No. 632,698. Patented Sept. 12, 1899.

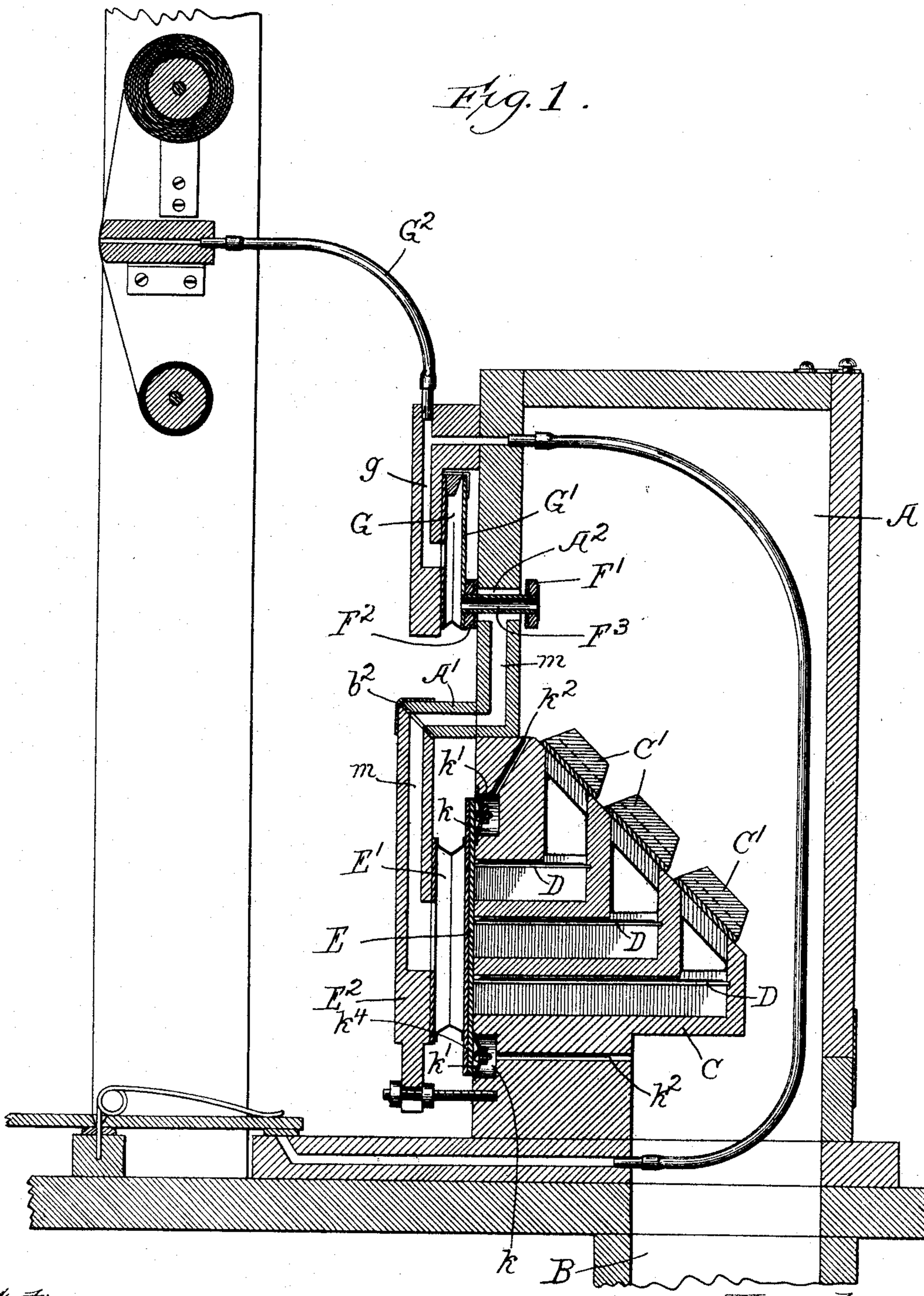
# M. CLARK.

## PNEUMATICALLY OPERATED ORGAN.

(Application filed May 23, 1898.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.




Witnesses:
Edward T. Wray.
Harry R. White

Inventor:
Melville Clark
By Burton and Burton
his attys

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Fig. 2.

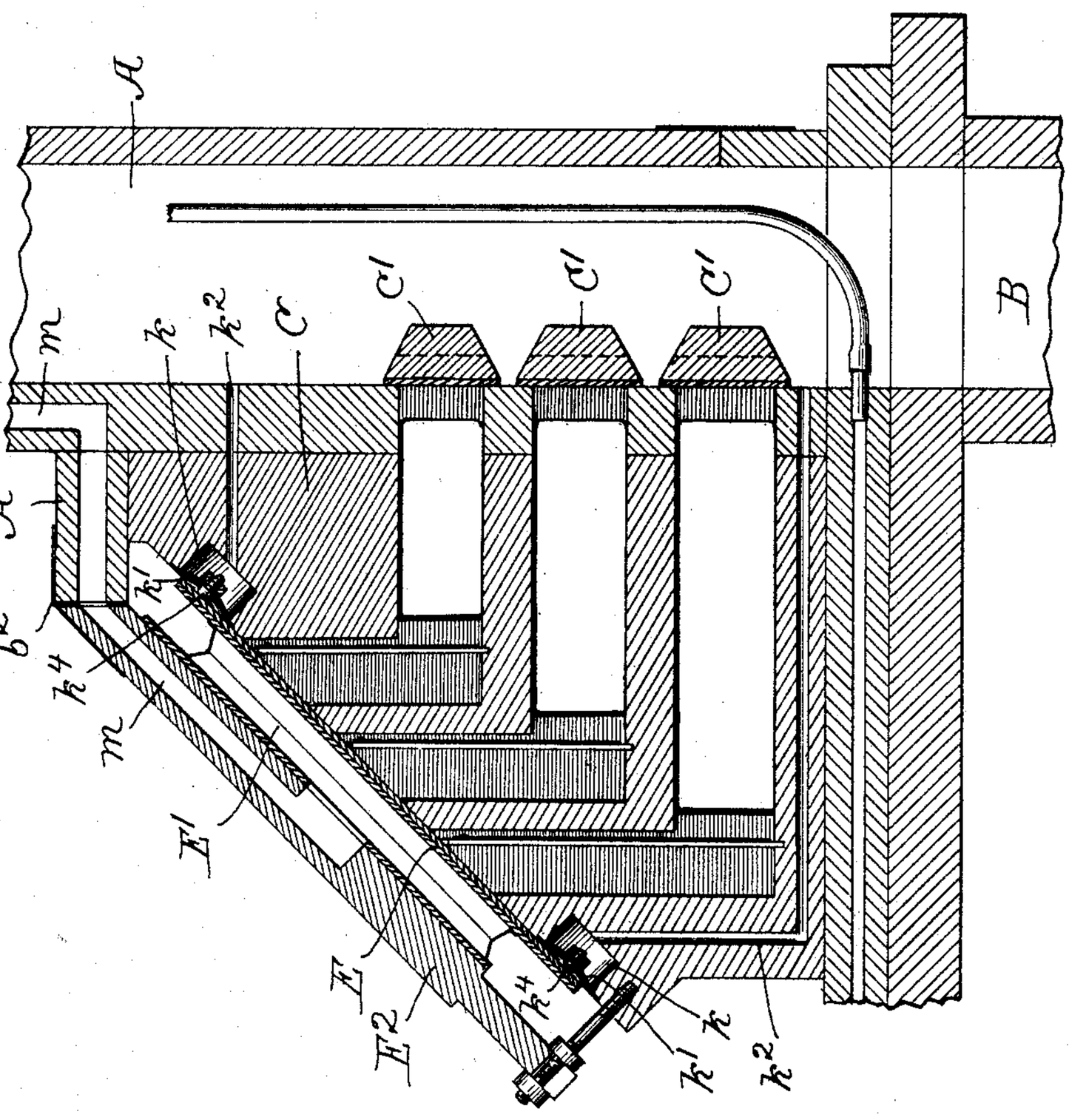


Fig. 6.

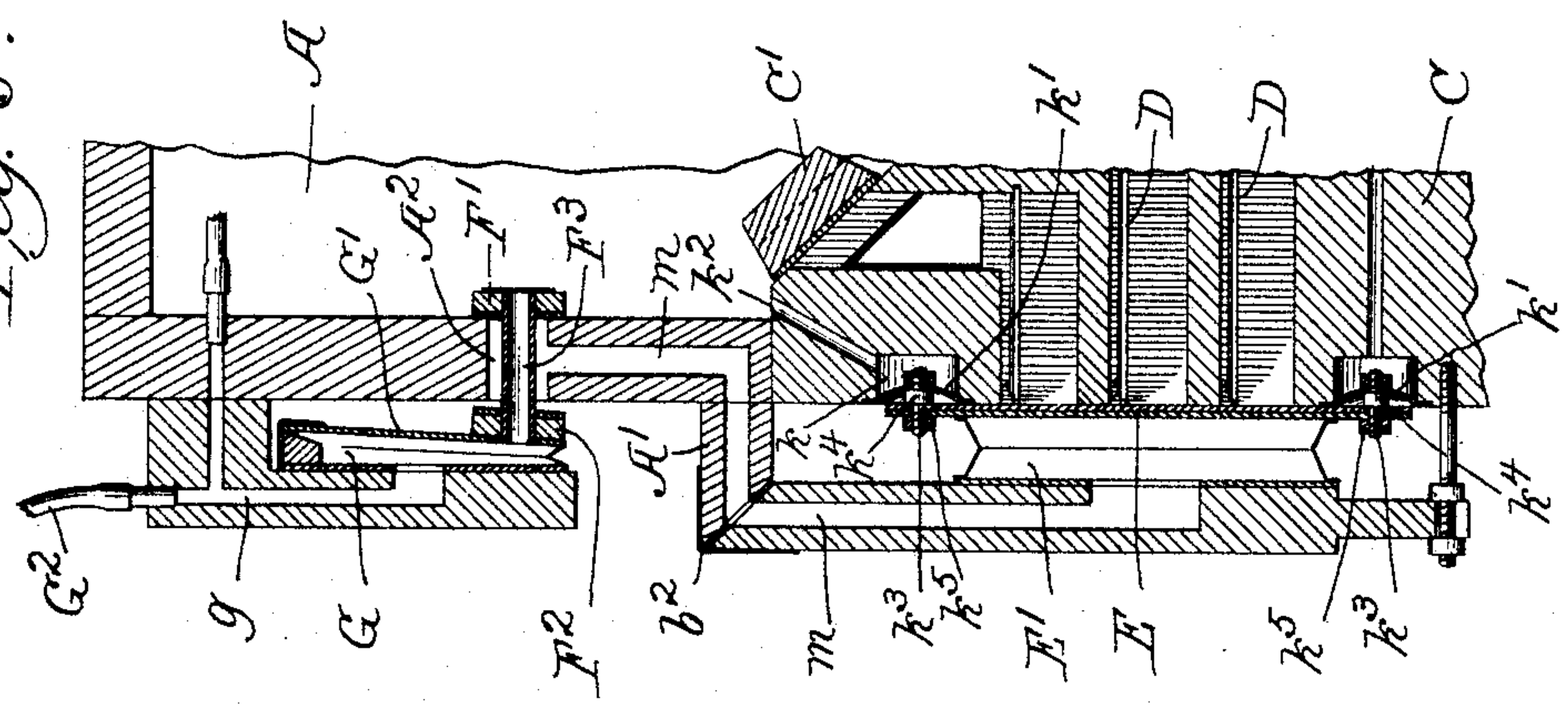


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Fig. 3.

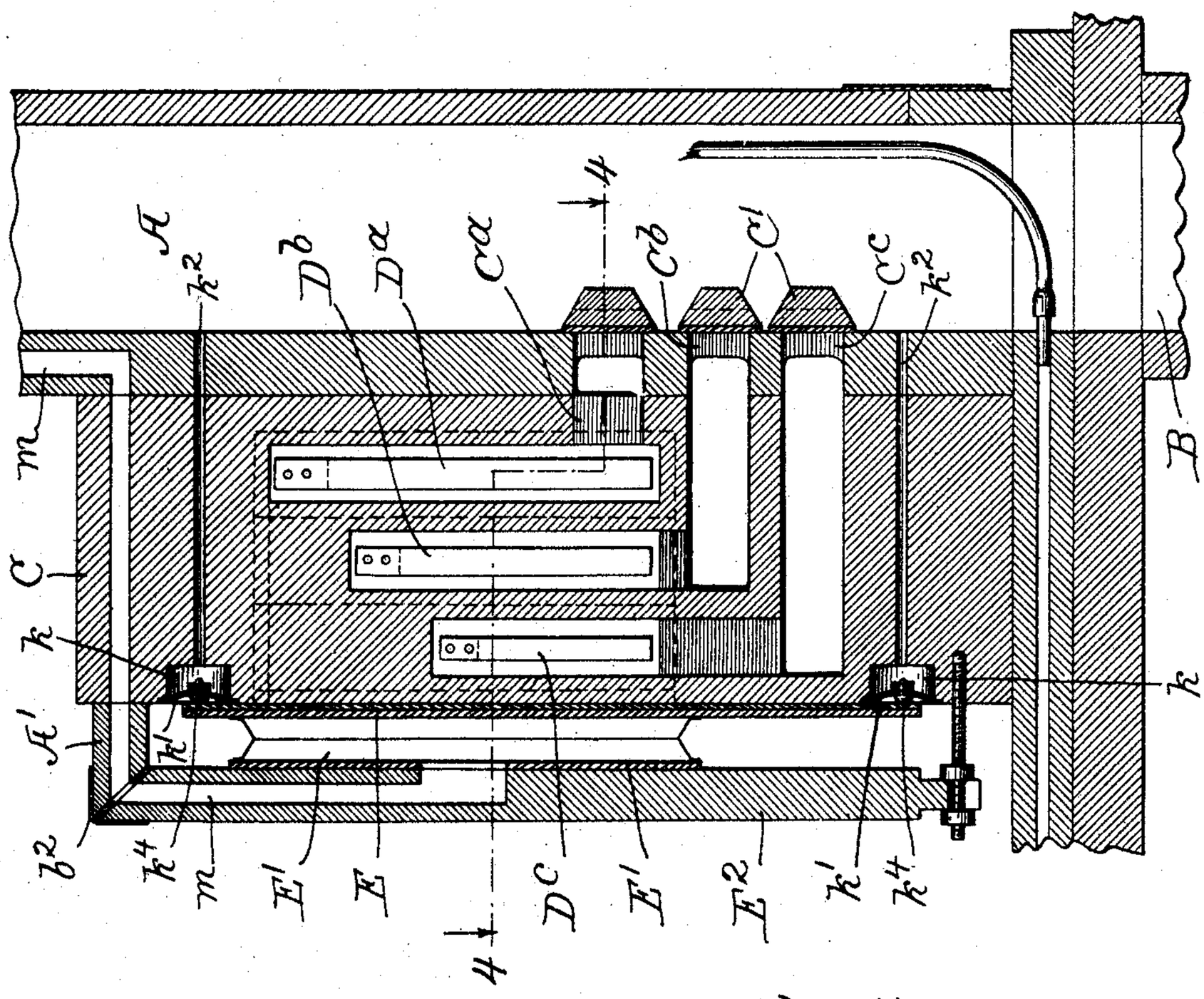



Fig. 5.

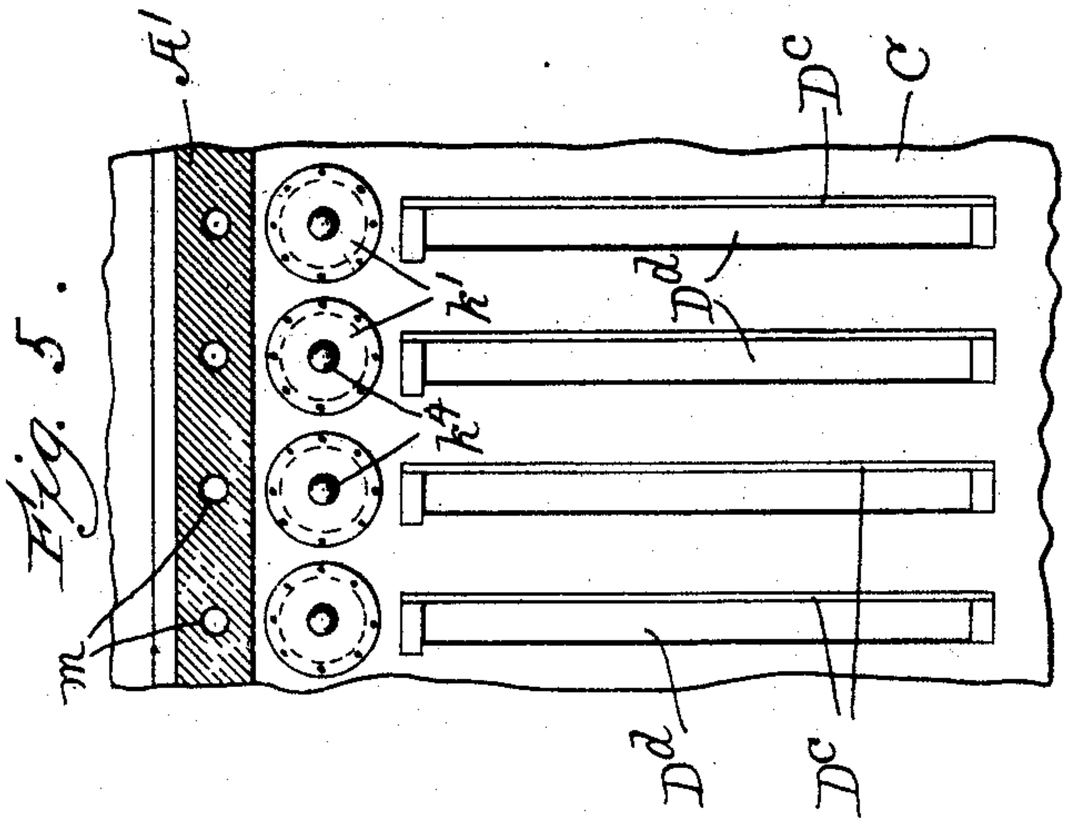
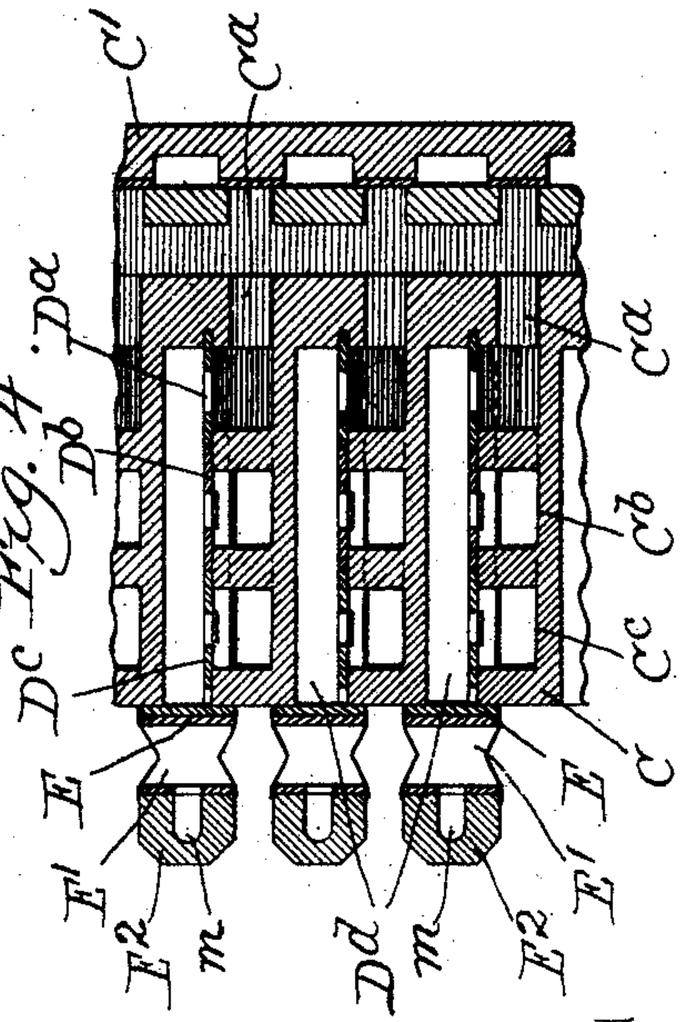



Fig. 4.

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# UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

## PNEUMATICALLY-OPERATED ORGAN.

SPECIFICATION forming part of Letters Patent No. 632,698, dated September 12, 1899.

Application filed May 23, 1898. Serial No. 681,465. (No model.)

*To all whom it may concern:*

Be it known that I, MELVILLE CLARK, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pneumatically-Operated Organs, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

The purpose of this invention is to provide a pneumatic action for an organ whose reeds are vibrated by a blast of air issuing from a pressure-bellows. It is well known that much greater volume of tone can be obtained from reeds through which the air is forced so that it is under some degree of compression when it passes the reed than can be obtained from the same reed by the same amount of power used in operating a bellows when that power is so applied as to produce a partial vacuum and draw the air in past the reed. Two reasons for this are obvious—first, that in the common exhaust-organ the air which is put in vibration by the reed is less dense than atmospheric air, and, second, that it is entering instead of issuing from the instrument and so tends to carry the sound inward rather than outward to the ear, whereas in a blast-organ both these conditions are reversed, the air in which the vibration is originated being under compression is much more dense than atmospheric air and is also an outcoming current and tends to carry the sound outward. Notwithstanding these known points of superiority of blast instruments over exhaust instruments, the latter have almost entirely superseded the former in use because of the great difficulty in obtaining expression from the blast instrument, the tone being generally rank and strident to an unpleasant degree and great difficulty being experienced in modulating or softening it. The difficulty in modulating or obtaining expression from reeds operated by a blast has been found a most serious obstacle in the way of applying pneumatic-operating devices to such instruments, and hitherto, as far as I am aware, blast-organs pneumatically operated have been almost wholly wanting in capacity of expression and have been only suitable for outdoor use. I have overcome these difficulties and produced a blast-organ pneumatically operated which while retaining the advantages of a blast instrument—namely, volume of tone and promptness of response—has also capability of the most delicate expression, because it is adapted to be operated with the lightest pressure of the bellows which is adequate to make the smallest reed speak with the softest tone; and this invention consists of the features of construction by which these results are accomplished.

In the drawings, Figure 1 is a fore and aft vertical section through the wind-chest and block of reeds and pneumatic-operating devices of an organ embodying my invention. Fig. 2 is a similar section of a modified form in which one feature shown in Fig. 1 is sacrificed for the purpose of locating the reeds in vertical position without complicating the structure. Fig. 3 is a similar view of a structure in which the reeds are vertical, as in Fig. 2, and in which both the leading features of my invention are retained. Fig. 4 is a section at line 4 4 on Fig. 3. Fig. 5 is a detail elevation of the face of the reed-block or valve-seat over the reed-chambers. Fig. 6 is a detail vertical section of a block of reeds and pneumatics pertaining thereto in an exhaust-organ, having certain features of my invention which are applicable to such organs.

A is the wind-chest, which is supplied by a compression-bellows through throat B, so that the air in the wind-chest is maintained under compression.

C is a reed-block—that is, a block containing a plurality of reed-chambers all opening into the wind-chest and controlled at that end by mutes C′ C′, &c., and all opening at the outer end through the vertical face of the block on which the reed-valve seats.

D D D are the reeds in the reed-block.

The reed-valve E is the moving wall of a motor-pneumatic or bellows E′, whose fixed wall $E^2$ is hinged at $b^2$ to a rib A′ on the vertical wall of the wind-chest. In the wall of the wind-chest and in said rib and in the fixed wall of the pneumatic E′ there is formed a duct *m*, which leads to an aperture $A^2$, which penetrates the wall of the wind-chest and is controlled at inner and outer ends by the valves F′ $F^2$ on the tubular stem $F^3$, which

is attached to the fluctuating wall G′ of the primary pneumatic G, into whose cavity the tubular stem $F^3$ leads, said primary pneumatic communicating through its fixed wall, in which a duct *g* is formed, with a tube $G^2$, leading to the tracker-range, over which a perforated music-sheet may operate in the well-understood manner. The structure of the primary pneumatic and the valves F′ and $F^2$, with their tubular stem, and the arrangement of the motor-pneumatic E′, having its fixed wall provided with a duct, which affords communication from the port $A^2$ to the motor-pneumatic, is substantially identical with that which is shown in my former patents, and particularly in Patent No. 603,127, dated April 26, 1898. The valve E, constituting the fluctuating wall of the motor-pneumatic E′, extends beyond the mouths of the reed-chambers in the valve-seat and rests upon pneumatic cushions or springs K K. These pneumatic cushions or springs are formed by countersinking chambers *k k* in the face of the reed-block and covering them with flexible diaphragms *k′ k′* and extending from said countersunk chambers ducts $k^2$ $k^2$ into the wind-chest.

The operation of this structure is that when the duct leading from the primary pneumatic is closed (by the music-sheet at the tracker-range) the primary pneumatic being inflated by the compressed air from the wind-chest entering through the tubular stem $F^3$ seats the valve $F^2$ on the outside of the wind-chest, leaving the inner end of the port $A^2$ uncovered and admitting compressed air through the duct *m* in the wall of the wind-chest and the fixed wall of the motor-pneumatic to the cavity of the latter, causing said motor-pneumatic to be inflated and the valve E to be seated. When the primary pneumatic is vented, as by the uncovering of the mouth of its vent-duct at the tracker-range, the primary pneumatic is collapsed by the action of the compressed air in the wind-chest upon the valve F′, forcing it onto its seat and unseating the valve $F^2$, thereby relieving the motor-pneumatic from tension. The valve E, constituting the fluctuating wall of the motor-pneumatic, being vertical is normally at its seat over the mouths of the reed-chambers without pressure thereon whenever it is entirely free from any influence proceeding from the wind-chest, such as compressed air in the motor-pneumatic or air which may issue through the reeds against its inner face. It is therefore adapted to be seated by minimum pressure admitted to the motor-pneumatic or to be unseated by minimum pressure of air issuing through the reeds. Independently, therefore, of the pneumatic springs or cushions it will be seen that when the primary pneumatic is vented if any one or more of the mutes C′ is off its seat, so that compressed air from the wind-chest can issue through one or more of the reeds, such air will move the valve E from its seat and allow the reed through which the air thus issues to speak. Since, however, the inertia of the valve might delay the action, especially in case the open mute were one controlling a very light reed, the addition of the pneumatic-cushions *k′ k′* is desirable, these cushions being always exposed to the tension of the wind-chest whatever that may be, whether slight or great, tending to protrude against the inner face of the valve and lift it from its seat; but the area of the diaphragms on these cushions being much less than the inner area of the motor-pneumatic and the latter being exposed to the same degree of pressure the cushions will not prevent the valve from seating whenever the motor-pneumatic is inflated; but when the motor-pneumatic is vented the cushions, being not vented, immediately operate as springs to carry the valve E from its seat, thus assisting the action which the air issuing through the reeds tends to cause. The result is very prompt action both in commencing and terminating the tone.

The vertical position of the reed-valve is not an obligatory or absolutely essential means to the result sought, because the pneumatic-cushions constitute a means for moving the valve from its seat instantly whenever the motor-pneumatic is vented, and they may be made of such area as to open the valve under the lightest pressure in the wind-chest, which is adequate to make the lightest reed speak with the lightest tone; for, experiment being made with the lightest reed in an instrument and the degree of tension in the bellows which is necessary to make it speak being ascertained, the pneumatic-cushions *k′*, operating on the valve which controls such lightest reed, will be given such an area as to adapt them to lift the valve when the tension of air in the wind-chest is at this minimum. I have therefore shown in Fig. 2 a construction which I find entirely satisfactory in the respects indicated, although in this form the valve E closes on an inclined seat and therefore does not necessarily stand normally at its seat without any pressure thereon when free from influence of the wind-chest. Even in this construction, however, the valve may meet this condition, because the slight contractile tendency of the bellows sides of the motor-pneumatic tends to support the weight of the valve, and it may thereby be adapted to rest upon its seat without pressure until the motor-pneumatic is slightly inflated. The advantage of the form shown in Fig. 2 is that it permits the reeds to be located vertically, which is much more favorable to their proper vibration and to steadiness of tone, especially in the case of long or heavy reeds.

In Fig. 3 I have shown a structure in which the reeds are vertical and the valve also vertical. In this form the reeds instead of being located facewise one in front of another or one above another are located edgewise

one in front of another, and the throat or air-passages from the wind-chest lead to one side of the reeds, respectively, at the lower end, the reeds at the other side facing a common chamber or throat which is controlled by the valve. The detail structure may be understood from Figs. 3, 4, and 5, wherein the several air-passages are indicated, respectively, by the letters $C^a$, $C^b$, and $C^c$, leading to the reeds $D^a$ $D^b$ $D^c$, respectively. The passage $C^a$ leads directly from the wind-chest to the right-hand side of the reed $D^a$, where it opens laterally against the reed. The passage $C^b$ extends in below the passage $C^a$ and turns upwardly in front of the forward end of the passage $C^a$ alongside of the reed $D^b$, to which it opens laterally. The passage $C^c$ extends below the passage $C^b$ and turns upwardly in front of the forward end of the latter, and at the same level at which the other passages open to their reeds it opens laterally to the reed $D^c$. In this construction all the reed-plates are preferably made of the same length, inserted edgewise one after another in the same grooves $D^d$ at the upper and lower ends and can be withdrawn edgewise laterally when the valve is off its seat and the motor-pneumatic swung about its hinge, which is provided for that purpose.

The device, consisting of the pneumatic $k'$ in communication with the air of the wind-chest and adapted to act yieldingly upon the reed-valve, may be applied with advantage in an exhaust or suction organ for the purpose of returning the valve promptly to its seat, from which it is withdrawn by the exhaust action of the wind-chest when the motor-pneumatic is in communication with the latter. In Fig. 6 I have shown a slight modification in which the lesser pneumatics $k'$ are connectèd to the valve E so that they operate in this manner, the connection being disengageable in order that they may not interfere with swinging the valve up out of the way to get access to the reeds.

It will be observed that the structure of the entire pneumatic action, including both primary and motor pneumatic, is the same in exhaust as in a blast organ, but the position of the valves $F'$ $F^2$ is reversed at a corresponding stage of the action, all the figures being made to show the position of the parts when the wind-chest is subject to the action of the bellows—that is, with the air either rarified or compressed, according to whether the organ is of one type or the other, and the reed-valve seated, as when the instrument is silent, no key being operated or tracker-range port uncovered.

A convenient method of attaching the lesser pneumatics $k'$ disengageably to the valve E is shown in Fig. 6, a small stem $k^3$ being attached to the button $k^4$, which is preferably in either form of instrument attached to the center of the diaphragm to take the wear of contact, such stem being threaded and extended through the projecting end of the valve E and provided with a removable nut $k^5$ outside the valve.

I do not limit myself to any particular form of pneumatic-cushion or lesser pneumatic, and instead of the mere flexible diaphragm K′ which I have shown for that purpose any convenient form of flexible and collapsible device communicating with the wind-chest may be substituted without departing from my invention.

I claim—

1. In a wind instrument, in combination with the wind-chest which operates the sounding devices; such sounding devices and valves which control the access thereto of air from the wind-chest; motor-pneumatics which are caused to act by communication with a source of air whose tension corresponds to that of said wind-chest, and which operate said valves; lesser pneumatics which communicate with the wind-chest and act upon said valves in opposition to said action of the motor-pneumatics.

2. In a wind instrument, in combination with the wind-chest, the sounding devices and the valves which control the air by which they are sounded; motor-pneumatics which communicate with the wind-chest and operate said valves, and lesser pneumatics which communicate with the wind-chest and act upon said valves in opposition to the action of the motor-pneumatic which is induced by their communication with the wind-chest.

3. In a reed-organ in which a plurality of reed-cells are controlled by one valve; the wind-chest; such reed-cells and valve, and a motor-pneumatic which operates the valve; and, in combination therewith, and in distinction from such motor-pneumatic, a lesser pneumatic which communicates with the wind-chest and acts upon the reed-valve in the same direction as said valve is acted upon by the air-tension of the wind-chest through the reed-cells; as and for the purpose set forth.

4. In a reed-organ, in combination with the wind-chest, the reed-blocks having a plurality of reed-cells controlled by one valve; such valve and a motor-pneumatic which communicates with the wind-chest and operates the valve; and a lesser pneumatic communicating with the wind-chest and arranged to act upon the reed-valve in the same direction as the air-tension of the wind-chest operating through the reed-cells acts upon said valve, and in opposition to the action of the motor-pneumatic when in communication with the wind-chest.

5. In a blast-organ, in combination with the compressed-air wind-chest, the reed-chambers communicating therewith; and valves which control them at their outer ends; suitably-controlled motor-pneumatics which communicate with the wind-chest and operate

said valves, and lesser pneumatics or pneumatic cushions or springs communicating with the wind-chest and adapted to be inflated therefrom and arranged when inflated to act upon the reed-valves with a tendency to unseat the same to permit the reeds to speak.

In testimony whereof I have hereunto set my hand, this 19th day of May, 1898, at Chicago, Illinois.

MELVILLE CLARK.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.