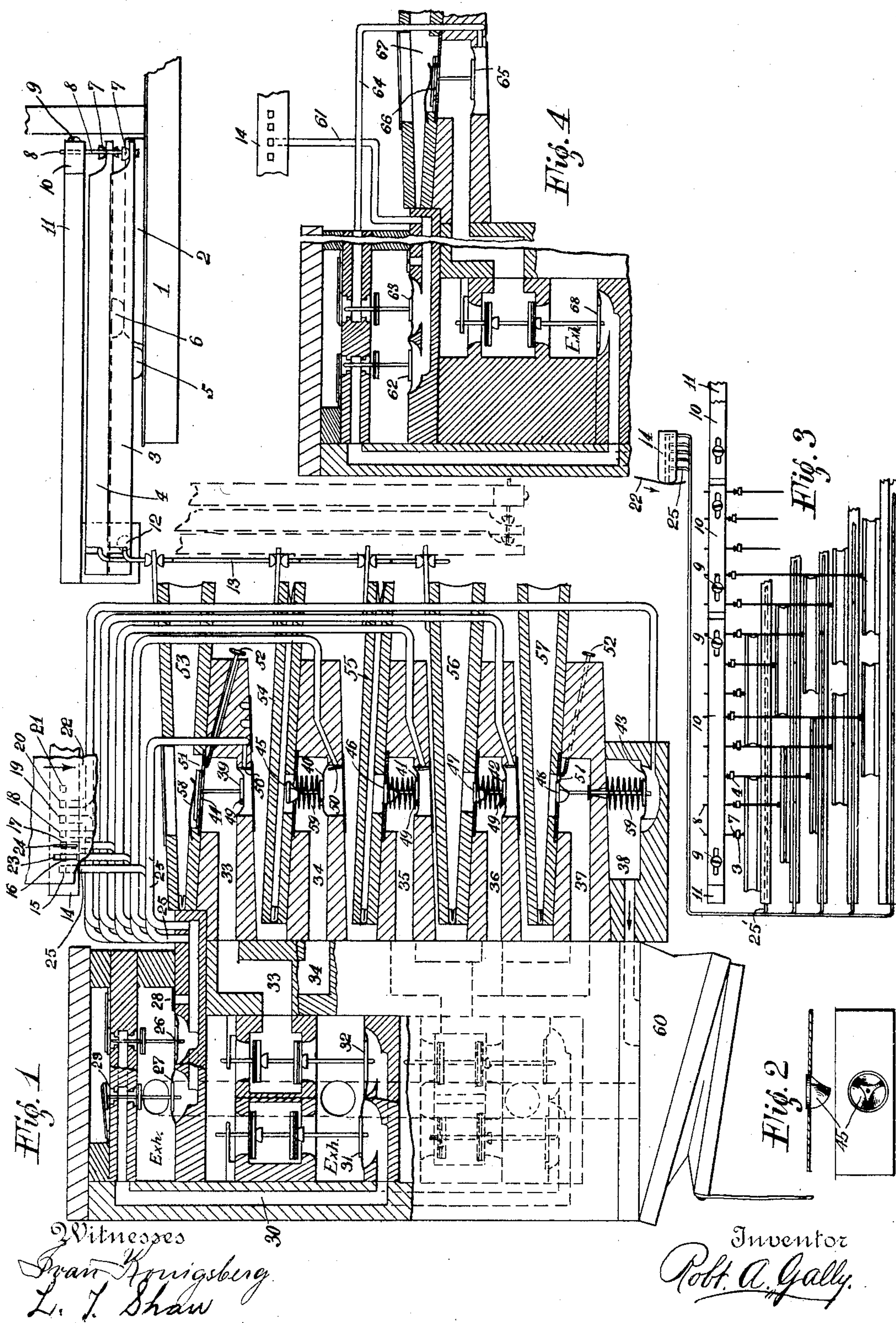


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R. A. GALLY.
SELF PLAYING MUSICAL APPARATUS.
APPLICATION FILED JULY 7, 1904.



UNITED STATES PATENT OFFICE.

ROBERT A. GALLY, OF BROOKLYN, NEW YORK.

SELF-PLAYING MUSICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 786,204, dated March 28, 1905.

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To all whom it may concern:

Be it known that I, ROBERT A. GALLY, a citizen of the United States, residing in the borough of Brooklyn, city of New York, county of Kings, and State of New York, have invented certain new and useful Improvements in Self-Playing Musical Apparatus, of which the following is a specification.

My invention has for its object the simpler and more perfect construction and control of pneumatic devices for actuating musical instruments automatically and with variation of stroke between melody and accompaniment notes and between the several "voices" or parts of a musical composition and the disposition of the necessary mechanism for direct and free movement of operating elements.

In the accompanying drawings, Figure 1 is an end view, partly sectional, showing my devices as applied in a piano-playing attachment, the exhausting-bellows being shown much smaller than true proportion to the other parts owing to restricted size of drawing. Fig. 2 shows two full-size views of the modifying-plug, under side plan and front view, respectively, with the port corresponding thereto. Fig. 3 is a rear view of several of the power-pneumatics, striker-levers, &c.; and Fig. 4 is an end view, partly sectional, of a modified form of the stroke-varying devices.

Although the restricted size of drawing only permits a few note-striking devices to be shown, it is to be understood that a sufficient number are in the apparatus to control the necessary scale of notes of the instrument to be operated thereby.

As a proper control of expression touch requires a very slow depression of the piano-key to produce a very soft tone, (ppp.) it is essential that friction of mechanical parts be practically eliminated, as otherwise a slight retarding of the motion at the critical point of stroke (when the jack escapes the hammer-butt) would cause the tone production to be missed, and it is at this point that the resistance of stroke is heaviest, or nearly so, while the usual form of pneumatic (bellows shape) has lost much of its power through closing of its folds. Therefore the simple key-striker lev-

erage now shown is very desirable. The natural-keys 1 and the sharp-keys 2 are actuated by striker-levers 3 and 4, having strikers 5 and 6 thereon, these strikers being preferably in close contact to the keys they are to actuate to avoid lost motion and with their fulcrum 7 at the rear of the keys and as near to the face of the keys as possible, so the arcs of movement of the strikers will as nearly as possible approximate the arcs of movement of the corresponding keys to minimize any friction from their rubbing one on the other. The fulcrum 7 are adjustable by their stems 8, so that the strikers 5 and 6 can be accurately leveled, and the stems 8 are preferably extended up through the rails 10, so the fulcrum may be readily leveled when the strikers are in position over the keys. As the placing of the levers for the natural-keys close to the face of the keys at the rear brings them into the narrow spaces between the sharp-keys, it is convenient to provide means for adjusting the levers to correspond to the various lengths of keyboards, which vary as much as one-sixteenth of an inch to the octave, seven-sixteenths to the entire keyboard of a piano. Such adjusting means are herein shown by divisions of the fulcrum-rail 10 into suitable sections as to its length, each section held to the main rail or frame 11 by adjusting-screws 9, situated in slots in the sections 10, each section 10 carrying its corresponding fulcrum 7 and stems 8. By moving these sections 10 to or from each other the positions of the levers 3 and 4 and their strikers 5 and 6 may be adjusted to any keyboard. As key-scales vary in the layout of their sharp-keys, it is desirable to divide the sections 10, so that each will include a single group of two or three sharp-keys and the adjacent natural-keys, so that each section 10 may be adjusted to suit its particular group of sharp-keys. With the present arrangement of striker-levers the power is applied at or near their forward ends, their strikers 5 and 6 lying intermediate their fulcrum 7 and the power-connection pitmen or rods 13, which insures great smoothness of action. As with the present arrangement the levers 3 and 4 extend so far to the rear of the main part of the apparatus

it is desirable to provide for drawing these levers and related parts closer to the main part of apparatus when not in operation, for which purpose frame 11 is hung on pivot-bearings 12, situated near the line of centers of connection of pitmen 13 to levers 3 and 4, so that the frame, with its entire set of levers, may be swung down and forward to a substantially vertical position of levers, as shown by the dotted lines at right of Fig. 1. To enable the levers and pitmen to come substantially parallel, offsets are made to the upper ends of the pitmen 13 where they connect to the levers 3 and 4, so that when the levers are vertical they will stand clear of the pitmen and without bending or cramping the latter.

The herein-shown devices for securing the variation of touch of melody and accompaniment, or of the individual notes of a chord, or of various voices or "parts" are designed to be adaptable to forms of apparatus now commonly made and sold instead of requiring a radical change of structure throughout, as with other proposed individual accent devices. The desirability of this for established manufactures is very apparent, as securing to them the desired results without altering their regular routine on the main structure. The present devices have the advantage of operating from a tracker-bar having only one aperture to each note instead of two or more apertures to a note, as with most proposed individual accent devices, securing simplicity and economy and allowing the interchangeable use of special individual accent vari-perforation music-sheets of minimum width and the ordinary uniform perforation music-sheets.

The tracker 14 has a series of apertures 15 16 17 18 19, &c., adapted to be controlled by a music-sheet 22, having note-perforations, as 23 and 24, the perforations being of varied size to admit large service of air, as by 23, or a small service, as by 24, to control a quick or slow stroke of the key-operating pneumatics by means of the elements now to be described. Each aperture 15 16 17, &c., connects by a separate tube or duct, as 25, to its primary pneumatic, as 26 or 27, &c., and the same aperture also connects through a continuing tube or duct, as 25', to a pneumatic motor, as 39 to 43, &c., each such motor connected to operate its corresponding air-current modifier 44 to 48, &c. Each primary, as 27, controls valves to a port, as 29, which leads by a continuing duct, as 30, to a secondary pneumatic, as 31, which in its turn controls valves to an air space or channel, as 34, to operate a power-pneumatic, as 54, for actuating the note-producing devices. Such a series of pneumatics and valves are common in this art and may have additional steps in the series or the first pneumatic and valve act directly on the power-pneumatics without departing from the spirit of my invention. The pneumatics, as 27 and 31, act to control the

exhaust of air from the power-pneumatics, as 54, while the motors, as 40, &c., control the air-current modifiers, as 45, &c., to regulate the speed of stroke of the power-pneumatics. The modifiers may be of any valve form, as 44, or of the peculiar form, as 45 to 48, or any substantial equivalent. The office of these modifiers is to alter the speed of flow of air from their power-pneumatics according to the position the modifier is in when the power-pneumatic is being exhausted, each modifier being situated in the windway connecting the power-pneumatic to its exhaust-valve. When the valve-form modifier 44 is used, it is necessary that there be an independent opening, as 51, to allow the slow exhaust of air when the modifier is closed, and it is convenient to have this opening 51 adjustable in size by suitable means, as 52, to enable the regulating of the slow stroke to suit the operation of each key of the piano. Such opening 51 may be placed in valve 44, if preferred. Such separate opening is not necessary when modifier of form 45 is used, as such modifier is preferably made quite free in the hole in which it normally stands to avoid any sticking, and such freedom can be sufficient to pass enough air for the slow stroke, as with 45 46 47, or the independent opening 51 with regulator 52 may be combined therewith, as shown with modifier 48, and thereby gain ease of regulating. The motors for controlling the modifiers may be in the intermittently-exhausted air spaces or channels, as are 39 to 42, or may be in independent exhaust-chamber, as is 43, its chamber 38 being directly connected to the general air-exhaust bellows 60. The primary pneumatics, as 26 27, &c., are of greater efficiency compared to the resistance of the valves of ports 29, &c., than is the efficiency of motors 39 to 43 to the resistance of the modifiers controlled by them, so that a small service of air through any small perforation, as 24, will be certain to operate the primary, and thereby cause the secondary pneumatic to exhaust its corresponding power-pneumatic 55, as shown; but such small perforation 24 will not be sufficient to operate the weaker-acting motor 41, and therefore the modifier 46 will restrict the exhaust of air from power-pneumatic 55, and the stroke of key will be slow and the tone soft. A large service of air through a perforation, as 23, will be sufficient to operate its primary 27 and secondary 31 and also to actuate the motor 40 so soon as the exhaust is started in air space or channel 34 by said operation of the secondary, whereby the modifier 45 will be moved to allow a free exhaust of air from power-pneumatic 54, producing a quick stroke and loud tone. When a slow stroke is completed, the ceasing of air-draft from a power-pneumatic and the consequent increase of tension in channel will usually cause such a lessening of load on the modifier and increased power of its

motor that the small perforation, as 24, will then actuate the modifier to its free opening, allowing a quick start of return of power-pneumatic when the perforation ceases; but
 5 a modifier of such form as 46 will return to its restrictive position before the power-pneumatic, as 55, has made much return movement, thereby slowing the return of the power-pneumatic, which is a great aid to a closely-follow-
 10 ing repetition of soft stroke, which has to be slow-moving and therefore needs the shortened distance of a partly-depressed key. This checking to part rise of key for repetition will also be attained with the quick stroke, thereby
 15 stopping lost motion and securing silent action of power movement. With the modifier of form 44 the self-checking return is not so easily attained, the return draft of air as the power-pneumatic rises being often sufficient
 20 to hold the modifier 44 open, and thus allow a sudden return of power-pneumatic. When sudden return is desired, 44 is an efficient form; but the liability to variance of "pluck" to its seat from changes of damp and dry af-
 25 fecting the leather gives the preference to the form of 45. When a perforation passes away from its tracker-bar aperture, the primary and secondary pneumatics and valves return to their normal condition, thereby closing the
 30 exhaust from the corresponding channel and power-pneumatic and opening the outside air thereto before the modifier and its motor in said channel have made much, if any, return movement, wherefore it is necessary to have a check
 35 valve or flap, as 50, to prevent the return movement of motor, as 39, from backing the air through tube, as 25', and causing a false or partial action of primary, as 26, which would often result in a hesitating release of the note
 40 or a continuing tremulant action. As the check valve or flap 50 would prevent the return venting of motor, as 39, from the return-vent 28 of the primary, an additional return-vent 49 is provided connecting the in-
 45 terior of motor, as 39, to the channel, as 33, wherein the motor is located. When a power-pneumatic is ceasing operation, so soon as the exhaust lessens in channel, as 33, the higher exhaust from 28 will close the check or flap
 50 50, thus sealing against any backflow to primary, as 26, and the return-vent 49 will allow the collapse of motor, as 39, by equalizing and connecting its interior air with that of channel 33. Return-vent 49 and check 50
 55 will insure against outside air leakage to the primary while the sheet is closed. It is to be noted that after the exhaust starts in a channel the check or flap 50 instantly opens to allow flushing of motor from perforation, and
 60 therefore both return-vents 49 and 28 are to be calculated as air loss against the air service of a perforation of the sheet after its initial moment of opening. With motor 43 in a constantly-exhausted chamber 38 it is not neces-
 65 sary to have the extra return-vent 49 or the

check 50, as is obvious; but this modified arrangement of my invention necessitates the extra chamber, a packed hole for rod, more space, less sympathetic action with the power-pneumatic, and prevents its introduction on
 70 many players as now constructed. Therefore in most cases I would give the preference to the form shown with power-pneumatics 54, 55, and 56. The springs 58 and 59 are not absolutely necessary except when the modifiers
 75 are inverted or work horizontally; but these springs are nevertheless desirable to aid quickness and certainty of operation. The modifiers 45 to 48 may be of various other forms
 80 without departing from the spirit of my invention, so that they will vary the flow of air according to their particular position; but the form 45, detailed in Fig. 2, is excellent, because free from friction in guiding to place
 85 on return and very quick to give the full opening when operated therefor.

The modification shown in Fig. 4 uses the same air-current modifier as heretofore described; but an extra primary is introduced
 90 between it and the tracker-bar, thus insuring a more rapid action, but adding to the complication. In this modified form tube 61 connects from the tracker-bar to two primary
 95 pneumatics 62 63, primary 62 actuating valves to control secondary 68, and thereby exhaust power-pneumatic 67, while primary 63 actuates valves to control motor 65 through tube
 100 64, and thereby actuate modifier 66. Primary 62 is made of much greater efficiency to the resistance of the valves it operates than the efficiency of primary 63 to its valves, so that when a
 105 small perforation of sheet is open only primary 62 will operate and secondary 68 will exhaust power-pneumatic 67 slowly, because modifier 66 is restricting the air-flow. When a large
 110 perforation is open in the sheet, primary 63, as well as primary 62, will be operated and modifier 66 will be actuated by motor 65 to allow a large flow of air from power-pneumatic 67, and thus give it a quick stroke. In
 115 this modification only one return-vent is needed, which is to return primaries 62 and 63, motor 65 being returned by the exhaust through tube 64 from exhaust-valve of primary 63. No check valve or flap is needed when this construction is used; but air-tight leather should
 120 be selected for motor 65 to prevent loss of air when note is not operating, as exhaust is then constantly inside of motor 65, while its outer face is then in normal atmosphere. As this construction returns modifier 66 so quickly
 125 at the end of a note-actuation, it is preferable to have the modifier 66 substantially as shown, (similar to 44,) as this permits the power-pneumatic 67 drawing open the modifier when
 130 said power-pneumatic is on its return movement.

Various modifications can be made to my invention without departing from the spirit thereof—as, for instance, the modifiers may
 135

be reversed, so as to normally allow a quick stroke from a small perforation and check the flow to a slow stroke when a large perforation is employed; but the construction shown herein I consider best for general use, yet do not limit myself to such specific form.

What I claim as my invention is—

1. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and having its key-striker part intermediate its length, its fulcrum rearward of such striker part, and automatically-controlled downwardly-operative means connected to it forward of such striking part.

2. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and having its key-striker part intermediate its length, its fulcrum rearward of such striker part, and a vertical tracker-pull connected to the said lever forward of its striker part.

3. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and having its key-striker part intermediate its length, its fulcrum rearward of such striker part, and a vertical tracker-pull connected to the said lever forward of its striker part and principally below the level of said lever.

4. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and having its key-striker part intermediate its length, its fulcrum rearward of such striker part, and a downwardly-acting pneumatic motor connected to said lever forward of said striker part.

5. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and having its key-striker part intermediate its length, its fulcrum rearward of such striker part, and two or more horizontal rows of downwardly-acting pneumatic motors, each motor connected to its corresponding key-striker lever at a point forward of the key-striker part of said lever.

6. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby and each said lever having its fulcrum at its rear end, and supporting means for all said fulcra adapted to swing downwardly and forwardly and thereby bring all said levers to a vertical position with all their fulcra below when said levers are not in use.

7. In a self-playing musical apparatus, a plurality of key-actuating levers, a corresponding plurality of pitmen or tracker-rods at an obtuse angle to said levers when both are in operative position, means arranged to change the relative positions of said levers and the pitmen or rods to substantially parallel positions one to the other when not in use, and an offset connection means where each pitman or rod engages its corresponding lever, each said means so arranged that its offset allows the clearance of its said engaged parts when in their substantially parallel positions.

8. In a self-playing musical apparatus, a plurality of key-actuating levers arranged in two or more groups in direction of the scale of manual-keys to be operated thereby, one group movable relatively to another in direction of said scale to justify said levers to various lengths or spacings of manual-key scales.

9. In a self-playing musical apparatus, a plurality of key-actuating levers arranged in two or more groups in direction of the scale of manual-keys to be operated thereby, a unitary supporting member for each said group, and means arranged to adjust said members and their groups of levers one to another lengthwise of said scale and lock them in such adjusted positions.

10. In a self-playing musical apparatus, a plurality of horizontal key-striker levers each arranged in position to lie over the respective manual-key of the instrument to be operated thereby, a fulcrum-rail above said levers, and to each lever a fulcrum engaged therewith extending upward through said rail for adjustment from above the rail to level its striker-lever to its key.

11. In a self-playing musical apparatus, a plurality of key-actuating levers arranged in two or more groups in direction of the scale of manual-keys to be operated thereby, each alternate group comprising the C \sharp and D \sharp levers and adjacent natural-note levers, and each other alternate group comprising the F \sharp , G \sharp and A \sharp levers and adjacent natural-note levers, a unitary supporting member for each said group, and means arranged to adjust said members and their groups of levers one to another lengthwise of said scale and lock them in such adjusted positions.

12. In a self-playing musical apparatus, a note-actuating power-pneumatic having valve means to effect its positive operation, pneumatic motor means to control said positive valve means, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, air-duct connection to said motor means from the corresponding note-aperture of the tracker-bar, air-flow-modifying means between said positive valve means and the power-pneumatic, an extra pneumatic motor means connected to said modifying means for control of the modifying operation, and air-duct connection to said extra motor

means from the same aforesaid note-aperture of the tracker-bar.

13. In a self-playing musical apparatus, a note-actuating power-pneumatic having valve means to effect its positive operation and its release, pneumatic motor means to control said valve means, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, air-duct connections to said motor means from the corresponding note-aperture of the tracker-bar, air-flow-modifying means between said valve means and the power-pneumatic, an extra pneumatic motor means connected to said modifying means for control of the modifying operation, and air-duct connection to said extra motor means from the same aforesaid note-aperture of the tracker-bar.

14. In a self-playing musical apparatus, a note-actuating power-pneumatic having valve means to effect its positive operation, pneumatic motor means to control said positive valve means, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, air-duct connection to said motor means from the corresponding note-aperture of the tracker-bar, air-flow-modifying means in the air-channel connecting said positive valve means and the power-pneumatic, an extra pneumatic-motor means in a space subject to the air service of said air-channel and connected to said modifying means for control of the modifying operation, and connection to said extra motor means from the same aforesaid note-aperture of the tracker-bar.

15. In a self-playing musical apparatus, a note-actuating power-pneumatic having valve means to effect its positive operation, pneumatic motor means to control said positive valve means, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, air-duct connection to said motor means from the corresponding note-aperture of the tracker-bar, air-flow-modifying means between said positive valve means and the power-pneumatic, an extra pneumatic motor means in a space atmospherically affected by the positive valve means and connected to said modifying means for control of the modifying operation, and air-duct connection to said extra motor means from the same aforesaid note-aperture of the tracker-bar.

16. In a self-playing musical apparatus, a note-actuating power-pneumatic having a pneumatically-controlled valve means to directly effect its positive operation, and an extra pneumatic motor means within a space atmospherically affected by the aforesaid valve means and arranged to vary speed or power of operation of the power-pneumatic.

17. In a self-playing musical apparatus, a note-actuating power-pneumatic, valve means arranged to effect the exhaust of said power-pneumatic, a modifier means arranged to

modify and regulate the flow of said exhaust to different degrees, a pneumatic controlling means to the aforesaid valve means and another to the modifier means, a tracker-bar having an aperture, and air connections from said one aperture to both said pneumatic controlling means, the said controlling means to the exhaust-valve means arranged to operate from less air service of the tracker-bar than the controlling means to the modifier means.

18. In a self-playing musical apparatus, a note-actuating power-pneumatic having a pneumatically-controlled valve means to directly effect its positive operation and an extra pneumatic motor means within a space atmospherically affected by the aforesaid valve means, and a return-vent connection from said air-space to the interior of said extra motor means.

19. In a self-playing musical apparatus, continuous air-tension-producing means, a note-actuating power-pneumatic having valve means to alternately connect the said power-pneumatic to the air tension and to the normal air, a primary pneumatic constantly in the air tension and arranged to control the aforesaid valve means, a return-vent from the continuous air tension to the interior of said primary pneumatic, a pneumatic motor disposed subject to the action of the alternate tension-air and normal air served by the aforesaid valve means, a return-vent from the alternate tension-air and normal-air service to the interior of said pneumatic motor, a tracker-bar having a note-aperture adapted to be controlled by a perforated music-sheet, air-duct connections from the interior of the aforesaid primary pneumatic and the interior of the aforesaid pneumatic motor to the aforesaid one note-aperture, and an air-check means disposed in the said air-duct connections between the two return-vents and arranged to close the connection between the two said vents when the said pneumatic motor is subject to the normal-air condition.

20. In a self-playing musical apparatus, continuous air-tension-producing means, a note-actuating power-pneumatic having valve means to alternately connect the said power-pneumatic to the air tension and to the normal air, a primary pneumatic constantly in the air tension and arranged to control the aforesaid valve means, a pneumatic motor disposed subject to the action of the alternate tension air and normal air served by the aforesaid valve means, a tracker-bar having a note-aperture adapted to be controlled by a perforated music-sheet, air-duct connections from the interior of the aforesaid primary pneumatic and the interior of the aforesaid pneumatic motor to the aforesaid one note-aperture, and an air-check means disposed in the said air-duct connections between the primary pneumatic and the pneumatic motor and arranged to close the connection between the

two said pneumatics when the said pneumatic motor is subject to the normal-air condition.

21. In a self-playing musical apparatus, a note-actuating power-pneumatic, an air-port thereto, an air-flow-modifying means consisting of a modifier normally located within the port but of less diameter, to partly reduce the flow of air through said port yet always allow some flow, and means arranged to move said modifier to allow a greater flow of air through said port when a quicker stroke is desired.

22. In a self-playing musical apparatus, a pneumatic having an air-port thereto and a modifier operating therein and of substantially cylindrical form at one end but tapered away in polygonal form toward its other end to facilitate its operation and the free flow of air at its tapered end.

23. In a self-playing musical apparatus: a note-actuating power-pneumatic having pneumatically-controlled valve means for effecting its operation; one constantly-open passage from said valve means to said power-pneumatic; additional optionally opened, or closed or restricted, passage between said parts; and a regulating means for adjusting the degree of opening of the said constantly-open passage to effect the exact minimum stroke.

24. In a self-playing musical apparatus, two or more parallel rows of bellows-shaped pneumatics, a tracker-bar above said rows and intermediate their length, and leaders or tubes from the several pneumatics carried lengthwise of the rows and between said rows to and around the ends of said rows and continued to and connected with the ducts of said tracker-bar.

25. In a self-playing musical apparatus a note-actuating power-pneumatic having pneumatic means for effecting its operation, additional pneumatic means for optionally modifying said operation, both said pneumatic means being individual to the one power-pneumatic, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection to both said pneumatic means of the one power-pneumatic from the corresponding single note-aperture of the tracker-bar.

26. In a self-playing musical apparatus, a note-actuating power-pneumatic having pneumatic means for effecting its operation and for optionally modifying said operation, the complete said means being individual to the one power-pneumatic, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection to the said effecting and modifying pneumatic means of the one power-pneumatic from the corresponding single aperture of the tracker-bar.

27. In a self-playing music apparatus, a note-actuating power-pneumatic having pneumatic means for effecting its operation and for

optionally modifying said operation, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection to the said effecting and modifying pneumatic means of the one power-pneumatic from the corresponding single aperture of the tracker-bar.

28. In a self-playing musical apparatus, a power-pneumatic having valve means and a plurality of primary pneumatics thereto for controlling its positive operation, said primary pneumatics being of varied ratios of power one to another as compared to their respective valve resistance, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection directly to each of the said plurality of primary pneumatics of the one power-pneumatic from the single aperture of the tracker-bar corresponding to that particular power-pneumatic.

29. In a self-playing musical apparatus, a power-pneumatic having a plurality of primary pneumatics for controlling its positive operation, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and an air-duct connection directly to each of the said plurality of primary pneumatics of the one power-pneumatic from the single aperture of the tracker-bar corresponding to that particular power-pneumatic.

30. In a self-playing musical apparatus, a power-pneumatic having a plurality of primary pneumatics and valves for controlling its positive operation, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection directly to each of the said plurality of primary pneumatics of the one power-pneumatic from the single aperture of the tracker-bar corresponding to that particular power-pneumatic.

31. In a self-playing musical apparatus, a note-actuating power-pneumatic having a plurality of actuating air-passages connected thereto for its positive operation, and means for adjustably regulating the relative sizes of the said several passages to determine the exact relative speeds of strokes to be controlled thereby.

32. In a self-playing musical apparatus, a tracker-bar adapted to be controlled by a perforated music-sheet; a note-actuating power-pneumatic having valve means controlled by said tracker-bar for effecting the operation of said power-pneumatic; and air-flow-modifying means between said power-pneumatic and its said valve means, individual thereto, and controlled by said tracker-bar to optionally vary the stroke of said power-pneumatic.

33. In a self-playing musical apparatus, a power-pneumatic having a plurality of primary pneumatics and valves for controlling its operation, intermediate pneumatic and valve means between one of said primary pneumatics and its valve and the said power-

pneumatic, direct air connection from the valve of another of the primaries to the said power-pneumatic, a tracker-bar having apertures adapted to be controlled by a perforated music-sheet, and air-duct connection directly to each one of the said plurality of primary pneumatics of the one power-pneumatic from

the single aperture of the tracker-bar corresponding to that particular power-pneumatic.

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Witnesses:

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