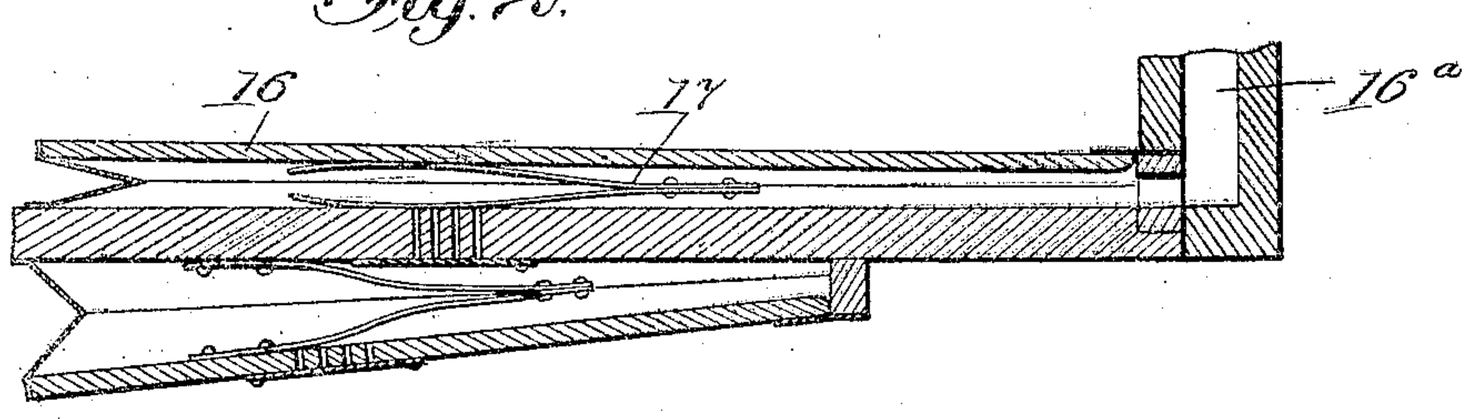
No. 879,738. PATENTED FEB. 18, 1908.

M. CLARK.

BELLOWS FOR AUTOMATIC MUSICAL INSTRUMENTS.

APPLICATION FILED DEC. 19, 1902. RENEWED NOV. 14, 1904.

Fig. 2.



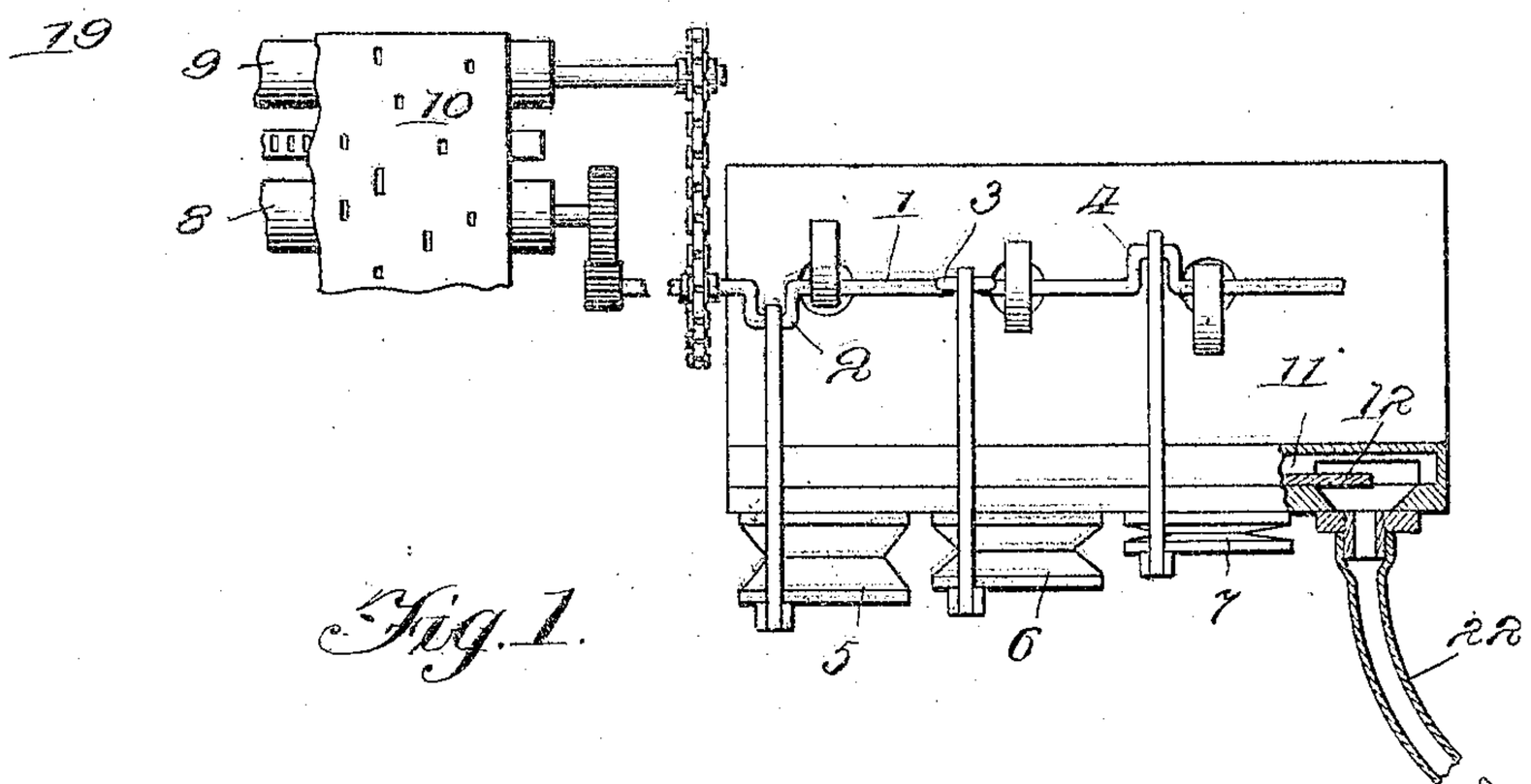
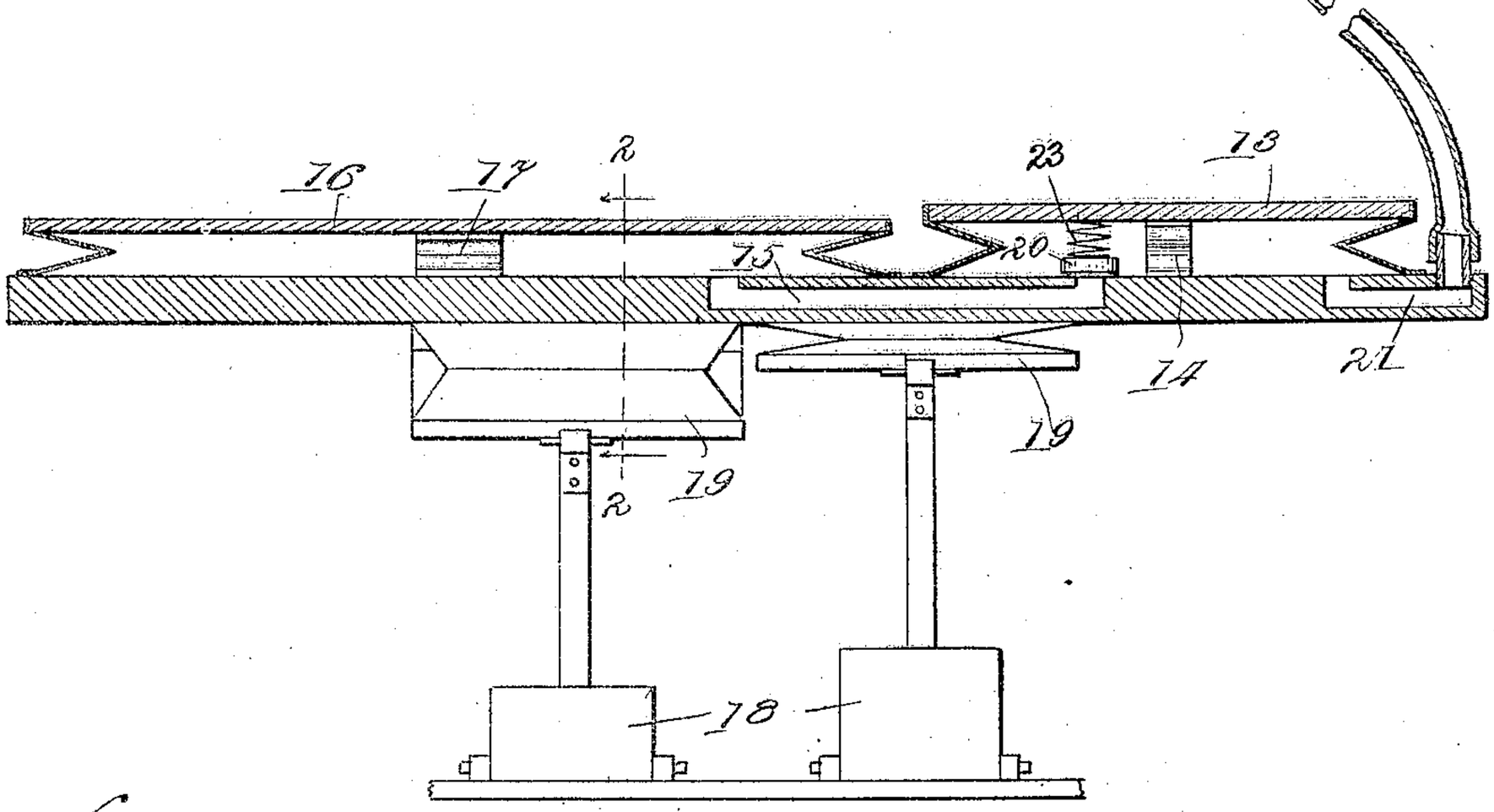


Fig. 1.



Witnesses:
H. L. Gaither
Fred'k G. Fischer

Inventor:
Merritt Clark
by Burton & Burton
his Attorneys.

UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

BELLOWS FOR AUTOMATIC MUSICAL INSTRUMENTS.

No. 879,738. Specification of Letters Patent. Patented Feb. 18, 1908.

Application filed December 19, 1902. Serial No. 135,898. Renewed November 14, 1904. Serial No. 232,585.

To all whom it may concern:

Be it known that I, MELVILLE CLARK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Bellows for Automatic Musical Instruments, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

This invention is designed to afford new and improved means for operating a pneumatic motor for actuating the perforated sheet in an automatic musical instrument or player in such manner that such motor, while deriving its power from the same source of air under tension, whether above or below atmospheric, as that which operates the pneumatics whose action is controlled by the perforated sheet, shall nevertheless derive a speed independent of the volume of air required for operating the pneumatics; so that, whether the music is to be played softly or loudly, the speed may be unvarying unless it is varied at the will of the performer by means of the devices provided for that purpose.

It consists in the features of construction set out in the claims.

In the drawings:—Figure 1 is a longitudinal vertical section of a portion of a player for a musical instrument having my improvement in the devices for operating the pneumatic motor. Fig. 2 is a section at the line, 2—2, on Fig. 1.

I have shown, without going into details, the main crank shaft and motor bellows or pneumatics operating it, constituting the operating devices of the pneumatic motor for actuating the perforated controlling sheet, these elements being of construction which is more or less familiar and which is not concerned in the present invention put only associated therewith. These parts will therefore be described only in general for the purpose of assisting the understanding of those parts of the invention which coöperate with them.

Triple-crank-shaft, 1, has its three cranks, 2, 3, and 4, connected with the three motor pneumatics, 5, 6, 7, respectively; and it may be understood without further explanation that by proper mechanical connections the crank-shaft drives the rolls, 8, 9, for actuating the perforated sheet, 10. In the structure illustrated, these pneumatics may be understood to be operated by exhaustion,—that is, by communication with a source of air whose tension is reduced below atmospheric tension, and such communication is afforded through passages not shown leading to the pneumatics respectively from the valve chamber, 11, in which a controlling valve, 12, is located, which may be operated at the will of the performer, by means not shown, when it is desired to vary the speed of the perforated music sheet. The purpose of the present invention is to preserve such speed unchanged unless it is modified by opening or closing the valve in said valve chamber; and in order that there shall be no variation of the speed unless it is effected by adjusting said valve, it is necessary that the tension of the air whose communication with the motors is controlled by said valve be maintained constant. For this purpose I provide a bellows, 13, which is held normally distended by means of a spring, 14, which communicates through a duct, 21, and pipe, 22, with the valve chamber, 11, and thereby with the motor pneumatics, 5, 6, 7, and which is in communication through a duct, 15, with the bellows, 16, which is connected by the throat, 16ª, with the pneumatics which operate the playing or sound-controlling devices. These latter pneumatics and playing devices are not shown but may be understood to be of any customary form and construction. This bellows, 16, is normally distended by a spring, 17, and is collapsed against the tension of the spring by the action of the pumpers, 19, operated by pedals, 18, in the customary manner. The spring, 17, is of suitable strength to require for its compression the exhaustion of air from the bellows, 16, to an extent suitable for the maximum intensity of action of the playing or sound-controlling devices,—that is to say, so that the loudest tones may be produced of which the instrument is capable. For example, in an ordinary piano player this spring will be what is termed a 40 pound spring, that is, it will require such rarefaction of the air in the bellows that the difference between the interior tension and the atmospheric pressure upon the whole exposed area of the moving wall of the bellows will amount to 40 pounds; thus, if the bellows' area is 120 square inches, the

rarefaction in order to compress the spring and collapse the bellows will amount to one-third of a pound per square inch. For the lightest action—that is, the action necessary to produce the softest tones of which the instrument is capable—the pumpers will be operated so as to compress this spring to a tension of from 15 to 20 pounds. Whenever the instrument is being operated for playing, therefore, there will be not less than 15 pounds' tension on this spring. The duct, 15, which affords communication between the two bellows, 13, and 16, is of sufficient size to render such communication entirely free, so that whatever the air tension may be in the bellows, 16, it will be experienced also in the bellows, 13, in the absence of any means to restrict or close this communication.

The spring, 14, which operates to hold the bellows, 13, distended, and which is compressed by the rarefaction of the air in the bellows, such as will occur whenever it is in free communication with the bellows, 16, when the pumpers are being operated to rarefy the air in that bellows and operate the playing devices, is so much lighter in proportion to the area of the bellows which it controls than the spring, 17, of the other bellows, that said bellows, 13, is collapsed to the utmost before the bellows, 16, is collapsed sufficiently to develop from the spring even the minimum tension of 15 pounds which is necessary to the lightest action of the playing devices. The duct, 15, opens into the bellows, 13 through a fixed wall of said bellows, and the opposite oscillating wall carries a valve, 20, adapted to seat at the mouth of the duct when the bellows is collapsed. This valve is mounted upon a spring, 23, which yields when the valve, in the collapse of the bellows, encounters the margin of the mouth of the duct, 15, so that during the very slight leakage that will occur around the valve before it is sufficiently pressed upon its seat to close the passage of air, the collapse continuing, the spring will be slightly compressed. The result of this construction is that whenever, in the operation of the pumper, the rarefaction of the air in the bellows, 13, has been carried to the degree necessary to compress its spring and collapse it until the valve reaches its seat and closes the mouth of the duct, 15, no further rarefaction can take place, and the subsequent action of the pumpers will develop the proper degree of rarefaction in the other bellows to adapt them to operate the playing devices to any extent that the operator desires; and whatever tension may be developed in the bellows, 16, by subsequent action of the pumpers, even up to the maximum of 40 pounds, to which the spring of that bellows may be calculated, the tension in the other bellows, 13, cannot be increased; and as the air is admitted into that bellows in operating the motor pneumatics, 5, 6 and 7, to drive the rolls and propel the perforated sheet, the bellows expands slightly under the action of its spring and unseats the valve, whereupon immediately the superior tension in the other bellows operates to collapse the bellows, 13, again and close the valve; and this operation of opening and closing, to the very least extent which will admit air past the valve, will continue as long as the instrument is in use, the variation of tension in the bellows, 13 being imperceptible, although sufficient to alternately seat and unseat the valve. The uniform tension which thus results in the bellows, 13, gives uniform action to the motor pneumatics and the mechanism which they drive for propelling the perforated sheet. This operation may be more or less rapid according to the adjustment of the controlling valve, 12, but for any given position of that valve it will be uniform without regard to the rate of action of the pumpers, which will be varied according to the intensity of action desired in the playing devices. The area of the bellows, 13, being, for example, half that of the bellows, 16, a "5 pound" spring in the smaller bellows will be collapsed when the rarefaction in the larger bellows is sufficient to develop a 10 pound tension in the spring of that bellows; and the minimum tension which will cause the playing devices to operate for the lightest tone being 15 pounds in that bellows, the maximum tension in the smaller bellows will always be maintained whenever the instrument is operated for playing. It will be understood that I do not limit myself to any precise relations between the areas of these bellows or between the tension of their springs or whatever other means are employed to hold them expanded; and in fact, inasmuch as the lightest music is usually played in slower time, requiring less rapid action of the motor which propels the perforated sheet, very satisfactory results may be obtained even when the bellows which operates these motor pneumatics is adjusted so that it is fully collapsed only by a tension greater than minimum tension necessary in the other bellows for operating the playing devices; but the most satisfactory construction and that which embodies most fully the principle of my invention is that herein indicated, in which the maximum tension of the motor-operating bellows is not greater, and practically somewhat less, than the minimum tension necessary in the other bellows for operating the playing devices. It will be seen also, upon consideration, that the result described is dependent upon the governing valve, 20, in the motor-operating bellows, because if there were no valve or equivalent means for shutting off communication between the two bellows when the lighter bellows is collapsed, vigorous action of the pumpers would draw the air through the

lighter bellows precisely as if it were a mere duct, and the action of the motor pneumatics for operating the perforated sheet would, in effect, be produced directly by the larger bellows, with the result that the speed would vary according to the tension maintained in that bellows. The essential feature, therefore, of my invention is the valve, 20, or an equivalent device; and the relation between the power of the distending springs of the two bellows is only a secondary feature.

It will be manifest, upon consideration, that the principle of my invention is not limited to an exhaust bellows, either for operating the playing devices or the pneumatic motor, and I employ the term "tension", referring to the degree of rarefaction of the air in the exhaust bellows employed in the structure shown in the drawings, to indicate, broadly, any difference which may exist between atmospheric tension and the tension within the bellows, whichever be the greater. The modifications in details of the structure which would be necessary to adapt the invention to an instrument employing compressed instead of rarefied air will be obvious to any one skilled in the art.

The bellows shown in the drawings constitute an air chamber in which the tension of the air is abnormal or unatmospheric, and this is the essential characteristic and quality of a chamber or chambers for the purpose of the present invention. The specific mechanical construction of the chamber by which it is collapsible and expansible has only specific convenience and utility; but my invention generically considered is not limited to this specific mechanical feature, though it is for certain reasons preferred and claimed specifically.

I claim:—

1. In an automatic musical instrument in combination with two exhaust chambers for different purposes, an exhauster having communication for exhausting both of said chambers; means for closing by the collapse of one of said chambers the port of communication through which such chamber is exhausted, said means including a valve constructed to be seated simultaneously over substantially the entire extent of its seat.

2. In an automatic musical instrument in combination with two exhaust chambers, one for operating the playing devices and the other for a supplemental purpose, an exhauster which operates to exhaust both said chambers; means for closing by the collapse of the supplemental chamber the windway or port through which it is exhausted, said means including a valve constructed to be seated simultaneously over substantially the entire extent of its seat.

In an automatic musical instrument, an exhaust chamber for receiving air from the devices of the instrument; an exhauster for exhausting the air from such chamber; means for closing by the collapse of said chamber the windway or port of communication through which it is exhausted, said means including a valve which is constructed to be seated simultaneously at substantially the entire extent of its seat, and a spring which is compressed in the seating of the valve.

4. In an automatic musical instrument, a pneumatic motor; an exhaust chamber or bellows for operating such motor; an exhauster for exhausting such bellows; means for closing by the collapse of said bellows the port of communication through which it is exhausted, said means including a valve constructed to be seated simultaneously over substantially the entire extent of its seat.

5. In an automatic musical instrument, in combination with a pneumatic motor, an exhaust chamber or bellows for operating it; an exhauster for exhausting the air from said bellows; means which control the windway or port of communication through which the bellows is thus exhausted, adapted for closing the same upon the approach of the tension in said bellows to a predetermined maximum and opening it upon recession from said maximum, said means including a valve constructed to be seated simultaneously over substantially the entire extent of its seat.

6. In an automatic musical instrument in combination with an air chamber for operating devices of the instrument; an exhauster for exhausting the air from said chamber having a port through which it is exhausted; a valve seating at such port constructed and supported to be seated simultaneously over substantially the entire extent of its seat, and means for moving such valve directly toward and from the port.

7. In an automatic musical instrument in combination with an exhaust air chamber for operating the playing devices; a second exhaust air chamber for an auxiliary purpose, both said chambers being provided with means for limiting the air tension which can be produced therein, the maximum tension of the second chamber being not greater than the minimum tension necessary in the first air chamber for giving the playing devices the lightest action; an exhauster connected for exhausting both said chambers; means for controlling the port through which the second chamber is exhausted, including a valve which is moved toward its seat by approach to the maximum of the tension in said second chamber and moved from its seat by recession from such maximum, such valve being constructed to be seated and unseated simultaneously over substantially its entire seat.

8. In an automatic musical instrument in combination two exhaust chambers for different purposes communicating with each

other, a valve in one chamber controlling said communication adapted for closing upon approach of tension in said chamber to a predetermined maximum and constructed to be seated simultaneously over substantially the entire extent of its seat.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 13th day of December, A. D. 1902.

MELVILLE CLARK.

In the presence of—
CHAS. S. BURTON,
FREDK. G. FISCHER.