(No Model.) 4 Sheets—Sheet 1.

E. H. WHITE & W. D. PARKER.

AUTOMATIC PIANO.

No. 573,427. Patented Dec. 15, 1896.

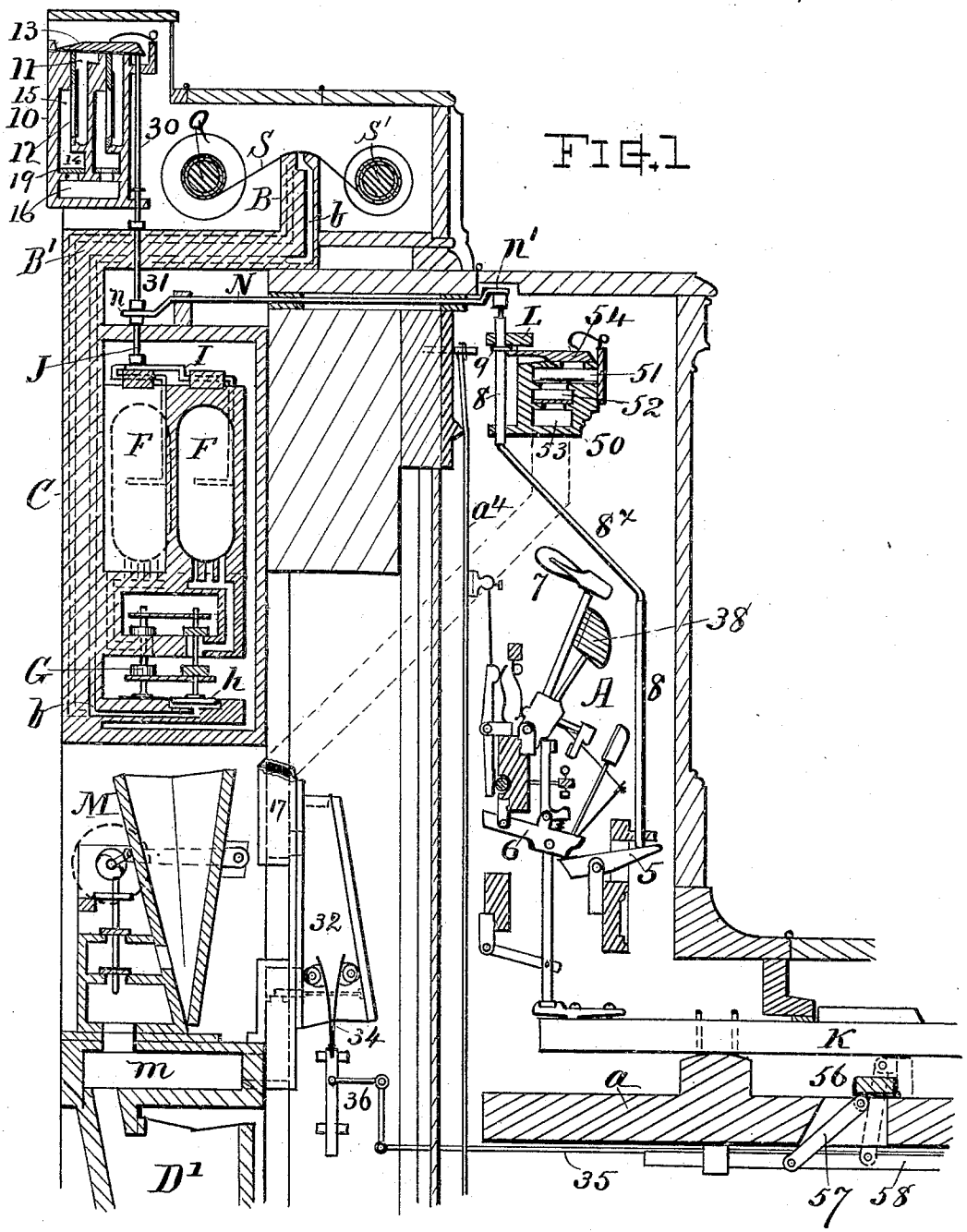

FIG. 1

Witnesses.

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(No Model.) 4 Sheets—Sheet 2.

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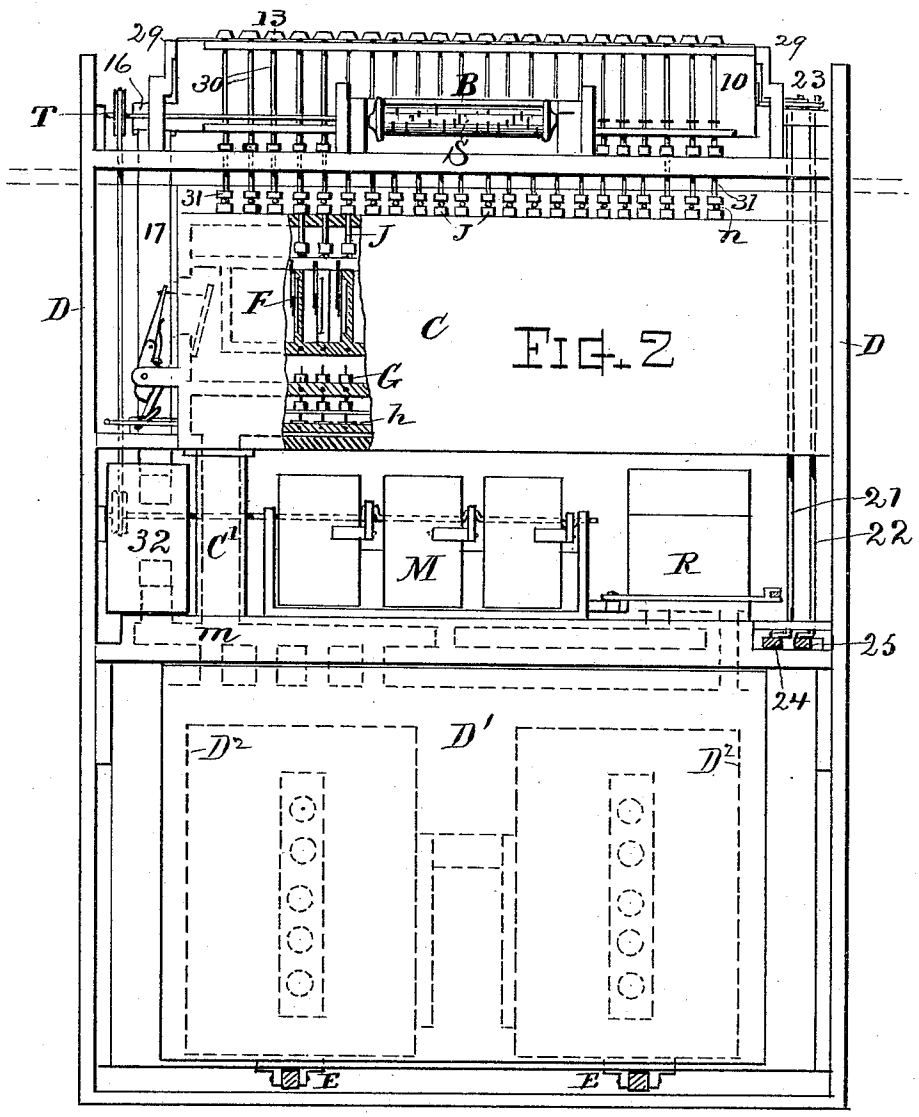


FIG. 2

FIG. 3

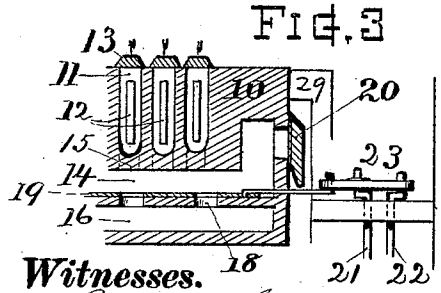
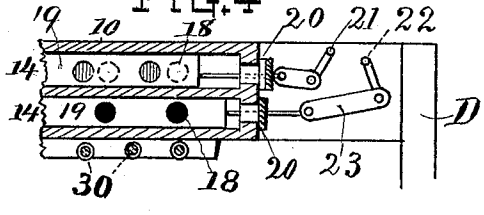


FIG. 4



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(No Model.) 4 Sheets—Sheet 3.

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AUTOMATIC PIANO.

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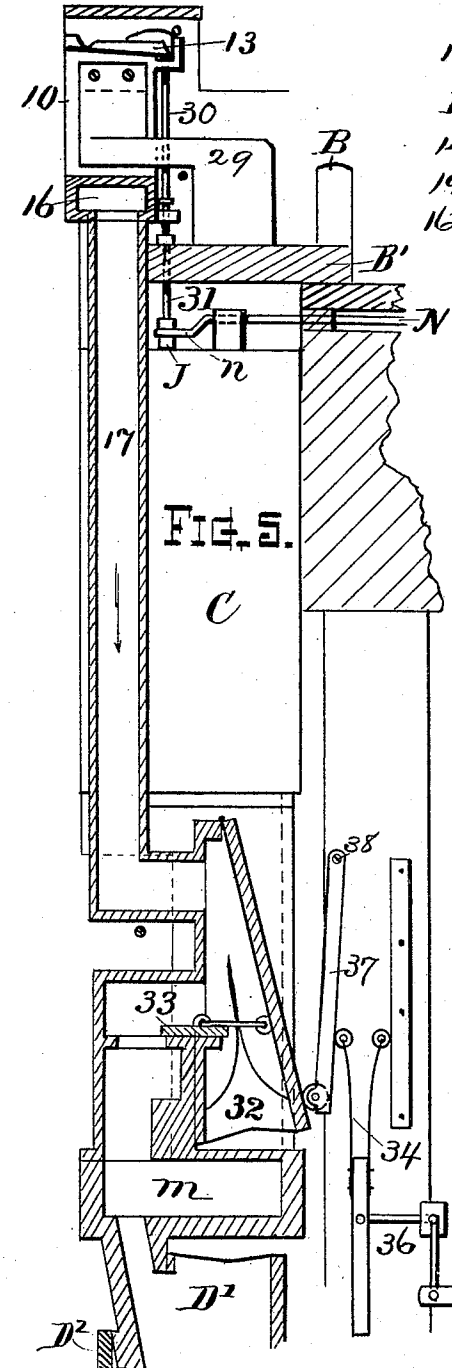

Fig. 5.

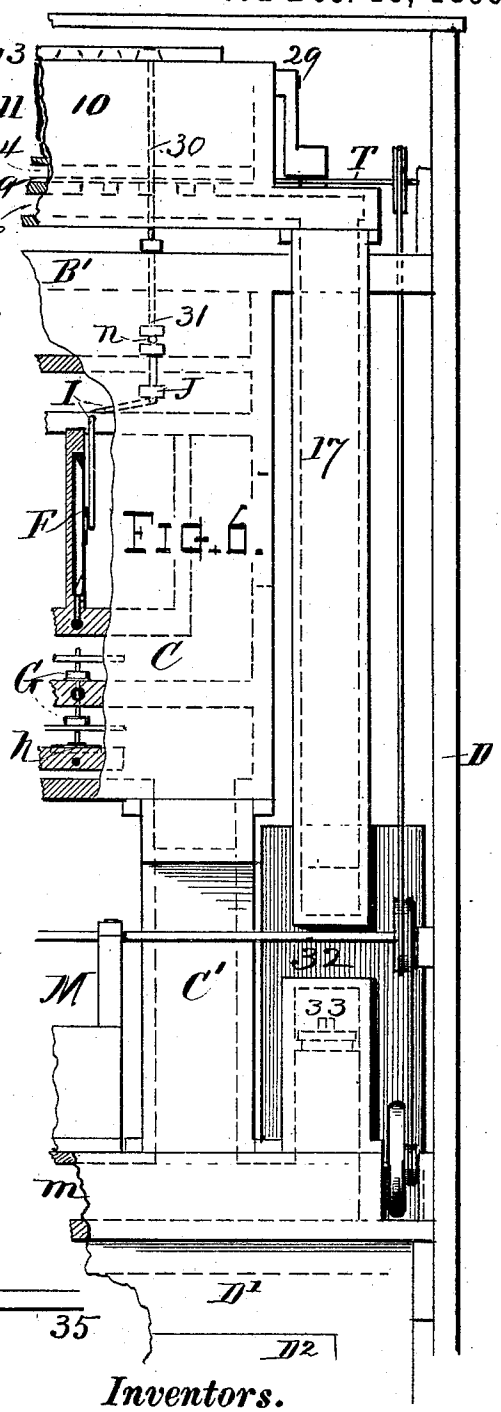

Fig. 6.

Witnesses.

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(No Model.) 4 Sheets—Sheet 4.

E. H. WHITE & W. D. PARKER.

AUTOMATIC PIANO.

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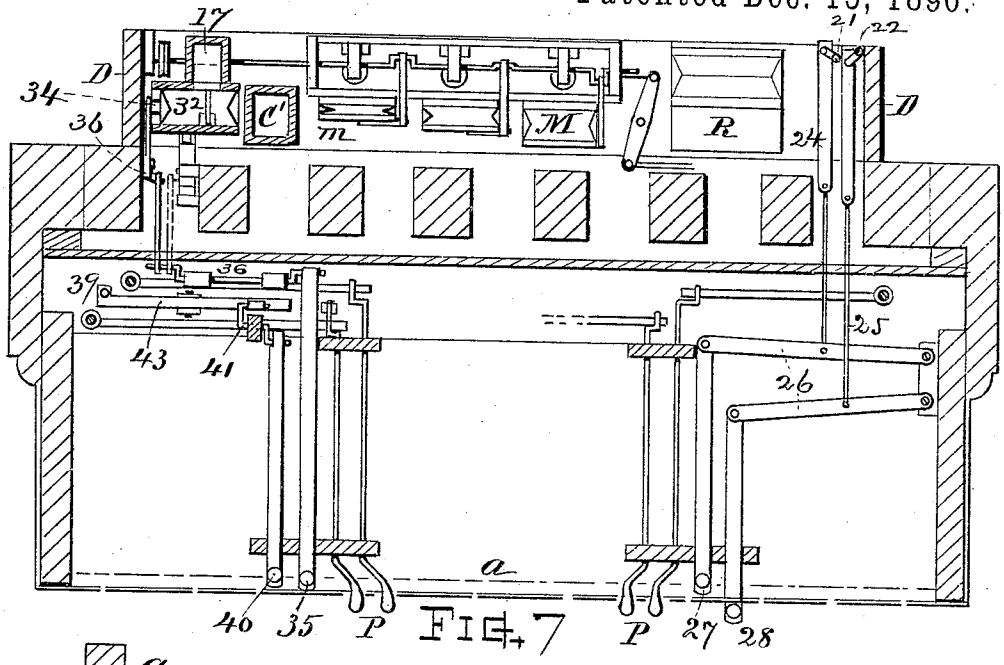

FIG. 7

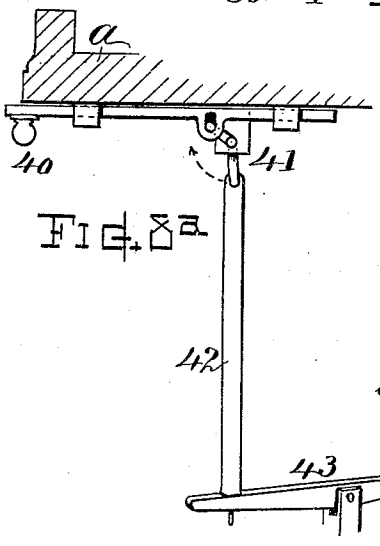

FIG. 8a

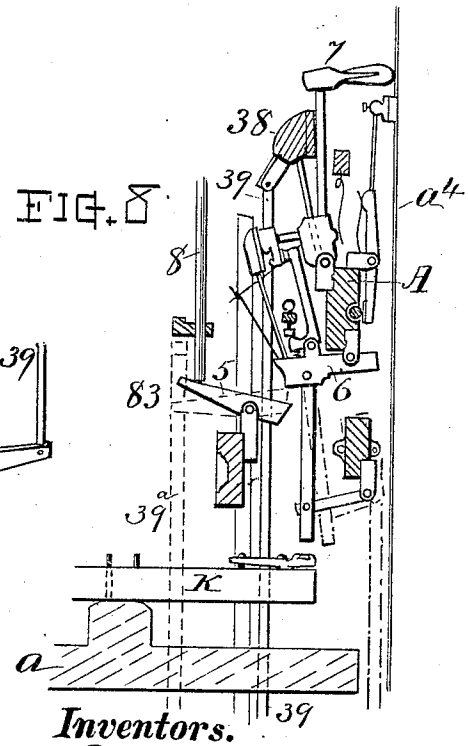

FIG. 8

Witnesses.

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UNITED STATES PATENT OFFICE.

EDWARD H. WHITE AND WILLIAM D. PARKER, OF MERIDEN, CONNECTICUT; SAID PARKER ASSIGNOR OF ONE-HALF OF HIS INTEREST TO SAID WHITE.

AUTOMATIC PIANO.

SPECIFICATION forming part of Letters Patent No. 573,427, dated December 15, 1896.

Application filed November 29, 1895. Serial No. 570,437. (No model.)

To all whom it may concern:

Be it known that we, EDWARD H. WHITE and WILLIAM D. PARKER, citizens of the United States, residing at Meriden, in the county of New Haven and State of Connecticut, have invented a new and useful Automatic Piano, of which the following, together with the accompanying drawings, is a specification sufficiently full, clear, and exact to enable persons skilled in the art to which this invention appertains to make and use the same.

The prime object of the present invention is to combine, in a practically efficient mode of operation, with a piano having the usual strings, hammer-action mechanism, and manual-keys, an automatic playing mechanism controlled by a traveling perforated music sheet or strip, a pneumatic-actuating motor-engine, and a set or series of organ-reeds and valves therefor respectively adapted for control and operation by the automatic playing mechanism that operates the respective movements of the piano-action independently of the manual-keys, as more fully hereinafter explained.

Another object is to provide in an automatic pneumatically-actuated piano having a reed accompaniment means for the automatic regulation of the wind-pressure in the wind-chest of the reed-sounding apparatus under varying conditions of the wind-pressure induced by the blowing apparatus, as required for working the motor and operating-pneumatics.

Another object is to provide means for adjusting the resistance of the regulator while in operation.

Another object is to provide a simple device for retaining the manual-keys while the piano-action is thrown out of operation.

These objects we attain by mechanism the nature, structure, and mode of operation of which is fully explained in the following description, the particular subject-matter claimed being hereinafter definitely specified.

In the drawings, Figure 1 is a vertical section of the upper portion of a piano, showing the automatic operating mechanism and reed-box attachment. Fig. 2 is a front view of the automatic operating mechanism and reed-box attachment, a portion of the pneumatic-chest being shown in section. Fig. 3 is a longitudinal section at one end of the reed-box. Fig. 4 is a horizontal section at one end of the reed-box, taken through the cut-off-valve chamber. Fig. 5 is a vertical section through the wind-trunk and pneumatic-governor for the reed mechanism. Fig. 6 is a rear view of the same. Fig. 7 is a horizontal section showing the various operating connections for throwing parts into and out of action and for controlling expression. Fig. 8 is a vertical section of the piano-action as adjusted to inoperative position, and Fig. 8ª shows the connections or means for effecting this throw-off adjustment.

Our improved attachment is designed to be applied to any common upright piano without material alteration in the piano structure, so that it can be readily applied to or arranged upon pianos already built and in use as well as incorporated in new pianos built especially therefor.

The mechanism herein illustrated can be employed in a piano embracing mechanism such as described in application Serial No. 552,663, and reference may be had to such case for a more full explanation of parts not herein particularly described.

The term "piano-action" as used in this specification and claims includes the group of operating parts above the manual-keys for producing the stroke upon the strings and effecting recoil of the hammers, comprising the hammer, its throwing-jack, rocker, back-catch springs, trip device, martingale, and lift-bar, and connecting-pivots for said parts, the same being well known and such as are commonly employed in pianos are thus referred to in a group for abridgement of description.

In the general structure of the present organized mechanism, as herein illustrated, the piano-action manual-key table, operating and controlling pneumatics, motor-engine, wind-inducing apparatus and pedal mechanism may be arranged substantially as heretofore employed and fully disclosed, the pneumatic-chest being arranged at the rear of the piano-frame and presenting at its upper part a series of endwise-moving puppets that engage with cranked rocker wires or levers which extend forward across the top of the piano-

frame and engage at their front ends with operators or connections that work automatic keys that actuate the piano-action as the respective puppets aforesaid are moved by the inflation and collapse of operating-pneumatics within the chest, the same being controlled by the primary devices and the perforated music sheet or strip carried across the tracker by suitable wind-roll mechanism to which power and motion are transmitted from the motor-engine worked by air-pressure generated or induced by the bellows or wind-inducing appliances.

Referring to these parts, A indicates the piano-action; B, the tracker having air-ducts therein; C, the pneumatic-chest; D, the attachment-supporting frame; D′, the bellows; D^2, the bellows-exhausters; E, the blow-pedal connections; F, the operating-pneumatics; G, the controlling-valves worked by the primary pneumatics *h*, that are connected with the tracker-ducts *b*, which lead through the channel-board B′; S, the perforated music-sheet strip or tablet that is advanced from the spool S′ to the winding roll Q, which is operated by suitable gearing in connection with shaft T and driving devices, from the motor-engine M. K indicates the manual-key; *a*, the key-table; P, the expression-operating finger-keys, and R the motor-regulator. N indicates the rocker-wire across the top of the piano, J the lifter or puppet, and I the lever for operating said puppet from the pneumatic diaphragm. These several parts in their arrangement and operation may be substantially the same as heretofore described in detail in said prior application for Letters Patent, and will be understood without more extended explanation herein.

As a feature of the present invention the piano-action and pneumatic mechanism for automatically playing said action have combined therewith, in the manner hereinafter specified and to be simultaneously operated by the same pneumatics or actuating motors, a reed-set, one or more, with suitable valves and stop devices, said mechanism being in its organized operative embodiment as follows: A reed-box 10 is supported above the channel-board B′ and pneumatic chest C. Said box is provided with a series of reed-cells 11, having organ-reeds 12 fitted therein, and provided with valves 13 over the inlet-openings of the respective reed-cells for controlling the sounding of the reeds. Beneath each set of reeds there is a chamber 14, into which the air-passages 15 from the respective reeds lead, and beneath said chambers is a wind-chest 16, which extends throughout the length of the reed-box, from which an air-trunk or windway 17 communicates with the wind-inducing apparatus, as will be hereinafter more fully described.

A series of occasional holes or air-passages 18 lead from the chamber 14 into the wind-chest 16, and a thin flexible strip 19, of wood or suitable material having a similar series of holes therein, is laid at the bottom of the chamber to serve as a valve for cutting off the chamber and its set of reed-cells from the wind-chest, when desired, by sliding the strip longitudinally, so as to bring the holes out of corresponding relation and for opening the same by opposite movement.

The valve 19 is connected through the end of the box 10 with suitable mechanism for effecting this movement. Small relief-valves and passages 20 are provided for the respective chambers 14, which are arranged to be closed when the valves 19 are opened and to open automatically when the cut-off valve is closed, thereby admitting external air to the chamber and equalizing pressures at the reeds at the instant the exhaust-pressure is cut off by the valve 19. The means for shifting these cut-off valves preferably consists of the cranked rocker-shafts 21 and 22, their upper cranks linked to the valves, as at 23, and their lower end cranks joined by connections 24 and 25 (see Fig. 7) with levers 26, that are fulcrumed on a stationary part of the frame and respectively pivoted to the endwise-movable stop-slides 27 and 28, arranged in suitable supporting-guides at the under side of the key-table *a*.

Along the exterior of the reed-box there is arranged a series of pitman-pins 30, respectively disposed beneath the ends of the reed-cell valves 13 and supported in suitable guide-bars. The lower end of each pitman-pin stands upon the head of a second pin or puppet 31, that extends through the channel-board B′ and in turn stands upon the end of the rocker-lever N or upon the head of the pneumatic puppet J, upon which the cranked end *n* of said rocker-lever wire rests. Thus when the operating-pneumatics under control of the primaries and traveling music-sheet act to move the respective puppets and rocker-levers for automatically playing the piano-action they will at the same time and by the same movement cause the opening of the respective reed-cell valves 13 and permit the sounding of the reed-notes in corresponding unison with the piano-tones, providing the wind-passages from the reed-cells 11 to the wind-chest 16 are open. When the cut-off valves 19 are closed, the automatic action of the reed-cell valves 13 takes place in the same manner, but there being then no wind-current through the reed-box of course no sound is produced by the reeds; but the piano-action may continue in full sounding operation.

The reed-box is best sustained by brackets 29 from the horizontal channel-board B′, said brackets being joined to the upper part of the reed-box, as shown. (See Figs. 2, 5, and 6.) By this structure derangement in the valve and pitman relations by shrinking and swelling of the wood of the reed-box is in a great measure prevented. Between the reed-box wind-chest 16 and the main wind-chest *m* or chamber of the bellows there is arranged a

pneumatic-governor 32 for rendering the air-pressure in the reed-box for sounding the reeds substantially independent of the fluctuations caused by the inflow to the bellows through the motor-engine and more or less of the operating-pneumatics. Said governor consists of a bellows-pneumatic in connection with the wind-trunk 17, and having a valve 33, worked by the movement of the movable back of said pneumatic, for opening or closing the air-passage therefrom to the wind-inducing apparatus. (See Figs. 5 and 6.) Combined with said governor-pneumatic there is a movable resistance spring or springs 34, adapted for shifting and adjustment toward or from the hinging end of the governor-pneumatic, so as to offer less or greater resistance according to its position of adjustment and thereby cause the governor to regulate at different degrees of air-pressure. Said shifting resistance-spring is connected with a suitable pull 35 and operating device 36, whereby its position can be controlled by the operator while the instrument is in use and the reeds put under greater or less air-pressure, thereby expressing softer or more powerful tones, as desired.

In Fig. 1 the resistance-springs are shown as acting by their antifriction-rolls directly upon the projecting edges of the governor-pneumatic 32 and arranged to slide up and down by aid of the angle-lever 36 and pull connection 35, while in Fig. 5 the spring is shown as acting between a fixed guide-bar and a swinging lever 37, which latter is pivoted at 38 with its movable end and roll acting against the movable part of the pneumatic 32. In the latter instance the adjustable resistance-springs act with the exhaust in opposition to the force of an expanding-spring in the pneumatic 32, and in the former instance in opposition to the exhaust-pressure in the pneumatic. In either instance, however, the shift of the resistance spring or springs, by the device 36 and pull 35, tends to raise or lower the degree of tension of the governor, and thereby vary the degree of pressure at which the governor maintains the air-currents passing through the reeds. This change can be made at any time while the instrument is in operation or otherwise.

For rendering the piano-action ineffective for producing sound without interfering with the continued action of the automatic operating mechanism the entire series of piano-hammers are forced backward and sustained at a dead position with their ends resting against the strings a^4 (or against an interposed object or felt placed adjacent to the strings) by means of the hammer-rest rail 38, usually employed for the soft pedal, arranged for disconnected action from the pedal leverage or pitman and provided with an operating connection 39, whereby it can be positively and completely moved backward and retained with the hammers 7, bearing upon and dampening the strings a^4. (See Fig. 8.) When the hammers are thus raised or forced backward, their jacks or rockers are free from engagement by the keys K or automatic keys 5, and the working of the automatic operators is rendered ineffective thereon and no sounding of the piano-strings occurs, although, at the same time, the operation of the pneumatics and automatic mechanism is continued, and the operation of the reed-organ attachment is effected without interruption by the throwing out or throwing in of the piano-action in the course of playing a piece of music.

In some instances, if desired, the movable throw-off bar can be arranged to act upon the ends of the automatic key 5, as indicated by dotted lines at 83 on Fig. 8. By depressing the bar 83 the hammers are lifted by the automatic keys 5, which latter are depressed beyond the limits of action of the operator-rods 8 and there all retained until the bar is again elevated.

For working the piano-action throw-off a slide 40 is provided beneath the key-table a (see Fig. 8^a) and connected by a cranked wire 41 and rod 42 with a lever 43, that joins or engages with the rod or connection 39, whereby the throw-off bar or rail is moved, as set forth.

When desired, a supplemental reed-box 50 is arranged at the front of the piano-frame to be actuated by the ends n' of the rocker-wires N. Said reed-box is best supported in connection with the removable guide-frame L, that supports the operators 8, or in other suitable manner. The operators 8 may be formed with an oblique offset portion, as at $8^\times$. This reed-box is provided with a series of reed-cells 51, containing reeds, a cut-off chamber and valve 52 therefor, and a wind-chest 53, as indicated. The reed-cells are provided with valves 54, which in the present instance are respectively adapted to be operated by projecting pins or lugs 9, carried upon the operator-rods 8, that work the automatic key 5 and hammer-rockers 6. The wind-chest connection for the reed-box 50 with the bellows is substantially the same as that described for the reed-box 10, and its cut-off valve operates the same as valve 19. The instrument having the automatic reed-organ attachment, as first described, may in any instance desired be made without the reed-box 50.

For retaining the manual-keys K uniform when the piano-action is rendered ineffective by lifting and sustaining all the hammers against the strings, as before described, we provide a key-locking device which consists of a rod or bar 56, arranged longitudinally from end to end of the manual, hinged or movably supported upon the key-table a beneath the keys. Said bar 56 is adapted for adjustment to a position flat upon the table, where it will not interfere with the key-action, and to a position of elevation or turned upward against the under side of the keys, (see dotted lines Fig. 1,) thereby forming a stop or support that retains all of the keys in elevated position. A connecting-link 57 and

pull or slide 58 are provided for working the key-lock bar, substantially as shown. This key-lock can, if desired, be connected to be worked with the piano-action throw-off, as by making slide 40 and slide 58 the same part or by other suitable manner of connection.

It may be noted that the reed-action and automatic operating connections are independent of the manual-keys, so that without disconnection of any parts the piano is at any time in condition to be played manually, should any person so desire; that is to say, when the automatic mechanism ceases its action it leaves the piano in normal condition for common piano practice manually, with the keys unobstructed and free, or not loaded with parts or connections that would interfere by their friction or weight in movement with the lightness or delicacy of touch in the manual operation of the piano—a result of importance in the successful operation of a combination automatic instrument of this class.

In the operation by pumping the bellows wind is induced by exhaust-action to operate the motor, the pneumatics, and the reeds. The motor advances the music-sheet in known manner, and as the perforations pass the tracker-ducts the primary devices and operating-pneumatics, act lifting the puppets J, and such motion is transmitted to the reed-cell valves 13 by the auxiliary puppet 31 and pitman-pins 30 at the same time the piano-action is actuated therefrom through the rocker N, rod 8, and automatic key 5. The valves 54 of the reed-box 50 are opened by the descending movements of the rods 8, their lugs 9 respectively acting upon the arms of the valves. When it is desired to cut off the sounding of any set of reeds, it can be done by shifting the valve 19, and to give greater or less force to the reed-sound the resistance-spring 34 is shifted by movement of the slide 35. The piano-action can be thrown out of or into sounding by the slide 40 and hammer-forcing bar connected therewith.

What we claim herein, and desire to secure by Letters Patent, is—

1. In an automatic piano, the combination as hereinbefore described, with the piano-action and strings, the connections for automatically playing the piano-action independent of the manual-keys, the cranked rocker-levers extending across the top of the piano-frame, the wind-chest in rear thereof containing the operating-pneumatics, primary pneumatic-controlling devices governed by a perforated music-sheet, and the vertically-moving lift-puppets arranged through the top of said chest, respectively carrying the ends of said rocker-levers and actuated by said operating-pneumatics; of the reed-box arranged above the top of the piano over said chest, provided with reed-cells, reeds, and valves disposed over said lift-puppets, and the upright standing connectors direct from the puppet-heads to the reed-cell valves and receiving motion from said lift-puppet together with the rocker-lever, and simultaneously actuated thereby, for the purpose set forth.

2. The channel-board having horizontal air-ducts and vertical holes between said ducts and the auxiliary puppet-pins arranged through said channel-board in line with the lift-puppets and the valve-pitmen, in combination with the pneumatic-chest containing the operating-pneumatics and lift-puppets below said channel-board, and the reed-box with reed-sets, valves and valve-operating pitmen above said channel-board, substantially as set forth.

3. In a combined or automatic piano, having the piano-action, an organ-reed attachment, a pneumatic-operating mechanism, and wind-bellows for inducing air-pressure to work the pneumatics and sound the reeds; the combination with the reed-chest, of an automatic pressure-regulator in the windway between the reed wind-chest and the bellows, and controlling the reed-chest pressure independent of the pneumatic-operating mechanism for the purpose set forth.

4. In an automatic piano, or instrument having a set of reeds or organ attachment, a pneumatic-operating mechanism and wind-inducing bellows, the combination with the windway from the reed wind-chest to the bellows, of the pneumatic pressure-regulator controlling the air-current therethrough, the adjustable resistance spring, or springs, acting upon the regulator-pneumatic, an operating slide or handle at the front of the instrument, and suitable connections from said slide for shifting said resistance spring, or springs, toward or from the hinging end of said regulator-pneumatic at the will of the operator, for the purpose set forth.

5. In an automatic combination-piano, comprising the upright piano-action, pneumatic-operating mechanism with rocker-levers therefrom extending over the piano-frame, and upright operator-rods in front of said piano-action, arranged for transmitting motion from said rocker-levers to the piano-action independent of the manual-keys; the combination with said rocker-levers and operator-rods, of the reed-box 50 containing reed-cells, reeds, and wind-chest connections, and the reed-cell valves respectively adapted for engagement with lugs on said operator-rods and to be operated by movement of the rocker-levers and operator-rods, substantially as shown and described.

6. In combination, with the reed-box having the reed-cell, reeds, playing-valves, wind-chest and intermediate chamber provided with passages into said wind-chest, and a relief or inlet opening from the exterior into said intermediate chamber, the cut-off valve and valve-operating connections, of a relief-valve controlling said inlet-opening, and adapted for operation in conjunction with the cut-off valve, substantially as set forth.

7. The combination with the manual-keys, of the key-stop consisting of a rod or rock-

ing-bar hinged or movably supported upon the key-table beneath the keys, and adapted to elevate or turn up under the same for retaining all of said manual-keys in stationary elevated position, a lifter-link, and a pull connected therewith for operating said stop-bar, as and for the purposes set forth.

Witness our hands this 26th day of November, 1895.

EDWARD H. WHITE.
WILLIAM D. PARKER.

Witnesses:
C. L. PIERCE,
A. G. KUHNLE.