O. HIGEL.

PNEUMATIC ACTION FOR MUSICAL INSTRUMENTS.

APPLICATION FILED MAY 17, 1909.

987,575.

Patented Mar. 21, 1911.

3 SHEETS—SHEET 1.

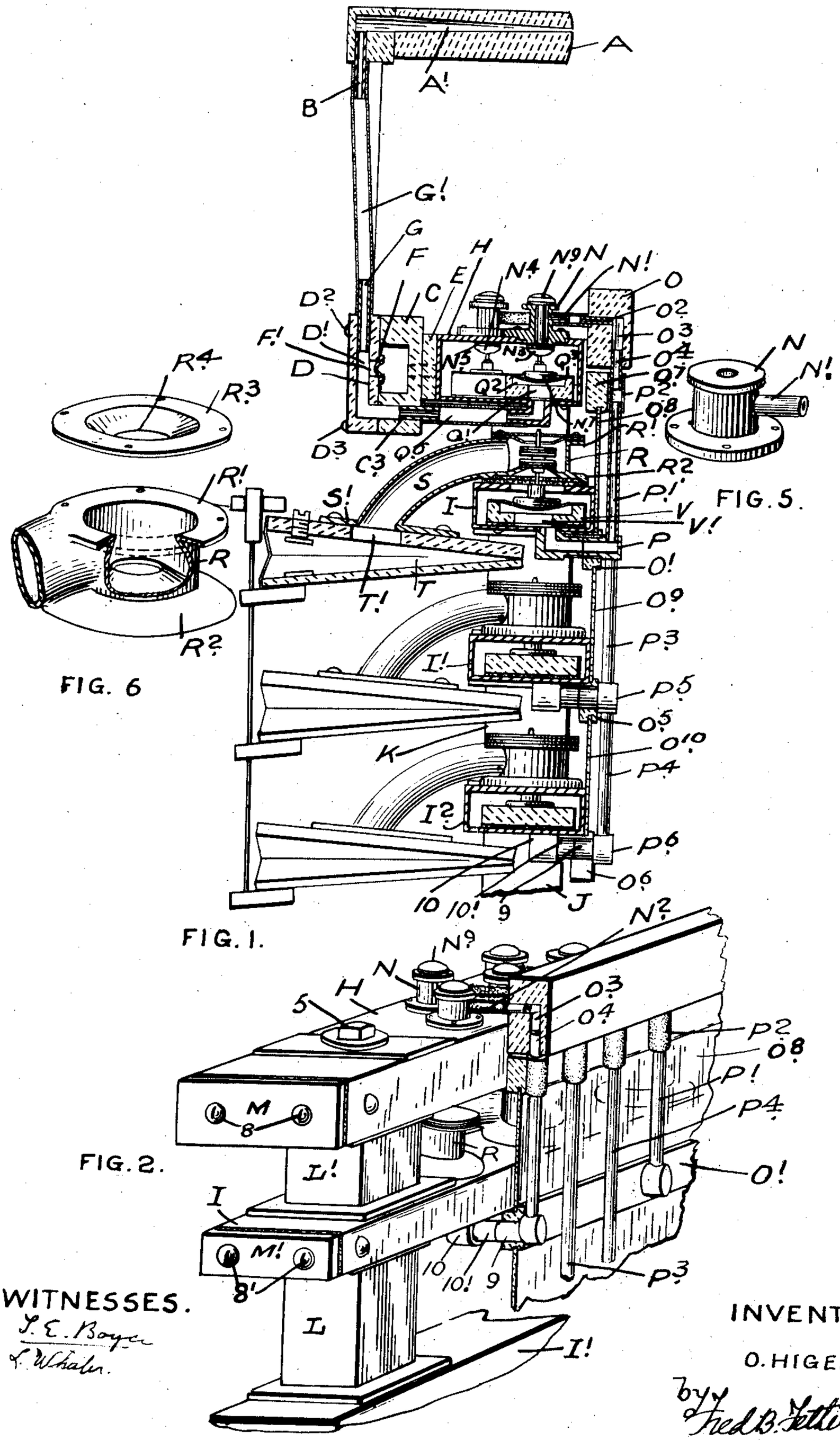

FIG. 1.

FIG. 5.

FIG. 6

FIG. 2.

WITNESSES.

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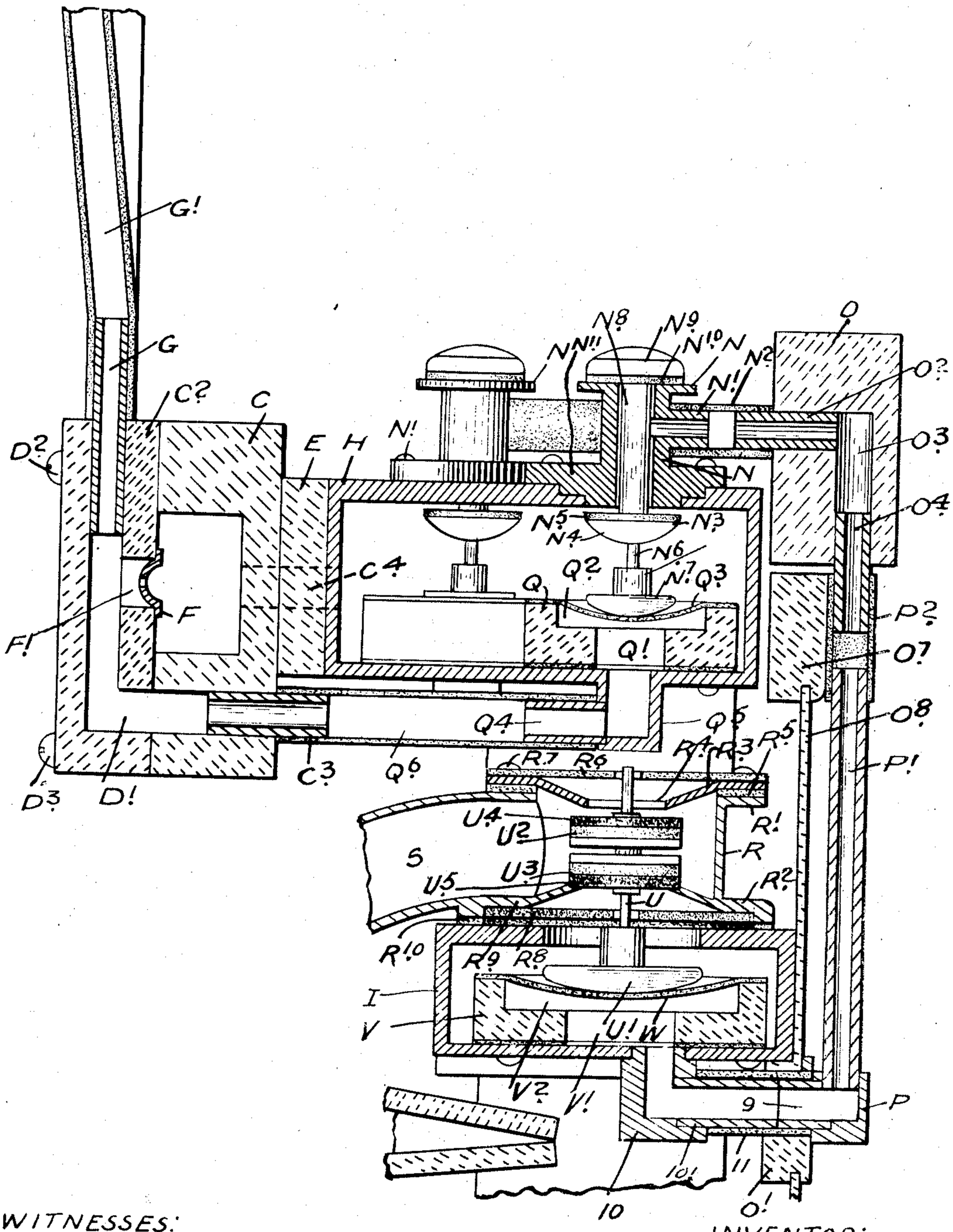

FIG. 3.

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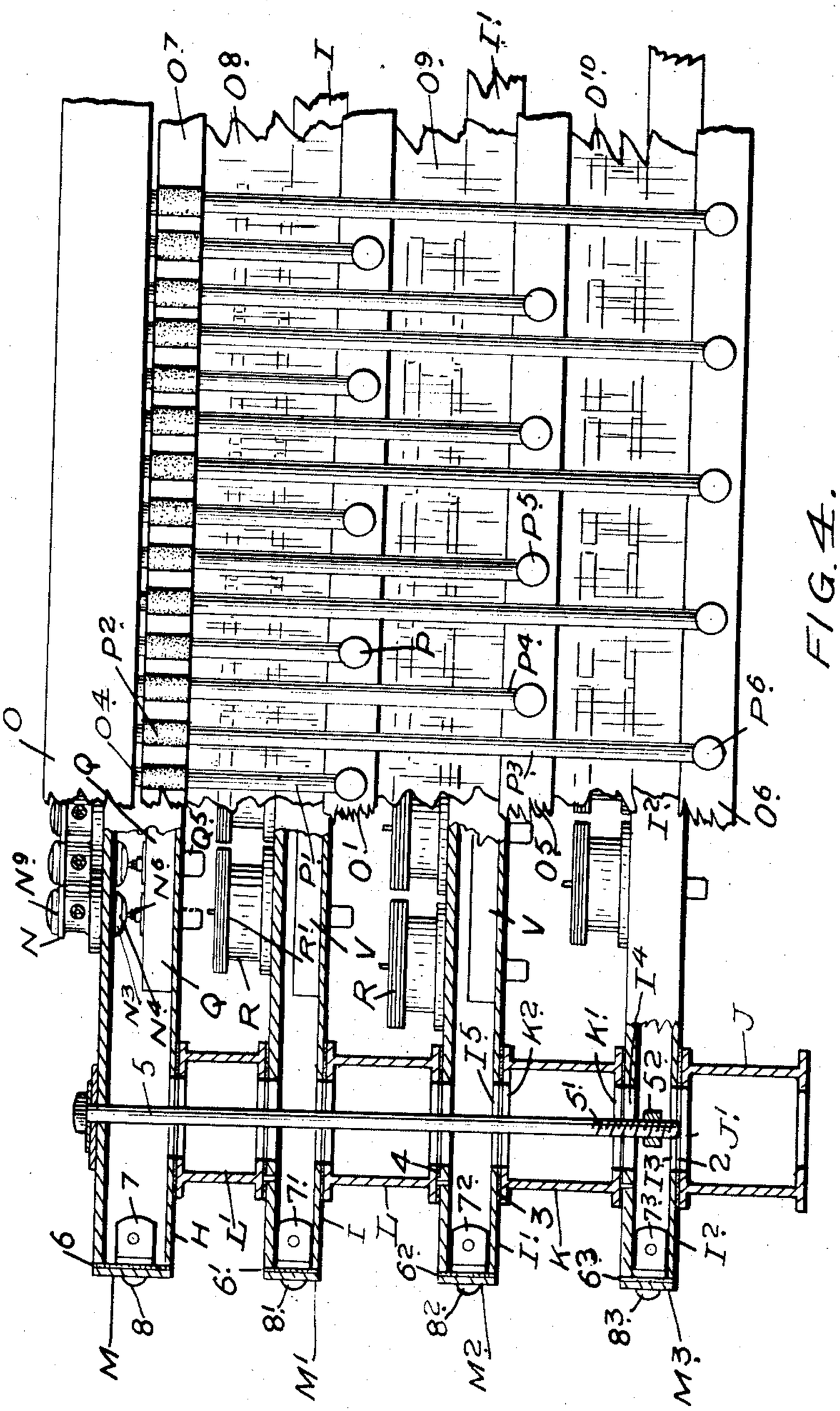

FIG. 4.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC-ACTION FOR MUSICAL INSTRUMENTS.

987,575. Specification of Letters Patent. **Patented Mar. 21, 1911.**

Application filed May 17, 1909. Serial No. 496,656.

To all whom it may concern:

Be it known that I, OTTO HIGEL, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Pneumatic-Actions for Musical Instruments, of which the following is the specification.

My invention relates to pneumatic actions for musical instruments.

It consists in improved details of construction, comprised chiefly of metal, the general object of which is to improve the operation and durability of the apparatus, as well as to simplify and to reduce the cost.

The particular parts and their combinations and uses are hereinafter described and specified in the claims.

In the drawings accompanying this specification Figure 1 is a cross section through the action from the tracker board to the bottom thereof. Fig. 2 is an enlarged perspective detail partially in section and broken away to exhibit the details of construction. Fig. 3 is an enlarged cross sectional detail showing the primary and secondary pneumatics and their connections one with the other and with the tracker board tube and vent chamber. Fig. 4 is a front view of a portion of the action, the end being in section to show particularly the means of connecting the vacuum chambers together and the tubular connections between the primary and secondary vacuum chambers. Fig. 5 is a perspective detail of the preferred form of valve casing for the primary pneumatic valve. Fig. 6 is a perspective detail partially broken away showing parts of the secondary valve chamber separated.

Referring to Fig. 1, A represents the tracker board formed in the usual manner, and with a series of passageways A′. One of a series of tubes B is shown depending from the rear of the board, these tubes being preferably made of metal.

The vent chamber C has a cover D with passages D′ corresponding in number with the primary valves. It is provided with passages C^4 (Fig. 3) which communicate with the primary vacuum chamber, and is secured to a bar E, shown in Figs. 1 and 3. A series of vents F are attached on the inside of the vent chamber cover, at the passages F′. The cover of the vent chamber is held detachably by screws D^2, D^3, so that dust may be removed, if necessary. A series of metal tubes G form extensions of the passages D′ in the cover of the vent chamber, and these are connected to the tubes B by tubes G′, preferably of metal, forming a continuous passage.

As shown clearly in Fig. 1, H indicates the primary vacuum chamber, and I, I′, I^2 the secondary vacuum chambers. The lowest secondary chamber rests on a post J, which has orifices J′, registering with orifices I^3 in the lowest vacuum chamber (Fig. 4). A washer 2 of rubber or other suitable material is interposed between the top of post J and bottom of chamber, to render the joints tight. The vacuum chamber I rests on a hollow post L, supported on chamber I′. The ports or orifices K′, K^2 register with openings I^4 and I^5 in the chambers, respectively, as shown in Fig. 4, and washers 3 and 4 are interposed here also. Hollow posts L′, similarly formed connect the primary chamber H and the secondary chamber I. A rod 5 threaded into a bar 5^2 connects the chambers and hollow posts, and holds them at the ends in proper position. The vacuum chambers are closed at both ends alike by metal plates M, M′, M^2 and M^3, secured with interposed washers 6, 6′, 6^2 and 6^3, to brackets 7, 7′, 7^2 and 7^3 by screws, as shown in Figs. 2 and 4.

Vacuum chambers have been heretofore made of wood, which is liable to swell and shrink in atmospheric changes. Metal chambers, however, do not afford proper surfaces for attaching the diaphragms. To avoid both objections in a simple and effective way, I have formed the vacuum chamber of metal, and have placed within on the bottom a sheet of wood or equivalent fibrous material, in which the orifices may be made, and which affords at all points a suitable surface for attaching the diaphragms, the wood or fiber being better for this purpose than the metal. I thereby avoid the special and expensive devices for attaching the diaphragms which have been heretofore employed.

Referring to the upper vacuum chamber, for example of the details, the wooden bar is shown at Q. It has an orifice Q′ enlarged at its upper end at Q^2, and the flexi-

ble diaphragm is attached to the wood, covers the cavity of the enlargement A^2, and rests at the margins on the wooden surface.

Primary valve casings N are secured on the top of the primary vacuum chamber. This is shown in place in Fig. 1, and detached in Fig. 5. Each has a vertical chamber and the ordinary nipple N′ on one side for connection with the tube O^2. As heretofore made, these valve casings have been formed to screw into the top of the valve chamber. This makes difficult the securing of an airtight joint, and also the alinement of the nipple with the projecting tube with which it is to be connected. Instead of this I form the valve casing with a flange on its lower end, adapted to rest on the top of the chamber, and to be connected therewith by screws with an airtight interposed packing. Holes are made in the flange, and corresponding holes are threaded into the top on which it rests, these so registering as to bring the nipple into proper alinement with certainty, and without special care, when the screws are inserted in the holes. Also the joint is certain to be tight. The casing may be made in one piece and cheaply; and may be quickly and certainly put in place. The primary valve N^3, which is located in this casing, is provided with a bottom N^4, on top of which is a yielding washer N^5, and at the bottom it has a stem N^6 carrying a button N^7, which normally rests on the diaphragm Q^3 (Fig. 3). An enlarged continuation N^8 of the stem N^6, extends up through the casing, and carries at its upper end a button N^9 having on its under face a washer N^{10}. This rests normally on the valve casing, but the stem N^8 is long enough in relation to the casing to permit the proper movement of the valves. The passage through the stem N′ opens as usual into the annular space between the stem and the interior walls of the casing. The passage from the orifice Q′ below the diaphragm Q^3 is formed by the nipple Q^4, tube Q^6 and nipple C^8 to the passage D′ in the rear of the vent chamber. Passages from the primary vacuum chamber to the vent chamber are shown in dotted lines in Fig. 3 at C^4, and the series of vents and orifices from the vent chamber to the passage D′.

The front top bar of the frame is shown at O, in which the tubes O^2 are inserted, and these form a continuation of the vertical passages O^3 in the bar O, further continuation of the passage being formed by metal tubes O^4 inserted in the passage O^3, and projecting downward, as shown in Figs. 1 and 3. With these tubes O^4 are connected metal tubes P′ by flexible tubes P^2 of rubber, and the tubes P′ are in connection with the metal elbows P. As shown in these figures also, these elbows form communication with the recess in the vacuum chamber I under the diaphragm therein. Similar elbows P^5 and P^6 form connections and by elbows 10, through similar rubber tubes and connections, respectively, with the recesses in the vacuum chambers I′ and I^2. P^3 and P^4 are similar connections, as shown in Fig. 1.

Figs. 1 and 3 show the connections between the elbow P^6 and the vacuum chamber I^2, consisting of nipple 9, elbow 10 connected to the bottom of the vacuum chamber, nipple 10′ and tube 11 covering and connecting both nipples. These parts are shown on a larger scale, and in section in Fig. 3. The connections at the bottom of chambers I′ and I^2 are the same. These figures also illustrate the arrangement of the primary vacuum chamber with its valve chambers, over the secondary vacuum chambers with their valve chambers, and the direct communication between them. Fig. 3 also shows plainly the double shoulder on the valve casing, fitting into a corresponding annular double shoulder on the top of the primary vacuum chamber, with the washer packing and securing screws.

The main part of the secondary valve casing R is made in one piece of metal like the primary valve casing, but differs somewhat as its place and connections require. It is connected with or forms part of the arc-shaped tube S, which leads to the motor pneumatic T (Fig. 1) operating in the usual manner. The tube S has a flange S′ on its lower end whereby it is secured to the top of the motor pneumatic, in connection therewith, as shown. The casing R has an upper laterally extended flange R′ on which rests with interposed packing R^5 a dish-shaped cover R^3 having a central opening R^4. Over this is located a plate preferably of fiber, R^6. It has a guide hole, and is held to the casing by the screws which hold the cover R^3 and make with the packing an air-tight joint. The bottom flange R^2 of the casing is recessed underneath and has a fiber plate R^8 fitting into it, and there is a ring packing R^{10} which forms an airtight joint between the casing and the top of the vacuum chamber next below. The form of this valve casing and the integral construction of its main part, together with the arc-shaped tube, are shown in the detached Fig. 6. The stem U of the secondary valve carries disk valves U^2 and U^3 properly located, as shown, and these are provided with suitable yielding washers, U^4 and U^5. These valves act in the usual manner. These valves operate vertically. When atmospheric pressure is admitted through the opening in the tracker bar, the diaphragm expands upwardly, and thus lifts the valve, cutting off communication between the atmosphere and the motor pneumatic. When the opening in the tracker bar is closed the diaphragm and

valve drop, allowing air to enter the motor pneumatic. When the valve is pushed upwardly and held against the dish shaped cup, communication is established between the vacuum chamber and the motor pneumatic which causes the pneumatic to collapse. The bar of wood or other fibrous material, shown at V, is located in the bottom of the vacuum chamber, as hereinbefore described. It also has the series of orifices, in this case marked V′, located at suitable distances throughout the length of the bar, and corresponding in number and location to the secondary valves and, as there are three secondary vacuum chambers and one primary, the number of secondary valves in each of the three is one third of the number of the primary. The construction will be clear from the drawings and previous description, the communication from the chamber underneath the diaphragm W being through the elbow 10 and passage shown at 9, to the passage P′. The diaphragm W is secured to the wood or fiber by glue, cement, or in any convenient way. It is normally in contact with the button U′. The other secondary vacuum chambers with their co-acting valves and casings have the same construction as hereinbefore described, and the connections of such chambers by tubes to the primary vacuum chamber set vertically over them are the same, by the same form of tube, the lower having the longest and the top the shortest.

There is a second bar O^7 located beneath the bar O, and upon bars O^7 and O′ is supported a transparent plate (preferably of celluloid) for closing the major part of the action, and yet permitting inspection. Similar bars and screens are provided, as shown in Fig. 1, for the other chambers.

Having now described the principal parts involved in my invention, I shall briefly describe its operation and utility.

When the music sheet passes over the tracker board and air is admitted through its perforations to the tracker ducts, the vacuum existing in the tube G′ and passageways communicating therewith to the diaphragm Q^3 is broken, the primary valves forced upwardly and the air allowed to pass through the valve casing N and passageways N′ and communicating passageways hereinbefore described to the recesses beneath the diaphragms W, thereby forcing up the double valve U^2 and U^3, thus closing the orifice in the plate R^3, thereby producing a vacuum in the arc-shaped tubes and corresponding motor pneumatics thus operating on the action in the usual manner.

It will be seen from the construction I have described that all the essential co-acting parts upon which the air tightness of my device and the production of vacuum is assured are made of metal except the seats for the diaphragm within the vacuum chambers, which are preferably made of wood or other material to which the leather diaphragm may be affixed, so as to insure a lasting air tight joint. It will also be seen that my action is constructed with the primary vacuum chambers vertically above the secondary vacuum chambers and that, therefore, the primary and secondary valves are assisted in their action by gravity and thus less liable to leak.

The primary and secondary valves are connected by metal tubes and elbows and the flexible rubber connecting tube in front of the bar O^7, thereby forming a simple, permanent and durable form of protection, which will obviate the necessity of separating the entire action, should any notes become silent through foreign matter getting under the valve seats, and this allows the cause of the trouble to be simply and instantly located and rectified as will be understood by those skilled in the art.

The form of connection of the secondary valve casing to the power pneumatic is very advantageous, as it avoids any liability of leakage, and at the same time provides a shorter and smooth passage of the air from the pneumatic to the valve, and thus reduces the friction on the column of air passing therethrough to a minimum.

The valve casings being made of metal and being vertically disposed, may be readily separated at the top should any defect occur therein, which is an important desideratum.

The simplicity of the connection of the vent chamber cover to the vent chamber will be appreciated by those skilled in the art, as if dust should accumulate, the cover may be easily removed, and thereby allow the vents to be cleaned.

I claim as my invention:

1. The combination with the metal primary vacuum chamber rectangular in cross section, of a metal valve casing secured to the top of the vacuum chamber having its orifice vertically disposed, and a flanged top, and a valve stem having upper and lower washered buttons, and a nipple leading from the vertically disposed orifice in the primary valve casing, a secondary metal vacuum chamber disposed beneath the primary vacuum chamber, a front bar provided with a right angular orifice, a nipple extending from the horizontal portion of the orifice opposite the nipple in the valve casing and a rubber tube connecting the aforesaid nipples, a nipple extending from the lower portion of the right angular orifice, elbows connected to the bottom of the secondary vacuum chamber, a bar located in front of such elbows, a second set of elbows located in front of the bar, nipples extending into both elbows opposite each other, an encompassing

flexible tube for the nipples, metal tubes extending up from the front elbows and a flexible encompassing tube connecting the vertical extending metal tube with the nipples extending from the orifices in the front bar as and for the purpose specified.

2. In a pneumatic action for musical instruments, the combination with the secondary vacuum chamber arranged horizontally of a valve casing arranged vertically superimposed upon the secondary vacuum chamber, a motor pneumatic and a support therefor extending from the valve casing.

3. In a pneumatic action for musical instruments, the combination with the secondary vacuum chamber, of a secondary valve casing superimposed upon the secondary vacuum chamber and having the double operating valve working vertically therein, a motor pneumatic and an arc shaped tube integral with the valve casing for supporting the motor pneumatic as and for the purpose specified.

4. In a pneumatic player, the combination with the secondary metal vacuum chamber casing rectangular in cross section, a passageway leading upwardly to the valve casing of the primary vacuum chamber, and a bar of fibrous material extending lengthwise of the casing and provided with an orifice registering with the passageway leading to the primary valve casing, a flexible diaphragm cemented on to the bar and closing the orifice, a valve casing provided with a flanged bottom and packing surrounding the opening in the top of the vacuum chamber, a top provided with a central orifice, a double acting valve located between the top and bottom of the valve casing, a motor pneumatic and a tube leading from the valve casing to the motor pneumatic as and for the purpose specified.

5. In a pneumatic action for musical instruments, a secondary valve casing having a cylindrical portion and an integral arc shaped tube forming part of the same and extending from the valve casing to the motor pneumatic and provided with means for fastening it to such pneumatic as and for the purpose specified.

6. In a pneumatic action for musical instruments, the combination with the vacuum chamber casing made of metal, of a diaphragm-bar made of fibrous material suitably secured to the bottom of the casing and extending continuously from end to end of the casing, and having orifices and seats for the diaphragms, as and for the purpose specified.

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