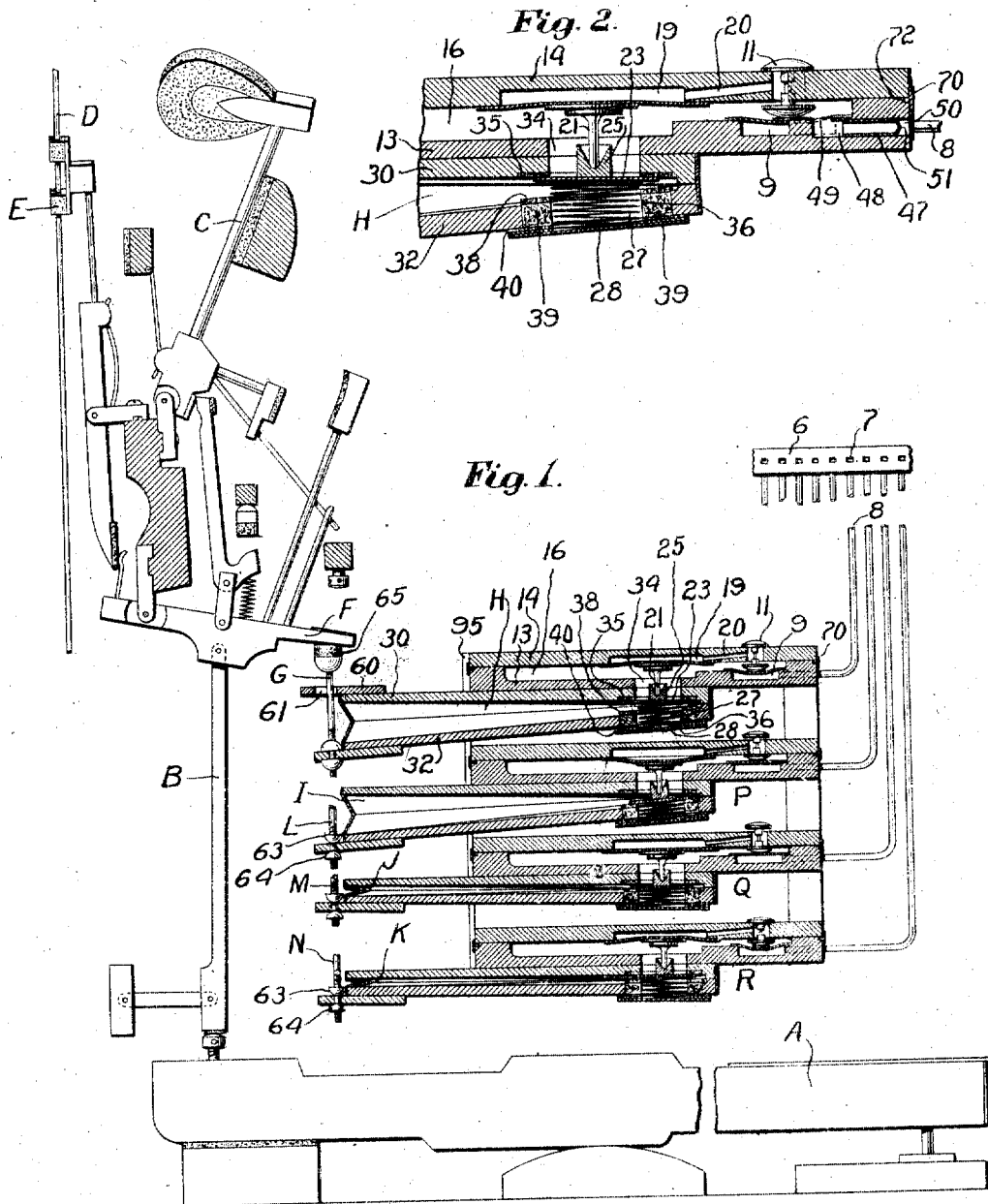


C. F. STODDARD.
MUSICAL INSTRUMENT.
APPLICATION FILED JAN. 9, 1909.

Patented Jan. 15, 1918.

2 SHEETS—SHEET 1.

1,253,744.



Witnesses:
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Robert H. Kammela.

Inventor:
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Attys.

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2 SHEETS—SHEET 2.

Fig. 3.

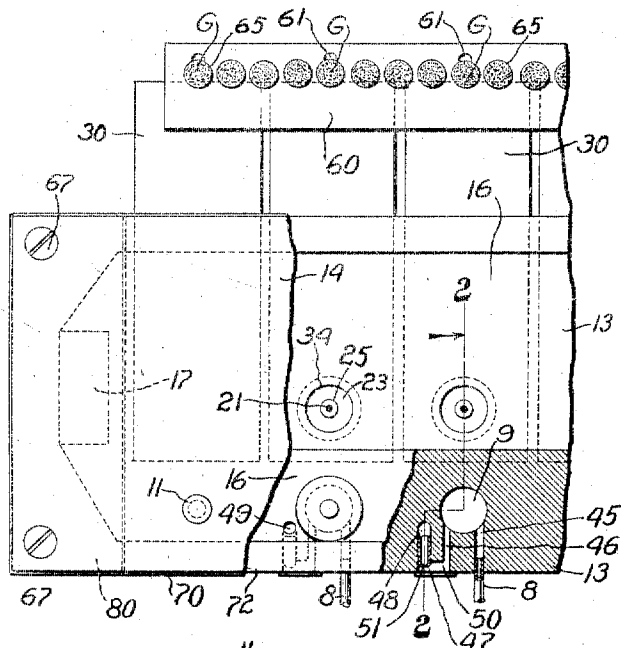


Fig. 4.

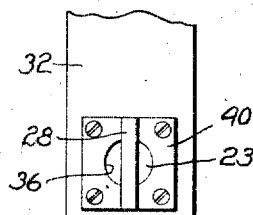


Fig. 5.

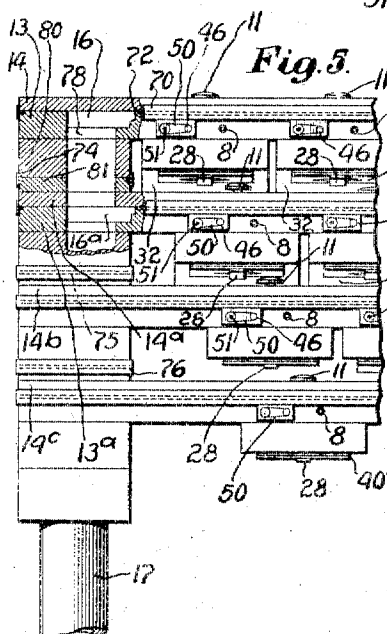
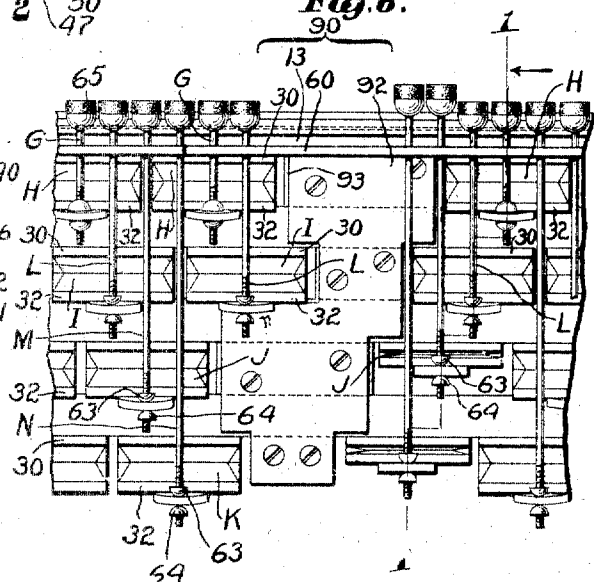


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES F. STODDARD, OF BOSTON, MASSACHUSETTS

MUSICAL INSTRUMENT.

1,253,744.

Specification of Letters Patent. Patented Jan. 15, 1918.

Application filed January 9, 1909. Serial No. 471,471.

To all whom it may concern:

Be it known that I, CHARLES F. STODDARD, a citizen of the United States, residing at Boston, in the county of Suffolk and Commonwealth of Massachusetts, have invented an Improvement in Musical Instruments, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts:

This invention relates to pneumatic musical instruments; and pertains more particularly to improvements in construction whereby the parts of such an instrument may be assembled in convenient compact form, and may be thoroughly responsive and efficient in operation. Certain features of the invention pertain also to structural improvements which contribute strength and stability to instruments of the character described.

The invention may be best understood by reference to a specific illustrative embodiment thereof shown, merely by way of exemplification, in the accompanying drawings.

In the drawings—

Figure 1 is a diagrammatic view of an action showing a series of motor-pneumatics in section on a line 1—1 of Fig. 6;

Fig. 2 is an enlarged detail of certain parts shown in Fig. 1; the plane of section is on the line 2—2 of Fig. 3;

Fig. 3 is a plan view of two motor-pneumatics partly in section on a line 3—3 of Fig. 1;

Fig. 4 is a detail bottom plan view of part of a motor-pneumatic valve mechanism hereinafter described;

Fig. 5 is a detail front elevation (viewed from the right in Fig. 1) of the tiers of motor-pneumatics; and,

Fig. 6 is a detail rear elevation of the tiers of motor-pneumatics viewed from the left in Fig. 1.

Referring now to Fig. 1—there is shown a key A which, when struck, elevates a sticker B, rocking a hammer C and causing the latter to strike a string D, at the same time withdrawing from the string a damper E.

Instead of being actuated through the key A, the hammer action may have applied to its wippen F a sticker G controlled by a

motor-pneumatic H. The specific motor-pneumatic H illustrated in Fig. 1 is normally (when its corresponding hammer is idle) open to atmosphere. When desired, the pneumatic H is closed to atmosphere and opened to the tension or suction in the wind-chest, which collapses the pneumatic H, and thereby elevates the sticker G, rocks the wippen F and operates the hammer action for striking the string D.

The construction of the motor-pneumatic H, as exemplifying certain features of this invention, is of importance.

It has been customary heretofore to associate with a motor-pneumatic a primary and a secondary valve for controlling, in one way or another, the operation of the pneumatic. So far as I am at present advised, such primary and secondary valves have been, at least in a large measure, structurally separate from the pneumatic itself, thereby necessitating a more or less bulky structure to accommodate the different separate parts. It is one of the objects of this invention, so to assemble a motor-pneumatic and its controlling valve mechanism, as to admit of an extremely compact arrangement. This object may be conveniently and practicably effected by the construction shown in Fig. 1.

For illustration, the pneumatic H is represented as being under the ultimate control of a tracker 6 cooperating with the usual perforated note sheet (not shown). The tracker 6 may have the usual vents, one for each note. A vent 7, for instance, may lead to a duct 8 which communicates with a diaphragm chamber 9 to which atmosphere is admitted whenever a perforation of the note sheet registers with the vent 7. Atmosphere in the chamber 9 distends its diaphragm and thereby elevates a duplex primary valve 11, the office of which will be described presently.

The board 13, in which the diaphragm chamber 9 may be formed, is so related to the opposed board 14, that there intervenes between them an exhaust chamber 16. Referring to Fig. 4, the exhaust chamber 16 is preferably in constant communication with a wind-trunk 17, which in turn communicates with the main wind-chest which may be exhausted in any practicable manner, as by any of the means already known

in the art. Thus, the working tension or exhaust for actuating the motor-pneumatics may be always available in the exhaust chamber 16.

5 Referring again to Fig. 1—there is provided, preferably by means of a recess in the top board 14, a diaphragm chamber 19, having a duct 20, which leads to a port controlled by the primary valve 11. Preferably
10 secured to the diaphragm of the chamber 19 (as by being cemented thereto) is a valve-governing device exemplified by a depending stem 21. In position to cooperate with the stem 21, but preferably not actually connected thereto, is a motor-pneumatic governing
15 valve 23. The valve 23 may cooperate with the stem 21, or its equivalent, through the agency of a block 25, which may be cupped or otherwise constructed partially to
20 embrace the end of the stem 21. It is preferred, at least with the specific arrangement shown, that the block 25 have a substantially frusto-conical recess to receive the stem 21, so that when said stem is moved toward the block 25, or vice versa, the two
25 will tend to center themselves and register automatically.

Coöperation between the stem 21, or its equivalent or substitute, and the valve 23,
30 may be contributed to effectively by providing some means to apply a yielding force to the opposite side of the valve 23 from the stem 21. For instance, a light coil spring 27 may be interposed between the face of the
35 valve 23 and a bridge 28, shown in Figs. 1, 2 and 4, as extending across, but not closing, the outlet port through the movable bellows board.

The motor-pneumatic H may have a stationary board 30 fixed to the under side of the board 13; and a movable board 32 hinged in any practicable manner to the stationary board 30.

A passage 34 may lead from the exhaust chamber 16 to the interior of the pneumatic H; and the passage 34 may be closed, as occasion requires, by means of the valve 23. The seat for the valve 23 preferably consists of an annulus 35 of felt, chamois, or the
50 like, for deadening the sound of impact of the valve 23 and to supply a tight closure in coöperation with the valve; and the annulus 35 preferably encircles the passage 34 and may be countersunk in the inner face of the stationary bellows board 30.
55

The movable bellows board 32 of the pneumatic H has a port 36 to atmosphere, and the same may be closed from within by the valve 23 by moving the latter to the position shown at P just below, in connection with the motor-pneumatic I. Preferably, in closing the passage 36, the valve 23 seats upon an annulus 38, similar to the annulus 35, which may be of felt, chamois or the
60 like.
65

Referring to Fig. 2—the annulus 38 may be secured to and backed by a support 39, of felt, pasteboard or other suitable material, which may in turn be supported by a plate 40, of metal if desired, which plate, 70 at its periphery, may overlie the outer face of the movable bellows board 32 around the port 36, and may be secured to said board, as by screws 41 shown in Fig. 4.

Preferably the annulus 38, support 39 and 75 plate 40, or their substitutes, are substantially unitary in construction so that by removing the screws 41 (Fig. 4) all of the parts are permitted to be withdrawn from position to give ready access to the interior 80 of the motor pneumatic. The aperture in the bellows board 32 to receive the annulus 38 and the other parts connected thereto, may be large enough to permit withdrawal of the valve 23 when the annulus and other 85 parts connected thereto have been removed as described. The bridge 28 or other means for supporting one end of the spring 27 may be formed integral with the plate 40 or may be secured thereto in any practicable manner.
90

It is preferred that all of the movable parts, as the stem 21 and valve 23, be of as light weight as practicable so that their inertia shall offer minimum resistance to 95 prompt response in operation. For instance the stem 21 may be made of a light wood. The block 25 may also be made of light wood; or else the block or its equivalent may be substantially integral with the valve 100 23, and the whole may be made of aluminum. If desired, the valve 23 may be made of card-board or aluminum and the block 25 may be cemented thereto.

Referring to Fig. 3—the diaphragm chamber 9 is there shown as communicating by a passage 45 with the duct 8 shown in Fig. 1. To exhaust the chamber 9 when the same has been closed to atmosphere a passage 46 leads therefrom to a bleeder vent 47, and the latter 110 communicates with an upwardly inclined duct 48 (see the lower part of Fig. 3) which enters the exhaust chamber 16 at 49. The bleeding vent 47 may be provided conveniently by a constricted opening in the end 115 of a thimble of metal or the like, as shown in Fig. 3; and this thimble may be mounted in the passage 48, as by threading into it. Preferably the passage 46 and bleeder vent 47 communicates with each other through an 120 intervening chamber 50, which extends to the outer face of the board 13, and is there provided with a transparent closure, such as a plate 51 of mica or glass. The plate 51 may be readily secured in place by cement. 125 When any stoppage occurs in apparatus of this sort, it is most likely to result from an obstruction of the bleeder vent; and the arrangement just described permits ready inspection of the bleeder vent 47 and also per- 130

mits the same to be cleaned when necessary by merely stripping off the transparent plate 51, after which it may be readily cemented in place. Also the thimble supplying the bleeder vent 47 may be readily withdrawn to be cleaned, repaired, or replaced by another.

The above described mechanism operates, for the purposes of the specific illustration, as follows. Atmosphere, admitted at the vent 7 in the tracker 6, traverses the duct 8 and distends the diaphragm of chamber 9, thereby lifting the duplex primary valve 11. This closes communication between the exhaust chamber 16 and the secondary diaphragm chamber 19; and also opens the chamber 19 to atmosphere through the duct 20 and past the disk of the primary valve 11. Atmosphere thus admitted to the chamber 19, distends the diaphragm thereof and depresses the stem 21, thereby forcing the valve 23 downwardly against the force of spring 27, and causing said valve to seat on the annulus 38 to close the ports 36. Thus, at least momentarily, the parts take the positions shown at P in Fig. 1. Depression of the valve 23 opens communication from the exhaust chamber 16 through the passage 34 to the interior of the motor pneumatic H, from which air is rapidly exhausted, causing the same to collapse, elevate its sticker G and sound its corresponding note. Thus the parts assume the positions shown at Q in Fig. 1.

If the vent 7 continue open, the parts will remain in the positions shown at Q, communication between the interior of the motor pneumatic and the exhaust chamber 16 being maintained so that the corresponding action is held in active position. When, however, the vent 7 is closed, atmosphere is exhausted from the diaphragm chamber 9 through the bleeding vent 47, and permits the valve 11 to assume the position shown at R.

When the diaphragm of chamber 9 collapses (see R Fig. 1) and the valve 11 descends, communication is reopened between the secondary diaphragm chamber 19 and the exhaust chamber 16, thereby balancing pressures on opposite sides of the secondary diaphragm and permitting the valve 23 to assume the position shown at R. This may be assisted by the spring 27 contributing to thrust the valve 23 upwardly against its seat 35. This shuts off exhaust from the interior of the motor pneumatic and opens the same to atmosphere through the port 36, and thereupon permits the parts to resume the positions shown at the top of Fig. 1 in connection with the motor pneumatic H.

Regarding the spring 27, it should be said that the same is not indispensable, for this reason: When the parts are in the position shown at Q (Fig. 1) atmospheric pressure

acts upon the lower face of the valve 23. This is opposed by atmosphere acting upon the greater area of the secondary diaphragm of chamber 19. Thus the downward pressure on said secondary diaphragm prevails and holds the valve 23 closed downwardly against upward pressure of atmosphere on the valve itself. When, however, atmosphere is exhausted from the diaphragm chamber 19, the upward pressure of atmosphere on the valve prevails; and the valve, even without the assistance of the spring 27, would be forced upward against its seat 35. While the spring 27 is thus not absolutely necessary, it is desirable in that it may serve to hold the valve in normal inactive position when the mechanism is idle, instead of permitting it to drop to its lower seat and requiring to be returned pneumatically when the operation of the mechanism begins.

In the described illustrative arrangement it will be noted that the plane of the valve 23 is at one time substantially perpendicular to the stem 21, and at another time (P, Fig. 1) may be at an angle to the stem 21. To accommodate these different angular relations of the stem and valve, the end of the stem may be rounded to cooperate with a correspondingly shaped recess on or connected to the valve; for instance, the recess in the block 25 may have a rounded bottom. With such an arrangement the valve may be entirely free from any improper restraint in its different movements and may be always maintained in proper centered relation to its seats and the stem 21.

As shown in Figs. 1 and 6, the motor pneumatics are arranged in four tiers, H, I, J and K. The individual pneumatics of different tiers may be in staggered relation permitting their respective stickers to lie in the same plane aligned across the width of the piano action. A guide rail 60 having apertures to receive and guide the stickers, may be mounted in any practicable situation, upon the stationary bellows boards of the top tier of pneumatics.

As illustrated in Fig. 1, each sticker G of the top tier is rigidly mounted on its movable bellows board 32 and to accommodate the resulting oscillation of the sticker about the axis of movement of the bellows board, the guide rail 60 has for each such sticker an enlarged aperture 61. The contacting parts of a sticker G and wippen F preferably stand substantially in the line of centers of their respective oscillatory movements; and therefore their conjoint oscillation involves minimum relative movement one on the other.

The lower tiers of stickers, L, M and N are preferably snugly engaged by the guiding apertures of the rail 60 to insure travel in proper paths; and to accommodate such oscillation as may occur the stickers may

be connected to their respective bellows boards by opposed parti-spherical nuts 63, 64 having their convex faces adjacent. The upper end of each sticker may be capped by a felt pad 65.

The top board 14 and board 13 (Fig. 1) having between them the exhaust chamber 16, may extend from end to end entirely across each tier; and the exhaust chamber 16 may likewise extend clear across the tier constituting a chamber common to all the pneumatics of the tier. It will be noted that the top board 14 is of very simple construction, it consisting merely of a flat board having recesses therein to provide a secondary diaphragm chamber 19 for each pneumatic, a short duct 20, and a port extending clear through the board for the primary valve 11. The bottom board of the exhaust chamber 16 is likewise of very simple construction. It is channeled nearly from end to end to provide the main part of the chamber 16. It has an aperture extending through it to provide, in part, the port 34 for each pneumatic. It is recessed to provide a primary diaphragm chamber 9 for each pneumatic; and each said chamber 9 has entering it a duct 45 and a duct 46. Likewise each chamber 9 is accompanied by a chamber 50 and a passage 48 containing the bleeder vent thimble. The cabinet work to shape these boards in finished form is exceedingly simple compared with that usually encountered in supplying parts for actions of a comparable character, such as have been used heretofore; and this constitutes a very substantial commercial advantage of economy.

The top board 14 and the bottom board 13 of each tier may be assembled by simply screwing them together face to face; and they are preferably provided with some closure which will serve to make the joint air tight. Such a closure may be supplied conveniently by a strip of paper 70 or the like (Figs. 2 and 5) glued completely around the entire tier and forming a unitary and effectively air-tight joint.

To facilitate rupturing this joint to permit separation of the boards 13 and 14, a groove 72 may be provided in the rear of the strip 70, permitting a knife edge or a pointed instrument to be inserted through the strip into the groove, and then run along the groove to break the strip so far as desired. This is obviously more convenient than scraping or otherwise breaking the strip 70 when it is desired to part the same. The groove 72 may be supplied conveniently by rabbeting the upper edges of the board 13, or corresponding edges of the board 14 or both, if desired, or in any other practicable way.

A like construction of closure comprising a strip 70 with or without a groove 72, may be employed in any practicable position for

closing joints in the pneumatic mechanism, as, for instance, at the points 74, 75 and 76 shown in Fig. 5.

Referring now to Figs. 3 and 5, the bottom board 13 of the top tier has an aperture 78 by which the exhaust chamber 16 for the upper tier communicates with the trunk 17. As shown the trunk 17 extends through a spacing block 80, secured to the under side of the bottom board 13 and through a mating spacing block 81 secured to the top board 14^a of the second tier. The trunk 17 likewise extends through the top and bottom boards of the second tier and through the exhaust chamber 16^a thereof. The remaining tiers having the top boards 14^b and 14^c, are traversed in like manner by the trunk 17. Each of the spacing blocks 80, 81 may be duplicated between other adjacent tiers; and they preferably extend clear across the tiers from front to rear, as indicated by dotted lines at the left of Fig. 3. Screws 67, 67 (Fig. 3) may pass through the successive boards and spacing blocks to secure together all the tiers.

Fig. 5 shows the arrangement of spacing blocks and the like at one end only of the tiers of motor pneumatics and associated parts. As will be understood by those skilled in the art the spacing blocks may be duplicated at the opposite extremity of the tiers, either with or without a second trunk 17. In this manner the tiers may be connected at opposite ends in a unitary stack to be supported in any practicable manner in relation to the usual hammer actions of a piano, or comparable actions of any other instrument. When supported only at their extremities the tiers are likely to sag for want of support at intermediate points along their lengths; it is preferred therefore to supply strengthening means about to be described.

In the typical piano action, for instance, as is well understood by those familiar with the art,—there are certain "breaks" or spaces between the hammer actions, at intervals along the width of the action. Fig. 6 illustrates one of these breaks, in which a strut or the like, such as a metal plate 92, is secured to the respective tiers. A block 93 may be secured to the bottom board 13 of the top tier and the plate 92 fastened thereto by screws. Said plate may be screwed also to similar blocks on the respective bottom boards of the second tier and of the third and fourth tiers. This strut or plate 92 supplies effective means intermediate the lengths of the tiers for properly spacing them apart and for supporting them collectively as a unitary structure. The strut 92 may be supported in any practicable manner at its lower end if desired.

To contribute further to the strength of the structure, each tier may have secured

along its length a girder 95, preferably of metal; and the same may overlie the closure strip 70 and be secured in place by screwing to the board 13 of each tier. These girders 5 95 alone, whether in single lengths or sectional, tend to stiffen each tier and to support the same against sagging. Said girders together with one or more struts 92 and the described arrangement of the tiers, supply 10 an exceedingly stable, unitary construction, which is at once compact and convenient to insert and remove from the piano action and very easy to take apart and assemble.

It is to be understood that the invention is 15 by no means limited to the specific details of construction, organization and mode of operation hereinbefore described in connection with the specific disclosure of the drawings. On the contrary the invention is sus- 20 ceptible of various embodiments such as will appear to those skilled in the art. It is by no means indispensable that all the features of the invention be used conjointly, since they may be used to advantage separately.

25 Claims:

1. In a musical instrument the combination of a pneumatic; a secondary valve within said pneumatic; a secondary chamber having a diaphragm for controlling said 30 valve; a support coaxial with the valve to provide for relative angular movement of said valve and support and to control said movement; and a primary valve mechanism to govern the pneumatic condition within 35 the secondary diaphragm chamber.

2. In a musical instrument the combination of a pneumatic having ports in opposite boards thereof; a valve controlling diaphragm; and valve means controlled by 40 said diaphragm and including a stem and substantially unyielding valve member mounted thereon for universal relative angular movement to enable said valve member always to maintain a proper centered 45 relation relative to said ports respectively and to its stem.

3. In a musical instrument the combination of a pneumatic; a diaphragm chamber having a diaphragm above the valve; valve 50 controlling means depending from said diaphragm; a valve for controlling said pneumatic and bearing against said controlling means; and means to hold the valve in position while providing for angular movement 55 of said valve relative to said sustaining means.

4. In a musical instrument the combination of a pneumatic having ports in opposite

boards thereof; a valve adapted to seat against said ports respectively; a valve stem 60 upon which said valve is mounted for universal angular movement; a spring normally sustaining said valve; and a valve controlling diaphragm to operate the valve in opposition to said spring. 65

5. In a musical instrument the combination of a pneumatic; a floating valve for controlling the condition therein; valve sustaining means, including a spring, acting upon one face of said valve but disconnected 70 therefrom; and pneumatic means acting upon the other face of the valve but disconnected therefrom.

6. In a pneumatic valve mechanism for musical instruments, the combination of a 75 diaphragm chamber having a downwardly facing diaphragm; a depending valve controlling device secured to the diaphragm of said chamber; a valve separated from but acted upon by said device; and means 80 to maintain said device and valve in operative relation.

7. In a pneumatic valve mechanism for musical instruments, the combination of a diaphragm chamber having a downwardly 85 facing diaphragm; a depending valve controlling device secured to said diaphragm; a valve separate from said device but governed thereby; and yielding means to maintain said device and valve in opera- 90 tive relation.

8. In a musical instrument having "breaks" or intervals in the tone sounding action thereof, the combination of a plurality of tiers of motor pneumatics; and supporting 95 means for the tiers of said "breaks" or intervals.

9. In a musical instrument having "breaks" or intervals in its tone sounding action, the combination of a plurality of tiers of motor pneumatics; and a strut to support said tiers at a "break" or interval. 100

10. In a musical instrument having a "break" or interval in its tone sounding action, the combination of a plurality of tiers 105 of motor pneumatics; a strut common to the tiers in said "break" or interval; and a strengthening girder common to the pneumatics of a tier.

In testimony whereof, I have signed my 110 name to this specification, in the presence of two subscribing witnesses.

CHARLES F. STODDARD.

Witnesses:

HENRY L. LLOYD,
GUSTAVE W. RIDGELY.

It is hereby certified that in Letters Patent No. 1,253,744, granted January 15, 1918, upon the application of Charles F. Stoddard, of Boston, Massachusetts, for an improvement in "Musical Instruments," errors appear in the printed specification requiring correction as follows: Page 5, line 41, claim 2, before the word "substantially" insert the article *a*; same page, line 96, claim 8, for the word "of" read *at*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of February, A. D., 1918.

[SEAL.]

F. W. H. CLAY,

Acting Commissioner of Patents.