(No Model.) 2 Sheets—Sheet 1.

M. CLARK.

ORGAN.

No. 472,032. Patented Apr. 5, 1892.

Fig. 1.

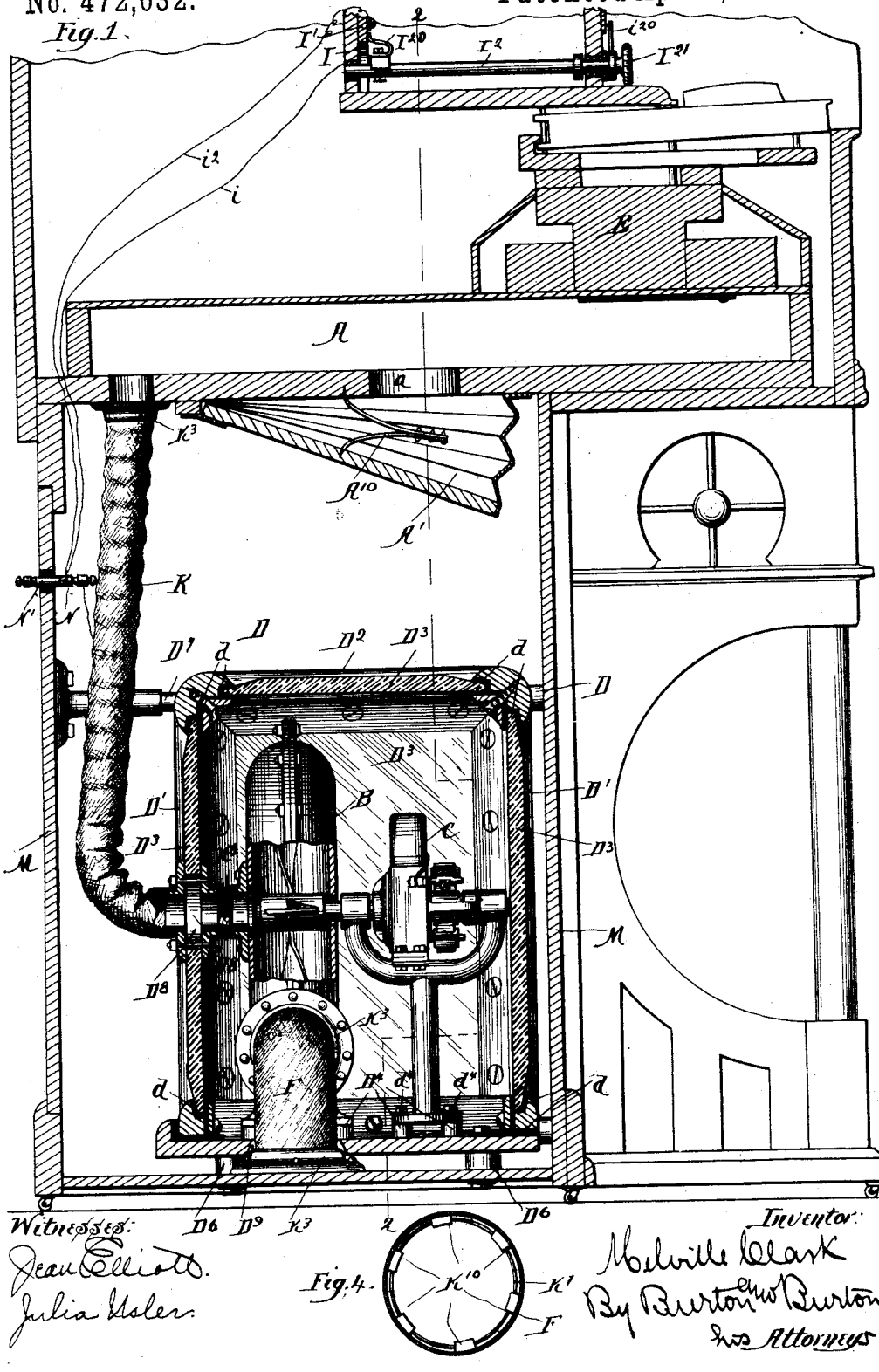

Fig. 4.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

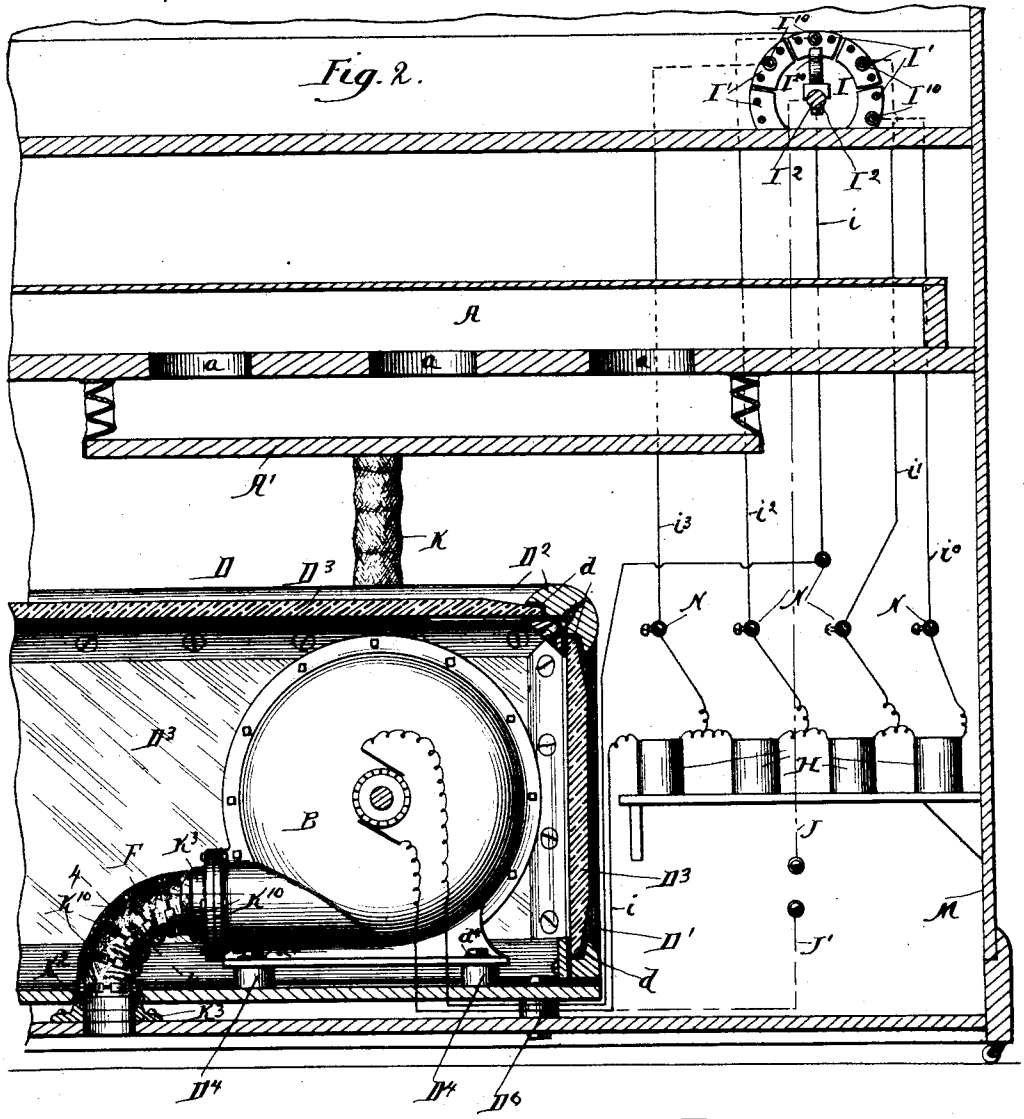
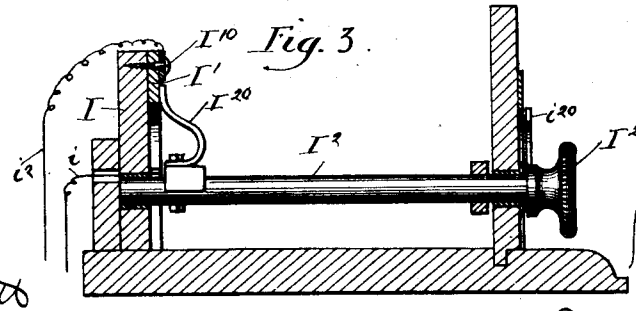


Fig. 3.



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UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

ORGAN.

SPECIFICATION forming part of Letters Patent No. 472,032, dated April 5, 1892.

Application filed March 9, 1891. Serial No. 384,279. (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 Organs, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention relates to the application of an exhaust-fan to an organ as a means of exhausting the air from the vacuum-chamber in lieu of the customary exhaust-bellows.

It relates, also, to the use of an electric motor to operate such exhaust-fan and to the construction of the organ-action, which consists in providing it with a stop to regulate the action of such electric motor, and thereby of the exhaust-fan, according to the use required.

In the drawings, Figure 1 is a vertical sectional side elevation, section being made from front to rear through the vacuum-chamber and the lower portion of the cabinet containing the exhaust-fan and motor. Fig. 2 is a longitudinal vertical section at 2 2 on Fig. 1, showing, however, no part of the motor except the commutator and brushes and the shaft. Fig. 3 is a detail sectional side elevation of the motor-controlling stop, section being made through its bearings. Fig. 4 is a section at the line 4 4 on Fig. 3, showing the electric circuit and battery in diagram.

The action of a rotary fan to operate an organ is radically different from that of the ordinary exhaust-bellows chiefly in that the latter is positive, (provided the valves are tight,) while the former is merely potential and becomes actual only as the use of the instrument gives occasion—that is to say, when the ordinary exhaust-bellows is operated the air is rarefied in the vacuum-chamber positively and definitely an amount dependent upon the relative capacity of the vacuum-chamber and the capacity of any action given to the bellows, a certain amount of air being drawn out from the vacuum-chamber at each actuation of the bellows to a certain extent. The power with which the air is drawn through the reeds when the keys are operated, being dependent strictly upon the degree of vacuum existing in the vacuum-chamber, will therefore depend upon the extent to which the bellows has been operated to exhaust the air before depressing the keys, and the intensity of tone developed from any given reed will be largely affected by the number of keys operated at once, because the power will be distributed among all that are operated simultaneously. When the exhaust device is a rotary fan instead of a positively-acting pump or bellows, this is not the case. On the contrary, if such fan be operated in or in communication with the vacuum-chamber while no keys are depressed and while consequently, except for leakage, there is no access of air into the vacuum-chamber past the reeds or from any other source the fan will be able to discharge practically no air, however rapidly it is operated. It is true a certain degree of tension will be produced, because a little air can be withdrawn by the fan in such motion; but after the tension reaches a certain degree dependent upon the speed of the fan the pressure of the exterior air will produce a practical equilibrium in the fan-chamber, so that the fan will simply revolve in a partial vacuum which its own motion produces and maintains, the air probably passing both in and out at the discharge-aperture and not passing through the fan—that is, not entering at the receiving and passing out at the discharge aperture to any important extent; but if now the vacuum or exhaust chamber be provided with an inlet for air an outgoing current will immediately be perceived at the discharge-mouth of the fan, and that current will increase in volume and intensity as the inlet-opening in the vacuum-chamber is enlarged until the air coming in through such opening is equal to the full capacity of the fan to discharge; and, further, I believe from my observation that the air will enter no more rapidly through a small inlet under the same action of the fan than through a large inlet, only the quantity varying with the size of the inlet. I judge this from the fact that when the fan is being operated most rapidly a given key being depressed, producing a tone of given intensity, if other keys are depressed the intensity of the tone of the first key is not thereby af-

fected, each note having, therefore, an intensity dependent upon the rate of action of the fan and independent or practically independent of the number of keys operated simultaneously with it.

A is the vacuum-chamber, bearing the usual relation to the action which is represented conventionally at E above said chamber.

A′ is a regulating-supplement to the vacuum-chamber.

B is the fan. C is the motor which actuates it.

D is a glass case in which the fan and motor are inclosed.

K is a non-vibratory pipe through which the air is exhausted by the fan from the vacuum-chamber.

F is a like non-vibratory pipe connected to the discharge-mouth of the fan to conduct the air-blast out through the organ-case.

H represents conventionally a galvanic or storage battery of several cells connected for intensity and in circuit with the motor and with the segmental switch-board I and with a stop, the operation of which will be hereinafter explained.

In the simplest form in which my invention may be operated it is not material where the fan is located nor how it is driven. It is essential only that from the intake of the fan a proper duct be provided connected with the exhaust or vacuum chamber of the organ; but I prefer to locate the fan within the cabinet-case M of the organ first because there is space sufficient for it in the position usually occupied by the exhaust-bellows and because it is thereby rendered more convenient and immediately accessible and its control is easier. Being located within the cabinet-case of the organ, it is almost essential that it should be operated by power which does not require mechanical connections extending outside of the organ-case, since such mechanical connections could not be operated without more or less noise, which could not be drowned or muffled effectively and would seriously interfere with the use of the instrument. For this purpose I prefer an electric motor requiring only the wires to connect the current to extend outside the case to a suitable battery also within the case, if desired, and I have so shown it in Fig. 2; but I do not consider it of special consequence to locate the battery in the case, because connection with the motor can be so readily made from an exterior battery by means of binding-posts fixed on the case. It is important, however, that the noise caused by the action of the motor and fan shall be completely muffled, and not only that, but that the vibration produced by the motion of the fan and motor should be absorbed and prevented from communicating vibration to the case. For the first purpose—that is, muffling the sound of the moving mechanism—I inclose both motor and fan in the case D, which I make of glass or with glass sides, partly for appearance and partly in order that the action of the mechanism may be at all times readily observed and because by making it thus of glass the necessity for opening it to observe it is obviated and the mechanism may thereby be kept entirely free from dust. This case D consists of frame-work of wood or metal, as preferred, made up of corner-posts and bars D' D' and D^2 D^2, interiorly rabbeted to receive the beveled glass panels D^3, the rabbets being first lined with rubber strips d, in which the glass panels are seated, the strips being then folded over the inner edge of the panel and the panel secured by molding-strips fastened to the frame-work on the inside, so that the glass nowhere comes into contact with the frame-work, but is guarded on both sides by the elastic strips of rubber in which it is seated. The standards for the fan and motor rest in like manner upon rubber blocks D^4 D^4, interposed between said standards and the bottom of the case, and the bolts which secure said standards are in like manner muffled by rubber washers d^4, interposed between the heads of said bolts and the base-flanges of the standards.

The entire glass case is supported within the organ-case without contact with the wood or other solid material of the case, rubber blocks D^6 D^6, serving as feet for said glass case, being interposed between the same and the bottom of the organ-cabinet. These feet are most conveniently made of heavy rubber tubing, whose aperture or bore is sufficient simply to admit a bolt through it from top to bottom, and under the heads of the bolts, which pass through the bottom of such case and through the legs into the bottom of the organ-case, rubber washers are placed, so that the bolts have no contact directly with the vibratory material of the bottom of the glass case.

To prevent a tremulous or vibratory motion of the glass case bodily by reason of the elasticity of its supports, buffers or lateral rubber stops D^7 D^7 may be secured to its upper corners and extended to the proximate inner sides of the organ-cabinet, thereby steadying it and staying it laterally. This glass case is entirely closed, except at one side, where it has an aperture D^8 for the exhaust pipe or duct K, leading from the vacuum-chamber of the organ, and at the bottom, where there is an opening D^9, through which the discharge-pipe F passes out. For the purpose of this pipe connection from the fan-case to the exhaust or vacuum chamber, as well as for every other pipe connection from the fan, I prefer to employ the structure shown, in which K is a tube made of thin sheet-rubber—such as is frequently employed in the manufacture of bellows—or of felt, within which are rings K' K', on which are mounted at intervals throughout their circumference several wood blocks K^{10} K^{10}. These rings are of such diameter that, with their blocks on them, as illustrated, they fit tightly within the tube, and the blocks

are provided for the purpose of affording convenient means for gluing to the tube, thereby retaining the rings in such position as desired therein. These rings are located at intervals in the length of the tube, their purpose being to define the area of the longitudinal collapse of the tube whenever it is used in such situation as to be collapsed and to prevent transverse collapse during the exhaustion of air from it by exterior pressure. For some purposes I prefer to make this tube of felt; but the rubber is preferable where the tube is to be collapsed frequently, being less liable to rupture in collapsing by reason of the repeated creasing or folding at the same points. The end of the tube is provided with a metal ferrule K^2 and a wooden marginal flange or fitting K^3, by which it is adapted to be secured to the wall of the case at one end and to the wall of the vacuum-chamber at the other, the rubber washer K^4 being interposed between it and said wall at such connection to prevent vibration, although the entire pipe itself, being of non-vibratory material, quite effectually absorbs any vibration which might be communicated. A short piece of similar pipe K^6 is similarly connected to the fan-case at one end and at the other end to the wall of the case D at the opening D^8. A similar pipe F leads from the discharge-mouth of the fan out through the bottom of the glass case, and thence through an opening in the bottom of the organ-cabinet, and said cabinet being supported a very short distance, not exceeding one inch, from the floor by suitable casters or other supports the air from the fan is discharged downwardly onto the floor, and thereby dispersed laterally and escapes all around the bottom edge of the organ.

The switch-board consists of a base I of insulating material, having mounted upon it in a circle metallic segments I′, each provided with a binding-screw I^{10}, while at the center of said insulating-base is journaled the metallic stop-rod I^2, carrying the metallic contact-finger I^{20}, which extends radially to a position where it may rest upon the metallic segments. I provide a metallic bearing or lining for the bearing of the rod I^2 in the base I, and from that metallic lining a wire i runs to the motor, and thence to one pole of the battery, and from one of the extreme binding-screws I^{10} wire i^0 runs to the opposite pole of the battery. From the connecting-wires between the successive cells I extend, respectively, the wires i' i^2 i^3 to the second, third, and fourth binding-screws I^{10}. The last segment I′, being unconnected, might for all purposes be either of insulating or conducting material, serving only as a block to hold up the point of the finger I^{10} to the level of the several metallic segments. The stop-rod I^2 extends from its bearing described forward through the organ-front and is provided with a stop-knob I^{21} in a convenient position to be operated, being, as illustrated, immediately over the keyboard at the right-hand end. It will be understood that by turning the stop-knob to set the finger I^{20} in contact with either the first, second, third, or fourth segments I′ the power of all four, three, two, or only one of the cells will be brought into the circuit and their power utilized to operate the motor, and the speed of the fan will thereby be regulated at the will of the operator. At the organ-front I provide a dial about the stop-knob and a suitable finger i^{20} on said knob, said dial having indicating points corresponding to the position of the finger I^{20} on the several segments I′ to guide the operator in setting said stop for the desired intensity of action. It will be understood that the number of cells and correspondingly the number of contact-segments and of index-points on the dial may be made greater or less, as desired. It will be obvious, also, that a similar method may be employed to regulate the force of current taken from an electric circuit by resistance-coils suitably arranged, so that one or more of them can be brought into the resistance-circuit in the same manner as the cells illustrated are brought into the motor-circuit by the operation of the stop over the switch-board, and the same result produced as when power is taken directly from galvanic or storage cells. By adding to Fig. 2 the broken lines J J′ to represent the entering and departing wires of an energized circuit and considering H H, &c., as resistance coils or cells said figure presents in diagram this alternative method.

The regulator A′ is generically a supplement to the vacuum-chamber, being a collapsing air-chamber, which communicates with the vacuum-chamber proper through the opening a in the bottom of the latter chamber. Within it are springs A^{10} A^{10}, tending to hold it distended and resisting its collapse when the fan is operated. Without any use of the manual or with the use of so few keys as to admit air to a less extent than the capacity of the fan to exhaust at the speed at which it is being driven a partial vacuum is produced in the vacuum-chamber, which will cause the regulator A′ to collapse under exterior atmospheric pressure. When the use of the manual is suddenly increased, requiring instantly an increased quantity of air, the regulator will expand under the action of the springs and will instantly draw such required increased quantity, and at the same time, according to the mode of action hereinabove stated, the fan will also draw air in an increased extent proportionate to the increased opening at the reeds produced by the increased use of the manual. This increase of movement of the air through the fan cannot occur so promptly as to prevent the diminution of intensity for an instant when a largely-increased number of keys is suddenly struck; but the regulator, under the action of its springs, is capable of responding practically

instantaneously, and it thereby prevents for even an appreciable instant the diminution of intensity of tone.

It will be understood that the fan may be used connected to the vacuum-chamber without being located within the organ-case and may be operated by other than an electric motor, or being operated by such motor or by an equivalent the inclosing case for such fan and motor may be dispensed with; but in each of these changes one or more features of subsidiary value in my invention would be omitted, while retaining other features, and in all these changes retaining one leading primary feature.

N N N N N are binding-posts for the connection of the wires from the battery and motor to corresponding wires which extend within the organ-case from the switch-board in any convenient course to reach said binding-posts in the portion of the organ-case where the case D is to be located when that construction is employed. N′ N′ N′ N′ N′ are similar binding-posts, to which the exterior wires from the battery may be extended when the battery and motor are located outside the organ-case. The same binding-posts will answer when power is derived from the line of circuit with resistance-coils.

I claim—

1. In a cabinet-organ, in combination with operating mechanism, a case other than and forming no part of the organ cabinet-case inclosing such mechanism to muffle the sound of its motion, substantially as set forth.

2. In a cabinet-organ, in combination with operating mechanism, a case inclosing such mechanism located within and independent of the organ cabinet-case to muffle the sound of such mechanism, substantially as set forth.

3. In a cabinet-organ, in combination with operating mechanism, a case other than and forming no part of the organ cabinet-case inclosing such operating mechanism to muffle the sound of its motion, such operating mechanism and muffling-case being located within the organ cabinet-case, and elastic supports and stays interposed between such muffling-case and the walls of the organ cabinet-case to cut off sonorous vibration, substantially as set forth.

4. In a cabinet-organ, in combination with mechanism which operates it, a case inclosing such mechanism other than and forming no part of the organ cabinet-case and having its sides seated in non-sonorous cushions interposed between said sides and the corner frame-work of said case, whereby the sonorous vibration of the mechanism-inclosing case is absorbed, substantially as set forth.

5. In combination with a vacuum-chamber of an organ, an exhaust-fan communicating with such chamber to exhaust the air therefrom, said chamber having a yielding supplement normally distended and communicating freely with it and exteriorly exposed to atmospheric pressure, whereby the tension of air in the vacuum-chamber is automatically regulated, substantially as set forth.

6. In a cabinet-organ, in combination with a vacuum-chamber, an exhaust-fan communicating with such chamber to exhaust the air therefrom, a motor which operates the fan, and a case other than and forming no part of the organ-case inclosing the fan and motor to muffle the sound of their motion, substantially as set forth.

7. In a cabinet-organ, in combination with a vacuum-chamber, an exhaust-fan communicating with such chamber to exhaust the air therefrom, a motor which operates such fan, such fan and motor being located within the organ cabinet-case, and a case inclosing such fan and motor within and independent of the organ cabinet-case to muffle the sound of their motion, substantially as set forth.

8. In a cabinet-organ, in combination with a vacuum-chamber and an exhaust-fan communicating with such chamber to exhaust air therefrom, a case inclosing such fan and chamber to muffle the sound of their motion, such fan-motor and muffling-case being located within the organ cabinet-case, and rubber supports and stays interposed between such muffling-case and the walls of the organ cabinet-case to cut off sonorous vibration, substantially as set forth.

9. In a cabinet-organ, in combination with the vacuum-chamber and an exhaust-fan communicating with such chamber to exhaust the air therefrom, a case inclosing such fan, such case having its sides seated in non-sonorous cushions interposed between said sides and the corner frame-work, whereby sonorous vibration of the case is absorbed, substantially as set forth.

10. In combination with a vacuum-chamber and an exhaust-fan communicating with such chamber to exhaust the air therefrom, such fan being located within the organ cabinet-case, a pipe of felt or other non-sonorous substance leading from the discharge-mouth of the fan to the exterior of the organ-case, substantially as set forth.

11. In combination with the vacuum-chamber and an exhaust-fan communicating with such chamber to exhaust the air therefrom, such fan being located within the organ cabinet-case, the duct from the discharge-mouth of the fan, leading down through the bottom of the organ cabinet-case, whereby the air-blast from the fan is dispersed horizontally at the floor under the organ, substantially as set forth.

12. In combination with the motor-standard, the fan-case rigid therewith, the motor-shaft having bearings in the motor-standard and extended into the fan-case, and the fan on said shaft within said case, substantially as set forth.

13. In a musical instrument, the longitudinally-collapsible duct K, composed of flexible

tube, combined with the rings K′, secured to its inner wall at short intervals in its length to resist transverse collapse and permit longitudinal collapse between consecutive rings, substantially as set forth.

14. In a musical instrument, the longitudinally-collapsible duct K, composed of flexible tube, combined with the wire rings K′, having on them the wooden blocks K^{10}, whereby they are secured to the inner wall of the tubing, substantially as set forth.

In testimony whereof I have hereunto set my hand, at Chicago, Illinois, this 28th day of February, 1891.

MELVILLE CLARK.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.