

No. 839,880.

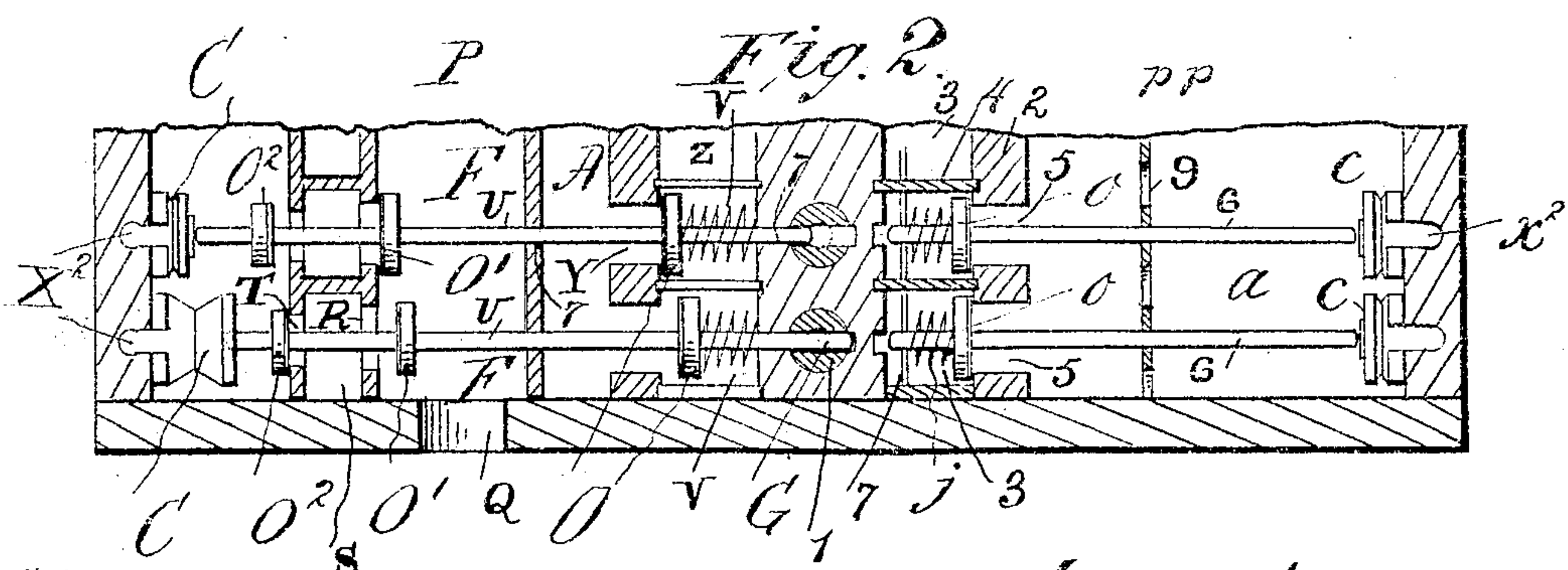
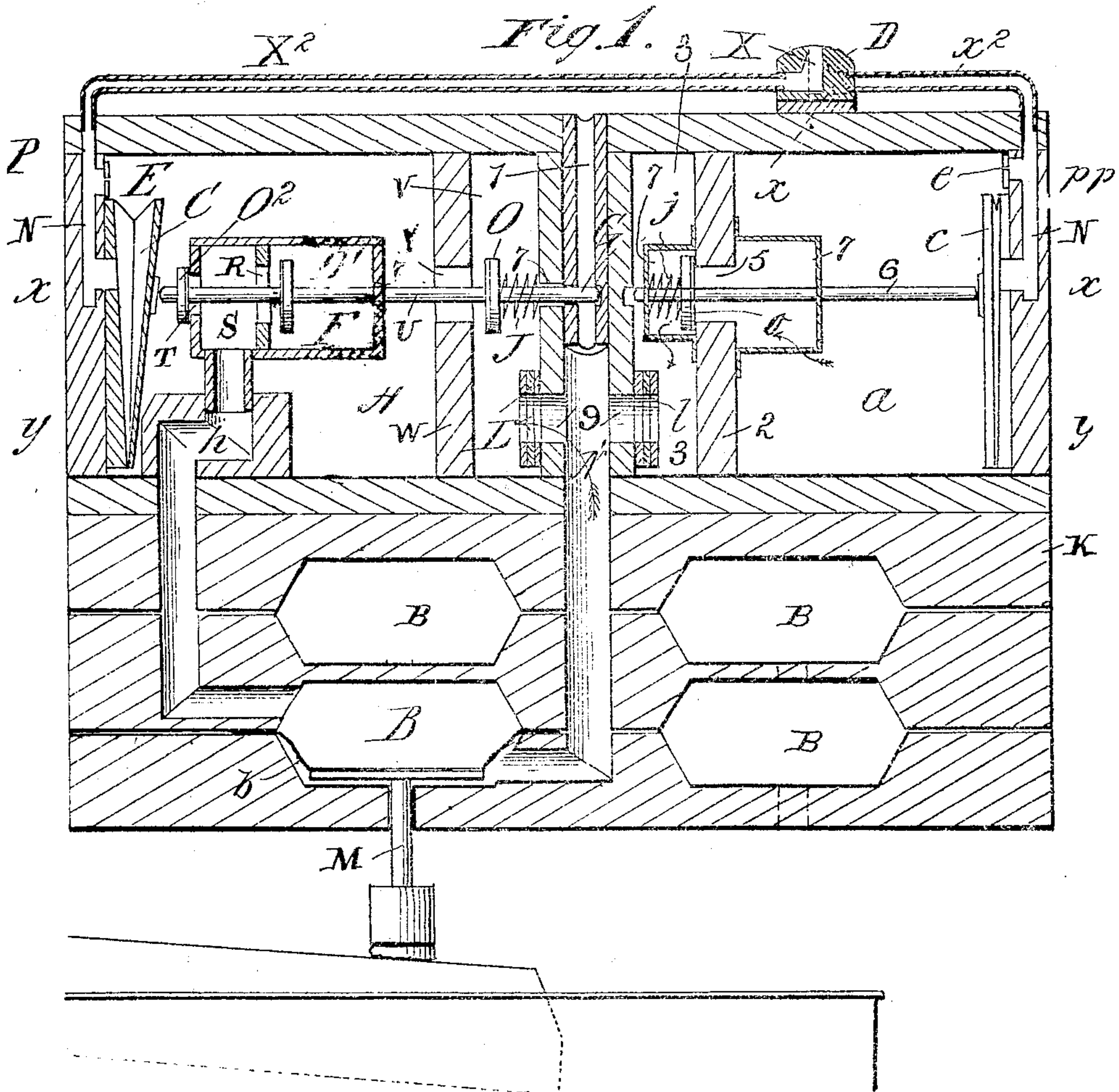
PATENTED JAN. 1, 1907.

A. E. OLNEY.

AUTOMATIC MECHANISM FOR PLAYING MUSICAL INSTRUMENTS.

APPLICATION FILED JULY 23, 1900. RENEWED FEB. 7, 1905.

2 SHEETS—SHEET 1.



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PATENTED JAN. 1, 1907

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AUTOMATIC MECHANISM FOR PLAYING MUSICAL INSTRUMENTS.

APPLICATION FILED JULY 28, 1900. RENEWED FEB. 7, 1905.

2 SHEETS—SHEET 2.

Fig. 3.

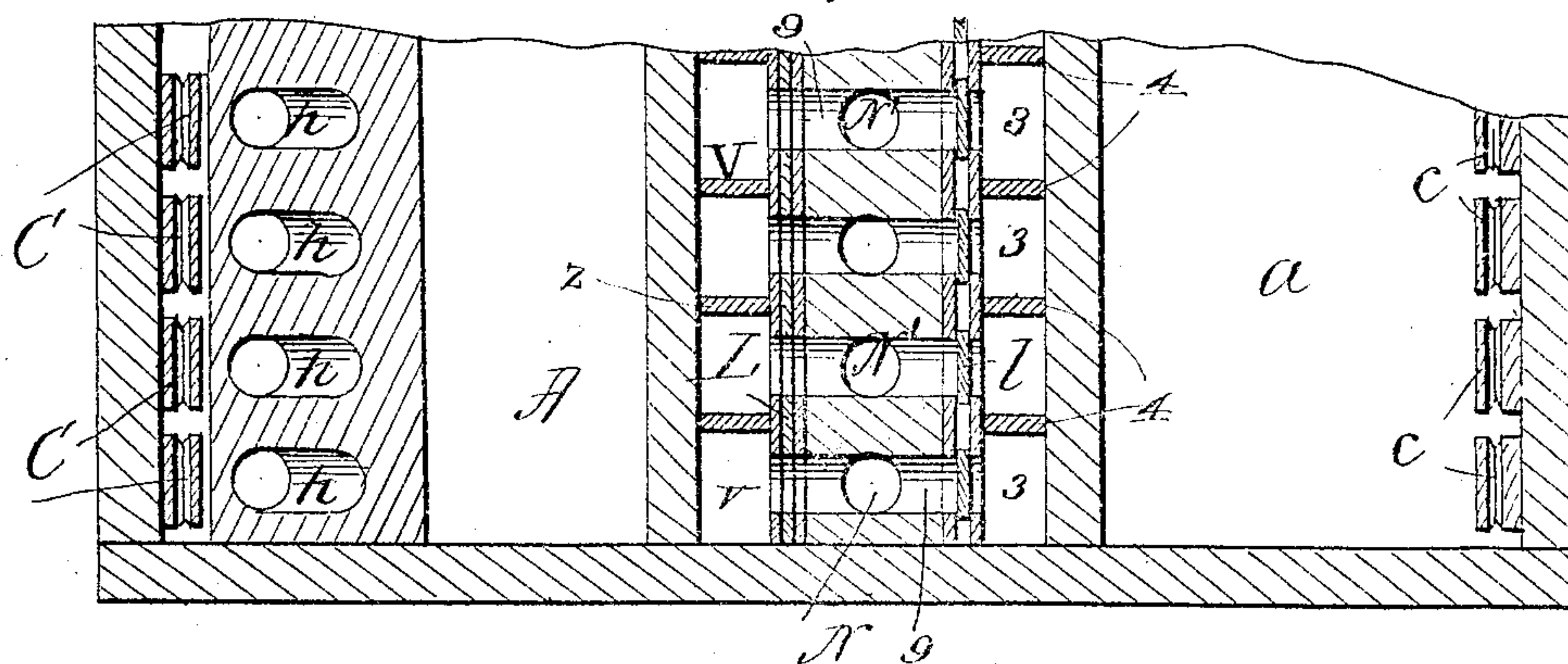


Fig. 4.

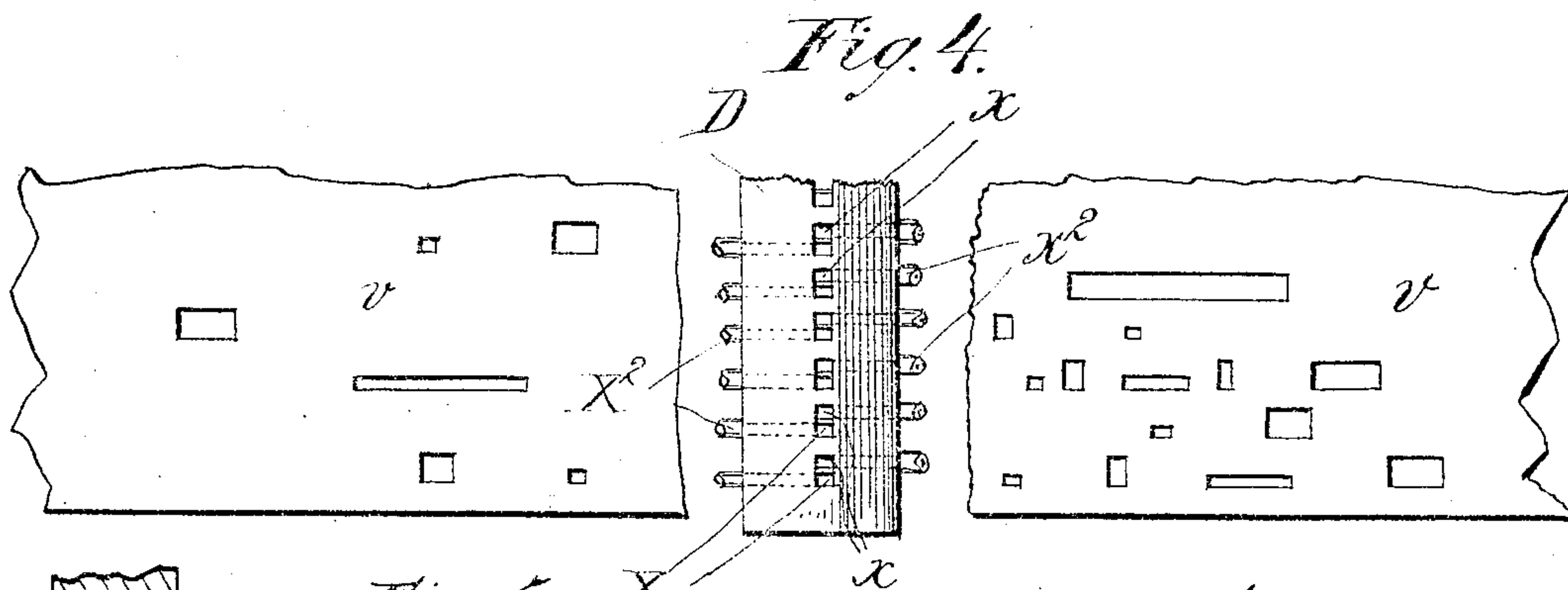


Fig. 5.

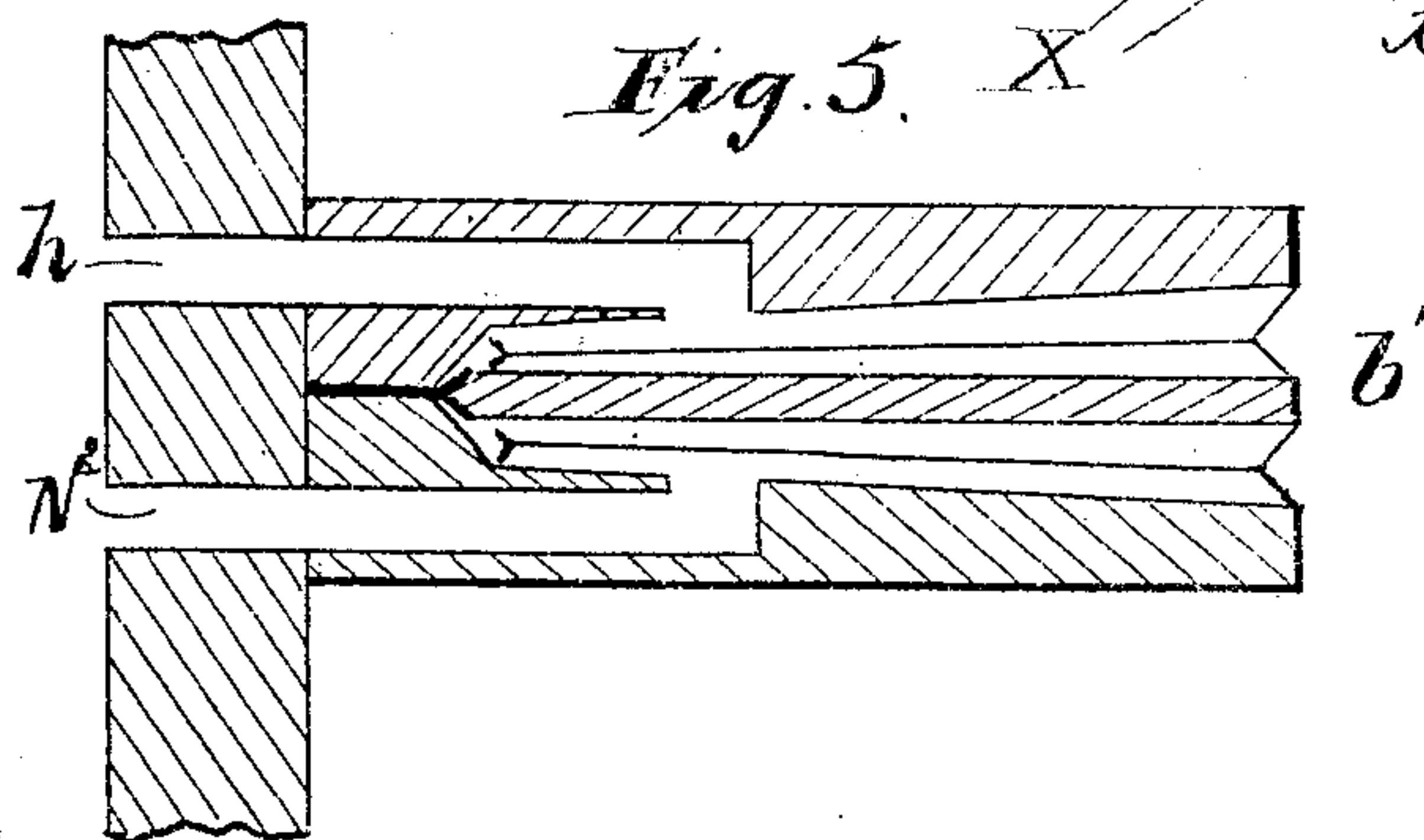
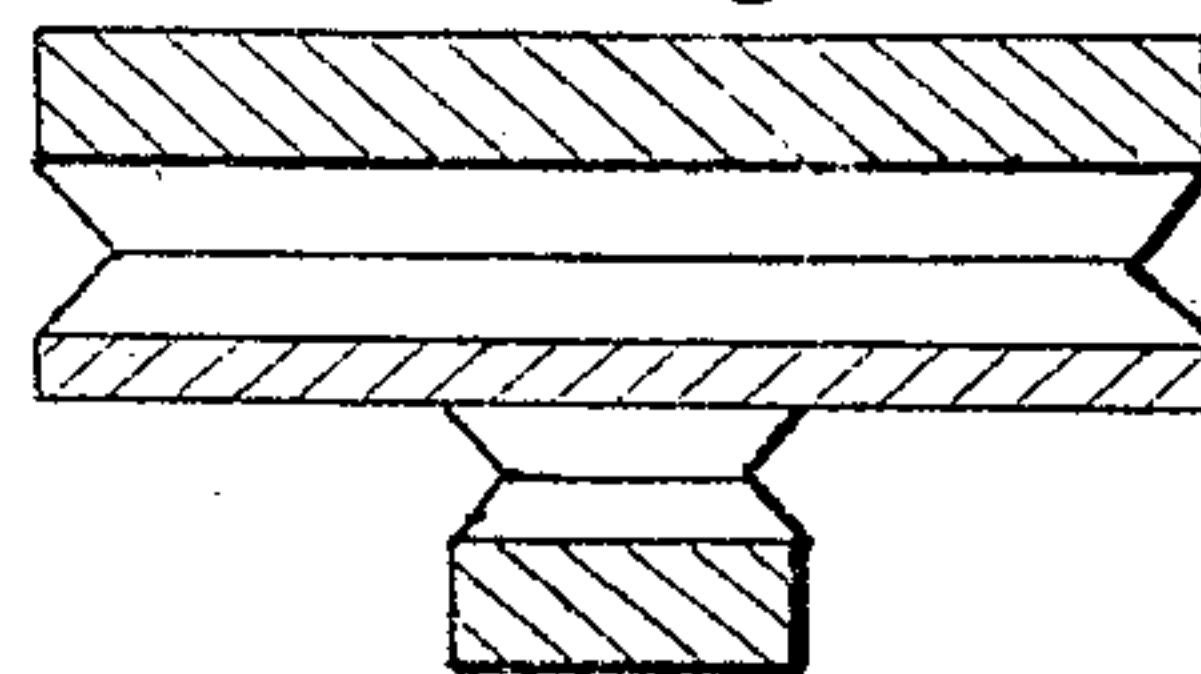


Fig. 6.



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AUTOMATIC MECHANISM FOR PLAYING MUSICAL INSTRUMENTS.

No. 829,880.

Specification of Letters Patent.

Patented Jan. 1, 1907.

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To all whom it may concern:

Be it known that I, ALLAN E. OLNEY, a citizen of the United States of America, and a resident of Pittsfield, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Automatic Mechanism for Playing Musical Instruments, of which the following is a full, clear, and exact description.

My invention relates to improvements in the class of pneumatic operating mechanism for automatically or mechanically operating the keys of pianos or organs or for operating the sound-controlling devices of chiming or bell-ringing or other musical instruments, and has for its objects to provide in a certain particular and improved manner a duplicated series of mechanisms or apparatus by means of which may be changed the pneumatic intensity in a series of ducts and by the agency of which may be produced or carried along the air and the accompaniment of a musical production and by which accentuation or variations of the air or the accompaniment may be produced and to provide improved means in the apparatus whereby may be determined and produced, as required, thrusts or blows of the parts of the apparatus which directly operate upon the keys or sound-controlling members of the musical instrument in conjunction with which the apparatus is to be used of varying degrees of force for giving loud or soft notes by the instrument being operated.

The invention consists in certain particular combinations or arrangements of parts, all substantially as hereinafter described, and set forth in the claims.

In the accompanying drawings, which represent a mechanism embodying my invention, Figure 1 is a vertical section. Fig. 2 is a horizontal cross-section taken on the line $x x$, Fig. 1. Fig. 3 is a horizontal section taken on a lower plane on the line $y y$ of Fig. 1. Fig. 4 is a plan view of a portion of the tracker-board and portions of a perforated sheet which is passed over the top of the tracker-board for the purpose of producing musical sounds. Figs. 5 and 6 represent different forms of pneumatics from those shown in Fig. 1.

K represents a suitable casing of framework in the upper part of which are formed the two correspondingly-arranged chambers A a , from which the air is exhausted by any suitable means, such as a suction-pump op-

erated by the feet, a spring mechanism, or any other means that may be preferred. In the lower portion of the same casing K is arranged a series of chambers B, corresponding to the notes of the scale, and in which chambers are placed the diaphragms b , each one of which is in operative engagement with a thrust-stem M for operating a piano or organ key or valve or operating by leverage on a hammer to strike a bell. These thrust-stems may either be of the construction here shown or any other that may be preferred and by the rising and falling of the diaphragms b operate the keys of a musical instrument or other mechanism engaged thereby or connected to them. These chambers B and their diaphragms b are arranged in two tiers and divided into two sets, one of the sets being arranged over the black keys and the other over the white keys of a musical instrument, and each chamber has communicating therewith the channel h , entering above its diaphragm b , and the passage N' below its diaphragm.

Upon the top of the apparatus is placed the tracker-board D, which has two adjacent or grouped openings X x for each note in the scale, and from which openings extend the tubes X² x^2 in opposite directions and communicate with corresponding pneumatics C c , placed in the exhaust-chambers A a . This tracker-board is to be controlled by means of valves, keys, or perforations in a sheet of paper v , which is moved along over its top, and which sheet of paper is provided with perforations of different widths and lengths, according to the character and length of the notes to be sounded. The tubes X² x^2 connect at their outer ends with the passages N, made in the walls of the casing K, and which passages communicate directly with the pneumatics C c , corresponding to each one of the tubes. Communicating with each of these passages N from the chambers A a is a small aperture E e , through which the air from the passages and the pneumatics C c is exhausted by the vacuum maintained in said chambers for the purpose of insuring that the pneumatics will remain closed until air is admitted to them through their corresponding openings in the tracker-board. So soon as air is admitted the pneumatics C c expand inwardly for the purpose of operating their corresponding valve mechanisms and through them the diaphragm which operates the corresponding thrust-stem.

In the exhaust-chamber A is placed hori-

zontally a single chamber or channel F, which is open through the port Q to the atmosphere, and which chamber F communicates, through a series of ports R, with a series of chambers S, corresponding to the notes of the scale, each of which chambers S has a port T through its side for communication with the exhaust-chamber A. These chambers F S extend horizontally through the exhaust-chamber A, and extending horizontally at right angles through the chambers F and each chamber S V is a valve-rod U, which carries the valve O in each chamber V, the valve O' for each port R, and the valve O² for each port T. Each chamber S communicates, through the channel h, with a chamber B above the diaphragm b, so that when the port R is normally closed the air in the chambers B and the channels h is exhausted by the suction in the chamber A and the diaphragms raised. At the same time that the port T is closed by its valve O² the corresponding port R in the opposite side of the chamber S is opened by its valve O', caused by the endwise movement of the rod U, and then air passes from the chamber F through the port R into the chamber S and through the channel h into upper portion of the chamber B, for the purpose of establishing an atmospheric pressure above and insuring the depression of the diaphragm b and corresponding thrust-stem M to operate the corresponding key, valve, or lever of the musical instrument being played. The outward endwise or return movement of the valve-rod U is caused by the spring J placed in the chamber V, and which spring keeps the valves O O' normally closed and the valve C² normally open and at the same time assists in the closing of its corresponding pneumatic C; but when the said pneumatic C is inflated the pressure of the pneumatic against the outer end of the rod U overcomes the pressure of the spring J and closes valve O² and opens valves O O'.

The chamber A is divided by the vertical partition W, so as to form a series of subdivided chambers V, which are placed side by side and separated from each other by the partitions Z. Through the outer side of each chamber V is a port Y, through which valve-rod U passes, and which port is normally closed by the valve O. As long as the valves O are closed there is no suction or exhaustion in the air-chambers V and through them from the channels N' and the spaces below the diaphragms. When the valve-rods U are forced endwise by their corresponding pneumatics C, their valves O uncover the ports Y, and then the suction is exerted from the chamber A upon the chamber or chambers V and through the channels N' upon the chambers B underneath the diaphragms b. The inner ends of the valve-rods U form valves G, which prevent the passages of air

through the down-passages 1 of which passages there is one for each note of the scale and which passages are normally open to the atmosphere. It is only when the corresponding pneumatic C for one of the valve-rods is expanded and the rod is forced endwise against the pressure of its spring J that the corresponding air-passage 1 is closed. At the same time that the valve G closes the passage 1 the valve O² closes the port T and prevents any suction above the top of the diaphragm b; and the valve O' permits the air to pass through the port R and channel h above the diaphragm.

When the pneumatic C collapses, as insured by the closing of the communication with the outer air at the tracker-board, and the spring J returns the valve-rod and valves to their normal positions, suction is exerted from chamber A through the chambers S and channel h above the diaphragm b, and then the diaphragm is raised and its responsive action or recovery is quick. The suction-chamber a, constructed in the opposite side of the casing of the apparatus from the chamber A, is divided vertically by the partition 2, and the space upon the inner side of this partition 2 is divided into chambers 3, which correspond to each note in the scale, by a series of partitions 4. Through the partition 2 there is formed a port 5, corresponding to each chamber 3, and for each chamber 3 there is a corresponding valve-rod 6, carrying the valve o and a pneumatic c. Upon the inner end of each valve-rod, which is supported in its endwise movements by suitable bearings 7, is placed a spring j, which holds the valve o normally against its port 5, so that no suction can take place from the chamber a through the passage N' and against the corresponding diaphragm in the chamber B until one or more of the pneumatics c are expanded by the admission of air through their corresponding tubes x², and then the expansion of any one of such pneumatics c causes its rod 6 to move endwise and unseat its valve o. When a valve o is opened, which in this apparatus, as shown, is only to be done concurrently with the expansion of a pneumatic C corresponding to the same note in the left-hand chamber A and with the rightward projection of the valve-carrying rod U, which establishes the conditions for suction action by chamber A for exhausting the air from under the corresponding diaphragm b and which then closes the air-passage 1, the suction takes place through the chamber a and through a passage N', leading to underneath the diaphragm, to act as an auxiliary to the suction-chamber A, assisting in the exhaustion of the air from thereunder.

Leading from near the bottom of each corresponding or paired chamber V and 3 are short passages 9, which connect with one of the vertical passages N', through which suc-

tion is exerted from both of the chambers A & a upon the under side of each of the diaphragms b. Extending through the chambers V is placed an endwise-moving perforated valve L, and in the chambers 3 is a corresponding valve L'. These valves preferably consist of strips of wood with holes bored through them to correspond with each of the passages 9. The operator by moving these valves controls the amount of air passing through them from their respective chambers V & 3, with the result of regulating the strength of the weight of the blow given by the diaphragms b. That side of the apparatus containing the chamber A may, for instance, be regarded as the "soft" or accompaniment side, while in the opposite side of the frame is a valve system on the same note and which may be regarded as the "air" or melody side. If only a note is desired to be produced from the chamber A side, a narrow perforation is made through the paper v, and this perforation uncovers the passages X; but should it be desired to make that particular note louder a perforation of double width is made through the paper, and this uncovers both of the holes X & z, bringing both of the chambers into action at the same time, and thus accentuating the note or making it louder, the result being especially insured at the will of the performer by having the valve l on the melody side opened wider than the valve L on the accompaniment side. Should it be desired, the chamber a side can be shut off entirely from communication with the passage N', and the air and accompaniment can be played all from the chamber A side, but without accentuation.

It will be explained that in this apparatus as more usually employed a moderate intensity of exhaust is to be maintained equally in chambers A and a and of less potentiality, so far as its effect upon the diaphragm b is concerned, than the unrestricted atmospheric pressure to which the diaphragm may be subjected as rendered manifest. In this aspect of the case any air which may be present under the diaphragm is to be regarded as a resistant opposed to the overpowering action of the atmospheric pressure above the diaphragm, which latter pressure is in this serial-key-operating motor for a musical instrument the positively acting agent, and the celerity with which the resistant air is exhausted from under the diaphragm through duct or passage N' determines whether the stroke of the diaphragm may be with its maximum or with less than its maximum force, and so with the valve L placed nearly closed to leave the communication between chamber A, channel V, and duct N' much restricted and with valve l placed more open to leave communication between chamber a, channel 3, and said duct much less restricted there clearly will be a greater

readiness of exhaust from under the diaphragm when both chambers A and a are simultaneously in exhausting communication with duct N' than when only the chamber A is in such exhausting communication with said duct.

As here shown the channel h permits both suction above the diaphragm b or the admission of air, according as the pneumatics are operated. This construction does away with the necessity of springs having to be overcome. This construction, however, is not absolutely necessary, for the diaphragms can be collapsed by suction through the passages N', but against the springs which are commonly applied to the upper sides of the diaphragms, in which case no channels h and corresponding valves and chambers are necessary. By imparting a spring recovery to the diaphragms the openings l may be omitted, in which case the note may be sounded by the uncovering of either tracker-board openings X or z.

Instead of the chambers B and the diaphragms b, as shown in Fig. 1, pneumatically-operated diaphragms b', such as are shown in Figs. 5 and 6, may be used, each diaphragm b' being connected above with the channel h and below with the passage N'.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a pneumatic action for automatic musical instruments, the combination of a series of air-ducts individual to respectively corresponding notes, each duct having a plurality of terminal orifices, and a valve which is adapted to vary the area of one of the terminal orifices of each said duct, and means actuated through the instrumentality of each said duct to produce a musical note.

2. In a pneumatic action for automatic musical instruments, the combination of a series of air-ducts, individual to respectively corresponding notes, each duct having a plurality of terminal orifices, and separate valves which are adapted to vary the areas of the terminal orifices of each said duct, and means actuated through the instrumentalities of each said duct to produce a musical note.

3. In a pneumatic action for automatic instruments the combination with two series of air channels or chambers V and 3 pairs of which are individual to respectively corresponding notes, and a passage N' in common to both said channels of a pair, and means whereby said passage N' may have variably free communication with the different ones of said channels V and 3, of means actuated through the instrumentality of said passage to produce a musical note, and automatic means for establishing pneumatic actions in said channels V and for also, concurrently therewith, establishing pneumatic actions in the channels 3.

4. In an automatic mechanism for playing a musical instrument, two suction-chambers in common to two sets of individual valve-operating mechanism, a tracker-board, provided with paired or grouped sets of openings each group corresponding to one note in the scale, a pneumatic in each suction-chamber, individual to each note, in communication with a respective tracker-board opening and having by a restricted opening a communication with its suction-chamber, an individual diaphragm-chamber corresponding to a given note and diaphragm, an individual duct adapted to have through, valved openings communications from both of said suction-chambers with the diaphragm-chamber, individual valves, controlling communication between both suction-chambers and said individual duct, which valves are in relation to their corresponding pneumatics to be operated thereby, to open such valves, means for varying the freedom of communication between the suction-chambers and said ducts, a thrust member, operated by the diaphragm, and means for effecting the recovery of the diaphragm.

5. In a mechanism for automatically playing a musical instrument, a series of note-sounding thrust members, and diaphragms in chambers therefor, controlling said members a duct leading to each diaphragm-chamber, pneumatic apparatus comprising a chamber, with valved passages communicating with said ducts, a secondary chamber having also communication with said ducts, and automatic means for opening communication between the primary chamber and said ducts, and concurrently therewith, as required, communication between the secondary chamber and said ducts, for the purpose set forth.

6. In an automatic mechanism for playing a musical instrument, a common suction-chamber, a tracker-board provided with an opening corresponding to each note in the scale, and a pneumatic individual to each note in communication with a respective tracker-board opening and having by a restricted opening a communication with the suction-chamber, an individual diaphragm-chamber and diaphragm, an individual duct having by a valved opening a communication from the suction-chamber to the diaphragm-chamber, an individual valve, controlling communication between the suction-chamber and said duct, which valve is in relation to its corresponding pneumatic to be operated thereby, to open such valve, means for closing the valve, a thrust member, operated by the diaphragm, an individual channel or way leading to the diaphragm-chamber at the opposite side of the diaphragm from the entrance of said duct, and having ports which communicate both with the suction-chamber and the outer air and valves concurrently operated by the corresponding individual pneu-

matic for closing communication between said way and the suction-chamber, opening it to the air, and for reversing said relations, for the purpose set forth.

7. In an automatic mechanism for playing a musical instrument, a common suction-chamber, a tracker-board provided with a series of paired openings each pair corresponding to a note in the scale, and a pneumatic individual to each note in communication with a respective tracker-board opening and having by a restricted opening a communication with the suction-chamber, an individual diaphragm-chamber corresponding to each note, and diaphragm therein, an individual duct having by a valved opening a communication with the suction and diaphragm chambers, an individual valve, controlling communication between the suction-chamber and said duct, which valve is in relation to its corresponding pneumatic to be operated thereby, to open such valve, means for closing the valve, a thrust member, operated by the diaphragm, and a secondary common suction-chamber having respective communications with the above ducts, valves for opening and closing such communications, pneumatics, controlling said valves operated, from the tracker-board, and means for regulating the degree of freedom of communication between said ducts and said suction-chambers.

8. In a pneumatic mechanism for playing a musical instrument the combination with a tracker-board having individual note-apertures, a common suction-chamber A, a common air-chamber F inclosed within the suction-chamber a series of individual diaphragm-chambers B corresponding to individual notes, a series of pneumatics in said suction-chamber which have connections with the tracker-board openings, and restrictedly with the suction-chamber, the series of individual channels V having ports Y opening to the suction-chamber, and communicating with a diaphragm-chamber under the diaphragm therein, the serial individual channels or chambers S, communicating with the diaphragm-chambers above their diaphragms, a valve-stem U for each note operated by a respective one of said pneumatics and having the valves O, O' and O'', for simultaneously opening port Y, and closing chamber S from the suction-chamber, and opening it to the air-chamber F, and self-retracting means for the valve-stem.

9. In an automatic mechanism for playing a musical instrument, the combination with an apertured tracker-board, a common suction-chamber, a series of diaphragm-chambers B with diaphragms therein, a series of individual ducts leading to the chambers B below the diaphragms therein, and connecting-channels V having ports opening to the suction-chamber, a common air-chamber F, individual chambers S with ports opening to

both the common suction and air chambers, passages *h* leading from the chambers *S* to the chambers *B* above the diaphragms, a series of pneumatics in communication with the tracker-board apertures and restrictedly with the suction-chamber, a valve-stem actuated by the pneumatics having the valves *O* *O'* and *O''*, operative on the expansion of their corresponding pneumatic to open a channel *V* to the suction-chamber and a chamber *S* to the air-chamber closing the latter from the suction-chamber and a series of passages *l* communicating from the outer air to below the diaphragm, and a valve operated by the pneumatic to close said air-passage when the lower portion of chamber *B* is in communication with the suction-chamber.

10. In a device of the character described, the combination of mechanism for striking the theme-notes and the accompaniment-notes distinctly as such, independently of the relative position of said notes in the musical scale, and means, controllable at will, while the device is in action, for gradually chang-

ing the expression of said theme-notes as a whole independently of said accompaniment-notes, so as to give the operator complete control at all times over the volume of sound of said theme-notes independently of their relative position in the musical scale.

11. In a device of the character described, the combination of means for selectively striking the accented notes and the unaccented notes distinctively as such, independently of the relative positions of said notes in the musical scale, and separate mechanisms, controllable at will during the operation of the device, for gradually changing the expression of said accented notes as a whole and of said unaccented notes as a whole, independently of said relative positions of said notes in said musical scale.

Signed by me at Springfield, Massachusetts, this 28th day of March, 1900.

ALLAN E. OLNEY.

Witnesses:

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