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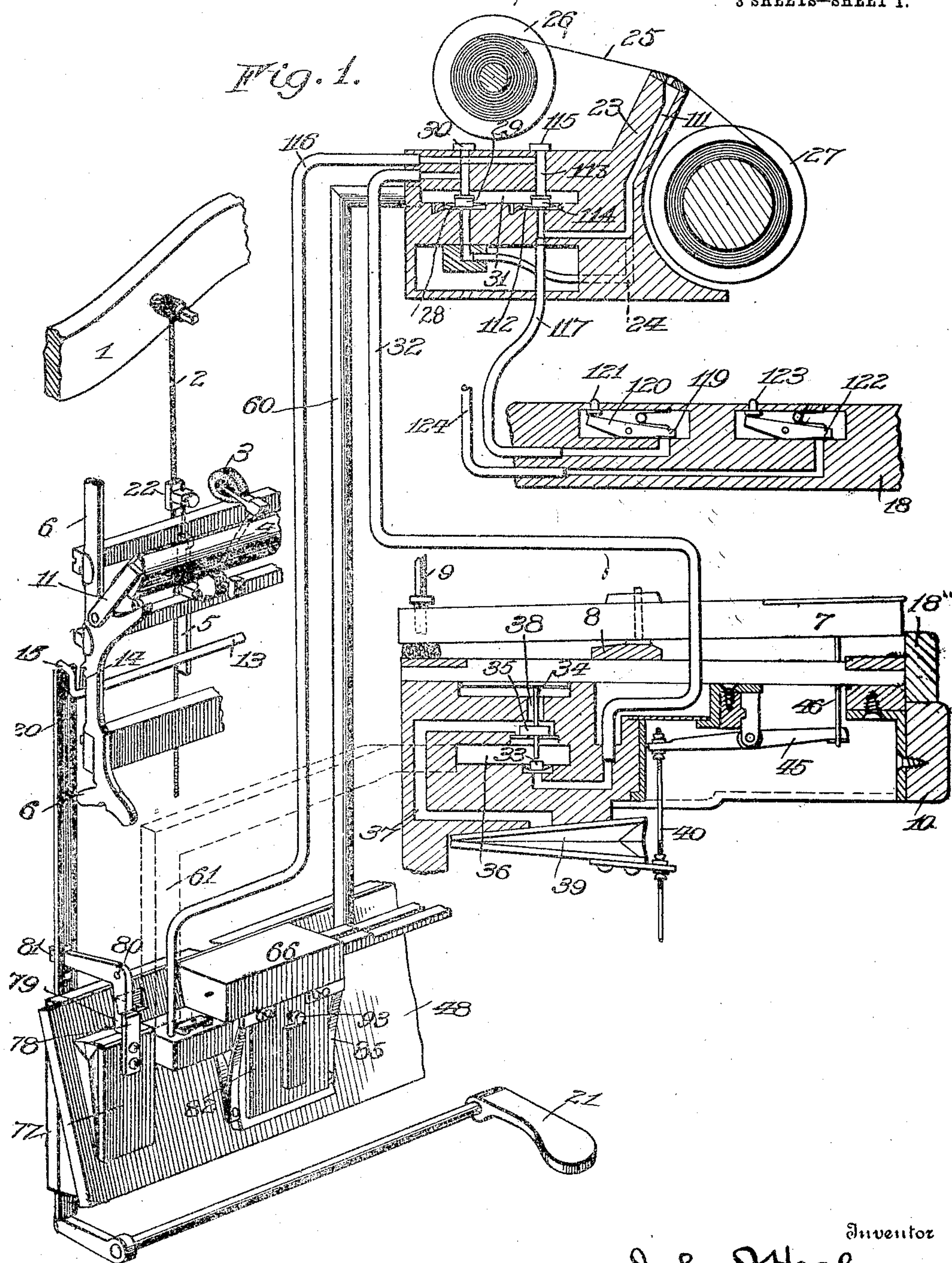
PATENTED APR. 16, 1907.

J. J. HEALY.

EXPRESSION MECHANISM FOR SELF PLAYING MUSICAL INSTRUMENTS.

APPLICATION FILED MAY 15, 1905.

3 SHEETS—SHEET 1.



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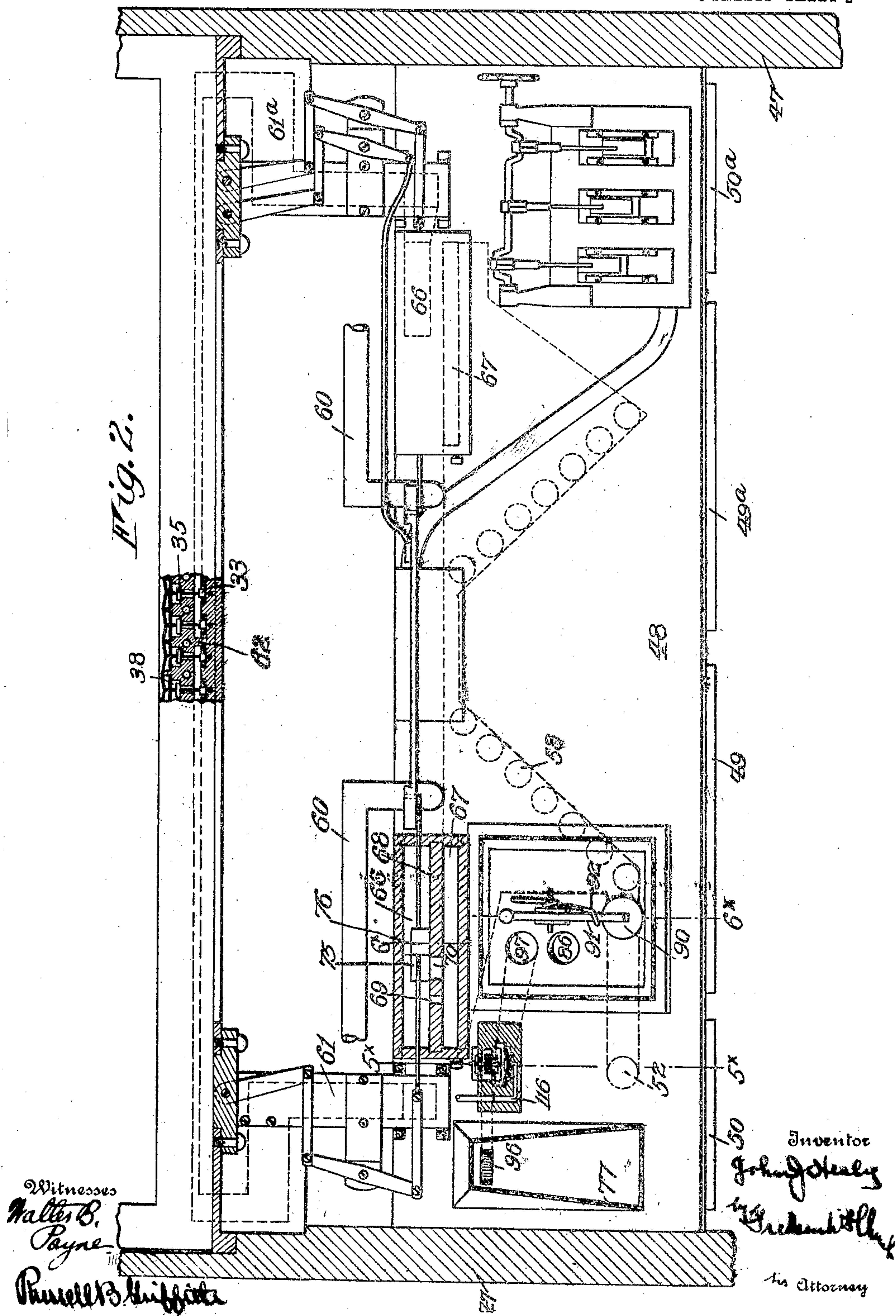
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3 SHEETS—SHEET 2



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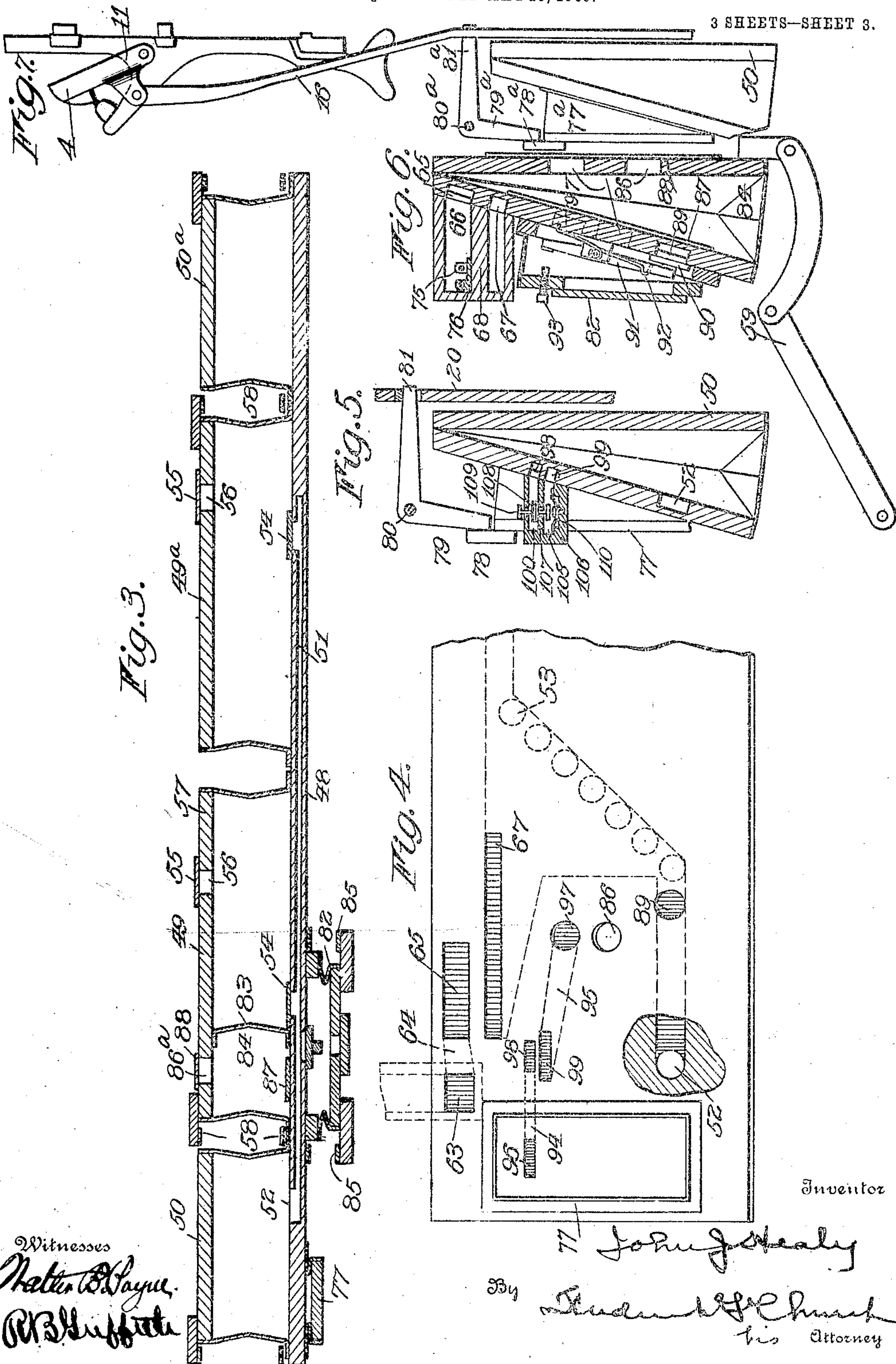
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3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

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EXPRESSION MECHANISM FOR SELF-PLAYING MUSICAL INSTRUMENTS.

No. 850,303.

Specification of Letters Patent.

Patented April 16, 1907.

Application filed May 15, 1905. Serial No. 260,402.

To all whom it may concern:

Be it known that I, JOHN J. HEALY, of Cohocton, in the county of Steuben and State of New York, have invented certain new and
5 useful Improvements in Expression Mechanism for Self-Playing Musical Instruments; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying
10 drawings, forming a part of the specification, and to the reference-numerals marked thereon.

My present invention relates to pneumatically-operated musical instruments and to
15 those devices employed in connection therewith for producing pianissimo and forte effects; and it has for its object to provide suitable mechanism to be employed in connection with a pianoforte for operating the
20 string-dampers and, if desired, the hammer-rail or other attachments, whereby these parts may be controlled by perforations in the music-sheet or independently thereof, at the will of the operator, whenever it is de-
25 sired to subdue or accent certain notes in a musical composition.

To these and other ends the invention consists in certain improvements and combinations of parts, all as will be hereinafter more
30 fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings, Figure 1 is a diagrammatic view illustrating the devices embodying my invention and portions of a piano-
35 forte to which they are connected. Fig. 2 is a front elevation, partly in section, showing the arrangement of the pneumatic operating devices of the instrument. Fig. 3 is a longitudinal sectional view of the division-board, showing the various bellows mounted thereon. Fig. 4 is a detail view of one end of the
40 division-board. Fig. 5 is a sectional view thereof, taken on the line 5^x 5^x of Fig. 2. Fig. 6 is a similar view taken on the line 6^x 6^x of Fig. 2. Fig. 7 is a detail view showing the devices employed for operating the hammer-
45 rail.

Similar reference-numerals in the several
50 figures indicate similar parts.

As my invention is adapted to be applied particularly to an upright piano, I have shown certain parts thereof which may be of the usual or any preferred construction.

1 indicates the usual frame carrying strings 55
2, with which coöperate the hammers 3, adapted to be operated by any form of action, as will be understood, the only portions thereof to which it is necessary to refer specifically being the hammer-rail 4 and the
60 damper-lever 5, both of which are supported on the action-frame 6. The key or digital 7 is mounted in the usual manner upon the bed 8, so that its inner end when operated upwardly will raise the jack 9 to cause the ham-
65 mer 3 to strike its string, while its outer end is arranged over the breast or forwardly-projecting portion 10. These parts all operate in the well-known manner, the hammer-rail 4 being provided at its ends with arms 11, 70
which are pivoted to the frame 6, enabling it to be adjusted relatively to the strings by means of a lifting-rod 16, operated by the soft pedal.

The damper-levers 5, pivoted on the frame 75
6, are operated by a swinging bar 13, supported by a pivoted arm 14 and provided with an offset end 15, with which engages a lifting-rod 20, adapted to be elevated by the
80 loud pedal 21, whereby all of the damper-levers may be operated to hold their pads 22 out of engagement with their strings to permit the latter to vibrate without check.

The following description, which will be confined to the devices for taking the place 85
of the loud pedal, may also be applied in lieu of the soft pedal, although by the arrangement of the parts I employ for operating the keys low tones may be produced by modifying the force with which they are operated, 90
and the mechanism for operating the hammer-rail may be omitted.

The tracker-board 23 comprises a plurality of passages 24, which are controlled by perforations in a music-sheet 25 as the latter is 95
unwound from the spool 26 onto the reel 27. Each of these passages leads beneath a diaphragm 28, upon which rests the head 29 of a primary valve 30, said head being normally in the position shown in Fig. 1, opening com- 100
munication between the primary valve-chest 31 and a passage 32, leading beneath a puff or diaphragm 33, which operates its respective secondary valve 34. This secondary
105 valve comprises a head 35, which normally disconnects the secondary wind-chest 36 from the exhaust-passage 37 and opens the latter through a port 38 to allow the free entrance

of air to the key-operating bellows 39. The latter is connected, as shown in Fig. 1, to the key or digital 7 by means of a rod 40, a pivoted lever 45, and a rod 46, whereby the outer end of the key will be drawn downwardly to elevate the jack 9 and cause the hammer 3 to engage its string whenever the secondary valve 35 is operated to close the port 38 and permit the air contained in the key-bellows 39 to be exhausted through the wind-chest 36 as the result of the venting or flushing of the corresponding tracker-board passage 24, which operates the primary valve 30 to flush the passage 32 and raise the puff or diaphragm 33.

The pneumatic devices for exhausting the air from the primary and secondary wind-chests 31 and 36 are arranged beneath the key-bed and are supported between the sides 47 of the piano-casing. These devices comprise a division-board or support 48, having at its rear side two feeder or pumping bellows 49 and 49^a and main bellows 50 and 51^a, all of which are connected by a passage 51 in the division-board. One-half of this passage is shown in dotted lines in Fig. 4, which communicates with the main bellows through apertures 52 and with the feeder-bellows through apertures 53, which are covered by flap-valves 54, operating alternately with similar valves 55, controlling openings 56 in the movable back boards 57 of said bellows. The latter are opened outwardly by springs 58 and are collapsed by the operation of pumping-pedals 59. (Shown in Fig. 6.) The passage 51 constitutes a common wind-trunk, from which branches, such as pipes 60, lead to the primary wind-chest 31, and branches 61 61^a are connected to the treble and bass subdivisions of the secondary wind-chest 36, which are formed at opposite sides of a partition or wall 62, located therein.

In order to regulate the tension of the air in the branch wind-trunks 61 and 61^a, they are connected to apertures 63 at one end of a passage 64 in the division-board, the other end of which (indicated at 65) opens into a valve-box 66, which also embraces an aperture 67, opening into the passage or wind-trunk 51. Arranged in the box 66 and between the apertures 65 and 67 is a partition or wall 68, provided with a small aperture 69 and a larger opening 70, one or both of which may be opened or closed by valve-heads 75 and 76, capable of lateral adjustment to vary the area of the apertures, and consequently increase or decrease the attenuation of the air in the respective passages 61 61^a.

The foregoing devices are those employed for operating the key-pneumatics, and they may be varied if it is found necessary or desirable to do so without affecting the operation of the expression mechanism, which is to be further described.

At one end of the division-board is mount-

ed a bellows 77, having a finger or extension 78 cooperating with an arm 79 of a bell-crank lever pivoted at 80, the other extremity 81 of which engages the lifting-rod 20. Also arranged on the front of the division-board is an auxiliary main bellows 82, located in alignment with one end of the feeder-bellows 49, which latter is provided with an inner collapsible partition 83, forming a supplemental feeder-bellows 84. The latter is designed particularly for collapsing the bellows 82 against the tension of its spring 85, and it is connected thereto by an aperture 86 in the division-board covered by a flap-valve 87. The end of the back board 57 in rear of the supplemental bellows 84 is provided with apertures 88^a, covered by a flap-valve 88. By this arrangement the auxiliary main bellows 82 is collapsed by a separate supplemental feeder, and when it is operated to exhaust the bellows 77 the comparatively large volume of air required by the latter in no wise disturbs or varies the tension of the air in the main reservoir or wind-trunk.

As the string-dampers are only occasionally operated and it is desired to hold the bellows 82 collapsed without forming a drag or pull on the feeder-bellows 49 49^a, which might hold them collapsed against the tension of the springs 58, I provide a passage 89, connecting said bellows 82 with the passage or wind-trunk 51 in the division-board. Covering this passage is a valve-head 90, supported on an arm 91 and operated by spring 92 to normally hold the valve in closed position. Arranged in alignment with the other end of the arm 91 is an adjustable stop, such as a set-screw 93, carried on the movable back board of the auxiliary bellows 82, which operates to raise the valve-head 90. These parts perform the function of a safety-valve, which relieves the suction on the supplementary feeder when the auxiliary main bellows is collapsed by connecting the latter bellows with the passage or wind-trunk 51.

Passages 94 and 95 are provided in the division-board, and they are respectively connected by apertures 96 and 97 with the power-bellows 77 and the auxiliary main bellows 82. At their proximate ends these passages terminate in apertures 98 and 99, with which communicate chambers 100 105 in a valve-box 106. The chamber 100 is normally open to the external atmosphere and it is connected to the chamber 105 by a small passage 107, normally closed by a valve 108, mounted upon a stem 109, the lower end of which rests above a puff or diaphragm 110 in the chamber 105. The power-bellows 77^a, having a finger 78^a, Fig. 7, may be attached to the lifting-rod 16, cooperating with the hammer-rail 4, by a bell-crank lever comprising arms 79^a and 81^a, pivoted at 80^a, and a duplication of the auxiliary reservoir or

bellows 82 and the other parts operating therewith may be employed, if desired.

Forte expression or pianissimo effect may be produced by perforations in the music-sheet which control passages 111, similar to the passage 24 in the tracker-board, the opening of which causes the operation of the power-bellows 77 or 77^a, as will be further described. The passage 111 terminates beneath a puff or diaphragm 112, supporting a primary valve 113, having heads 114 and 115, adapted to alternately release and control the entrance of air into a passage 116, terminating beneath the puff 110 of the valve 108, as shown in Figs. 1 and 2. The primary valve 113 is normally in a position shown in Fig. 1, closing the passage 116 against the entrance of air under atmospheric pressure and connecting it with the valve-chest 31, and when the passage 111 is opened by a perforation in the music-sheet the primary valve is raised, as shown in dotted lines, to flush the passage 116 and cause the secondary valve 108 to be raised to close the aperture in the chamber 100, connecting that chamber with the exhaust-chamber 105. With the secondary valve in the operated position the air contained in the bellows 77 passes through the aperture 96, passage 94, aperture 98, chamber 100, aperture 107, chamber 105, aperture 99, passage 95, issuing through the aperture 97 into the auxiliary main bellows 82, allowing the latter to move outwardly under the influence of the springs 85. At the beginning of the outward movement of the auxiliary main bellows the stop 93 is carried out of engagement with the lever 91, when the spring 92 operating thereon immediately closes the valve 90 over the aperture 89.

In order to enable an operator to vary the forte effect irrespective of the music-sheet, I extend a passage 117 from the primary valve-puff 112 to a convenient point in the front rail 118 of the key-bed, which is controlled by a manually-operated valve 119 on pivoted arm 120, located in an aperture formed in said rail, and adapted to be operated by a small button 121, which the operator may press with one of his fingers. If a duplication of the supplemental pumping-bellows, the auxiliary main bellows, and the power-bellows 77 is employed for operating the hammer-rail 4, they will be controlled by primary and secondary valves similar to the valves 113 and 108, and their manual operation may be effected by the opening and closing of the valve-head 122, operated by a button 123, arranged in the rail in proximity to the valve 119 and controlling air in a branch passage 124, leading to its respective primary valve, as will be understood.

The devices which I have described may be used in addition to any desired form or arrangement of the feeder and main bellows

employed for operating the other portions of the instrument, and while I have confined my description of the supplemental feeder and auxiliary bellows to those devices for producing pianissimo and forte expressions they may also be used for operating attachments which are sometimes applied to pianofortes for producing other effects.

Various changes in the devices I have described may be suggested to those skilled in the art. For instance, the supplemental feeder-bellows may be omitted and the auxiliary main bellows exhausted by the main feeder-bellows. As such an alteration would embody the spirit of my invention, I do not limit it to the precise form I have shown.

I claim as my invention—

1. In a pneumatically-operated musical instrument, the combination with an action embodying string-dampers and keys, key-pneumatics and devices for operating said dampers, a power-pneumatic connected to the latter, separate exhaust-bellows for operating the pneumatics and valves for controlling them, of separate feeder-bellows for the exhaust-bellows, a valved passage connecting the latter, means for operating the feeder and means for controlling the operation of the valves.

2. In a pneumatically-operated musical instrument, the combination with an action embodying string-dampers and keys, key-pneumatics, operating devices for the dampers and a power-bellows for actuating them, of separate reservoirs for operating the key-pneumatics and power-bellows, feeder-bellows exhausting said reservoirs and a passage connecting said reservoirs, a valve controlling it and means for governing the operation of the key-pneumatics and power-bellows.

3. In a pneumatically-operated musical instrument, the combination with an action embodying keys, pneumatic devices for operating them and feeder and main bellows for operating the key-pneumatics, of means for operating a part of the instrument independent of the keys, a bellows for actuating said independent part and a separate feeder and main bellows for said actuating-bellows and means for simultaneously operating the two feeder-bellows, a passage connecting the two main bellows, a valve controlling said passage and means for operating it.

4. In a pneumatically-operated musical instrument, the combination with an action embodying keys, pneumatic devices for operating them and feeder and main bellows for operating the key-pneumatics, of means for operating a part of the instrument independent of the keys, a bellows for actuating said independent part and a separate feeder and auxiliary main bellows for said actuating-bellows, means for simultaneously operating the two feeder-bellows, a passage connecting

the main and auxiliary main bellows, a valve normally closing the passage and means for opening it when the air is exhausted from the auxiliary main bellows.

5 5. In air - exhausting devices for pneumatically-operated instruments, the combination with a main reservoir, a feeder-bellows exhausting air therefrom and pneumatically-operated devices connected to the
10 reservoir, of a separate feeder attached to the main feeder, an auxiliary reservoir connected to the separate feeder, power-bellows, a passage connecting it to the auxiliary reservoir and a valve controlling said passage, an-
15 other passage connecting the auxiliary reservoir and main reservoir, a valve controlling it, means for closing the latter when the other valve is opened and means for operating the feeders.

20 6. In air - exhausting devices for pneumatically-operated instruments, the combi-

nation with a main reservoir, a feeder-bellows exhausting air therefrom and pneumatically-operated devices connected to the reservoir, of a separate feeder attached to the
25 main feeder, an auxiliary reservoir connected to the separate feeder, power-bellows, a passage connecting it to the auxiliary reservoir and a valve controlling said passage, a primary valve controlling the first - men-
30 tioned valve and a tracker-board having a passage controlling said primary valve, a supplemental passage under the control of the operator for governing the operation of the power-bellows independently of the
35 passage in the tracker-board and means for operating the feeder.

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Witnesses:

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