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M. CLARK.

PNEUMATIC ORGAN.

(Application filed July 15, 1899.)

(No Model.)

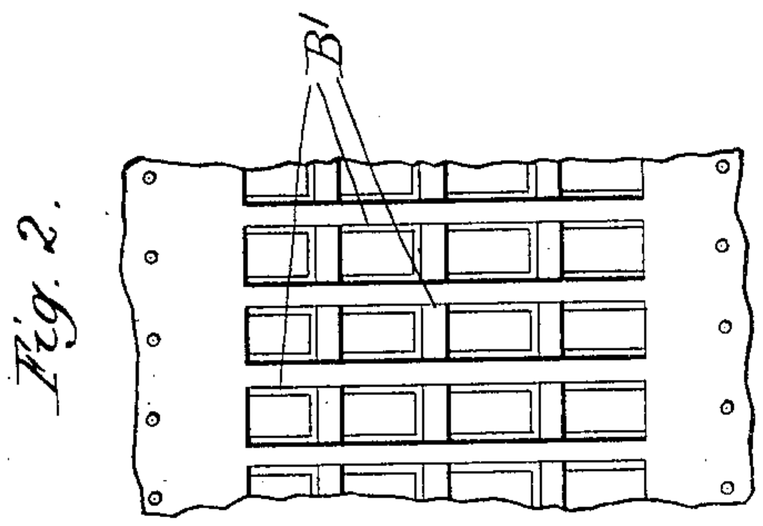
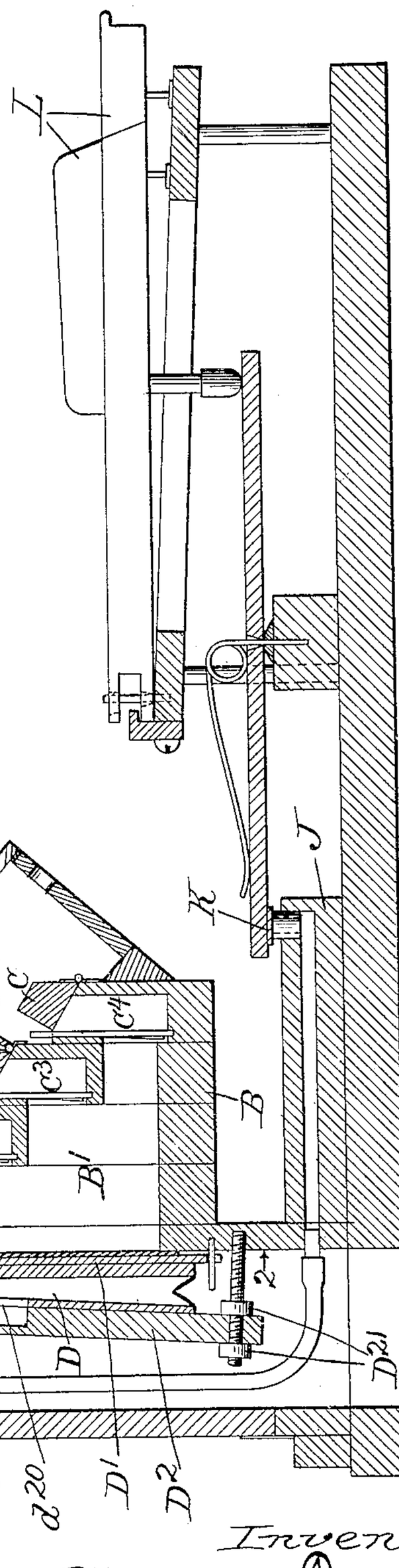


Fig. 2.



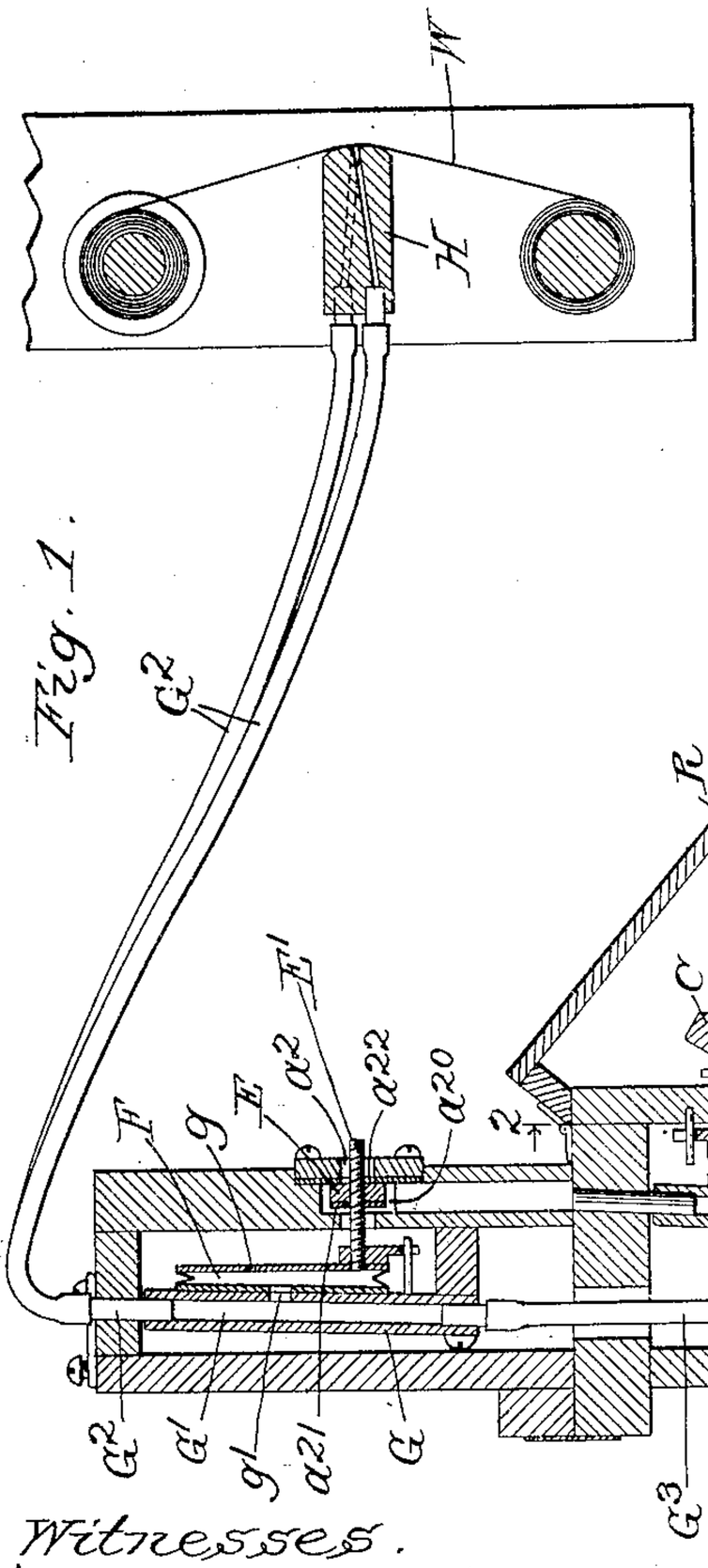


Fig. 1.

Witnesses.
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UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

PNEUMATIC ORGAN.

SPECIFICATION forming part of Letters Patent No. 659,210, dated October 9, 1900.

Application filed July 15, 1899. Serial No. 723,913. (No model.)

To all whom it may concern:

Be it known that I, MELVILLE CLARK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Pneumatic Organs, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a vertical fore-and-aft section of an organ containing my improvements, unnecessary parts being omitted or broken away. Fig. 2 is a detail elevation of a portion of the inner wall of the wind-chest and reed-block mounted on the outer part thereof, as the same would be seen at the plane of the line 2 2 on Fig. 1, looking in the direction of the arrows applied to said line.

A is the wind-chest, and B a reed-block thereon.

C C C, &c., are the mutes exterior to the wind-chest, which control the reed-cells C′ C^2 C^3 C^4, formed in the reed-block B.

B′ is the common throat, leading from all the reed-cells in the series C′ to C^4 into the wind-chest.

D is a motor-pneumatic within the wind-chest, its front or moving wall D′ constituting the valve which closes the mouth of the throat B′, its fixed wall being mounted on the diaphragm or bridge D^2, adjustably fixed within the wind-chest, and having the air-passage d^2, which leads by way of the opening d^{20} into the motor-pneumatic D. The air-passage d^2 is continued in the wall of the wind-chest to the port a^2, whose enlargement a^{20} constitutes the mouth of said duct or passage d^2 in the port a^2 and the chamber for the valve E, which has slight range of movement transversely with respect to the passage d^2, so that it seats either at a^{21}, closing communication of the port a^2 with the wind-chest, or at a^{22}, closing communication of said port with the atmosphere.

F is a primary pneumatic mounted within the wind-chest on the hanging wall or diaphragm G and having the stem E′ of the valve E rooted rigidly in its moving wall. The hanging wall or diaphragm G has an air-passage G′ leading through the port g' into the primary pneumatic, said air-passage being connected by a duct G^2 with the tracker-range H and also by a duct G^3 with the valve-board J, where its mouth is controlled by the valve K, operated by suitable lever connections with the proper key L of the manual.

It will be noticed that the reed-cells C′, C^2, C^3, and C^4 in the reed-block B have a common throat B′ leading into the wind-chest, and that said throat at its mouth in the wind-chest wall, which is covered and controlled by the valve D′, has an extent as great as the total exposure of the reed-cells in said throat. If each reed-cell were made or considered as a separate box, such boxes are intruded into the throat formed in the reed-block, one in front of another, successively, commencing immediately outside the wall of the wind-chest, the upper end portion of each cell after the first lapping the lower end portion of the preceding cell a sufficient distance to complete the closure of the throat at the top except as to the air-passage through the cells, the remainder of the inner wall of each cell below such lapping portion constituting the exposure or opening of the cell into the throat, these exposures all facing the wind-chest and the valve-controlled mouth of the throat, which, as stated, is in extent as great as the total of such exposures. The result of this structure may be stated to the effect that the throat widens from the most remote cell toward the valve-mouth in the wind-chest. By this means and without requiring any additional space for the purpose the most remote reed of the series contained in the cells, which are controlled by the same valve D′, is as completely exposed to the action of the wind-chest pressure or tension as the nearest reed, and the most remote reeds, therefore, speak as promptly as the nearest, whatever be the number of reeds in the series.

It will be understood that the foregoing description relates to the assemblage or combination of parts pertaining to one key of the manual and controlled thereby and comprising a series of reeds all of the same pitch and to one port or throat of the tracker-range controlled by the apertures in the music-sheet W in line with such port and that each of the mutes C controls a group consisting of one or more octaves of reeds of consecutive pitch.

The peculiarities of the construction herein

described and the advantages obtained by it may be understood by following the operation, which will now be stated. Assuming that this structure is used in a blast-organ and that in operation, therefore, the wind-chest contains air under more than atmospheric tension when the primary pneumatic is vented by uncovering either the mouth of the duct G^2 or that of the duct G^3, atmospheric communications being made with the primary pneumatic, it will be collapsed by virtue of the greater tension within the wind-chest, and the valve B will be seated at a^{21}, cutting off communication from the interior of the wind-chest to the interior of the motor-pneumatic D and opening communication by way of the seat a^{22} through the port a^2 between the interior of the motor-pneumatic and the atmosphere. The moving wall of the motor-pneumatic, it will be noticed, is now exposed on both sides to atmospheric pressure only, for its outer side closes the mouth of the throat B′, which is freely in communication with the atmosphere through one or more of the reed-cells whose mutes are open, (and even when the mutes are closed the tension in this throat is atmospheric, because there is always sufficient leakage around the reed-plates to cause this result.) As to the mere margin of the valve D′, which obtains seat around the mouth of the throat on the inner side of the wind-chest wall, I make this as narrow as consistent with certainty of obtaining seat, and the surfaces being covered with felt the contact is not of such nature as to cause adhesion by reason of a perfect exclusion of air from between them, and this surface may therefore be practically disregarded in considering the opposite areas of pressure. The side walls of the pneumatic, however, of bellows form, are exteriorly exposed to the wind-chest pressure and interiorly to the atmospheric pressure only, which is less. They are therefore pressed inward, with the result of drawing the valve from the seat and admitting air from the wind-chest into the throat B′ and out through the reeds whose mutes are open, the motor-pneumatic being instantly collapsed, because it is now exteriorly exposed on the outer side of its moving wall, as well as upon the bellows side, to pressure only so much less than that of the wind-chest proper as is caused by the escape through the reeds whose mutes are open. Upon the closing of the vent of the primary pneumatic, cutting off communication of the atmosphere therewith, the air from the wind-chest passes rapidly into said primary pneumatic through the small filling-port g, and it becomes expanded to its normal form, its moving wall being now exposed to the same pressure—to wit, that of the wind-chest—on both sides. The normal position of the moving wall of the primary pneumatic is such as to seat the valve E indifferently at the seat a^{21} or at a^{22}; but the rush of air from the wind-chest instantly seats it at the seat a^{22}, closing communication of the motor-pneumatic with the atmosphere and opening communication with the wind-chest, the result being that the motor-pneumatic, being inflated with air at wind-chest tension, seats its moving wall (the valve D′) over the mouth of the throat B′ and cuts off the air from the reeds. It will be noticed that in this action not only the moving wall D′ of the motor-pneumatic, but its bellows sides, are interiorly exposed to the wind-chest pressure, and that in consequence the pneumatic very quickly resumes its normal expansion, which is such as to locate the outer face of the moving wall (the valve D′) at its seat around the margin of the throat B′. Immediately upon touching its seat it will be seen that the valve D′ becomes exposed to atmospheric pressure only, and being now interiorly exposed to wind-chest pressure, it is immediately forced firmly against its seat and there held. Nevertheless it will be seen that as soon as the primary pneumatic is again vented, so that atmospheric pressure is substituted for wind-chest pressure within the motor-pneumatic, the pressure of the moving wall D′ is practically balanced, and the total excess of wind-chest pressure over atmospheric pressure on the bellows side of the pneumatic operates to withdraw the moving wall of the latter (the valve D′) from its seat, where, it will be observed, it would hang without pressure, even if the bellows sides did not operate as described. Thus the motor-pneumatic is made extremely sensitive to the change of pressure within it, which results from the venting and closing and consequent action of the primary pneumatic, and the instrument thus constructed is capable of the most rapid alternation of tone, the valve D′ moving to and from its seat and seating perfectly at each instance as rapidly as the primary pneumatic can be vented by any movement of the perforated music-sheet over the tracker-range and by any action which the finger of the operator can give to the manual-key, and the instrument is thereby capable of sounding the shortest possible notes in the most rapid possible succession and perfectly distinguishing them by the complete interruption of tone in the intervals, however short. Another peculiarity of this construction is that it operates precisely with the same effect, obedient to precisely the same action at the manual or tracker range, whether the wind-chest pressure be above or below atmospheric pressure—that is, whether the organ be an exhaust organ or a blast-organ. This will be apparent upon following the action through in the same manner as above, only assuming rarefication of air instead of compression in the wind-chest. The primary pneumatic, being without communication through either the duct G^2 or the duct G^3 with the atmosphere, will be exhausted through its aperature g—that is, it will have both interiorly and exteriorly wind-chest tension only and in position to hold the valve E indifferently against the seats a^{21} and a^{22}—

but the tendency of the air to rush through the port A^2 immediately tends to seat the valve on the seat a^{21}, and being once seated it is held firmly on its seat by the excess of atmospheric pressure over wind-chest tension, and the atmosphere is admitted through the duct g^2 to the interior of the motor-pneumatic D, causing it to be expanded, because it is exteriorly as to its bellows sides exposed only to the wind-chest tension, which is below atmospheric pressure, and such expansion immediately seats the valve D′ and holds it seated, closing the mouth of the throat B′. Immediately upon the venting of the primary pneumatic by opening either of the ducts G^2 and G^3, the atmosphere being admitted and operating within against wind-chest tension, which is acting against the outside of the primary pneumatic, causes the pneumatic to be expanded at a^{22}, cutting off atmospheric communication with the interior motor-pneumatic and opening communication with the wind-chest instead, from which there results an escape of air from the motor-pneumatic and its collapse, which withdraws its moving wall (the valve D′) from the mouth of the throat B′ and permits the reeds whose mutes are open to be sounded by the air entering. It will be understood, of course, that the position of the reeds would have to be reversed, but with this change only. The same pneumatic action is adapted to either an exhaust-organ or a blast-organ, and this result is due to the fact that the motor-pneumatic and the valve which it operates are both within the wind-chest and that the valve controlled by the primary pneumatic and which controls the motor-pneumatic is constructed and arranged so that when the primary pneumatic is collapsed said valve is seated in position to cut off communication between the motor-pneumatic and the wind-chest and open communication between said pneumatic and the outer air, and when the primary pneumatic is expanded the valve is reversed and reverses the air connections of the motor-pneumatic. It will be noticed that in case of a blast-organ the primary pneumatic is collapsed when it is vented, and in the case of an exhaust-organ the primary pneumatic is collapsed when its communication with the atmosphere is closed, and that whereas in the case of the blast-organ the primary pneumatic and motor-pneumatic are in the same condition—either both collapsed or both expanded at the same time—in the case of an exhaust-organ the primary pneumatic is expanded when the motor-pneumatic is collapsed, and vice versa; but notwithstanding these differences it is essential, in order that the structure shall operate with the same effect for both exhaust and blast organs, that the collapse of the primary pneumatic shall produce communication of the motor-pneumatic with the atmosphere and that its expansion shall produce communication with the wind-chest.

In order to permit accurate adjustment of the motor-pneumatic with respect to the wall of the wind-chest on which the reed-blocks are mounted, so that the valve D′ may seat precisely as desired, the lower end of the diaphragm D^2 is secured by studs projecting from the fixed wall of the wind-chest inwardly and taking through the lower margin of the diaphragm, which is checked between nuts D^{21} D^{21} on the inner threaded end of the studs.

In order to provide means for delicately graduating the tone of such sets of reeds as may require such provision, I provide over the mutes pertaining to such sets a muffle hood or box M, which is normally seated in the position shown in full line in Fig. 1 and at that position permits the mute to be opened sufficiently to allow the reeds to speak, but represses or muffles the tone, because it has only a small mouth or slot M′ through which the sound can escape. When, however, it is desired to have the reeds of this set yield a fuller tone, the mute-stop will be operated to open the mute more widely, and when thus opened—as, for example, to the position shown in dotted line in Fig. 1—the mute encounters a projection or shoulder M^2, which protrudes inwardly from the hood in the path of the opening mute, and the opening movement of the latter lifts and opens the hood, giving, in addition to the slot M′, a further aperture at the other side of the hood for the escape of the sound. The mute-stop may be constructed to rest at any point between the position at which it opens the mute only sufficiently to allow the reeds to speak and a point at which, in addition, it opens the hood to its widest extent, and thus any desired number of gradations of the volume of tone may be produced. Such a muffle or hood is designed to be in addition to the general swell R, which may be arranged as illustrated, hooding and muffling the entire number of sets of reeds on the reed-block. Such swell may be operated, as usual, by a stop, and the muffle-hood may be operated, as described, through all the gradations while the swell is closed, producing one set of tones, and it may also be operated through all the gradations while the swell is open, thus giving an additional set of effects. I have shown the muffle M applied only to one set of reeds; but it may be understood that this is merely an illustration, and its applicability is not limited to a single selected set; but the same expedient may be employed in as many sets as desired.

I claim—

1. In a pneumatic organ, in combination with the wind-chest, reed-blocks mounted thereon having a throat communicating therewith, reed-cells through which said throat leads, and mutes for closing the exterior openings of the cells; the motor-pneumatic within the wind-chest having its moving wall operating as a valve to close said mouth and exposed therethrough to atmospheric pressure operating exteriorly upon it over substantially

the same area as that which is exposed interiorly.

2. In a reed-organ, in combination with the reed-cells and the valves which control them located within the wind-chest; mutes located outside the wind-chest; muffle-hoods applied to individual mutes and the sets of reeds which said mutes control respectively; and a swell box or hood applied to a plurality of mutes and their respective sets of reeds.

3. In a reed-organ, in combination with reed-cells having valves interior to the wind-chest and the mutes exterior thereto; a muffle-hood applied to any mute and the set of reeds which it controls, such hood being independent of the initial opening movement of the mute, and being engaged and opened by the mute in the latter part of said opening movement.

In testimony whereof I have hereunto set my hand, at Chicago, Illinois, this 23d day of June, 1899.

MELVILLE CLARK.

In presence of—
CHAS. S. BURTON,
JEAN ELLIOTT.