

J. HATTEMER.
MANUALLY OR MECHANICALLY OPERATED PIANO.

APPLICATION FILED SEPT. 22, 1904.

3 SHEETS—SHEET 1.

FIG. 1.

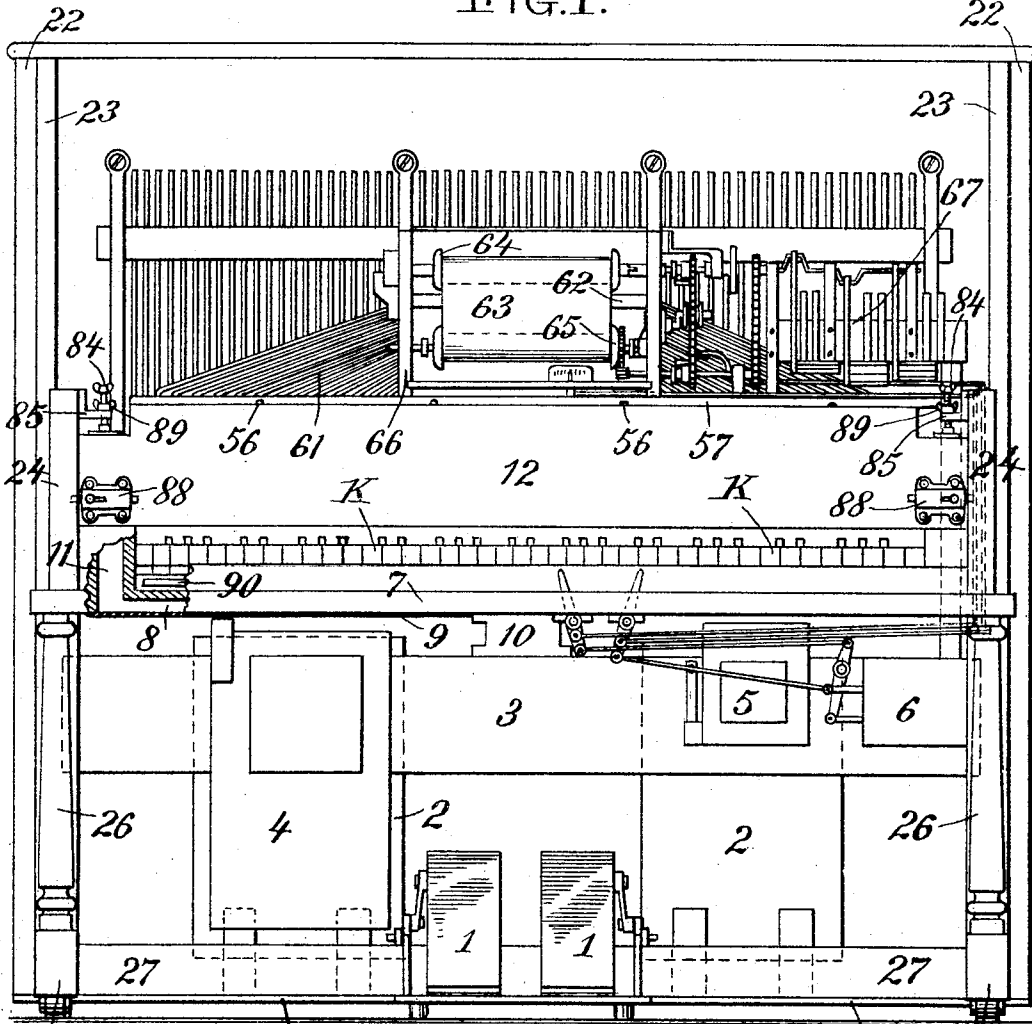
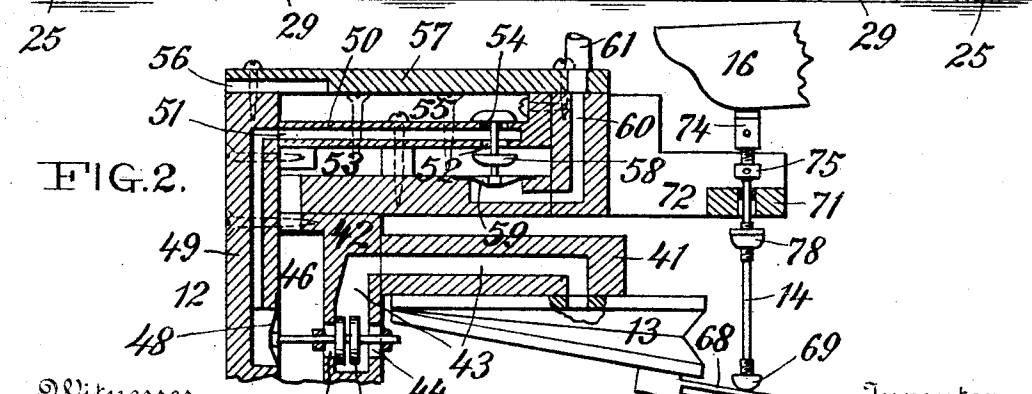


FIG. 2.



Witnesses
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3 SHEETS—SHEET 3.

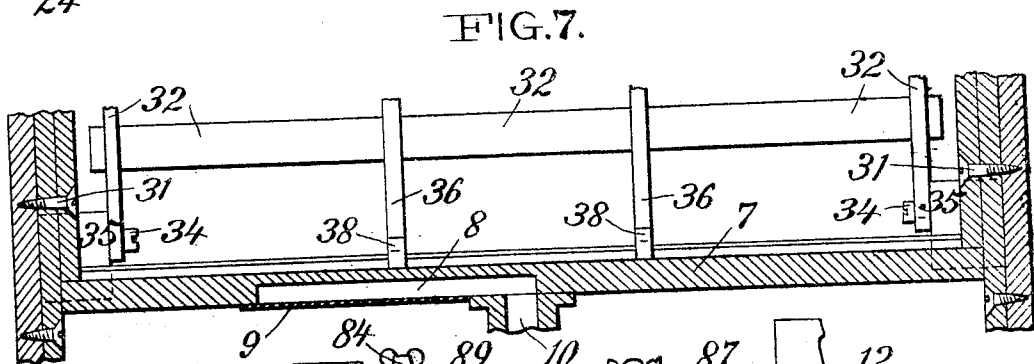
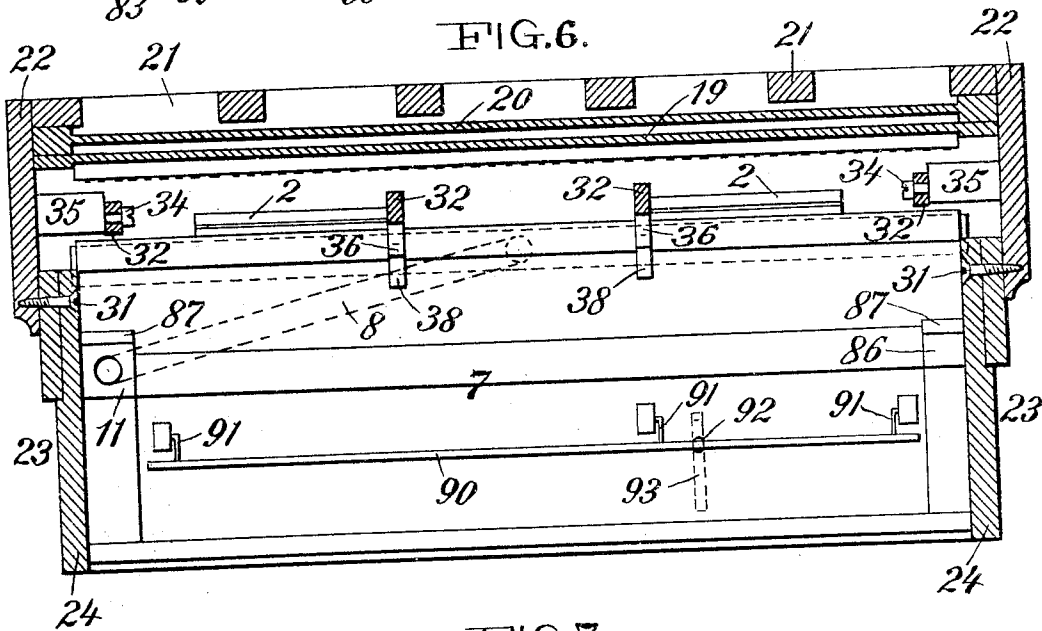
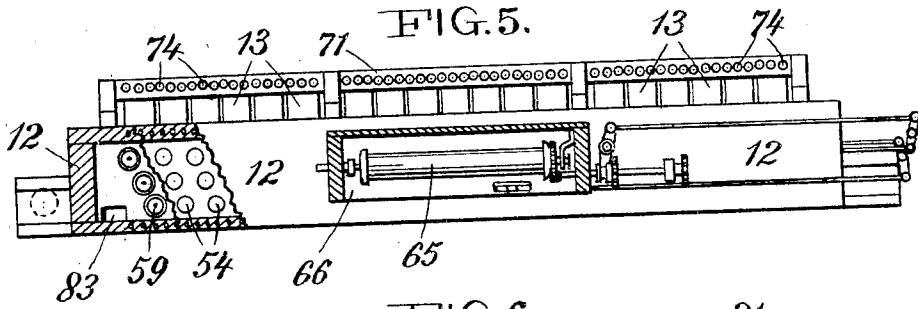


FIG. 8.

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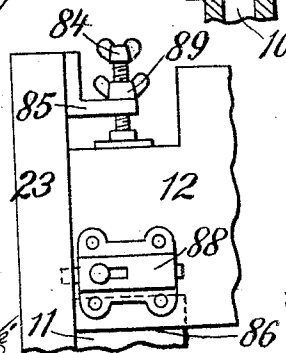
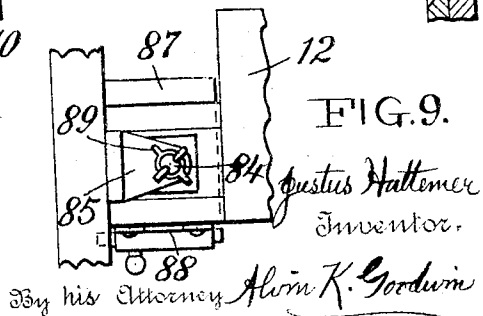


FIG. 9.



Justus Hattemer
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UNITED STATES PATENT OFFICE.

JUSTUS HATTEMER, OF NEW YORK, N. Y., ASSIGNOR TO HARDMAN PECK & COMPANY, OF NEW YORK, N. Y., A CORPORATION.

MANUALLY OR MECHANICALLY OPERATED PIANO.

No. 803,757.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed September 22, 1904. Serial No. 225,400.

To all whom it may concern:

Be it known that I, JUSTUS HATTEMER, a citizen of the United States of America, residing at the city of New York, State of New York, have invented certain new and useful Improvements in Manually or Mechanically Operated Pianos, of which the following is a specification.

This invention relates to pianos, organs, or other musical instruments adapted to be played manually or mechanically, and has for its object to simplify and cheapen the construction and improve the operation and durability of instruments of this class.

The invention comprises a special arrangement within the key-table of an air-passage connecting the striking pneumatic wind-chest with the main wind-inducing devices.

The invention also includes a special divisible construction of the piano-case to facilitate inspection and repair of parts and to make transportation easier along narrow halls or stairways.

The invention also includes simple and efficient arrangements of the striking-pneumatics and their abstracts operating the piano-action, whereby practically perfect repetition of notes or tones is effected during mechanical playing, while special provision is made for taking up lost motion and for preventing jamming of the tone-producing hammers or parts.

The invention also includes certain novel arrangements of parts of the automatic playing mechanism, facilitating their convenient removal for inspection and repairs.

The invention also includes novel fastenings for the wind-chest, containing the valve systems of the striking-pneumatics, and, finally, the invention includes various other novel details of construction and combinations of parts of the instrument, all as hereinafter described and claimed.

Reference is made to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a partly-sectional front elevation of a piano embodying the invention with the action represented diagrammatically and parts of the casing removed. Fig. 2 is an enlarged vertical transverse sectional view illustrating the striking-pneumatics and their wind-chest and valves and action-operating abstracts. Fig. 3 is a central vertical sectional view of

the piano as adjusted for mechanical playing. Fig. 4 is a detailed sectional side view showing a modified form of action-wippen. Fig. 5 is a partly broken out and sectional plan view of the removed striking-pneumatics and their wind-chest, with the attached music-roll frame also in horizontal section. Fig. 6 is a sectional plan view taken in a plane above the piano key-table and with the key-levers removed. Fig. 7 is a detail vertical sectional view of portions of the key-table and action-frame and the piano-case ends. Fig. 8 is a detail front view of one end of the striking pneumatic wind-chest and its fastenings, and Fig. 9 is a plan view thereof.

In the piano shown in the drawings the pedals 1 operate air-pumping bellows 2, held to a main wind-chest 3, to which the ordinary reservoir-bellows 4, the automatic valved air-current regulator 5, and the communicating music-sheet motor-valve chest 6 are attached. These parts 1 to 6 are below the key-table 7, which is specially recessed, Figs. 1 and 7, to provide an air channel or passage 8, preferably having a bottom wall 9 of leather or other suitable thin fabric or material. This passage 8 preferably runs diagonally and connects at one end by a short trunk 10 with a central portion of the main wind-chest 3 and connects at its other end by a short upwardly-projecting fixed trunk 11 with the wind-chest 12 of the striking-pneumatics 13, by whose abstracts 14 the piano-action or other sound-producing devices may be mechanically operated, as hereinafter more fully explained. Forming the air-passage 8 in the key-table 7 lessens expense of manufacture and decreases weight, and also lessens the chances of air leakage and also economizes vertical space in the instrument-case, as compared with the use of a separate horizontal trunk connecting the chests 3 and 12.

The keys K are fulcrumed on the table 7 and when depressed during manual playing lift the abstracts 15, which operate the wippens 16 and throw the action-hammers 17 against the strings 18. These strings are held to the usual metal frame 19, arranged in front of a sounding-board 20. The parts 19 20 are secured to the ordinary wood backing-frame 21, sustained within the piano-case.

The piano-case is made in two vertically-divided sections comprising a rear section 22, in

which are permanently held the above-named parts 18 to 21 and a front section 23, which includes the opposite end arms 24 and the connected key-table 7, the opposite end feet 25, the front pillars 26, the lower front rail 27, at which are fitted the ordinary manual-playing pedals 28, and a bottom board 29, which is fixed to the parts 25 27 and is also normally but detachably fastened to the ends of the rear case-section 22 by screws 30 or other suitable fastenings. The bottom board 29 sustains the wind-inducing devices 2 3 4 5 6 and the fulcrum-bearings of the pedals 28. Screws or bolts 31 applied, preferably, from inside the piano-case securely and detachably fasten the ends of the front case-section 23 to the ends of the rear section 22. The action-frame 32 has opposite end slots 33, which lock over headed screws or pins 34, fixed to blocks 35, held to the ends of the rear case-section 22. Two intermediate feet 36 on corresponding bars of the action-frame 32 have preferably angular ends fitting in recesses 37, made in blocks 38, fastened to the key-table 7. The upper parts of the action-frame 32 are held by the removable screw-caps 39 of bolts 40, fixed to the string-frame 19.

When it is necessary to separate the two piano-case sections and their contained parts to facilitate inspection or repairs or transportation along narrow halls or stairways, the screws 30 in the bottom board 29 will be removed, and then the end screws 31 will be withdrawn. This allows the front case-section 23 and all contained parts to tilt until the bottom board 29 rests at its rear edge upon the floor and also causes the recesses 37 of the key-table blocks 38 to fall from the feet 36 of the action-frame 32, which frame, with the entire piano-action 15 16 17, remains supported by the lower pins 34 and the heads 39 of the upper bolts 40. The back-frame 21, with the sounding-board 20 and string-frame 19, strings 18 and the entire action-frame 32, with the abstracts 15, wippens 16, and hammers 17, thus remain always in the rear piano-case section 22, while the manual-keys K, the wind-chest 12, the pneumatics 13 and their abstracts 14, the wind-inducing devices 1 to 11, and the tracker and music-sheet rolls remain within the front piano-case section 23. The case-sections 22 23 may readily be reassembled by slipping the front section 23 within the rear section 22 and then blocking up the inner part of section 23 until the recesses 37 again engage the feet 36 of the action-frame, and after the end screws 31 are reapplied and tightened the bottom screws 30 will also be tightened, and the piano is again ready for use.

Referring now more especially to Figs. 2, 3, and 4 of the drawings, it will be seen that the striking-pneumatics 13 are fastened in rows to shelves 41, in which and in the lower rear wall 42 of the pneumatic wind-chest 12 are formed air-passages 43, which open to the

respective pneumatics, and also open at 44 to the atmosphere, and also open at 45 to the main exhaust-chamber 46 of the wind-chest 12, which chamber is common to all three rows of pneumatics 13 and communicates by the trunk 11 with the main wind-chest 3 above mentioned. In the passage 43 for each pneumatic 13 is fitted a secondary double-faced valve 47, adapted to close either of the openings 44 45, and the guided stem of this valve is acted upon by a diaphragm-pneumatic 48, held to the detachable front wall 49 of the wind-chest 12. In this wall 49 and also in a removable horizontal partition 50 in the upper portion of the wind-chest 12 is formed for each pneumatic 13 an air-passage 51, which opens to the diaphragm 48 and also opens at 52 to an exhaust-chamber 53, common to all the pneumatics and itself opening into the main exhaust-chamber 46. The passage 51 also opens at 54 into an upper chamber 55, which is common to all the pneumatics and communicates with the atmosphere by several passages 56, formed in the detachable top wall 57 of the chest. A double-faced primary valve 58 may close either of the openings 52 54. This valve 58 is adapted for operation by a diaphragm-pneumatic 59, fitted at the inner end of an air-passage 60, made in the chest 12 and communicating for each individual pneumatic 13 by a tube 61 with a passage in the tracker 62, over which travels a music-sheet 63 from a delivery-roll 64 to a take-up roll 65. The tracker and music-sheet rolls are sustained in a frame 66, preferably supported on the pneumatic wind-chest 12, which also preferably sustains the pneumatic motor 67, which operates the music-sheet 63.

Atmospheric air entering the openings 44 and passages 43 holds the valves 47 forward to close the openings 45 and keeps each individual pneumatic 13 inflated and holds its abstract 14 down to allow normal adjustment of the corresponding wippen 16 and hammer 17. When a perforation of the music-sheet 63 opens by a tube 61 to a corresponding passage 60 in the chest 12, the diaphragm 59 lifts the primary valve 58, thereby closing the opening 52 and opening the one 54. Atmospheric air admitted at 56 then passes along at 55 54 51 and presses the diaphragm 48, thereby moving the secondary valve 47 and closing the opening 44 and connecting the corresponding pneumatic 13 via the passages 43 45 and the chamber 46 with the exhaust to the main wind-chest 3 and causing instant collapse of the pneumatic 13, which thus lifts its abstract 14, and thereby directly operates the wippen 16 to throw the corresponding hammer 17 to its string 18. The abstract 14 may operate any other sound-producing device. Immediately the music-sheet perforation passes the tracker-opening atmospheric pressure in the conduit 61 and the passage 60 is cut off, and like pressure in the chamber 55 instantly

lowers the valve 58 to close the passages 54 51, and the exhaust in the chamber 46 again causes the valve 47 to close the opening 45 and permit atmospheric air entering at 44 43 to expand the pneumatic 13 and lower the abstract 14, and the parts again have the normal relative positions shown in Figs. 2 and 3 of the drawings. By removing the top wall 57 of the wind-chest 12 the primary valves 58 may be inspected, and by removing the front wall 49 and the upper channeled partition 50 the diaphragms 48 and 59, as well as the valves 47 58, are easily accessible for examination or repairs. Screw-fastenings are preferably used to hold the detachable walls of the chest 12, as sufficiently indicated by the full and dotted lines in Fig. 4 of the drawings.

Special mention is made of the peculiar arrangement of the striking-pneumatic abstracts 14, as more clearly shown in Figs. 2 and 4 of the drawings. It may be preferable to couple these abstracts to the pneumatics by a slotted or elastic finger 68, fixed to the movable wall of each pneumatic and engaged above and below its elastic end by two nuts 69 70, fitted to a screw-thread of the abstract which passes through a hole or slot of the finger. The upper parts of the abstracts 14 are guided by a rail 71, sustained, preferably, by brackets 72, fastened to the pneumatic wind-chest 12. Above the guide-rail 71 each abstract 14 preferably has a screw-thread 73, to which is fitted a felt-capped striking-head 74, which operates directly upon the action-wippen 16 and is vertically adjustable to take up lost motion between the expanded pneumatic and the wippen or other sound-producing part it is to operate. Fitted quite tightly to the thread 73 below the head 74 is a holdback-nut 75. Both parts 74 75 have lateral holes 76, adapted to receive pins used for adjusting the head 74. One pin is inserted in the nut 75 and is held steadily, while another pin inserted in the head 74 is turned to adjust the head on the screw-thread up or down to take up lost motion between the head and the action-wippen 6. The power required to turn the head 74 will not move the more tightly-fitted holdback-nut 75. Hence by the use of two pins in the head and nut, as above described, the abstract-heads may be adjusted readily and perfectly without requiring removal of the wind-chest 12, the pneumatics 13, and their abstracts 14 from their supports and fastenings, this being an important consideration while regulating automatic musical instruments of this general class. Below the guide-rail 71 each abstract 14 has a screw-thread 77, to which is fitted a felt-capped nut 78, which is vertically adjustable to limit, by contact with the guide-rail, the range of vertical movement of the abstract by the collapsing-pneumatic, and thereby prevent jamming of a piano-action hammer with its back-stop, which might occur without the use of a ver-

tically-adjustable stop on the abstract. To give room for the stop-holding screw 77 of the abstract to enter the guide-rail, the latter is bored out at 79 to receive the screw and a felt bushing 80 is fitted at the top of this bore to directly guide the abstract.

The slotted or elastic finger 68 may be substituted by a rigid finger, if desired. The elastic finger may be preferable, as it eases the shock and noise attending collapse of the pneumatic, or the limiting of this movement by the stop 78, or the contact of the abstract-head 74 with the action-wippen 16 or other sound-producing device. Said elastic finger on the pneumatic also assures delivery of a yielding blow upon the action or sound-producing device simulating that resulting from the touch of the human hand in manual playing. Substantially similar results may be obtained by slotting the wippen or otherwise constructing it to provide on the wippen itself an elastic tongue or finger 81, which the abstract-head 74 strikes. This finger 81 may have a felt buffer or cushion 82, preventing noise of possible contact with any opposing portion of the wippen, as shown in Fig. 4 of the drawings.

Special mention is made of the arrangement of the striking-pneumatics 13 and their abstracts 14 for operation directly upon the wippens 16 of a piano-action. This direct operation of the wippens by the pneumatic-abstracts, especially when accompanied by provision for vertical adjustment of said abstracts or parts thereon to avoid lost motion between the inflated pneumatics and the wippens, and also when stops are provided on the abstracts for preventing jamming of the piano-action permits very quick, clear, and practically perfect repetition of notes or tones, and also does not overburden the striking-pneumatics by the weight or friction of interposed lever or striker systems heretofore used. Intervening joints liable to loosening wear also are eliminated, such joints, for instance, as appear when the pneumatic-abstracts operate upon the piano-action abstracts 15 and not directly upon the action-wippens 16, as herein described. Special mention also is made of the arrangement of the stops 78 directly upon the pneumatic-abstracts, because when thus located these stops limit movement of the action by the striking-pneumatics only during mechanical playing and can never interfere with movement of the action by or from the keys K to obtain any desired tone effects during manual playing.

In order that inspection and necessary repairs of the upper pneumatic playing mechanism may be made most conveniently, the entire chest 12, with the pneumatics 13, their striking-abstracts 14, and the superposed music-sheet rolls and tracker and music-sheet motor, are together removable and are provided at the chest 12 with simple and effective

fastenings. The left hand of the chest 12 communicates by a bottom opening 83 with the trunk 11, leading to the key-table passage 8 and the main wind-chest 3. Hence an airtight joint of the parts 11 12 at this end is essential. While the right-hand end of the chest 12 need have no communication with the wind-chest 3, it is desirable to provide quite as effective a fastening for it. It is preferable to use similar fastenings at both ends of the wind-chest 12 and fastenings of such character as will permit the wind-chest and attached parts to be unfastened and removed without using tools. These end fastenings preferably comprise thumb-screws 84, fitted in metal angle-plates 85, fixed to opposite end arms of the piano-case and adapted to bear down by foot-pieces or otherwise upon the top of the wind-chest 12 when it is adjusted upon its end seats 86 and against inner shoulders or stops 87, to which the chest ends may be held snugly by any suitable locking devices at the front of the chest. These devices may be ordinary bolts 88, fixed to the chest-wall and entering sockets in the end arms of the piano-case. The thumb-screws 84 are preferably provided with lock-nuts 89, which are to be turned down upon the fixed plates 85 after the screws are tightened upon the top of the wind-chest 12. With this construction it is obvious that the entire chest 12, with its attached pneumatics 13 and their abstracts 14, together with the superposed tracker 62 and music-sheet rolls 64 65 and the motor 67, may be very quickly and easily removed after detachable front panels or portions of the piano-case are lifted out by simply loosening the lock-nuts 89 and then turning back the screws 84 and shooting the bolts 88 from the case-arms and then lifting the whole structure 12 13 14 62 64 65 66 67 from the piano-case. This may be done without using special tools and without in the least interfering with the piano-action or with the keyboard or with the lower wind-inducing devices of the instrument. This detached structure may as readily be replaced, and the screws 84, the nuts 89, and the bolts 88 will then be readjusted to lock the structure securely, with assurance that there will be no air-leakage next the wind-trunk 11 and that jars attending ordinary use or transportation of the instrument will not disarrange the parts.

To prevent dropping of the outer ends of the keys K when the abstracts 15 are lifted from their inner ends by mechanical playing of the instrument, a rail 90, running laterally under the keys, is hinged by bent wires 91 or otherwise to blocks fixed to the key-table 7, and a vertically-movable plunger 92, fitted in said table, rests normally upon a slide 93, held beneath the table and having an inclined face 94, which when the slide is pulled outward lifts the plunger 92, and thus raises the rail 90 to the bottoms of all the keys K to hold them at

rest during mechanical playing. When the slide is pushed inward, its face 94 slips from under the plunger 92 and lets it and the rail 90 fall to normal positions (shown in Fig. 3 of the drawings) to permit manual playing of the instrument.

Various modifications of the pneumatic mechanism operating the piano-action may be made by the skilled mechanic within the scope of some of the appended claims—as, for instance, it is not essential that the valved pneumatics 13 be located above the keyboard, as they may be otherwise disposed, provided the abstracts 14, operated by them, act directly upon the piano-action wippers; nor is it necessary that said valved pneumatics and their abstracts and wind-chest be removable together from the instrument-case. The abstracts operated in any approved manner also may act directly upon the wippers without having the adjustable striking-head providing for taking up lost motion and also without having the adjustable stop acting on the abstract guide-rail to prevent jamming of the piano-action, and the hold-back nut or part on the abstract also may be omitted. Other modifications of the invention may be made as the particular class of automatic piano or other mechanical musical instrument may suggest or require.

I claim as my invention—

1. A manually or mechanically operated musical instrument having wind-inducing devices and pneumatically-operative sound-producing devices and provided within its key-table with an air passage or channel in the line of communication between said wind-inducing devices and sound-producing devices.

2. A manually or mechanically operated musical instrument having a key-table, sound-producing devices, wind-inducing devices below the key-table, and valved striking-pneumatics above the key-table adapted to operate the sound-producing devices; said key-table being recessed to form an interior air passage or channel in the line of communication between the wind-inducing devices and the wind-chest of the striking-pneumatics.

3. A mechanical musical instrument having sound-producing devices, striking-pneumatics, and abstracts operated by the pneumatics and actuating the sound-producing devices, said abstracts having stops, combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the sound-producing devices.

4. A mechanical musical instrument having sound-producing devices, striking-pneumatics, and abstracts operated by the pneumatics and actuating the sound-producing devices, said abstracts having adjustable stops, combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the sound-producing devices.

5. A mechanical musical instrument having

- 5 sound-producing devices, striking-pneumatics, and abstracts operated by the pneumatics and having heads or parts adapted for adjustment to take up lost motion between the pneumatics and the sound-producing devices operated by the abstracts; said abstracts also having stops, combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the sound-producing devices.
- 10 6. A mechanical musical instrument having sound-producing devices, striking-pneumatics, and abstracts operated by the pneumatics and having heads or parts adapted for adjustment to take up lost motion between the pneumatics and the sound-producing devices operated by the abstracts; said abstracts also having adjustable stops, combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the sound-producing devices.
- 15 7. A mechanical musical instrument having sound-producing devices, striking-pneumatics, and abstracts operated by the pneumatics and provided with two adjustable parts, one adapted to take up lost motion and the other adapted for limiting movement of the sound-producing devices.
- 20 8. A manually or mechanically operated piano having an action including wippens and also having striking-pneumatics, and abstracts operated by the pneumatics and acting directly upon the wippens; said abstracts having stops combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the piano-action.
- 25 9. A manually or mechanically operated piano having an action including wippens and also having striking-pneumatics, and abstracts operated by the pneumatics and acting directly upon the wippens; said abstracts having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the piano-action.
- 30 10. A manually or mechanically operated piano having an action including wippens and also having striking-pneumatics, and abstracts operated by the pneumatics and having heads or parts acting directly upon the wippens and adapted for adjustment to take up lost motion; said abstracts also having stops combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the piano-action.
- 35 11. A manually or mechanically operated piano having an action including wippens and also having striking-pneumatics, and abstracts operated by the pneumatics and having heads or parts acting directly upon the wippens and adapted for adjustment to take up lost motion; said abstracts also having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted for limiting movement of the piano-action.
- 40 12. A mechanical musical instrument having sound-producing devices and striking-pneumatics provided at their movable walls with elastic fingers, and abstracts operated by said fingers and adapted to actuate the sound-producing devices; said abstracts having heads or parts adapted for adjustment to take up lost motion between the pneumatics and the sound-producing devices.
- 45 13. A mechanical musical instrument having sound-producing devices and striking-pneumatics provided at their movable walls with elastic fingers, and abstracts operated by said fingers and adapted to actuate the sound-producing devices; said abstracts having stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the sound-producing devices.
- 50 14. A mechanical musical instrument having sound-producing devices and striking-pneumatics provided at their movable walls with elastic fingers, and abstracts operated by said fingers and adapted to actuate the sound-producing devices; said abstracts having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the sound-producing devices.
- 55 15. A mechanical musical instrument having sound-producing devices and striking-pneumatics provided at their movable walls with elastic fingers, and abstracts operated by said fingers and having heads or parts adapted for adjustment to take up lost motion; said abstracts also having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the sound-producing devices.
- 60 16. A manually or mechanically operated piano having an action including wippens; and provided with striking-pneumatics having elastic fingers on their movable walls, and abstracts operated by said fingers and acting directly upon the wippens for operating the piano-action; said abstracts having stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the piano-action.
- 65 17. A manually or mechanically operated piano having an action including wippens; and provided with striking-pneumatics having elastic fingers on their movable walls, and abstracts operated by said fingers and acting directly upon the wippens for operating the piano-action; said abstracts having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the piano-action.
- 70 18. A manually or mechanically operated piano having an action including wippens; and provided with striking-pneumatics having elastic fingers on their movable walls, and abstracts operated by said fingers and acting directly upon the wippens for operating the piano-action; said abstracts having adjustable heads or parts adapted to take up lost motion between the elastic fingers of the pneu-

matics and the wippens, and said abstracts also having adjustable stops combined with a relatively fixed rail or part to which said stops are adapted to limit movement of the piano-action.

19. A manually or mechanically operated piano having grouped above the keyboard and in front of the piano-action which includes wippens, the following devices; a wind-chest, valved pneumatics held thereto, and abstracts guided for operation by the pneumatics and acting directly upon the wippens and having stops adapted to the abstract-guide for limiting movement of the piano-action.

20. A manually or mechanically operated piano having grouped above the keyboard and in front of the piano-action which includes wippens, the following devices; a wind-chest, valved pneumatics held thereto, and abstracts guided for operation by the pneumatics and acting directly upon the wippens and having stops adapted to the abstract-guide for limiting movement of the piano-action; said wind-chest, pneumatics and abstracts being together removable from the instrument-case.

21. The combination with a main wind-chest beneath the key-table, and a striking-pneumatic wind-chest above said table, of a trunk 10 opening to the main wind-chest, a trunk 11 opening to the pneumatic wind-chest, and a channel 8 formed in the thickness of the key-table and communicating with the trunks 10, 11, substantially as described.

22. The divisible piano-case comprising a rear section 22 containing the string-frame and sounding-board and having upper and lower supports normally sustaining the piano-action; and a front section 23 carrying a pneumatic-action comprising opposite ends overlapping the ends of the rear section and having a fixed bottom board 29, screws 31 fastening the ends of the two case-sections together, and screws 30 holding the bottom of the front case-section to the ends of the rear case-section; the action-frame in the rear-section having support on vertically-detachable rests or blocks on the key-table in the front section.

23. The combination with the piano-action having wippens 16, of striking-pneumatics 13, a guide-rail 71, abstracts 14 coupled to the pneumatics and moving in the guide-rail and acting directly upon the wippens, and provided with adjustable stops 78 adapted to the rail 71 for limiting movement of the piano-action.

24. The combination with the piano-action having wippens 16, of striking-pneumatics 13, a guide-rail 71, abstracts 14 coupled to the pneumatics and moving in the guide-rail and having adjustable heads 74 acting directly upon the wippens and providing for taking up lost motion; said abstracts also having adjustable

stops 78 adapted to the rail 71 for limiting movement of the piano-action.

25. In a mechanical musical instrument, sound-producing devices, pneumatics, and abstracts operated by the pneumatics and adapted to actuate the sound-producing devices; said abstracts having a screw-thread 77 and a stop 78 adjustable on said thread, combined with the abstract guide-rail 71, having an opening 79, admitting the thread 77 when the stop 78 strikes the guide-rail.

26. In a mechanical musical instrument, the striking-pneumatic wind-chest having a common air-chamber 46 and removable front and top walls 49, 57, and removable upper partition 50, said parts 49, 50 having coincident passages 51, said part 49 also having diaphragms 48 adapted to actuate secondary valves of the striking-pneumatics, and said part 50 having primary valves 58 adapted for operation by diaphragms 59 at passages leading to the tracker and music-sheet; the relative arrangement of parts being adapted to give easy access to the primary and secondary valves and their actuating-diaphragms, substantially as described.

27. In a mechanical musical instrument, the combination of the instrument-case, striking-pneumatics, a wind-chest therefor, plates 85 fastened to the instrument-case, and screws 84 fitted in said plates and bearing on the wind-chest.

28. In a mechanical musical instrument, the combination of the instrument-case, the striking-pneumatics, the wind-chest therefor, plates 85 fixed to the instrument-case, screws 84 fitted in said plates and bearing on the wind-chest, and lock-nuts 89 fitted on the screws and adapted to the plates.

29. In a mechanical musical instrument, the combination of the instrument-case, striking-pneumatics, a wind-chest therefor, plates 85 fixed to the instrument-case, screws 84 fitted in said plates and bearing on the wind-chest, and bolts 88 held to the front of the wind-chest and adapted to engage the case.

30. In a mechanical musical instrument, the combination of an action comprising keys and a key-table below the keyboard, pneumatically-operated devices for engaging said action, a rail 90 hinged to the key-table at 91, a plunger 92 fitted in the key-table and a slide 93 having an inclined face 94, adapted to the plunger and movable on the key-table for lifting the plunger 92 and raising the rail 90 to lock the keys.

Signed at the city of New York aforesaid this 21st day of September, 1904.

JUSTUS HATTEMER.

Witnesses:

J. CHRIS LARSEN,
JOSEPH C. FRANKE.