(No Model.) 2 Sheets—Sheet 1.

G. W. INGALLS.

MECHANICAL MUSICAL INSTRUMENT.

No. 263,787. Patented Sept. 5, 1882.

Fig. 1.

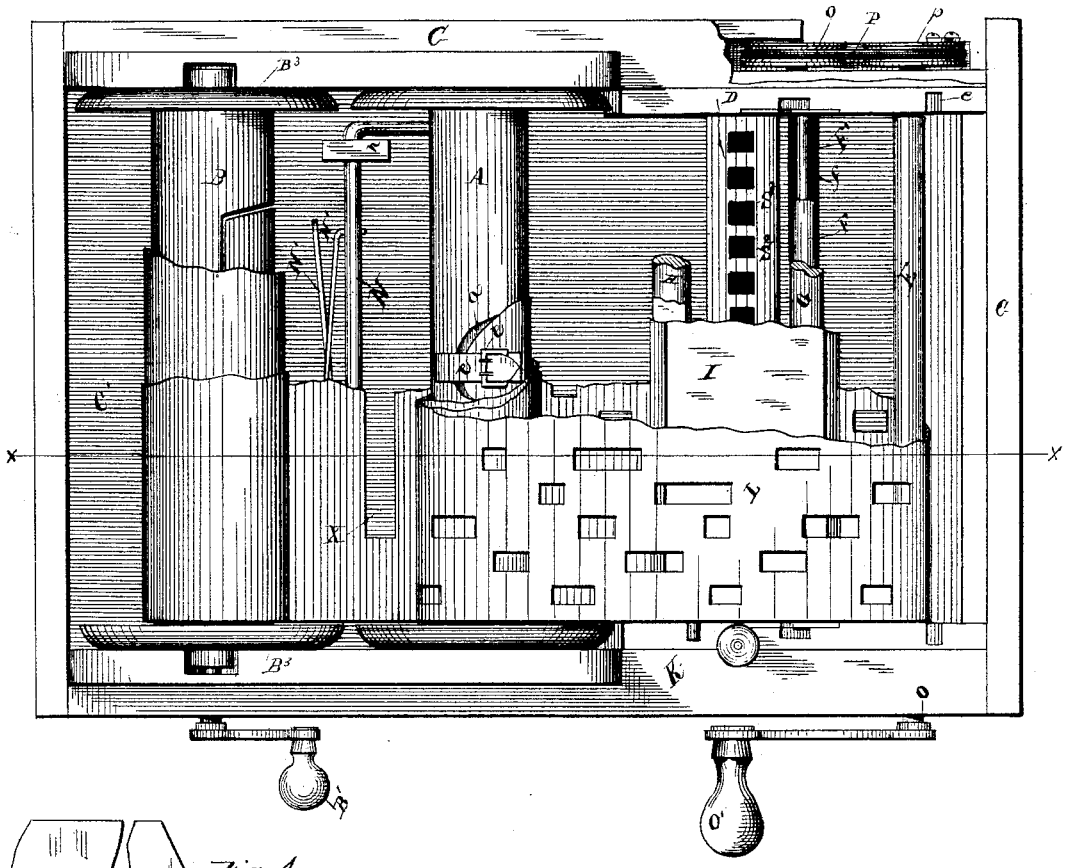


Fig. 4.

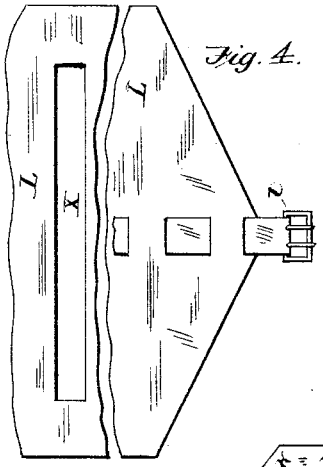


Fig. 3.

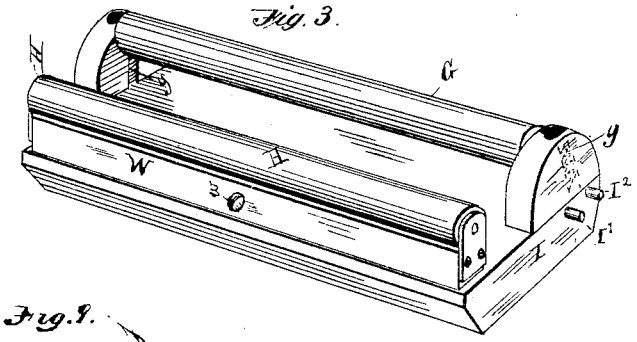
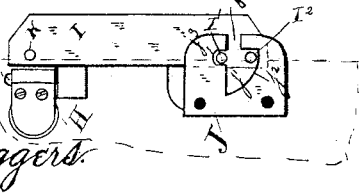


Fig. 2.



WITNESSES:
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Edw. G. Siggers.

INVENTOR
Gustavus W. Ingalls
by Wm. H. Babcock
Attorney

(No Model.) 2 Sheets—Sheet 2.

G. W. INGALLS.

MECHANICAL MUSICAL INSTRUMENT.

No. 263,787. Patented Sept. 5, 1882.

Fig. 2.

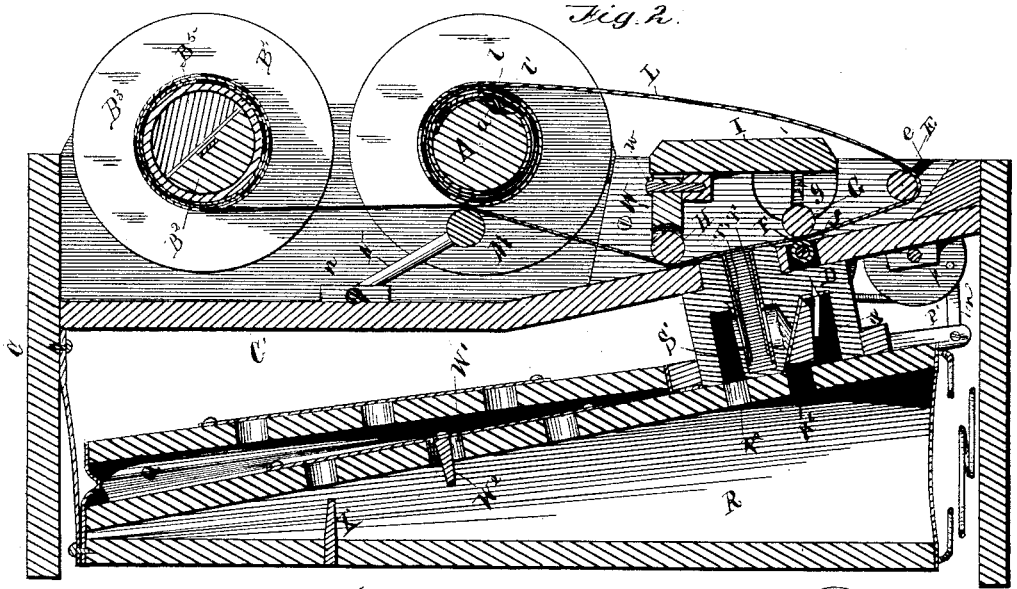


Fig. 5.

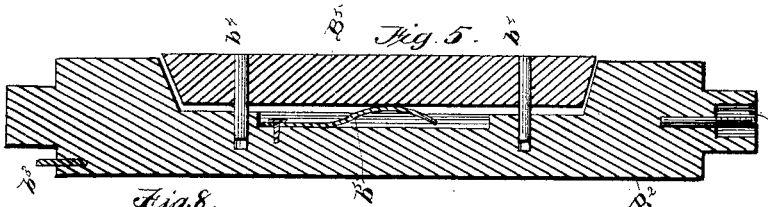


Fig. 8.

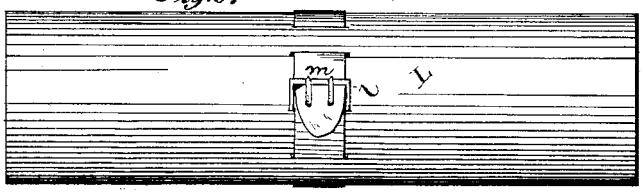


Fig. 6.

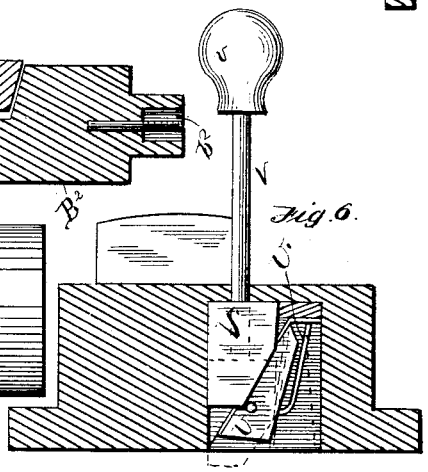


Fig. 7

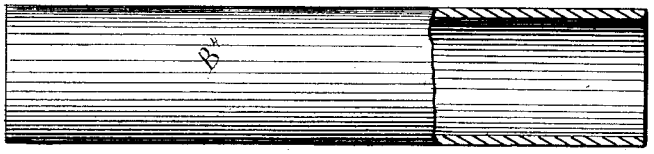
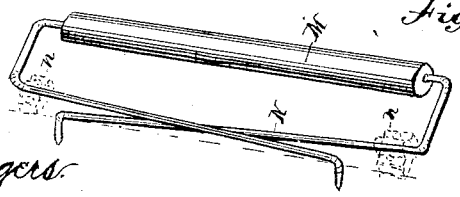


Fig. 10.



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UNITED STATES PATENT OFFICE.

GUSTAVUS W. INGALLS, OF WORCESTER, MASSACHUSETTS.

MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 263,787, dated September 5, 1882.

Application filed April 22, 1882. (No model.)

To all whom it may concern:

Be it known that I, GUSTAVUS W. INGALLS, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Automatic Musical Instruments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of automatic musical instruments in which the music-sheet acts as a valve-sheet for the reeds. Some of the improvements hereinafter described are, however, applicable to any kind of automatic musical instruments.

The said invention consists, first, in a music-sheet for an automatic musical instrument, having an opening equal in breadth and length to the feed-roll of said instrument, adapted to allow the said feed-roll to turn therein without taking hold of said music-sheet; second, in an automatic musical instrument, a rewinding-roll consisting of an outer sleeve, an inner recessed shaft, a pair of detachable end caps, and a block provided with guides and a spring, and operating in the recess of said shaft as a friction-clutch for the sleeve; third, an automatic musical instrument having both the winding-rolls on one side of the reed-board and a supplemental guide-roll on the other side thereof; fourth, in combination with the winding-roll, the rewinding-roll, and the music-sheet, a tension-roll, a U-shaped bar in the upper ends of which the tension-roll is journaled, bearings in which said bar is mounted and turns, and a spring or springs which act on said bar to force said tension-roll against the music-sheet and the winding-roll; fifth, in combination with the music-sheet and the body of a musical instrument, a rack or frame, an upper feed-roll, a presser roll or bar, and a pair of springs which operate to hold both of said rolls simultaneously against the music-sheet; sixth, in combination with a pair of brackets constructed substantially as described, a rack, frame, or cap, provided on each side with two pivots, both near one end of the frame, a presser-roll attached to the other end of the frame, an upper feed-roll located above the pivots and in the same transverse vertical plane, with a line between the two forward and the two rearward pivots, and springs bearing on said feed-roll so as to hold both rolls down when the rack is turned into operative position; seventh, a frame or rack having a presser roll or bar at one end of it, a spring-pressed feed-roll at the other end, and an intervening pivot, in combination with a stop which prevents said presser-bar from being forced down against said music-sheet beyond a certain point; eighth, in an automatic musical instrument, a presser roll or bar held by yielding pressure, in combination with a stop which prevents it from being forced against the body of the instrument; ninth, in an automatic musical instrument, a presser-bar provided with means for preventing it from being pressed toward the instrument beyond a certain point; tenth, a presser-roll, in combination with a trough-shaped bar to which it is journaled and a hinged cap or frame to which said bar has a pivotal attachment, allowing its ends to yield for the purpose of automatically adjusting said bar to any inequalities in the music-sheet; and, finally, in combination with the sound-producing devices, the winding and rewinding rolls and music-sheet of an automatic musical instrument, a spring-pressed roll held against said music-sheet and guiding it and exerting tension upon it in the act of rewinding, all substantially as hereinafter particularly set forth.

In the accompanying drawings, Figure 1 represents a top view, partly broken away, of an automatic musical instrument embodying my invention. Fig. 2 represents a vertical section through the same on the line *x x* of Fig. 1. Fig. 3 represents a perspective detail view of the under side of the rack, frame, or cap to which the presser-bar and the upper feed-roll are attached. Fig. 4 represents a detail view of a part of the music-sheet, showing the buckle whereby it is attached to the winding-roll, and also the opening which stops the winding. Fig. 5 represents a detail view, in longitudinal section, of the shaft of the winding-roll. Fig. 6 represents a detail side view

(the reed-board being in vertical section) of the devices for shutting off or opening at will the communication between the reed-ducts and one set of reeds. Fig. 7 represents a detail view of the sleeve of the rewinding-roll. Fig. 8 represents the said sleeve detached from the instrument with the music-sheet wound and buckled thereon. Fig. 9 represents a side view of the rack and brackets, and Fig. 10 represents the tension device for the winding-roll.

The same letters are used to designate like parts.

Automatic musical instruments ordinarily employ a pair of feed-rolls to cause the forward movement of the music-sheet; a winding-roll on which the sheet accumulates as thus fed forward, and a rewinding-roll from which it is drawn as thus fed forward and on which it is rewound after the tunes on the sheet have been played. This construction is not universal, but is probably the most common in use.

Referring to the annexed drawings, I mount my winding-roll A near the middle of the top of the instrument and my rewinding-roll B directly behind the same, both of these rolls being journaled in bearings attached to the sides of the upper part of case C of the instrument. The upper part of said instrument is divided from the lower part by a partition, C′, the rear part of said partition being horizontal and the front part upwardly inclined. The reed-board D extends up through this forward part of the partition, thus affording air-passage through the reed-ducts from the music-sheet to the reeds or from the reeds to the music-sheet, according as a suction-bellows or pressure-bellows is used. By this arrangement of winding and rewinding rolls and reed-board the two former are located on the same side of the latter, so that the music-sheet would not pass over the mouths of the reed-ducts unless an additional device were employed. I therefore make use of a guide-roll, E, at the other side of the reed-ducts—that is to say, at the forward end of the instrument—and I pass the music-sheet around the same, as shown in Fig. 2. The journals of guide-roll E turn in oblique slots *e e*, which are made downward and rearward from the upper edges of the side walls of the case C. The draft of the music-sheet holds the said journals in the bottoms of these slots, but they can be easily removed therefrom.

The arrangement of the winding and rewinding rolls at the rear part of the instrument affords a counter-balance for the reed-board, the large end of the main bellows, the rack for the upper feed-roll and presser-roll, and other parts, which are arranged at the forward end of the instrument. If the winding-roll were at the forward end of the instrument, (in accordance with the usual construction,) it would not be possible to maintain perfect equilibrium. Of course the parts could be adjusted so as to balance when the entire music-sheet is on the winding-roll, or when it is all on the rewinding-roll; but as it is continually shifting from one roll to the other, the problem would change constantly. In my construction there is no shifting of weight from one side of the center to the other, for the bulk of the music-sheet is always on the two rolls, and they are always on the same side of the center. I am therefore able to maintain at all times the center of gravity unchanged and to present a strong and symmetrical instrument, while allowing the music-sheet to pass freely over the top of the instrument, as usual.

The music-sheet is moved forward by a feed-roll, F, which turns in a transverse recess, *f*, of partition C′. This feed-roll consists of a spindle, F′, which is journaled in the sides of the case C, and of a shorter enlarged piece or sleeve, preferably of rubber, which constitutes the roll proper. An upper feed-roll, (or, more properly, an "idle" roll,) G, holds the sheet against the lower feed-roll, F. These feed-rolls F and G are on the forward side of the reed-ducts. Another roll, H, known as the "presser-roll," holds the sheet down against the partition C′ on the other side of the reed-ducts, so that the sheet will pass over the latter in immediate proximity to them, and will act as a valve to the reeds. I do not, however, allow the presser-roll to be forced against the music-sheet beyond a certain point, which is determined by a stop or stops, hereinafter described.

The pressure of feed-roll G and that of presser-roll H are effected by means of the same pair of springs—namely, the ones which bear directly downward on the journals of feed-roll G, and which are marked *g*, one being shown in full lines in Fig. 3 and the other in dotted lines. Both these rolls are attached to the same frame, rack, or cap I, which is detachably hinged to bearings J on case C. The said rack or frame is provided with two parallel studs, I′ I², at each end near its forward corners. The feed-roll G extends across said rack near its forward edge and parallel thereto. The presser-roll H similarly extends across near the other edge of this rack I. Of course whenever the pivotal line or fulcrum-line of the rack is between these two rolls the rack will act like a lever of the first kind, and the lifting-power of springs *g*, which is applied near one end or edge, will hold down the presser-bar at the other. Of course the said springs will simultaneously hold down the upper feed-roll, G, and lock the entire rack in position. To allow this action the two studs above referred to are arranged one on each side of the point at which the feed-roll is journaled, so that when the rack is turned down on the instrument in position for the latter to operate, the stud I′ on each side is in the rear of said point, and the stud I² is forward of the same, the terms "forward" and "rear" being used with reference to the line of motion of the music-sheet over the reed-ducts. These studs serve in turn as the journals or the trunnions of said frame or rack. They are set into one of the bearing-brackets J, attached to the case, these two brackets J

being counterparts. Each of them has a neck, *j*, which leads to an internal recess, *j'*, like that shown in Fig. 9. The forward part of this recess has a curved wall or edge, j^2, inclining obliquely upward and forward. The rear part of said recess has an offset, j^3, near its upward end.

When the rack is turned up away from the music-sheet the forward studs, I^2, ride as trunnions on the curved oblique bearing-edges j^2 of the two brackets J. When the rack is turned down the rear studs, I', enter the offsets j^3, and become in their turn the trunnions or pivots of the rack, the other studs riding upon the said bearing-edges and serving to guide the frame.

When the feed-roll G comes in contact with the music-sheet and the partition C', which is in effect the top of the case, the springs *g* are compressed, and their efforts to expand in both directions will hold both rolls G and H against the music-sheet, as stated. Of course in the case of roll G this expansive force is exerted against said roll without any check or impediment; but the other end or edge of frame I is provided with a lateral stop, K, which comes in contact with the top of one side of the case C and prevents the pressure of the springs from acting beyond that point. Thus the music-sheet will be snugly held in place without being crowded against the body of the instrument. This improvement lessens materially the friction of the sheet as it is fed and the risk of tearing the same.

The presser-roll H which I employ is journaled in the ends of a trough-shaped bar, W, which is pivoted at its middle by pivot *w* to a block on the rack I. This construction (shown in Figs. 1 and 3) allows said roll to turn freely, while enabling it to adjust itself endwise, so as to accommodate any inequality in the music-sheet.

One end of the music-sheet L is connected to the winding-roll A by means of a buckle, *l*, on the end of said sheet and a strap, *l'*, attached to said winding-roll. This roll is made solid, and is provided with a recess, *a*, which receives said buckle when the winding operation begins. Near the other end of said sheet, as shown in Fig. 4, but at a distance therefrom at least equal to that between the rewinding-roll and the feed-roll F, the said sheet is provided with a transverse opening, X, of sufficient size to allow the said roll to turn therein without seizing upon the paper of the sheet. Of course when this opening comes opposite said roll F the music-sheet will no longer move, and all strain upon it between that point and its attachment to the rewinding-roll is prevented. This simple expedient is an efficient protection against the danger that the sheet will be torn by carelessly continuing to turn the operating-crank after the music has all been played and the music-sheet all unwound.

The rewinding-roll B is provided with a crank, B', whereby it is turned in the usual manner to bring the music-sheet back to said roll, so as to be in readiness for playing again. This roll consists of a solid spindle or shaft, B^2, two end caps, B^3 B^3, and a sleeve, B^4. The part B^2, Fig. 5, has in one of its journals a prismatic recess, b^2, for receiving the similarly-shaped end of its crank B'. On this journal sets one of the end caps B^3. The other end cap sets on the other journal, and has a small socket in its inner face to receive a stud, b^3, which projects from the end of said roll-shaft. In the side of the latter is a movable block, B^5, guided by pins b^4, and forced outward by a spring, b^5, interposed between it and the body of said shaft. Sleeve B^4 is set between the caps B^3 and around the shaft B^2. The pressure of said spring b^5 on said block B^5 establishes a friction-clutch connection between said shaft and said sleeve. The end of the music-sheet is attached to said sleeve, as shown in Fig. 8. When in the operation of rewinding the sheet has been wholly unwound from the winding-roll there would be danger of tearing said sheet by a careless additional turn or two but for this friction-clutch attachment. The latter allows the shaft of the rewinding-roll to turn within its sleeve, so that no harm will be done, although the buckle to the winding-roll holds firm. By unfastening this buckle the music-sheet is left free to be entirely rewound on said rewinding-roll. It may then be buckled about the same by means of its buckle aforesaid, and a strap, *m*, secured to the back of said music-sheet at a suitable distance therefrom. The end cap B^3 opposite to the crank of the rewinding-roll may be removed from said shaft B^2 after the journal of the latter has been raised from its bearing, and the sleeve, with the roll of music thus strapped on it, may be slipped endwise from said shaft. Another sleeve, with a roll of music upon it, may then be slipped upon the shaft instead, the cap B^3 replaced, and the roll-journal returned to its bearing. To facilitate these operations the said bearing is made open from the top of the side piece downward. The rolls of music thus strapped and buckled upon their sleeves and ready for application to an instrument may be put up, stored, and shipped in any desired quantities, the sleeve and roll together thus constituting a new and serviceable article of manufacture, though nevertheless forming legitimately parts of each instrument to which they are applied.

To insure proper tightness of winding, I use a tension device which bears upward against the winding-roll, as shown in Fig. 2. This consists of a roll, M, which is journaled in the upwardly-extending limbs of a U-shaped metal bar, N, which is arranged to turn in bearings *n n* raised on partition or floor C'. A pair of springs, N' N', operate against this bar so as to throw roll M against the music-sheet under the winding-roll, and thus apply the necessary degree of resistance to secure tight winding. The construction of this tension device appears more distinctly in Fig. 10.

The winding-roll A is turned by contact with

the music-sheet L as the latter is drawn forward by the feed-rolls between said tension device and said winding-roll.

O represents the driving-shaft of the instrument, which is operated by means of crank O′, and coupled at the other end to the shaft F′ of the lower feed-roll by a belt or chain, P, passing around pulleys *o* and *p* on the respective shafts. A pitman, P′, connects this driving-shaft with one of the two feeder bellows or pumps, and a similar pitman connects it also with the other feeder-bellows.

It has not been deemed necessary to show both these bellows, as they are identical in construction and operation, and are arranged in the usual manner on top of the main or reservoir bellows R. The feeder-bellows shown is marked Q. The two feeder-bellows act alternately, the upper connections of the pitman being with cranks or wrist-pins arranged to produce such action. The one shown is connected with a wrist-pin, *r*, on pulley *p*.

There are two passages or ports, R′ and R², communicating with the reed-chambers of the reed-board, which are also two in number, one being marked S, and the other one, S′, the terms "rear" and "forward" being used, as hereinbefore, with regard to the direction of motion of the music sheet as it passes over the reed-ducts. From the intervening space a series of reed-ducts, S², corresponding to the longitudinal lines of perforations in the music-sheet extend up through the reed-board. On one side of each duct a reed, T, intervenes between it and chamber S. On the other side a similar reed, T′, is likewise interposed between said duct and the chamber S′. A partition separates the said chambers in the intervals between the ducts. A pivoted cut-off, U, is arranged within said forward chamber and pressed by a spring, U′, against all the openings leading to the reeds T, so as to close them. This cut-off has an inclined face and is extended beyond the end of the reed-board.

V designates a push-pin, which protrudes through the top of the case, and has a suitable knob, *v*, at its upper end. On its lower end it bears a block, V′, which is guided in the side of the case and beveled, Fig. 6, to operate on the inclined face of said cut-off. By pressing on said knob the cut-off is forced back into the position shown in dotted lines, and both sets of reeds will operate together. When pressure is removed from said push-pin or stop V the cut-off automatically closes. By means of these devices I am enabled to use at will either one or two reeds with each duct, and thereby to vary the strength of the tone.

I do not use the ordinary safety-valve, but supply my bellows with means for operating the inside valves to effect the same result.

W′ indicates the inside valve, governing communication between feeder-bellows Q and reservoir R. This valve is provided on its under side with a lug or rod, W², which extends downward. Whenever bellows R is nearly exhausted it (this lug) will strike against the bottom of said bellows, (provided said valve be then closed,) and will raise said valve and allow the air to return from said feeder-bellows to said main bellows.

A lug or rod, X′, attached to the bottom of the bellows R, and rising therefrom, is used as an auxiliary to the rod or lug W², or it may be substituted therefor, as the operation is the same. The lug or rod in either case is located in the thinner part of the bellows, so as to act upon the valve gradually, beginning as soon as the need for its operation is felt.

The bellows above shown and described are of course suction-bellows. By substituting a link for a rod or lug, and connecting said link at one end to the valve and at the other to the bottom board of the bellows R, the same invention may be applied to pressure-bellows.

It is obvious that many features of my invention may be considerably modified without departing from its scope and spirit, and that those parts of it which relate to the reed board and to the bellows, and perhaps some others, may be applied to musical instruments which are not automatic.

All that part of this specification which relates to the bellows and its valves will form part of a separate application, and will be claimed therein.

The roll carried by the U-shaped bar, forced up by springs against the music-sheet to form a tension device, as stated, serves as a guide for said sheet in rewinding, and also causes the sheet to be rewound tightly.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A music-sheet for an automatic musical instrument, having an opening equal in length and breadth to the feed-roll of said instrument, adapted to allow the said feed-roll to turn therein without taking hold of said music-sheet, substantially as and for the purposes set forth.

2. In an automatic musical instrument, a rewinding-roll consisting of an outer sleeve, an inner recessed shaft, a pair of detachable end caps, and a block provided with guides and a spring and operating in the recess of said shaft as a friction-clutch for the sleeve, substantially as set forth.

3. An automatic musical instrument having both the winding-rolls on one side of the reed-board and a supplemental guide-roll on the other side thereof, substantially as set forth.

4. In combination with the winding-roll, the rewinding-roll, and the music-sheet, a tension-roll, a U-shaped bar in the upper ends of which the tension-roll is journaled, bearings in which said bar is mounted and turns, and a spring or springs which act on said bar to force said tension-roll against the music-sheet and the winding-roll, substantially as and for the purpose set forth.

5. In combination with the music-sheet and

the body of a musical instrument, a rack or frame, an upper feed-roll, a presser roll or bar, and a pair of springs which operate to hold both of said rolls simultaneously against the music-sheet, substantially as set forth.

6. In combination with a pair of brackets constructed substantially as described, a rack, frame, or cap provided on each side with two pivots, both near one end of the frame, a presser-roll attached to the other end of the frame, an upper feed-roll located above the pivots and in the same transverse vertical plane, with a line between the two forward and the two rearward pivots, and springs bearing on said feed-roll so as to hold both rolls down when the rack is turned into operative position.

7. A frame or rack having a presser roll or bar at one end of it, a spring-pressed feed-roll at the other end, and an intervening pivot, in combination with a stop which prevents said presser-bar from being forced down against said music-sheet beyond a certain point, substantially as set forth.

8. In an automatic musical instrument, a presser roll or bar held by yielding pressure, in combination with a stop which prevents it from being forced against the body of the instrument.

9. In an automatic musical instrument, a presser-bar provided with means for preventing it from being pressed toward the instrument beyond a certain point.

10. A presser-roll, in combination with a trough-shaped bar, to which it is journaled, and a hinged cap or frame to which said bar has a pivotal attachment, allowing its ends to yield for the purpose of automatically adjusting said bar to any inequalities in said music-sheet.

11. In combination with the sound-producing devices, the winding and rewinding rolls, and music-sheet of an automatic musical instrument, a spring-pressed roll held against said music-sheet from below and guiding it and exerting tension upon it in the act of rewinding, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

GUSTAVUS W. INGALLS.

Witnesses:
F. A. BEANE,
C. P. WHITNEY.