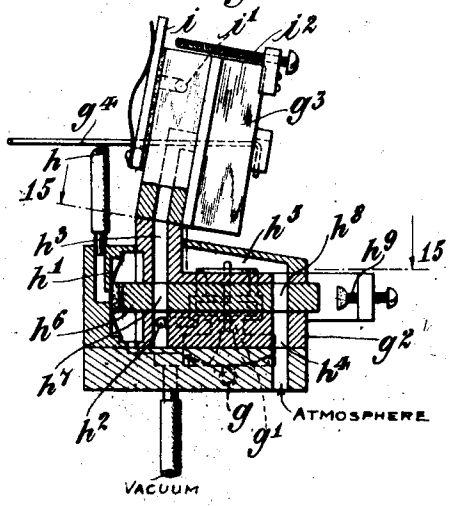


Fig. 14.

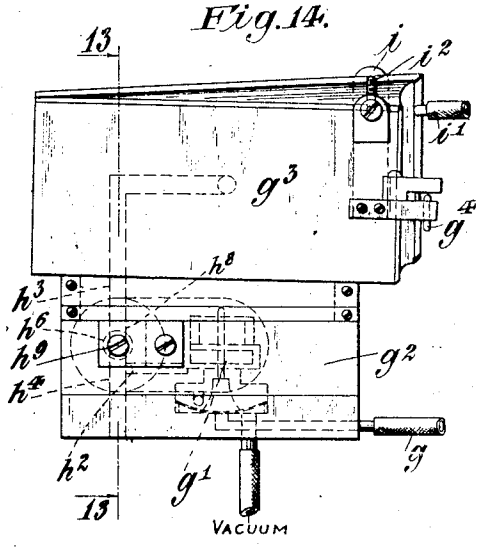


Fig. 15.

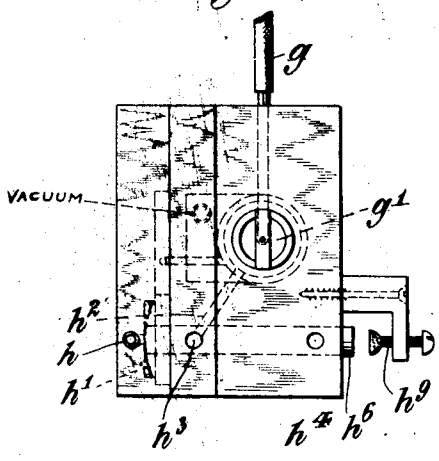
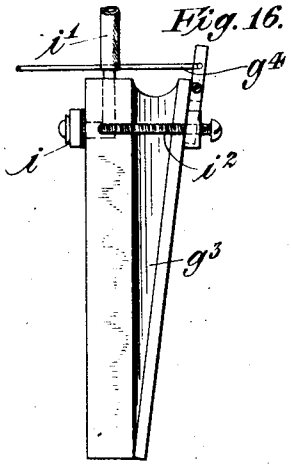


Fig. 16.



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7 SHEETS—SHEET 6.

Fig. 17.

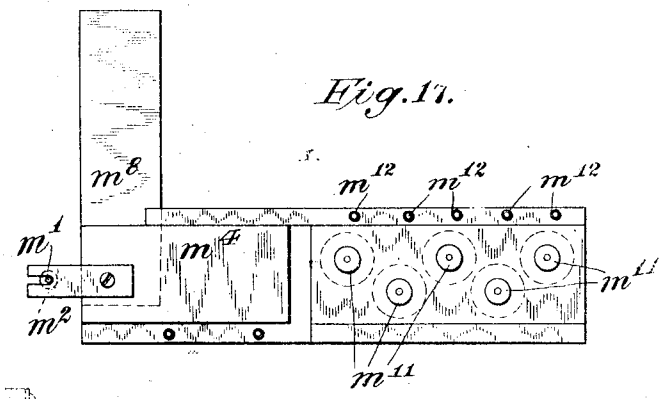


Fig. 18.

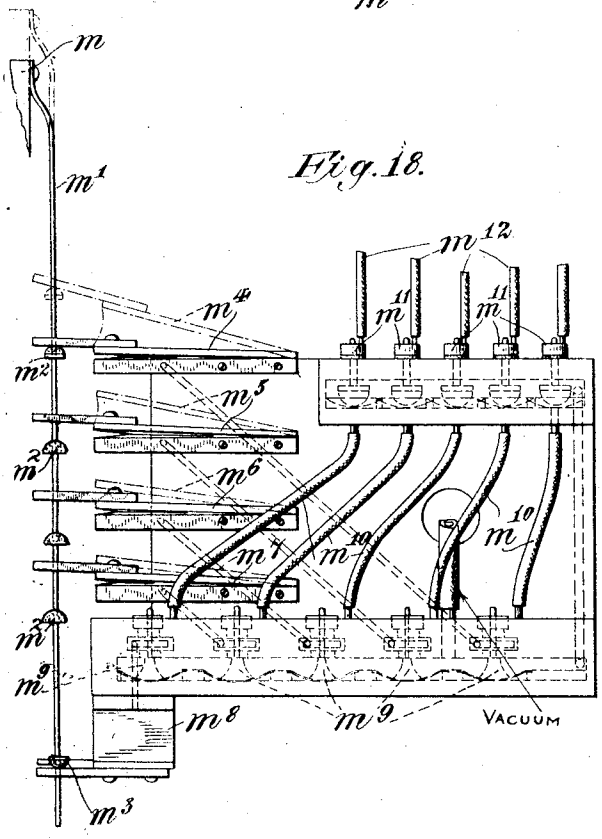
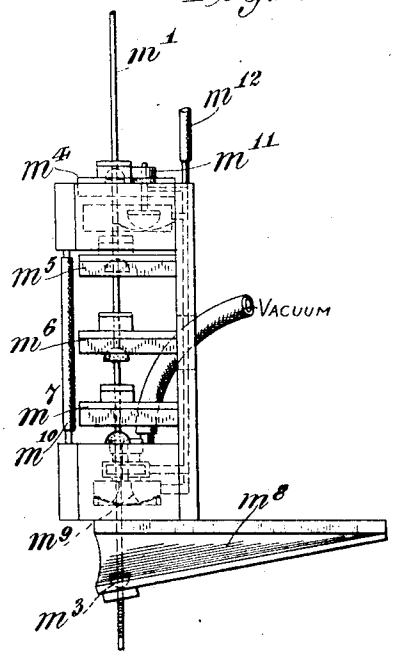


Fig. 19.



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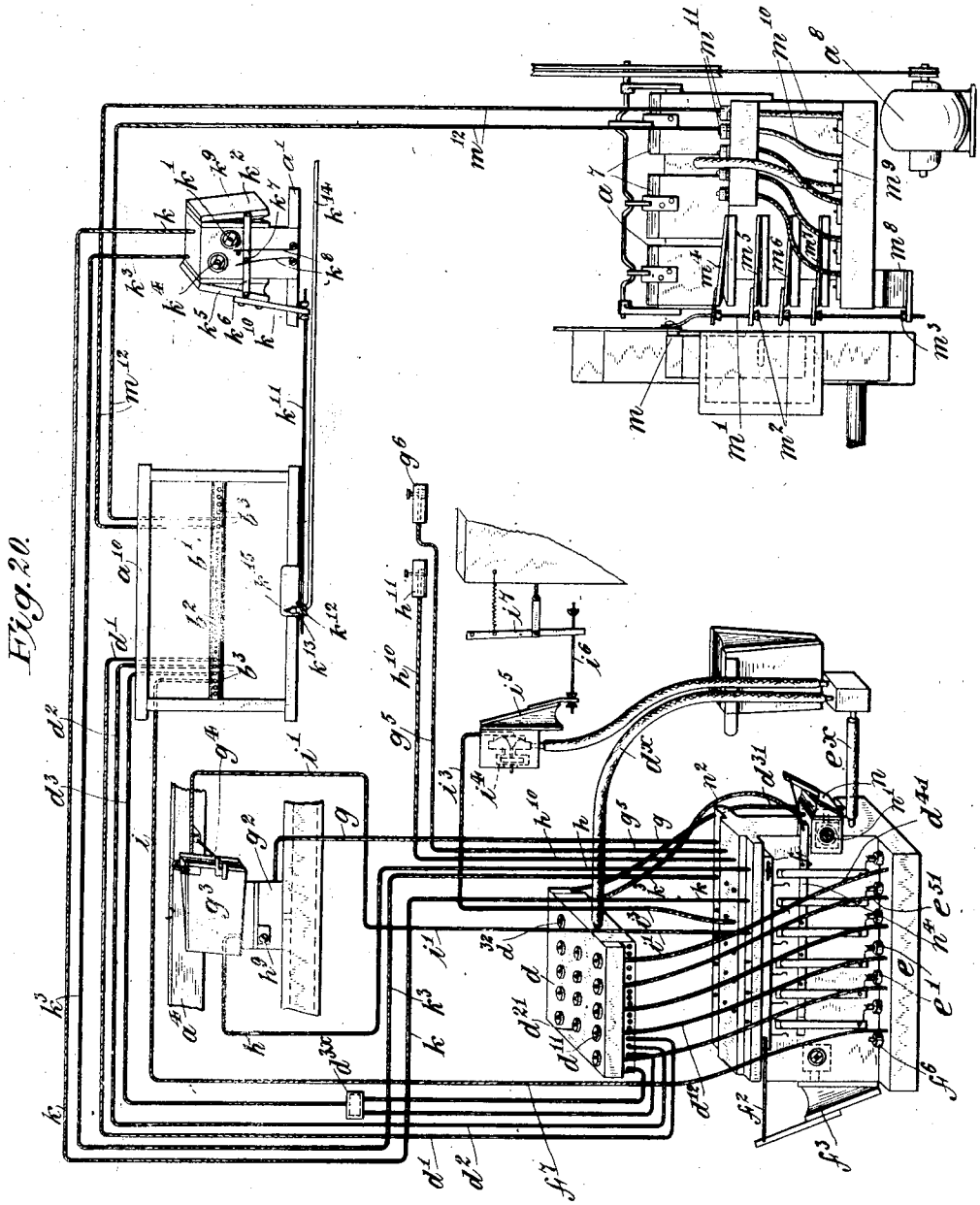
7 SHEETS—SHEET 7.

Fig. 20.



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UNITED STATES PATENT OFFICE.

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MECHANICAL MUSICAL INSTRUMENT.

1,088,000. Specification of Letters Patent. Patented Feb. 24, 1914.

Application filed March 22, 1910. Serial No. 550,976.

To all whom it may concern:

Be it known that I, JOHN A. WESER, a citizen of the United States, residing in the borough of Manhattan of the city of New York, in the State of New York, have invented certain new and useful Improvements in Mechanical Musical Instruments, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to mechanical musical instruments the operation of which is controlled automatically by a perforated music sheet, and in which the controlling and playing mechanism is embodied in the same casing with the musical instrument itself, as in a player piano, or forms separate and detachable mechanism, as in a mechanical piano player. The invention has been developed with particular reference to instruments of these kinds in which provision is made for the automatic control of the expression, as by special perforations in the music sheet; but it will be obvious, as this description proceeds, that some, at least, of the features of the invention are capable of useful application in subordination to hand operated controlling or regulating devices and without reference to purely automatic controlling devices. In accordance with the invention, in two other applications filed on April 3, 1913, Serial Nos. 758,587 and 758,588, are shown and described devices which may or may not be used in conjunction with the present improvements and which relate respectively to an auxiliary perforating device and an expression device whereby the air tension in the main wind way may be varied at the will of the operator. Again, the controlling or regulating mechanisms are so constructed and arranged that their operations are initiated by small, single perforations in the music sheet and likewise terminated by small, single perforations, so that the formation in the music sheet of long, continuous holes or of a long series of small holes close together, is avoided together with the weakening of the music sheet and the interference with proper tracking which result from the long, continuous holes and the series of small holes close together. The controlling or regulating mechanisms are also constructed and arranged in such manner that while the operation of any one of such mechanisms may be initiated singly, it is also possible to initiate the operation of any group of such mechanisms at the same time.

Still another feature of the invention consists in the provision of means whereby it becomes possible to effect, through the operation of otherwise ordinary pneumatic controlling devices, a gradual crescendo or a gradual diminuendo, such pneumatic controlling devices, especially those which vary the position of the hammer rest-rail, having acted rapidly heretofore so that, in wholly automatic instruments especially, it has not been practicable to make the crescendo or diminuendo so gradual as it should be.

Other features of the invention will be referred to and the invention will be fully explained hereinafter with reference to the accompanying drawings in which it is illustrated as embodied and in which—

Figure 1 is a view in front elevation of a player piano to which the invention is applied, the front casing being removed and some parts, which are not necessary to an understanding of the present invention, being omitted. Fig. 2 is a detail view illustrating the combination of the music sheet perforating device with the tracker board. Fig. 3 is a detail view in section on the plane indicated by the line 3—3 of Fig. 2, looking in the direction of the arrows. Fig. 4 is a top view of a portion of the controlling devices shown in Fig. 1. Fig. 5 is a view in front elevation of the parts shown in Fig. 4. Fig. 6 is a view, partly in end elevation and partly in section on the plane indicated by the line 6—6 of Fig. 5, of the parts shown in Fig. 5. Fig. 7 is a view in section on the plane indicated by the line 7—7 of Fig. 5. Fig. 8 is a top view of another part of the controlling devices. Fig. 9 is a view in front elevation of the parts shown in Fig. 8. Fig. 10 is a view in section on the plane indicated by the line 10—10 of Fig. 8, a pipe union also being indicated. Fig. 11 is a detail view in front elevation illustrating the improved tempo controlling devices. Fig. 12 is a detail view of the rod shown in Fig. 11 and its connections. Fig. 13 is a view, partly in end elevation and partly in section, on the plane indicated by the line 13—13 of Fig. 14, of the devices for controlling the movement of the hammer rest rail. Fig. 14 is a view in front elevation of the parts shown in Fig. 13. Fig. 15 is a view in section on the plane indicated by the line 15—15 of Fig. 13. Fig. 16 is a

top edge view of the bellows shown in Figs. 13 and 14. Figs. 17, 18 and 19 are respectively a top view, a view in front elevation and a view in side elevation of devices for controlling the vacuum pressure. Fig. 20 is a general, diagrammatic view indicating the relations and connections of some of the controlling and actuating devices.

For the purpose of illustration and explanation of the character of the invention, it is shown in the drawings as embodied in a player piano of well known type, which has, in substantially usual arrangement and relation, as shown in Fig. 1, an outer casing a, a supporting frame work a', finger keys a^2, hammers a^3, a movable hammer-rest-rail a^4 to vary the throw of the hammers, main or reservoir bellows, indicated generally at a^5, which may be operated by the feet of the performer through pedals a^6, su[illegible]ementary feeder bellows a^7 which may [illegible]e operated by a suitable motor, indicated at a^8, when the instrument is to be wholly automatic, player pneumatics, the casing and support of which is indicated at a^9, and a tracker box a^{10}, all with their usual connections and operating substantially as usual or as set forth in Letters Patent of the United States No. 923,225, dated June 1, 1909.

The operation of the player pneumatics is determined, as usual, by the coöperation of a perforated music sheet b (Figs. 2 and 3) mounted in the usual manner, with a tracker board b' (see Figs. 1, 2, 3 and 20), such tracker board having ports b^2 connected with the player pneumatics. The tracker board is also provided with ports b^3 by which is determined the operation of pneumatic controlling devices, by which, in turn, is determined the operation of various operating devices which regulate the wind pressure, the movement of the hammer rest rail, the speed and direction of movement of the music sheet, &c., all of such operating devices being necessary features of a wholly automatic instrument, while some of them are necessary or desirable features of non-automatic instruments, the operation of which is at least partly under the control of the performer. The music sheet is provided with so called side perforations for coöperation with the limited number of ports b^3 at the ends of the tracker board b', through which the operation of these various expression devices is initiated. The connections from the additional or expression ports b^3 will be fully explained hereinafter, so far as they are involved in the present invention, but consideration will be given first to the means whereby the performer is enabled to make in the music sheet, at will, whatever side perforations are necessary to produce any desired effects in the performance of any composition, whether the operation of the instrument is to be wholly automatic or is to be controlled, in part at least, by the performer. Such means are shown in a suitable and convenient form in Figs. 1, 2 and 3, in which there is shown pivoted to the frame of the tracker box, near each end thereof, a spring lever c which carries a punch c' by which side perforations may be made in the music sheet at the will of the performer. For facility in forming the additional side perforations, the punch c' is arranged to coöperate with holes in the tracker board and preferably, in order to prevent the entrance into the vacuum system of the small bits of paper punched out, with special holes c^2, shown in Figs. 2 and 3.

To insure accuracy in placing the additional side perforations so that they shall register with the ports in the tracker board, the lever is provided with a guide pin c^3 to coöperate with a gage plate c^4, provided with gage holes c^5, and preferably pivoted upon the frame of the tracker box so that it may be turned up out of the way, as shown at the left hand in Fig. 2, or turned down into operative position, as shown at the right hand in said figure. The guide pin c^3 is longer than the punch c' so that the guide pin may be introduced into the guide hole before the punch c' is permitted to touch the paper.

It will be obvious that the combination with the tracker box of means for making in the music sheet additional perforations, at the will of the performer, for the purpose of regulating the expression &c. will be of great advantage, even in connection with controlling and actuating devices as heretofore arranged, but in view of the fact that through carelessness an additional side perforation might sometimes be wrongly placed in the music sheet and of the fact that after experiment the performer may desire to modify in some respect the expression effect which he has previously produced and in view of the desirability of avoiding long openings or a long succession of small openings close together in the music sheet and therefore of initiating the operation of any particular expression device by one small perforation and of terminating it by another small perforation, it has been found desirable, in connection with the perforating means, to provide controlling devices of such a character that the effect of the operation of any of such controlling devices can be terminated at any time after it is initiated, through the proper placing of another perforation in the music sheet, or can be neutralized immediately, before any effect is produced, through the placing of a perforation in or near the same transverse line with that which may have been wrongly placed. The

construction and arrangement of the controlling devices which permits such results to be secured will now be described, particular reference being had to Figs. 1, 4–10 and 20, in which such devices are illustrated.

The end ports b^3, which coöperate with the side perforations in the music sheet, are connected, as usual, with the primaries of the controlling devices, or, it may be, of the operating devices, such primaries being placed with reference to their respective secondaries in any convenient manner, being grouped separately from the secondaries or in the same structure therewith as may be most convenient. The first right hand hole b^3 at the left hand end of the tracker board b', for example, is shown as connected by a tube d' (see Figs. 8 and 20) with a primary d^{11} located in a block d, with other primaries, all of which have a common connection with the vacuum system, as by a tube d^x. The primary d^{11} is in turn connected by a tube d^{12} with a secondary e' in a group of secondaries in a common block or box e with a common connection e^x to the vacuum system. In like manner, the second hole from the right of the same group of holes b^3 is shown as connected by a tube d^2 with a primary d^{21} of the group d, which in turn is connected with another secondary of the group e. The third hole of the same group of holes b^3 is shown as connected by a tube d^3 with a union d^{3x}, which is connected by two separate tubes with two separate primaries of the group d, so that a single perforation in the music sheet may in this manner be made to initiate the operation of two operating devices.

In order to avoid confusion no attempt has been made in the drawings to illustrate the connections, all the way through, from all of the holes b^3 of the tracker board to the respective operating devices, the operation of which is initiated through such holes, it being obvious that suitable connections will be made from the holes b^3 to the primaries d and from the primaries d to the secondaries e.

Each of the secondaries e, in the construction shown, is made substantially like a primary, the atmospheric pressure being admitted by the corresponding primary d, below the diaphragm e^{21} upon which rests a plunger e^{22}. The latter acts upon a short arm e^{23} which projects from a pivoted valve e^{24}, pressed by a spring e^{25} against the face of a board e^{26} and arranged to cover or uncover a port e^{27} in such board so as to admit or exclude atmospheric pressure to or from a conduit e^{28} formed in the board. Each of the conduits e^{28} is connected with an operating device as hereinafter described, so that the operation of such operating device is controlled by the opening or closing of the port e^{27}. The conduit e^{28} may also be connected with a push button or other valve under the control of the performer, as also described hereinafter, so that the operation of such operating device may be controlled by the performer as well as automatically by the music sheet.

The means just described provide for initiating the operation of the operating devices under the control of the music sheet. The means for terminating the operation of such devices will now be described. As will be observed, the valves e^{24} are moved to open the ports e^{27} by the secondaries e. The valves e^{24} are not moved in either direction by springs and therefore remain in the position to which they are moved by the secondaries e, with the ports e^{27} open, until they are restored to their initial position, closing the ports e^{27}, by an independent master device, the operation of which is also controlled by the music sheet. Upon the board e^{26}, on which the valves e^{24} are mounted, there is also mounted a sliding bar f which carries pins f' to coöperate respectively with the valves e^{24} and, through the movement of the bar f, to restore to initial position such of the valves e^{24} as have been moved from their initial positions by the means already described. The bar f is connected by a link f^2 with the movable member of a bellows f^3, normally expanded by a suitable spring f^4. The connection of the bellows f^3 with the vacuum system is controlled by a secondary f^5, of usual construction, shown clearly in Fig. 7, and the secondary f^5 is in turn controlled by a primary f^6, shown as mounted in the box e and connected with the vacuum system. Admission of atmospheric pressure under the diaphragm of the primary f^6 is controlled by the music sheet through one of the holes b^3 in the tracker board and a tube f^7 which may form a direct connection between the proper hole b^3 in the tracker board and the primary f^6. Therefore, whenever a termination perforation in the music sheet should register with the corresponding duct in the tracker board the operation of the master device or bellows f^3 is initiated and all of the valves e^{24} which are out of normal position are immediately restored to normal position, thereby terminating the operation of all the operating devices which have theretofore been in operation, that is in operative position. If the perforation in the music sheet which initiates the operation of the bellows f^3 is in or near the same transverse line as a perforation which otherwise would initiate the operation of some one or more of the other operating devices, the operation of such other operating devices will not be initiated since the bellows or operating means f^3, which restores the valves e^{24} to normal position, is more powerful than the secondaries of the box e which tend to

move the valves e^{24} from normal position. It will, therefore, be seen that the effect of any side perforation which may have been wrongly placed in the music sheet is neutralized by making a perforation for communication with the bellows f^8 in or substantially in line therewith.

In order that the valves e^{24} may also be under the control of the performer a mechanical connection to the slide bar f is provided, as shown in Figs. 1 and 5, the slide bar f being connected through a link f^8, bell crank f^9 and rod f^{10} with a bell crank f^{11} conveniently placed for operation by the performer.

Each of the passages e^{23} is connected with an operating device or, it may be, through a suitable union, as indicated in Fig. 5, with two or more operating devices, so that the operation of such devices is controlled by the opening or closing of the coresponding port e^{27}. Obviously the operating devices, controlled in this manner, may be used to perform any of the many different functions which, in instruments of the character referred to, are performed either by pneumatic devices or by the hand of the performer. It is unnecessary, so far as the present invention is concerned, to show connections to all of such operating devices and therefore it has been attempted to show in the present drawings the connections to such devices only as are either involved in the present invention or serve to illustrate clearly its operation. Taking first, for example, the connections shown at the right hand end of the group of secondaries represented in Figs. 1, 4, 5, 6 and 20, the tube g connected to the air passage e^{28}, shown in the right hand portion of Fig. 6, is connected, as shown in Figs. 13, 14, 15 and 20, to the chamber below the diaphragm of a primary pneumatic g' in a block g^2, which directly controls, in the usual manner, a bellows g^3, the movable member of which is connected by a link g^4 with the movable hammer-rest-rail a^4, the rest-rail being movable toward the hammers, to reduce the throw thereof, when the bellows g^3 is collapsed, and moving from the hammers, to permit them to have their full throw, when the bellows is expanded. In order that the movement of the rest-rail toward or from the hammers may also be under the control of the performer, independently of the automatic operation initiated by the music sheet, the air passage e^{28} (Fig. 6) is also connected, through a tube g^6, with a valve g^6 conveniently placed for operation by the performer, so that, by opening such valve, he may admit atmospheric pressure to the pneumatic g' independently of the music sheet and so produce the desired movement of the rest-rail. Each of the passages e^{28}, in fact, may be thus provided with a connection to means whereby the corresponding operating device may be controlled by the performer independently of the music sheet or, as will presently appear, by some other device, independently of the music sheet.

The secondary c shown at the right hand of Fig. 6, which operates the valve e^{24} to control the port e^{27} of the passage e^{28} with which the tube g^5 is connected, is itself controlled, through a tube d^{31} by a corresponding primary d^{32} of the primary board d, as represented in Fig. 20, and operation of the primary d^{32} is initiated through a connection to the corresponding duct of the tracker board by the registration of a perforation in the music sheet, in the manner already described.

The passage shown in dotted lines at the left of Fig. 6 is connected by a tube h with the chamber back of a diaphragm h' in the block g^2, the chamber on the opposite side of the diaphragm being connected with the vacuum system in the usual manner. This diaphragm h' is the actuating part of a device which, when brought into operation, causes the movement of the bellows g^3 to be gradual and therefore the crescendo or diminuendo, effected by the corresponding movement of the rest-rail, to be gradual, and this device will now be described. When the pneumatic g' is caused to operate, as hereinbefore described, the vacuum system is placed in communication with the bellows g^3, to collapse the same, through a channel h^2, shown in Fig. 13, and a channel h^3, and likewise, atmospheric pressure is admitted to the bellows g^3, to permit the same to expand, when the pneumatic g' is restored to normal position, through a channel h^4 and a chamber h^5. In the block g^2 is mounted a sliding valve h^6 which has in it a port h^7, which registers fully with the channel h^3 when the valve h^6 is in normal position, and a port h^8 which registers fully with the channel h^4 when the valve is in normal position. When, however, atmospheric pressure is admitted through the tube h behind the diaphragm h' the valve h^6 is moved to the right in Fig. 13 so that the channels h^3 and h^4 are partially, but not entirely, closed, an adjustable stop h^9 being provided to limit the movement of the valve h^6 so that the passages shall not be completely closed. This partial closing of the passages h^3 and h^4 so restricts the flow of air through the passages, both from and to the bellows g^3 that the collapsing or expanding of the bellows, as the case may be, is slow. The movement of the hammer-rest-rail in either direction is therefore slow and the crescendo or diminuendo is correspondingly gradual.

The air passage to which the tube h is connected, as above described, is also connected by a tube h^{10} with a valve h^{11} conveniently placed for operation by the per-

former, so that the performer may at any time admit atmospheric pressure through the tubes h^{10} and h to the chamber back of the diaphragm h' and so cause the movement of the bellows g^3 to be slow and the crescendo or diminuendo to be gradual, regardless of the automatic operation of the features initiated by the music sheet.

The secondary of the group e through which the operation of the valve h^6 is controlled is shown in Fig. 20 as connected by a tube d^{41} with the corresponding primary and the operation of the latter is initiated from the tracker board by a connection the representation of which is omitted to avoid confusion, but will be readily understood.

On the stationary member of the bellows g^3 is mounted a spring-pressed valve i which controls the terminal of a tube i'. An adjustable stop i^2 is mounted on the movable member of the bellows so that when the bellows g^3 is nearly collapsed the valve i will be opened and atmospheric pressure will be admitted through the tube i' to the air passage of the corresponding secondary of the group e, as shown in Fig. 20. The air passage of this secondary is also connected by a tube i^3 with a pneumatic i^4, shown in dotted lines in Fig. 20, which controls the connection of the vacuum system with a small bellows i^5. The latter, through a suitable connection, such as the link i^6 and lever i^7, operates a valve, not shown, which controls the connection of the strong wind or high pressure bellows with the main windway, as set forth in the Letters Patent of the United States above mentioned No. 923,225, so that when the hammer-rest-rail has been moved toward the hammers to restrict their throw to the fullest extent to which it is desirable to restrict the throw of the hammers, a further diminuendo is effected by shutting off the strong wind or high pressure and permitting the further operation of the player pneumatics by the weak wind or low pressure.

The admission of air through the tube i^3 to the controlling pneumatic i^4 may be itself controlled from the music sheet through the corresponding valve e^{24} and its secondary and primary, as will be understood without further explanation.

In Fig. 20 two other connections from air passages controlled by secondaries of the group e are shown. One of such connections, the tube k, is shown as leading to a pneumatic k' (see Figs. 11 and 20), which controls a small bellows k^2, connected as usual with the vacuum system. The other is shown as connected by a tube k^3 with a pneumatic k^4 which controls an oppositely placed bellows k^5. The movable members of the two bellows are connected by a link k^6, which has a pin k^7 standing between two springs k^8, the function of which is to return the movable members of the two bellows and the part which is moved by them to normal position after they have been shifted from their normal position by the collapsing of one or the other of the bellows. A stationary pin k^9 between the two springs prevents movement of either of the two springs toward the other beyond its normal position. Admission of atmospheric pressure to the tubes k and k^3 is controlled by their respective valves e^{24} which in turn are controlled through the corresponding secondaries e and primaries d from the tracker board, the connection between one of the secondaries e and its corresponding primary being indicated at e^{51} in Fig. 20.

The movable member of one of the bellows k^2 or k^5 has an arm k^{10} which engages a rod k^{11} in such manner as to move the same in one direction or the other according to the movement of the operating bellows. The rod k^{11} is adjustably connected, through a set screw k^{12} and a block k^{13} with the tempo controlling rod k^{14}, the finger k^{15} of the latter entering the block k^{13} as clearly shown in Figs. 11 and 12. The tempo rod k^{14} is connected in the usual manner with the tempo controlling valve, being shown as so connected through a lever k^{16}, a vertical rock shaft k^{17}, a bell crank k^{18}, a rod or wire k^{19} and a bell crank k^{20} with the controlling valve indicated at k^{21} (see Fig. 1). Relative adjustment of the rods k^{11} and k^{14} permits the standard tempo at which the composition is to be performed to be determined by the performer, while variations of the tempo can be effected automatically from the music sheet through the operation of the bellows k^2 and k^5. It will be understood that one of the bellows expands as the other collapses through connection thereof with the vacuum system and that as soon as connection of the vacuum system to one or the other of the bellows k^2, k^5, is cut off, the springs k^8 restore the normal tempo.

Still another operating device is shown in the drawings as adapted to be controlled through the coöperation of the side perforations of the music sheet with the supplementary holes in the tracker board, this device being adapted to control the air pressure through opening of the bleed valve opening and the admission of air into the wind-way between the motor operated bellows and the main or reservoir bellows, as described in said Letters Patent No. 923,225, with a consequent reduction of the vacuum pressure, the opening of such bleed valve to a greater or less extent, admitting more or less air into the wind-way and therefore reducing more or less the vacuum which would otherwise be produced in the main or reservoir bellows by the continued action of the motor operated bellows. The device and its connections are shown particularly in

Figs. 1, 17, 18, 19 and 20. The bleed valve, indicated at m in Figs. 1, 18 and 20, has connected to it a rod m' which has fixed upon it a series of buttons m^2 and a button m^2. With each of the buttons m^2 coöperates one of a corresponding series of bellows m^4, m^5, m^6 and m^7. These several bellows are adapted, when they are collapsed, to pull down the rod m' and therefore to open the bleed valve m to different degrees. With the button m^3 coöperates a master bellows m^8 which lifts the rod m' and restores the valve m to its normal or closed position after it has been moved by any one of the series of bellows. Each of the bellows m^4, m^5, m^6, m^7 and m^8 is controlled by a corresponding secondary m^9 and each of such secondaries m^9 is in turn controlled through a tube m^{10} by a corresponding primary m^{11}. The operation of each of the latter is initiated through a corresponding tube m^{12}, by the registration of one of the side perforations of the music sheet with one of the corresponding holes in the tracker board.

Reference has been made hereinbefore to the possibility of initiating the operation of any group or combination of controlling or regulating mechanisms, means whereby the operation of any one of such mechanisms, singly, may be initiated through the movement of one or any of the valves e^{24} having been described. In Figs. 1, 4, 5, 6 and 20 are also shown the means first above referred to whereby the operation of any group or combination of such mechanisms may be initiated without interfering with the initiation of the operation of each mechanism singly. On the board e^{26} is mounted an operating bellows n, the connection of which with the vacuum system is controlled, in the construction shown, through a secondary n' connected by a tube n^2 with the primary board d, from which suitable connection is made in the usual manner to one of the side perforations of the tracker board. The movable member of the bellows n is connected by a link n^3 with a sliding bar n^4 mounted in a suitable guide-way in the board e^{26} and provided with pins as n^5, suitably placed for coöperation with such of the valves e^{24} as it is desired to operate in a group or in combination. The passage of a properly placed perforation in the music sheet over the tracker board will therefore initiate the operation of the bellows n and the movement of the desired group of valves e^{24} and therefore the operation of the desired group of controlling or regulating mechanisms. It will be obvious that the pins n^5 may be placed in the bar n^4 as desired and also that other similar bars n^4 and operating bellows n may be provided if it be desired to provide for the operation of a plurality of groups or combinations.

The operation of each of the several devices which are either involved in the invention or serve as illustrations of its application, has been fully explained in connection with the description of the construction and arrangement thereof and no further explanation is necessary.

It will be understood that various other devices, the functions of which are well understood in the art to which this invention relates, might be operated or the operation thereof might be controlled or initiated through the means which have been described in detail herein, or through similar means, and that the invention is not limited in its application to the particular devices which have been described herein nor to the details of construction and arrangement of the various parts, devices and mechanisms which are involved in the invention.

I claim as my invention:

1. In a mechanical musical instrument, the combination of a series of operating devices, a series of controlling devices severally connected therewith, a master controlling device relatively more powerful than the series of controlling devices, means whereby the controlling devices of said series are returned to normal position by the operation of the master controlling device, means to initiate the operation of said controlling devices singly, independent means to initiate the operation of a group of said controlling devices, and means to initiate the operation of the master controlling device.

2. In a mechanical musical instrument, the combination of a series of valves, a series of pneumatic devices to shift said valves severally in one direction, a bellows and operative connections for shifting a group of said valves in the same direction and devices for initiating automatically the operation of said pneumatic devices and of said bellows.

3. In a mechanical musical instrument, the combination of a series of valves, a series of pneumatic devices to shift said valves severally in one direction, a bellows and operative connections for shifting a group of said valves in the same direction, a bellows and operative connections for shifting all of said valves in the opposite direction, and devices for initiating the operation of said pneumatic devices and of said bellows.

4. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows, means to restrict at will the entrance or exit of air to or from said bellows, a tracker board and pneumatic devices connected with the tracker board and adapted to control the operation of said means.

5. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows, a valve to restrict the entrance or exit of air to or from said bellows,

a pneumatic device to actuate said valve and automatic means to initiate the action of said pneumatic device.

6. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows, a valve to restrict the entrance or exit of air to or from said bellows, a pneumatic device to actuate said valve, automatic means to initiate the action of said pneumatic device, and an independent hand operated valve and connections to said pneumatic device, whereby the action of the first named valve may be initiated automatically or by hand.

7. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows connected with the vacuum system, a pneumatic device for controlling the connection between the bellows and the vacuum system, a valve to restrict the connection between the bellows and the vacuum system, and an independent pneumatic device for shifting said valve.

8. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows connected with the vacuum system, a pneumatic device for controlling the connection between the bellows and the vacuum system, a valve to restrict the connection between the bellows and the vacuum system, an independent pneumatic device for shifting said valve, independent pneumatic controlling devices for said pneumatic devices and automatic means to initiate the action of said controlling devices.

9. In a mechanical musical instrument, the combination of a movable rest rail, an operating bellows connected with the vacuum system, a pneumatic device for controlling the connection between the bellows and the vacuum system, a valve to restrict the connection between the bellows and the vacuum system, an independent pneumatic device for shifting said valve, independent pneumatic controlling devices for said pneumatic devices and a tracker board and connections therefrom to said pneumatic controlling devices to initiate the action thereof.

10. In a mechanical musical instrument, the combination of a vacuum system, a movable hammer-rest-rail, an operating bellows operatively connected with said rest-rail and itself connected with the vacuum system, a valve to control the vacuum pressure in the vacuum system, a pneumatic controlling device for said valve, a pneumatic controlling device for said operating bellows, a valve controlling the admission of air to said last named controlling device, and means controlled by the movable member of said bellows to shift said last named valve, whereby when the rest-rail has been moved to a given point the same expression effect is continued by control of the vacuum pressure.

This specification signed and witnessed this 21st day of March A. D., 1910.

JOHN A. WESER.

Signed in the presence of—

CONRAD HARRIS,

W. H. KEATING.