

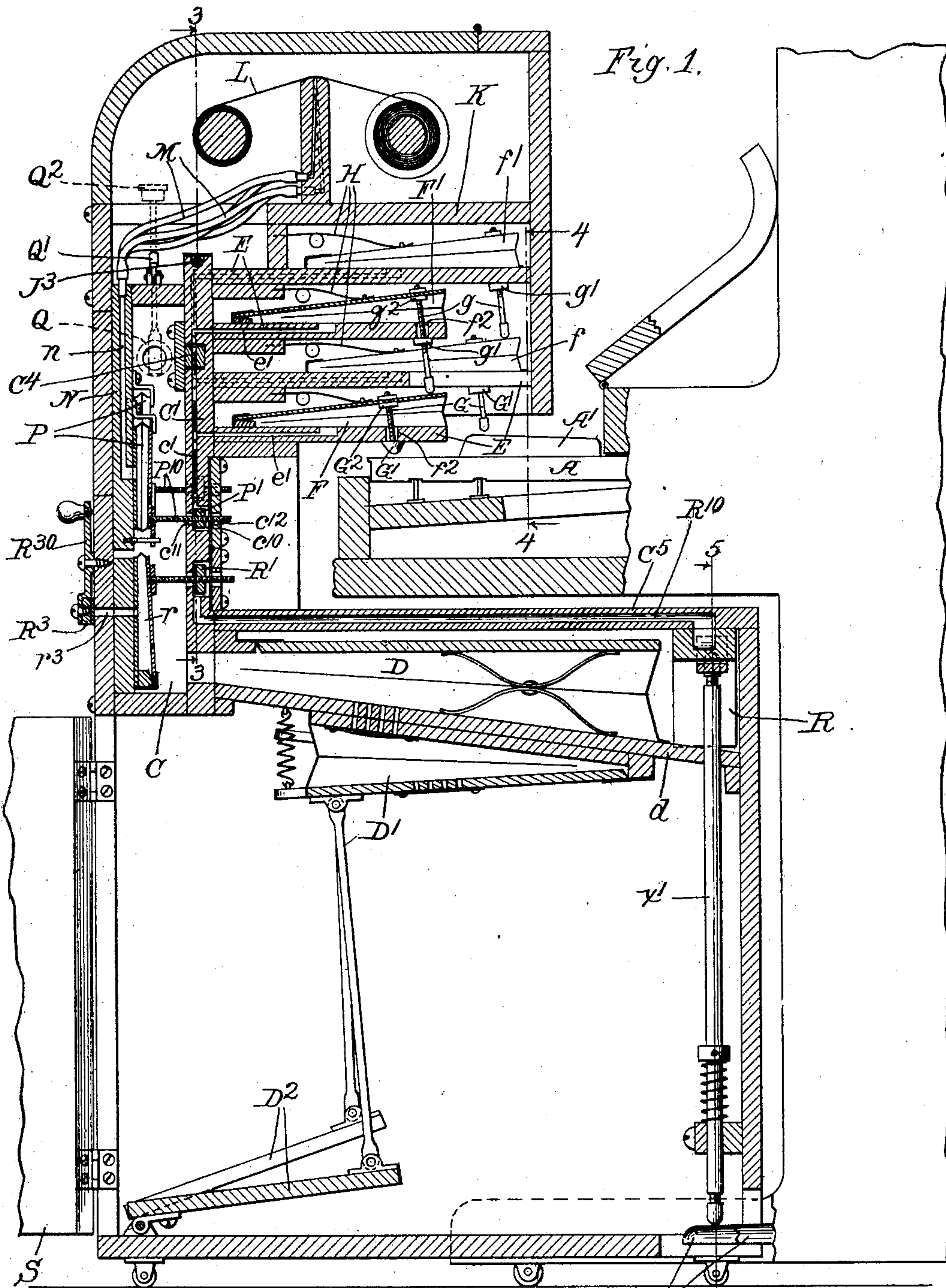
M. CLARK.

## AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.

(Application filed Dec. 4, 1899.)

(No Model.)

9 Sheets—Sheet 1.



Witnesses.

Edward T. Wray.

Adna H. Towne Jr.

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by Barton & Barton  
his Attys.

No. 709,962.

Patented Sept. 30, 1902.

M. CLARK.

AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.

(Application filed Dec. 4, 1899.)

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9 Sheets—Sheet 2.

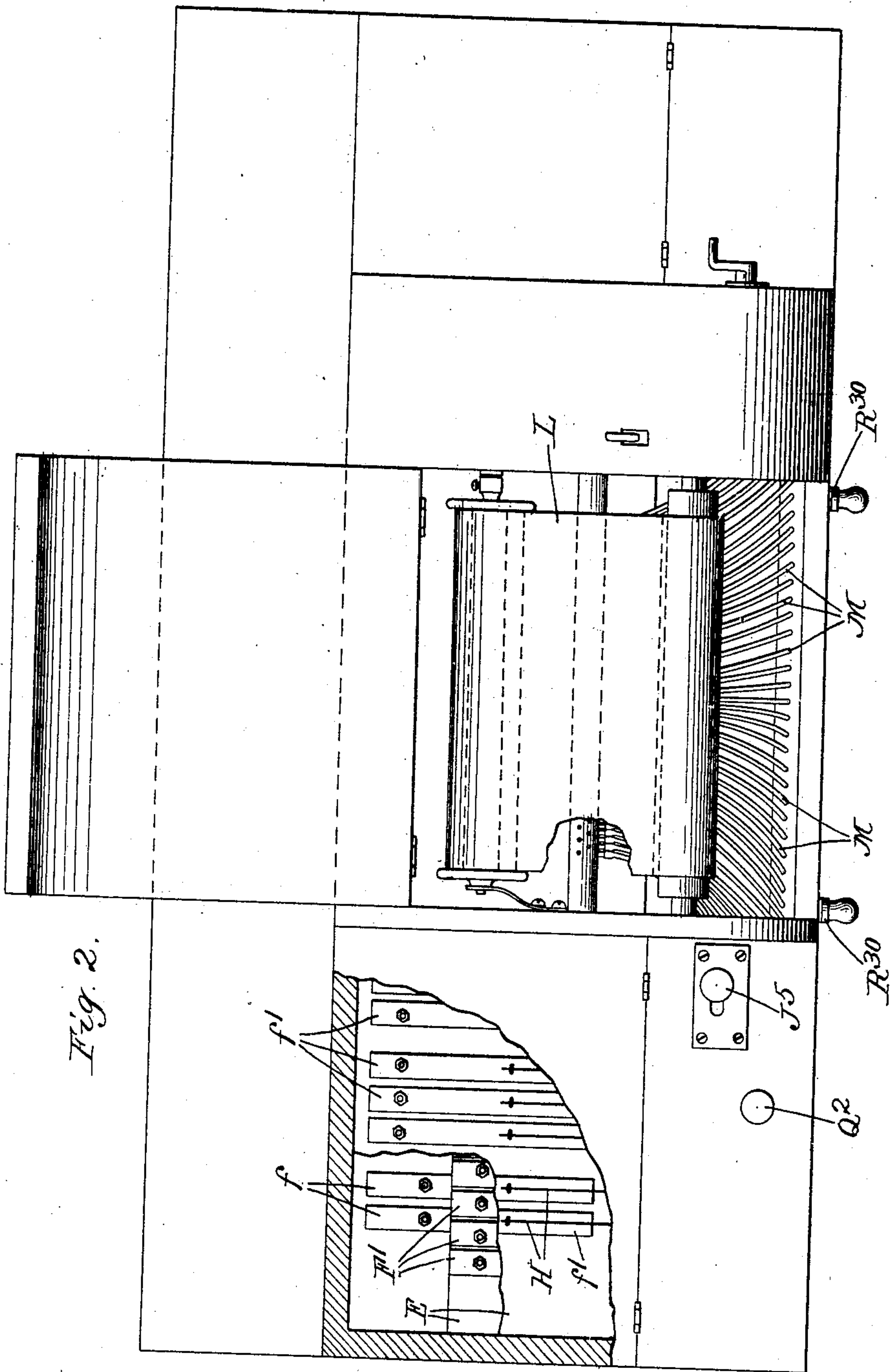


Fig. 2.

Witnesses.

Edward T. Wray.

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Inventor  
Melville Clark  
by Burton H. Burton  
his Atty's.



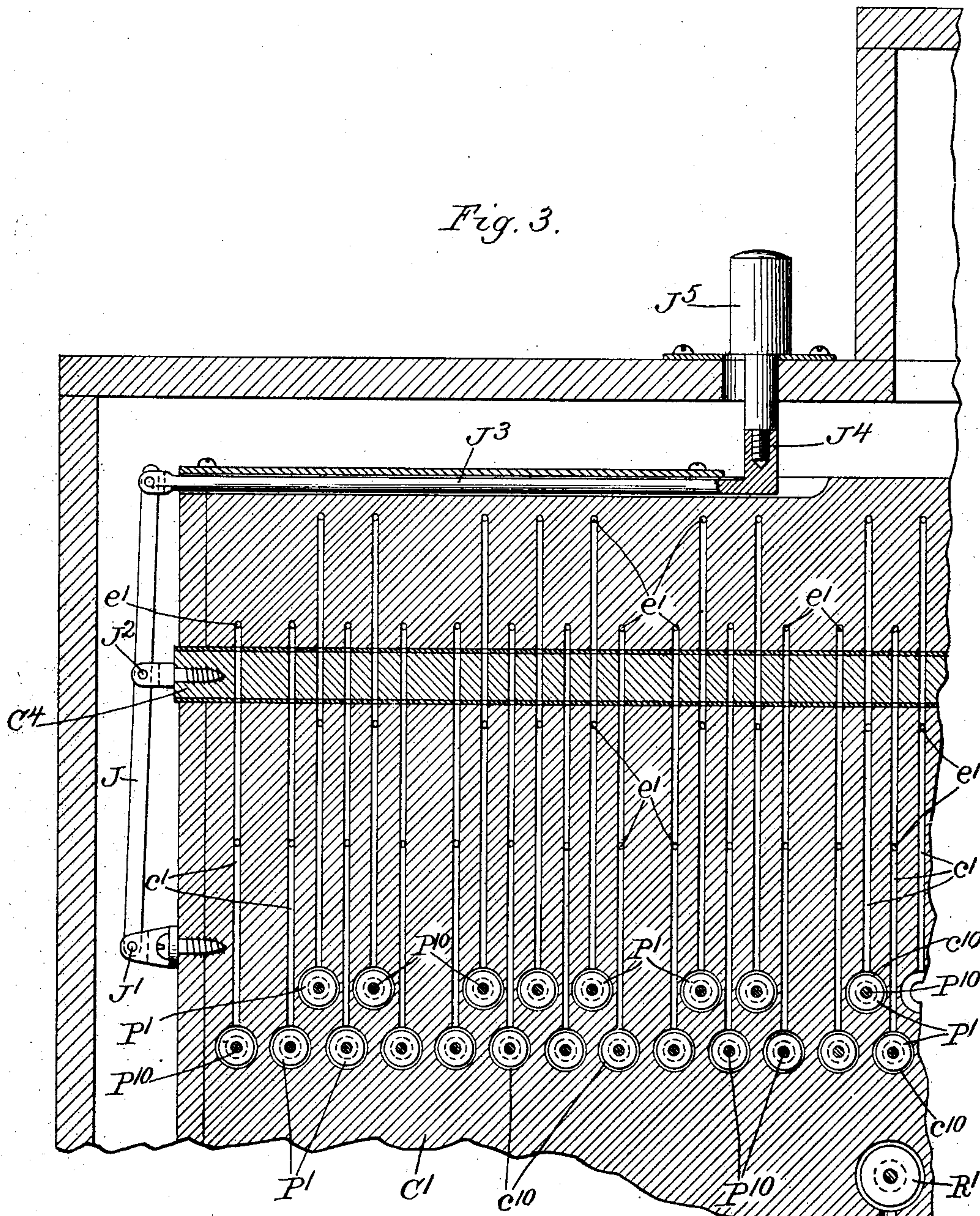
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Witnesses.

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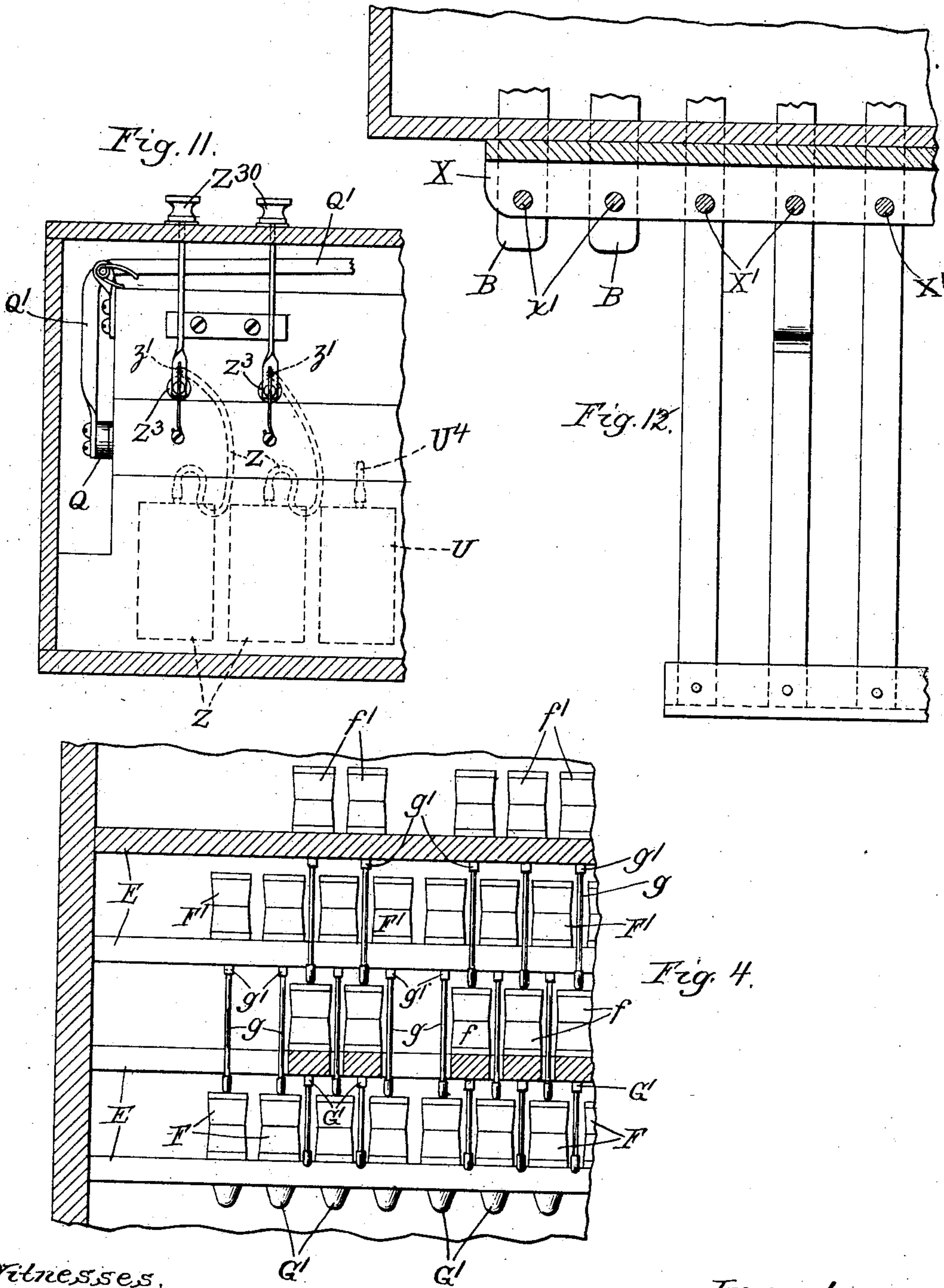
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Witnesses.

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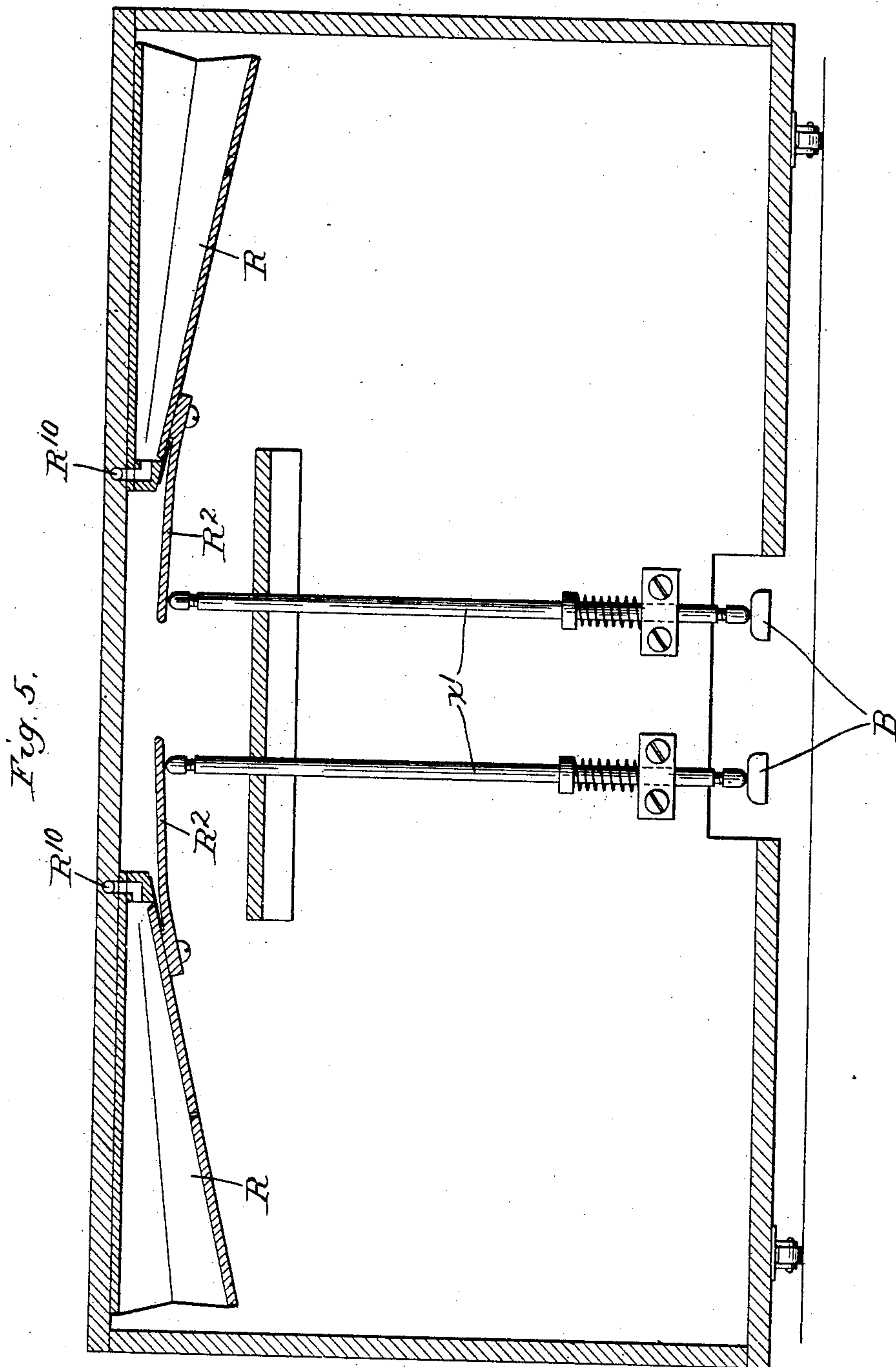
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(No Model.)

9 Sheets—Sheet 5.



Witnesses,

Edward T. Wray.

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No. 709,962.

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9 Sheets—Sheet 6.

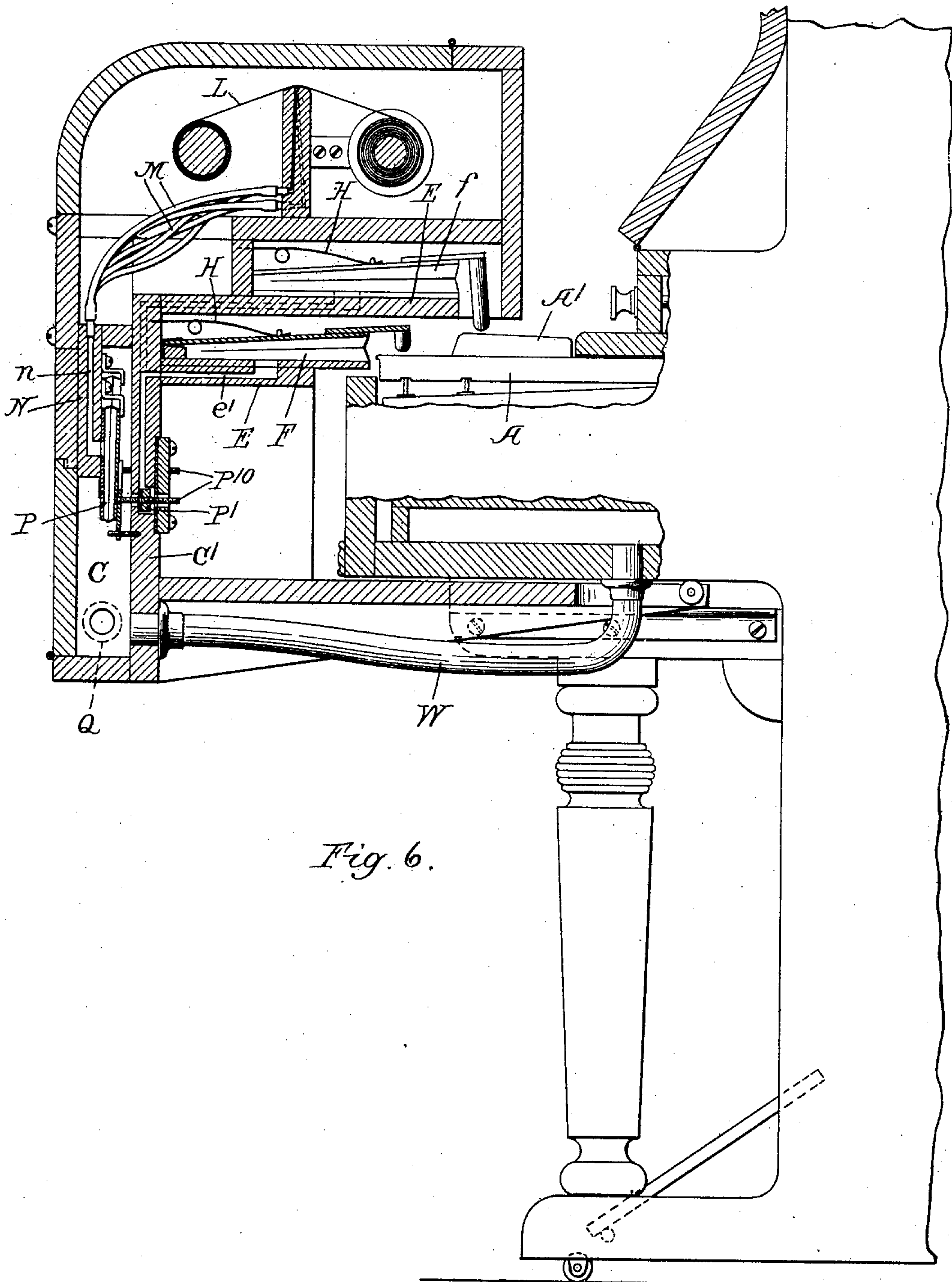


Fig. 6.

Witnesses.

Edward T. Wray.

Adna H. Bowring.

Inventor:

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*his Atty's*



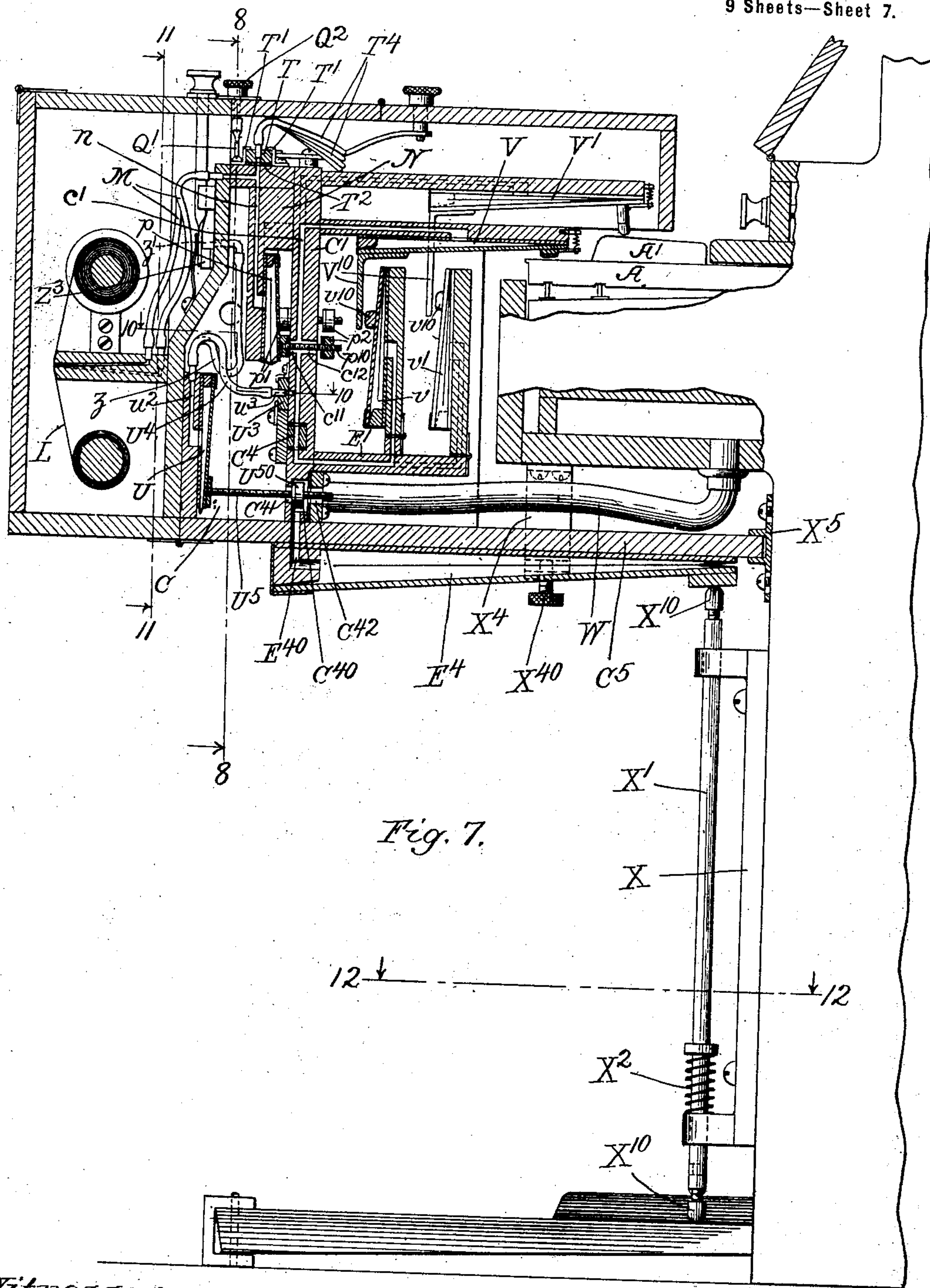
**M. CLARK.**

**AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.**

(Application filed Dec. 4, 1899.)

(No Model.)

9 Sheets—Sheet 7.



Witnesses,

Edward T. Wray.  
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Inventor.  
Melville Clark  
by Burton and Burton  
his Atty's.



**No. 709,962.**

Patented Sept. 30, 1902.

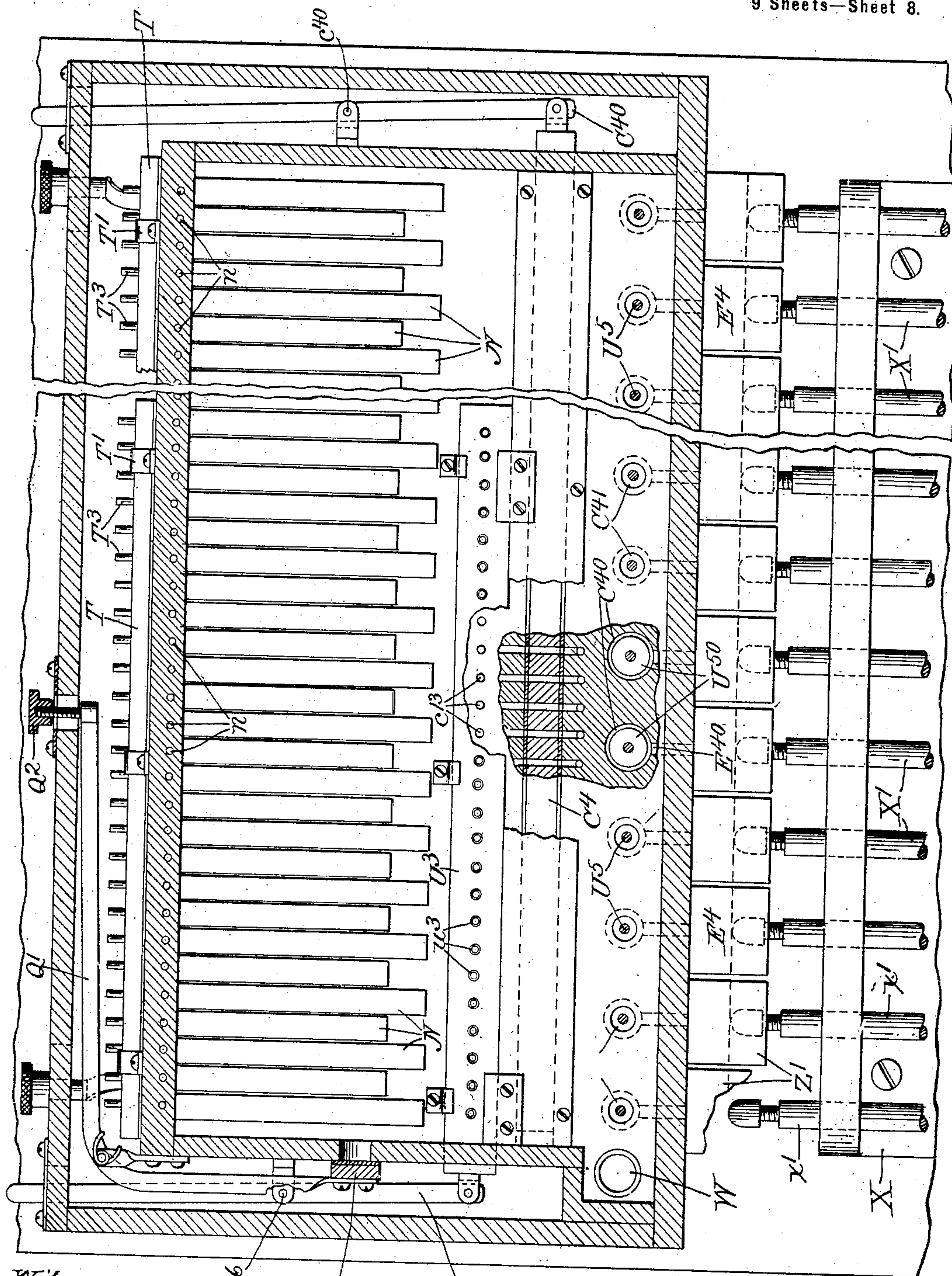
**M. CLARK.**

**AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.**

(Application filed Dec. 4, 1899.)

(No Model.)

9 Sheets—Sheet 8.



Witnesses.

Edward T. Wray.  
Adna H. Bowen Jr.

*Inventor.*  
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*his Atty's.*



M. CLARK.

AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.

(Application filed Dec. 4, 1899.)

(No Model.)

9 Sheets—Sheet 9.

Fig. 9.

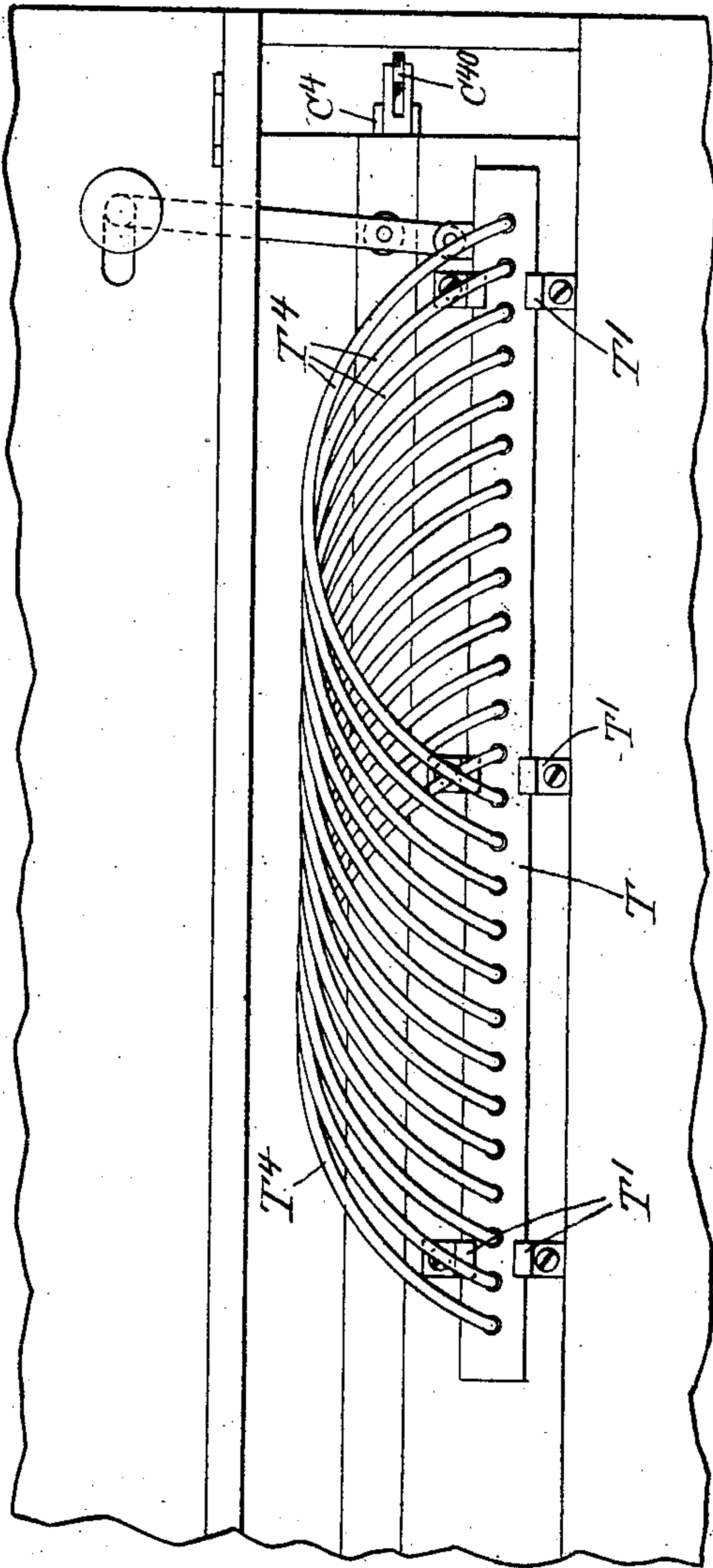


Fig. 13.

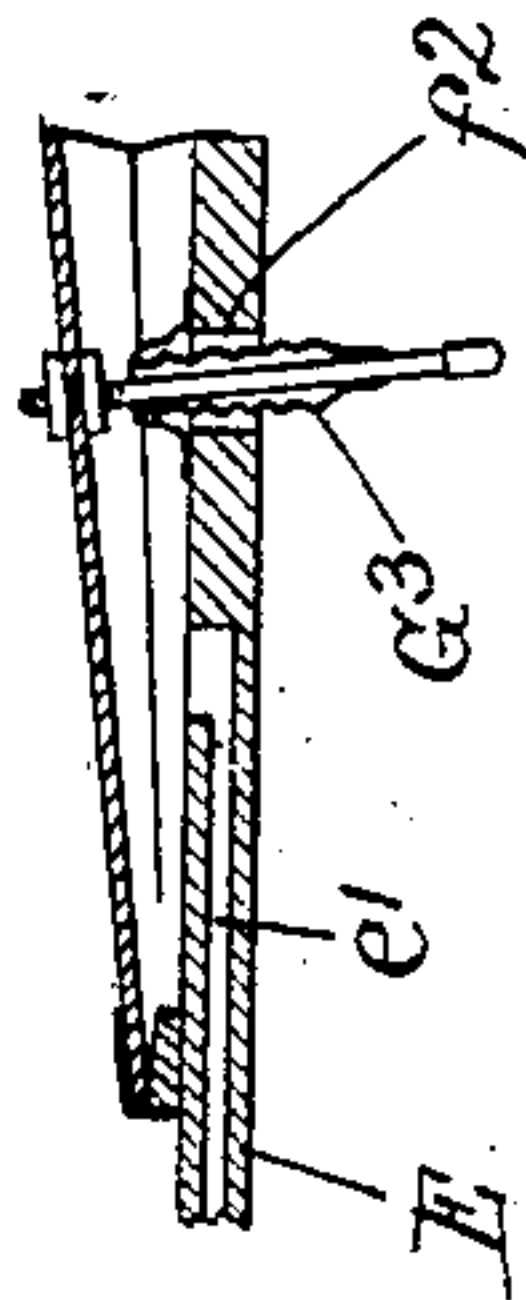
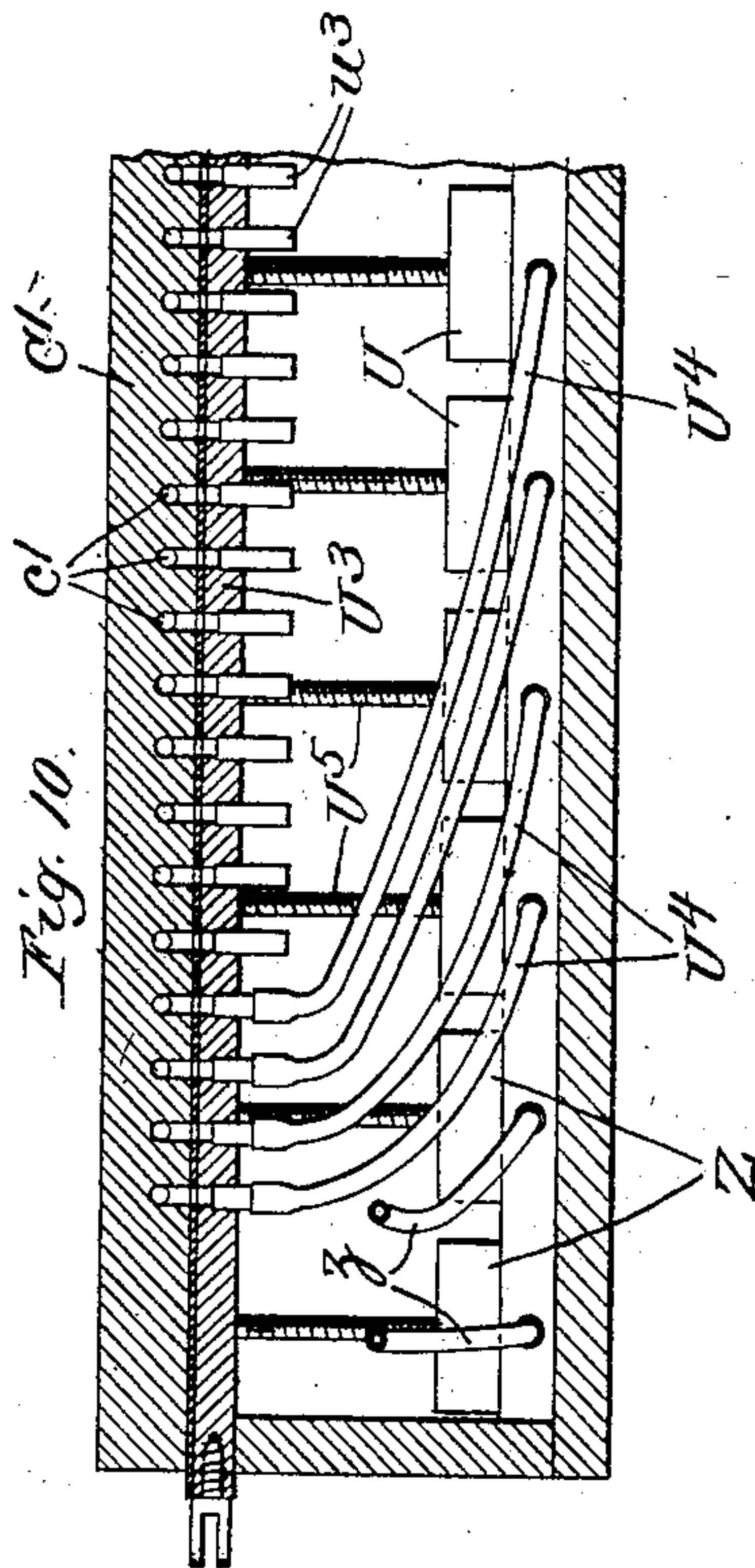


Fig. 10.



Witnesses.

Edward T. Wray.

Adna H. Bowin.

Inventor

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his Attys.



# UNITED STATES PATENT OFFICE.

MELVILLE CLARK, OF CHICAGO, ILLINOIS.

## AUTOMATIC PLAYER FOR KEYED INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 709,962, dated September 30, 1902.

Application filed December 4, 1899. Serial No. 739,190. (No model.)

*To all whom it may concern:*

Be it known that I, MELVILLE CLARK, a citizen of the United States, residing at No. 501 West Monroe street, Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Automatic Players for Keyed Instruments, which are fully set forth in the following specification, reference being had to accompanying drawings, forming a part thereof.

This invention is designed to furnish improved apparatus for playing keyed instruments, such as pianos and organs, without changing the structure of the instruments, the apparatus being an independent one adapted to be placed in position adjacent to the keyed instrument in order to operate upon its manual and to be detached or removed when the instrument is to be operated by hand in the customary way.

I employ pneumatic mechanism, and when designed to be used with a piano or other instrument having no bellows provide a bellows to be operated by a pedal to supply the necessary pneumatic tension or pressure and control the pneumatic device by a perforated music-sheet in a manner which is familiar in automatic or self-playing organs.

The invention consists in the features of construction which are broadly and specifically set out in the claims.

In the drawings, Figure 1 is a fore-and-aft vertical section through my improved player and a portion of the front of the keyed instrument to which it is adjusted, the arrangement being specially adapted for a piano. Fig. 2 is a top plan of the same with the lid open and parts of the inclosing case broken away to disclose the mechanism. Fig. 3 is a detail section at the line 3 3 in Fig. 1 on an enlarged scale. Fig. 4 is a detail section at the line 4 4 on Fig. 1 on a scale corresponding to Fig. 3, both these figures being full size. Fig. 5 is a detail section at the line 5 5 on Fig. 1, showing the mechanism for operating the pedals of a piano. Fig. 6 is a vertical fore-and-aft section of a modification of the player adapted to be used with an exhaust-organ and connected to the exhaust-chamber thereof, no bellows being provided with the player. Fig. 7 is a vertical fore-and-aft section of a further modification, adapted

to be used with a blast-organ—as, for example, a pipe-organ—and connected with the pressure-chamber of the organ and provided also with means for operating the pedal base-keys of a pipe-organ. Fig. 8 is a detail section at the line 8 8 on Fig. 7 on an enlarged scale. Fig. 9 is a detail plan of coupling mechanism. Fig. 10 is a detail section at the line 10 10 on Fig. 7. Fig. 11 is a detail section at the line 11 11 on Fig. 7, showing features at the left-hand end portion only. Fig. 12 is a detail sectional plan showing the left-hand end portion of the pedal-keys of the organ represented in Fig. 7 and certain pedal-stops located at the left-hand end of the pedal-keys, section being made at the line 12 12 on Fig. 7. Fig. 13 is a detail section showing modification in the construction of certain motor-pneumatics and their stroke-fingers for striking the keys.

I will first describe the details of my improved apparatus of the form which is shown in Figs. 1 to 5, inclusive, which is particularly arranged with reference to a piano, and in which I employ an exhaust-bellows to operate the pneumatics. In these figures, A A' are respectively the white and black keys of the piano, and B B are the loud and soft pedals of the piano. C is a wind-chest to which there is connected an exhaust-bellows D, which is exhausted by a pumper D', associated with it in the usual way and operated by the pedal D<sup>2</sup>. The fixed part of the bellows D is rigid with the wind-chest C, and the bellows extend forward from the wind-chest—that is, toward the instrument to be played and underneath of the protruding manual breast of said instrument, as seen in Fig. 1, the wind-chest C being upright and standing up in front of the breast of the instrument at a short distance therefrom. On the side of the wind-chest C toward the instrument and above the level of the manual of the latter I mount horizontal duct-boards E E E E, one above another, overhanging the manual, and on these duct-boards there are mounted motor-pneumatics F F' and f f', of which the duct-board constitutes the fixed wall, the moving wall being above the duct-board, to which it is connected by the bellows sides, so that said moving walls move downward in the collapse of the pneumatics. The two



lower duct-boards E E pertain to the pneumatics which directly operate the keys of the manual, those upon the lowest board being arranged to operate upon the white keys while those on the next board above are arranged to operate upon the black keys, the pneumatics of both series being arranged directly over the keys of the manual upon which they are respectively designed to operate. The pneumatics which operate the black keys are thus set opposite or above the intervals between the pneumatics which operate the white keys, the width of the pneumatics of both sets being thus the entire space apportioned to the white keys less only a sufficient interval to permit the stroke-fingers  $g$  of the upper sets of pneumatics to extend between them to reach the pneumatics with which they are respectively in tandem arrangement. The pneumatics which operate upon the black keys, it will be understood, extend forward beyond the end of those that operate upon the white keys in order to overhang the black ones and operate directly upon them, as described. In order that the stroke which the pneumatics give to the keys may be as forcible as consistent with given dimensions of the parts, I attach the stroke-fingers  $G$   $g$  to the upper or moving walls of the pneumatics, within the latter, at some distance back from the forward end of said moving wall—that is to say, as near the hinge of the bellows as possible in view of the necessity of having the fingers strike the key. These stroke-fingers are made as rigid as possible with the moving walls and have the identical movement of the latter in their stroke upon the keys. This arrangement necessitates providing apertures  $f^2$  in the fixed walls of the pneumatics—that is to say, in the duct-boards through which the stroke-fingers may protrude to reach the keys. These apertures are slightly elongated to accommodate the movement of the stroke-fingers about the hinge-pivot of the pneumatics, and in order that they may not be the cause of leakage, which would defeat the action of the pneumatics when the latter are open to the wind-chest, I provide on the stroke-fingers outside—that is, below the duct-boards—respectively, washers  $g'$   $G'$ , &c., which operate as valve seating over the lower ends of the apertures when the pneumatics are expanded, and on the fingers immediately against the under side of the moving walls of the pneumatics I place similar washers  $g^2$   $G^2$ , &c., which operate as valves seating over the upper ends of the apertures when the pneumatics are collapsed. These valves are made or faced with felt or leather, so that they operate effectually to close the apertures when seated as described. Light springs H H, &c., are provided above the moving walls of the several pneumatics, engaging them in any convenient manner, with the tendency to hold them up and keep the pneumatics expanded. Thus when the pneumatics are not in con-

nection with the wind-chest, but are held expanded by the springs, the valves  $G'$   $g'$  are seated so that when any pneumatic is put in connection with the wind-chest the suction or rarefaction of the air in the pneumatic is experienced without loss from leakage until the upper wall of the pneumatic begins to yield under the superior atmospheric pressure. This action, however, is so instantaneous that before any practical loss is experienced the pneumatic has become completely collapsed, and the valve  $G^2$  is seated above the aperture, and leakage is prevented. In Fig. 13 I have shown a modification for accomplishing the same result, consisting in providing a collapsible sleeve  $G^3$ , attached at one end around the aperture  $f^2$  and at the other end around the stroke-finger, such sleeve being long enough to allow the full stroke and soft and flexible enough to not materially impede it. The ducts  $c'$  in the forward wall  $C'$  of the wind-chest lead upward respectively from the valve-chambers  $c^{10}$  past the ends of the several duct-boards, opposite to which they are provided with branch ports  $e'$ , which constitute their connection with the ducts of said duct-ports leading to the several pneumatics on said ports. It will be understood that the ducts which pertain to the pneumatics designed to operate the white keys have their cross-ports  $e'$  leading into the ducts of the duct-boards having the pneumatics for operating the white keys, and the ducts pertaining to the pneumatics for operating the black keys have the cross-ports leading into the duct-boards on which the pneumatics for the black keys are mounted. The ducts for the white-key pneumatics have their cross-ports leading not only into the lowest of the boards E, but also in the third from the bottom, and the ducts for the black pneumatics have their cross-ports leading into the second and fourth duct-boards from the bottom, and on the third and fourth duct-boards from the bottom there are mounted a series of supplementary pneumatics, which are designed to reinforce the corresponding pneumatics of the series on the first and second boards, being in tandem arrangement with the latter, respectively, and having their stroke-fingers  $g$  extending down between the pneumatics of the series immediately below far enough to reach the upper or moving walls of the pneumatics which they are designed to supplement. These fingers terminate in suitable knobs, which in the normal position of the pneumatics of both series are in contact with the upper surfaces of the upper or moving walls of the lower and leading pneumatics. In order to enable the operator to control the action of the pneumatics, so that the keys may be struck by the force of one pneumatic only or by the force of both pneumatics at will, I provide a cut-off or slide valve  $C^4$  in the front wall  $C'$  of the wind-chest at a position between the level of the cross of the cross-ports



leading to the second and third duct-boards, where it intercepts all the ducts leading to the supplementary pneumatics for both the white and black keys. This slide thus contains a short portion of each duct, and being displaced from the position at which these short portions register with the adjacent portions cuts off all the ducts and prevents the upper series of pneumatics from operating.

In order to operate this cut-off, I provide at the left-hand end of the forward wall  $C'$  of the wind-chest a lever  $J$ , fulcrumed at  $J'$  and connected at  $J^2$  to the end of the slide cut-off  $C^4$  and extending up to the upper edge of the wind-chest wall and there connected to the link  $J^3$ , which terminates in an upstanding finger  $J^4$ , to which an operating-knob  $J^5$  is connected, said knob standing above the table or upper inclosing wall of the cabinet-work and in a convenient position to be operated to move the slide  $C^4$  to the right or left, so that its ports are either in or out of registration with the ducts to which they correspond. The motor-pneumatics in this construction are controlled in a manner which is familiar in the art and which will be described briefly. Upon the table  $K$  there is supported the "tracker-range" or duct-board over which the perforated music-sheet  $L$  travels.

From the ducts of this tracker-range I lead flexible tubes  $M M M$ , &c., to the ducts  $n$  in the primary duct-board, consisting of the blocks  $N$ , mounted within the wind-chest  $C$  and extending to the upper end thereof, so that the ducts  $n$  open out through the upper edge. Within the wind-chest are mounted the primary pneumatics  $P P$ , &c., one of the ducts  $n$  leading to each such primary pneumatic. These primary pneumatics stand with the oscillating ends of their moving walls respectively opposite the ports  $c^{11}$ , leading to the valve-chambers  $c^{10}$ , and the valves  $P'$  in said valve-chambers, respectively, have their stems  $P^{10}$  connected to the moving walls of the primary pneumatics, so that the valves are operated by the pneumatics and seat over the ports  $c^{12}$ , opening to the outer air when the primary pneumatics are inflated, and seat over the ports  $c^{11}$ , which lead into the wind-chest when the primary pneumatics are collapsed. The primary pneumatics are collapsed whenever the ducts leading into them are closed by the perforated music-sheet and are inflated whenever these ducts are open. The motor-pneumatics are therefore collapsed by being put into communication with the rarefied air of the wind-chest whenever the primary pneumatics are inflated by being put into communication with the atmosphere through the duct leading to the tracker-range when an aperture of the perforated music-sheet registers with said duct, and the motor-pneumatics are inflated or held expanded by their springs whenever the primary pneumatics are collapsed and the motor-pneumatic thereby put into communication with the atmosphere. The registration,

therefore, of any aperture of the music-sheet with a duct of the tracker-range causes the motor-pneumatics corresponding thereto to be collapsed and to strike the key of the manual which its stroke-finger overhangs. When the cut-off  $C^4$  is set so that the ducts from the valve-chambers are open to both the principal and supplemental motor-pneumatics, both said pneumatics will be collapsed by the influence of the same primary and will operate tandem on the manual, causing the key to be struck with double force.

The force with which the keys are struck, whether they are operated by one pneumatic or two, is dependent upon the air tension of the bellows or wind-chest. The operator, therefore, may control the stroke and the expression of the music as to intensity by operating the pumping-bellows more or less rapidly. It will be manifest that when a high tension or a high degree of rarefaction has been produced in the bellows or wind-chest the stroke of all the pneumatics upon their respective keys will be correspondingly intensified, and when it is desired to pass from loud to soft action instantly the air tension of the wind-chest must be instantly modified. To render this possible, I provide a vent-valve  $Q$  at any convenient point, as at the left-hand end of the wind-chest, and a lever  $Q'$ , terminating in a button  $Q^2$ , by which it may be operated by the finger of the performer pressing the button when it is desired to relieve the air tension and resume a soft touch.

Pedal-stops such as are usual on pianos for modifying the tone or on organs or other instruments for any other purpose are operated by special motor-pneumatics  $R$ , of which two are shown, each controlled by a primary pneumatic  $r$ , which operates the valve  $R'$ , controlling in a familiar manner the air-supply of the motor-pneumatic through the duct  $R^{10}$ , formed in the board  $C^5$ , which extends rigidly from the face of the forward wall of the wind-chest  $C$ , under the manual breast, and supports at its rear part the motor-pneumatics  $R$ , whose moving walls face downward and have each a finger or lever arm  $R^2$ , which overhangs the upper end of the thrust-rod  $x'$ , which is precisely similar to the rods  $X'$ , hereinafter described in connection with the structure shown in Fig. 7. The lower ends of the rods  $x' x'$  overhang and act upon the pedal-stop levers  $B B$ , respectively. The pneumatics  $r$ , which control the large motor-pneumatics  $R$ , are themselves controlled by valves  $R^3$ , closing the outer ends of the ports  $r^3$ , through which said pneumatics are vented, said valves  $R^3$  being each mounted on one end of a swinging lever  $R^{30}$ , fulcrumed on the forward side of the case, so that it may be in convenient reach of the operator, who by swinging the lever to throw the valve on or off the mouth of the port  $r^3$  brings the primary pneumatic into or out of action and causes it to bring its motor-pneumatic into or



out of action—that is to say, the wind-chest being operated by an exhaust-bellows when the port  $r^3$  is closed by the valve and the pneumatic  $r$  being collapsed by the exhaustion of air through the leak-port, its valve  $R'$  is seated inwardly and the motor-pneumatic  $R$  is put into communication with the outer air and remains inflated, so that it does not actuate the thrust-rod  $x'$ ; but when the valve  $R^3$  is moved to uncover the port  $r^3$  the primary pneumatic  $r$ , being inflated, seats its valve  $R'$  over the outer port and exposes the motor-pneumatic  $R$  to the suction of the wind-chest, by which it is collapsed and caused to thrust the rod  $x'$  downward to actuate the pedal-stop.

In Fig. 6 I have shown a modification in the construction of this apparatus by which it may be made somewhat more convenient for use upon an exhaust-organ and by which the bellows of such organ may be utilized, thus dispensing with the necessity for providing a special bellows for the "player." In an organ usually the expression and combinations of the reeds are controlled by a greater or less number of stops, which are located at the organ-front, usually above and behind the right and left hand end portions of the manual, and it is desirable that the arrangement of the devices for operating upon the keys of the manual shall not obstruct access to these stops. In the form shown in Fig. 6, therefore, instead of extending the pneumatics so as to overhang the manual and mounting them on several duct-boards one above the other, all overhanging the manual, as in Fig. 1, I locate them in front of the manual, merely extending the rigid fingers from their moving walls, so as to overhang the keys respectively upon which they are to operate. By this construction also I avoid the necessity of having the operating or stroke fingers penetrate the fixed wall of the pneumatics. In this figure I have not shown the supplemental pneumatics; but it will be understood that they can be arranged as illustrated in Fig. 7, in which the player is shown arranged for operating upon a pipe-organ or any other organ having a pedal-base. In any organ or other instrument having a wind-chest the player may be constructed without the bellows and the player wind-chest may be connected to that of the organ by a pipe  $W$ , leading from any convenient point of the wind-chest. The vent-valve  $Q$  in that case, it will be seen, operates to vent the organ wind-chest, and this produces the same effect upon the intensity of sound as when in the piano the player wind-chest is vented.

In Fig. 7 I have shown my player applied to a blast-organ, such as a pipe-organ. Certain changes in the detail construction are necessary, which require explanation. The action of the pneumatics being reversed, their positions are reversed, the principal pneumatics  $V V'$ , which operate upon the keys, being mounted on the under side of the

duct-boards and having their moving walls facing downward and carrying the stroke-fingers projecting downward from their outer surfaces. The primary pneumatics  $p$  carry the valves  $p' p^2$  on one stem  $p^{10}$ , which penetrates the wall of the wind-chest, extending through the ports  $c^{11} c^{12}$ , which are closed by the valves  $p' p^2$ , respectively, at the outer ends of the outer ports—i. e., at the opposite surfaces of the wall. These variations are familiar in pneumatic-organs. In this structure, since it is desirable to provide supplemental pneumatics to reinforce the principal motor-pneumatics in their action upon the manual-keys, in order that when the organ is one in which mechanical stops are arranged to bring various sets of pipes or reeds into action, each of which increases the demand for pressure upon the key in order to operate the valves, and since the stops should be left easily accessible and not hidden by the structure of the players, I locate the supplemental pneumatics below instead of above the principal pneumatics, and in order to do this with a compact structure I place the supplemental pneumatics  $v v'$  vertically, mounting them upright on the duct-board  $E'$ , extended horizontally from the forward or outer face of the wall of the player wind-chest toward the lower end of that wall, the moving walls of the supplemental pneumatics being hinged at the lower end and oscillating at the upper end, and from the hinged end of the moving walls of the principal pneumatics  $V V'$  extend downward rigid lever-arms  $V^{10} V^{10}$ , which stand alongside the upper portion of the moving walls of the supplemental pneumatics, so that suitable abutments or buttons  $v^{10}$ , which may be mounted on the outer face of said moving walls, afford direct contact with the lever-arms  $V^{10} V^{10}$ , respectively. It will be seen that with this arrangement the inflation of the supplemental pneumatics causes them to act directly against the lever-arms of the moving wall of the principal pneumatics and assist the inflation of the latter and add their own force to the force of the movement of said principal pneumatics, the action of the principal and supplemental pneumatics pertaining to each key being accumulated upon the key, the two pneumatics being virtually in tandem arrangement, so far as the application of the force is concerned. The ducts which lead to the supplemental pneumatics are extended from the cross-ports, terminating at  $c^{11}$  and  $c^{12}$  downward in the forward wall of the wind-chest to meet the ducts in the duct-board  $E'$  and to control the supplemental pneumatics—that is, to bring them into action or cut them out at will—I locate the cut-off slide  $C^4$  in the wall of the wind-chest below the cross-ports and extend it out through the right-hand end of the wind-chest, where it is engaged and operated by the lever  $C^{40}$ , fulcrumed on the stud  $c^{40}$  and extending up through the table or top board of the cabinet, so that it may be reached and operated by



the performer. In representing this form of my player I have shown another feature which may be employed in any of its forms—to wit, the coupling of the last octave at each end of pneumatics which are controlled directly by the music-sheet, with an octave of pneumatics beyond the one thus coupled, so that although the perforated music-sheet has, as is customary, only, say, fifty-eight lines of perforations, corresponding to fifty-eight keys of the manual, the player may be made to sound a full octave above and a full octave below these fifty-eight notes, the player being provided with these two additional octaves of pneumatics overhanging the two corresponding octaves of keys of the manual. Such coupling might be effected in the ducts leading from the primaries to the motors, only the motors being provided at the additional octaves, but it is more convenient to extend the system of primaries, as well as the system of motors, over the entire range to be played and to effect the coupling upon the ducts of the primaries, and I have so illustrated the structure. The ducts in the primary duct-board in the form shown in Fig. 7 are not extended out through the top of the wind-chest for the purpose of making the connection with the tracker-range, but instead that connection is made by extending the ducts rearward in the top board of the wind-chest to the rearward side, where the flexible tubes are arranged and lead to the tracker-duct board, which is mounted on and projects from the rear side wall of the wind-chest. For the purpose of effecting the coupling above referred to I extend the ducts of two extreme octaves of the primary duct-board up through the top of the wind-chest, and over their open ends at the top I mount a slide T, having apertures corresponding to the mouths of the ducts, so that the slide may be placed with its apertures registering with all said mouths of said apertures, but may be moved a little more than the diameter of the duct, so that its apertures shall not register with any of said mouths, but, on the contrary, so that the apertures shall close the mouths at the upper end. These slides (only one of which is shown, the one at the other end being precisely similar) are retained in air-tight contact with the upper side of the wind-chest by suitable guards T' T'. (See Fig. 9.) The under surface of the slide or the upper surface of the wind-chest, or both, being felted at T<sup>2</sup> to prevent leakage. In each of the apertures of the slide T short nipples T<sup>3</sup> T<sup>3</sup> are inserted and flexible tubes T<sup>4</sup> T<sup>4</sup>, &c., are connected each to two of these nipples, one end of each tube extending from the nipple to the nipple an octave distant on the slide, thereby connecting the corresponding ports of the slide an octave apart. Now when the slide is in position with its apertures registering it will be seen that the slide-ports and tubes connecting them as described effect connection between the ducts of the primary duct-board an

octave apart, so that when any duct within the range of the perforated sheet is vented by an aperture in the latter not only the primary pneumatic corresponding to that aperture is operated, but also the primary pneumatic one octave distant, above or below, as the case may be, is operated, and thereby the motor-pneumatics corresponding to both these primaries are operated and brought into contact with the corresponding keys of the manual. In case of a piano this will always cause both the notes to be sounded; but in the case of an organ it is possible to mute out the reeds or pipes which would primarily be caused to speak, and thus to cause the extreme octaves only to sound by means of the coupler, if desired.

When my automatic player is arranged for use in connection with an organ having a pedal-base, I construct it for this purpose with the following additional features: upon the cabinet-front of the organ above the point at which the pedal-base levers or keys pass into the organ-case I mount a frame  $\alpha$  in which are arranged vertically a series of thrust-rods X', &c., which overhang, respectively, the pedal levers or keys of the pedal-base, each of these thrust-rods being upheld by a light spring X<sup>2</sup>, so that it is out of contact with the pedal-base key which it is to operate. I extend rigidly from the wind-chest C under the manual-breast of the organ the board C<sup>5</sup> to support the set of motor-pneumatics E<sup>1</sup>, each of which is large enough to afford power necessary to operate the pedal-base keys, the moving wall of these motor-pneumatics being the lower wall and operating upon the keys when the pneumatics are expanded, the structure shown in this figure being assumed to be applied to a pipe-organ in which pressure instead of suction is employed. The remote end of the moving wall of these pneumatics overhangs, respectively, the upper ends of the thrust-rods X', and when the pneumatics are collapsed, which is their ordinary condition under the action of the springs X<sup>2</sup>, the moving walls are preferably in contact with the upper ends of the thrust-rods when the latter are at their highest position, upheld by their respective springs. When the pneumatics are inflated and their lower walls forced downward, they drive the rods downward and force the latter to act upon the pedal-keys. In order to adjust the parts to each other so as to obtain prompt and uniform action, I prefer to terminate each of the thrust-rods at both ends with an adjustable button X<sup>10</sup> X<sup>10</sup>, so that not only the articulation of the upper end of the thrust-rods with the pneumatic-walls, but also their articulation with the pedal-levers at their lower ends may be uniform, and the stroke which they give to their respective pedal-keys therefore may be substantially uniform.

Large motor-pneumatics are required for the purpose of operating the pedal-keys, and it is not desirable to make all the primary



pneumatics whose principal or primary duty is to control the motor-pneumatics which operate the keys of the manual, large enough to serve like purpose with respect to the motor-pneumatics which operate the pedal-keys, because this would involve a large waste of air at all times when the manual only is being played. Nevertheless, the pedal-keys must be operated by the control of the same primary pneumatics, because the perforated music-sheet is not provided with additional perforations for the purpose of controlling the pedal-base. I therefore interpose between the two lower octaves of primary pneumatics or so many of the primary pneumatics at the lower or base end of the group as there are keys to the pedal-base intermediate or secondary pneumatics U U, &c., whose relation to the primary pneumatics is precisely similar to that of the motor-pneumatics which operate the manual-keys, ducts being extended from the same cross-port terminating at  $c^{11}$   $c^{12}$  to these secondary pneumatics. It is most convenient to mount the secondary pneumatics U upon the inner side of the rear wall of the wind-chest, as seen in Fig. 7, and the ducts leading to them from the cross-port controlled by the valves  $p'$   $p^2$  are made from tapping into the ducts which lead down from said cross-port to supply the supplemental pneumatics forming apertures opening at the inner surface of the wind-chest wall, as seen at  $c^{13}$ , Fig. 8. Over this row of apertures a slide-valve  $U^3$  is seated and retained in the same manner as the slide T is retained on top of the wind-chest to control the coupling device above explained. Apertures in this slide-valve arranged to register with the port  $c^{13}$  are provided with short nipples  $u^3$ , to which flexible tubes  $U^4$  are attached and said tubes extend to and are connected at the upper mouths of the ducts  $u^2$ , leading into the secondary pneumatics, as seen in Fig. 10. The secondary pneumatics U have their moving walls facing forward—that is, toward the instrument to be played. They are hinged at their upper ends and oscillate at their lower ends, to which are attached rigidly the stems  $U^5$  of the valves  $U^{50}$ , which play in the valve-chambers  $C^{40}$  between the seats about the ports  $C^{41}$  and  $C^{42}$ , through one of which the wind-chest pressure passes to reach the pedal-base motor-pneumatics  $E^4$  by way of the ducts  $E^{40}$ , the other port  $C^{42}$  admitting atmospheric air through the same passage to said pneumatics. The slide-valve  $U^3$  extends through the left-hand end wall of the wind-chest and is operated by the lever  $U^6$ , attached to it outside the wind-chest within the cabinet-case of the player, being fulcrumed on the stud  $u^6$ , which is mounted on the end wall of the wind-chest and extending up through the slot in the top board or table, where the performer will operate it to move the slide one way or the other to bring the pedal-base into action or cut it out.

At the left-hand end of the row of second-

ary pneumatics U in the structure illustrated in Figs. 7 and 12 I locate additional precisely similar pneumatics Z Z, which control in a precisely similar way motor-pneumatics  $Z'$  precisely similar to the motor-pneumatics  $E^4$ , which operate upon the thrust-rods  $x'$  at the left-hand end of the group of rods X', to which they are precisely similar, being arranged, however, over the pedal-stops  $B^4$   $B^4$ , corresponding to the pedal-stops B B above described in connection with the description of the structure shown in Fig. 1. In the structure shown in Fig. 7 the primary pneumatics Z Z (see Figs. 10 and 11) are connected by flexible tubes  $z z$  with ports  $z'$ , leading through the rear wall of the wind-chest and closed at the outer end by slide-valves  $Z^3$   $Z^3$ , connected by suitable stems to the stop-knobs  $Z^{30}$   $Z^{30}$  outside the case. When said knobs are operated by hand to open or close the valves  $Z^3$ , the result is to vent or cause the inflation of the pneumatics Z, causing them in turn to operate the valves connected with their moving walls and controlling the motor-pneumatics  $Z'$  (see Fig. 8) to cause them to operate the pedals  $B^4$   $B^4$  through the thrust-rods  $x'$ . (See Fig. 12.)

When the player is arranged to be connected to an instrument having a wind-chest from which air-supply for the pneumatics for the player may be derived, it is preferably supported by an arm rigidly extended from the frame of the player under the manual-breast of the instrument, as shown in Figs. 6 and 7, and in order to locate the stroke-fingers of the manual-pneumatics in accurate relation to the manual-keys of the instrument it is desirable to provide some vertical adjustment for the player with respect to the instrument. In Fig. 7 I have shown such a provision, the construction therein illustrated comprising at each side (one side only being shown in the figure) a stirrup or hanger  $X^4$ , secured to the underside of the manual-breast of the instrument and having an adjustment-screw  $X^{40}$ , which may be set up against the board  $C^5$ , which constitutes a rigid arm of the player-frame projected under the manual-breast whose rear edge is entered in a socket  $X^5$  adjustably secured to the case of the instrument.

I claim—

1. An automatic player for a keyed instrument, comprising motor-pneumatics having rigid projections which terminate beyond the case and air-chambers of the automatic player and are arranged to overhang and act directly upon the exposed surface of the manual-keys of the instrument to be played.

2. An automatic player for a keyed instrument, comprising motor-pneumatics located exterior to the wind-chest or air-chamber, by which they are controlled or actuated, the moving walls of such motor-pneumatics having rigid projections which terminate beyond the case of the automatic player and are arranged to overhang and act directly upon the



exposed surfaces of the manual-keys of the instrument to be played.

3. An automatic player for a keyed instrument, comprising motor-pneumatics which are wholly exterior to the wind-chest or air-chamber by which they are controlled or actuated; the moving walls of such motor-pneumatics having rigid projections which are also wholly exterior to such wind-chest or air-chamber, and which terminate beyond the case and air-chamber of the automatic player and are arranged to overhang and act directly upon the exposed surface of the manual-keys of the instrument to be played.

4. An automatic player for a keyed instrument, comprising motor-pneumatics in position to overhang the manual-keys of the instrument to be played, said pneumatics having a moving wall, hinged at one end, fingers rigid with said moving wall, projecting downward therefrom between the hinge and the other end of the cavity of the pneumatic, and adapted to act directly upon the manual-keys respectively.

5. An automatic player for a keyed instrument, comprising two sets of motor-pneumatics for operating the keys of the instrument; one set of primary pneumatics, and ducts by which said primary pneumatics respectively control the corresponding motor-pneumatics of both sets, the ducts leading to the second set being provided with means for closing and opening the passage through them without affecting the ducts of the first set, whereby said first set may alone give the stroke to the keys, or may be reinforced by the second set when the ducts leading to the latter are open.

6. In an automatic player for a keyed instrument, in combination with a wind-chest erected vertically in front of the manual-breast of the instrument, motor-pneumatics located upstanding between the wind-chest and the manual-breast, and lever connections by which such motor-pneumatics cause the manual-keys to be struck.

7. In an automatic player for an instrument having a horizontal bank of manual-keys, a wind-chest erected vertically in front of the manual-breast of the instrument, a set of motor-pneumatics extended horizontally from the wind-chest to act upon the manual-keys, in combination with a second set of motor-pneumatics located upstanding between the wind-chest and the manual-breast, and lever connections between corresponding pneumatics of the two sets, by which the action of the latter set is directed upon the moving elements of the former set.

8. In an automatic player for a keyed instrument, in combination with a wind-chest, a system of motor-pneumatics supported by and deriving their air tension from such wind-chest, and projected horizontally therefrom toward the instrument to act upon the manual-keys of the latter; a second system of motor-pneumatics arranged vertically in the interval between the wind-chest and the

manual-breast, each of the pneumatics in said second system being in vertical fore-and-aft plane with the corresponding pneumatic of the first system, the moving element of the pneumatics of one set having each a lever-arm which extends along the face of the moving element of the corresponding pneumatic of the other set, and an abutment on said element which encounters the lever-arm to cause the movement of one of said parts to be communicated to the other.

9. An automatic player for a keyed instrument comprising pneumatics for all the keys to be struck; a tracker-duct board and perforated music-sheet having respectively ducts and apertures for controlling the pneumatics pertaining to a portion, only, of the keys; a coupling-slide having ports adapted to register with the ducts of a portion of the pneumatics, and tubes from such ports respectively to the ducts of octave-distant pneumatics, the ducts at one end of the tubes being those for which the perforated music-sheet has controlling-apertures, and the ducts at the other end being beyond the range of the music-sheet.

10. In an automatic player for a keyed instrument, comprising pneumatics for all the keys to be struck, a tracker-duct board and perforated music-sheet having respectively ducts and apertures for controlling the pneumatics pertaining to a portion, only, of the keys; a coupling device, consisting of a slide having ports adapted to register with the ducts pertaining to the pneumatics which are to be coupled, and flexible tubes from the ports of one half of the entire set of ports on the slide to the corresponding ports of the other half of said set, and means for moving the slide at will to cause its ports to register or not to register with the pneumatic-ducts respectively.

11. In an automatic player for a keyed instrument, in combination with the motor-pneumatics which operate the manual-keys, primary pneumatics which control them respectively; secondary pneumatics controlled by a lower or base-range portion of the system of said primary pneumatics, and motor-pneumatics which operate the pedal-keys of the instrument and connections by which said secondary pneumatics control said pedal motor-pneumatics.

12. In an automatic player for a keyed instrument, in combination with pneumatics for operating the manual-keys, other pneumatics for operating the pedal-keys, a perforated music-sheet and duct-board having, respectively, perforations and a system of ducts corresponding to a portion, only, of the manual; branch ducts from the ducts of the lower or base-range portion of the system of tracker-ducts, and primary pneumatics controlled through such branch ducts; secondary pneumatics controlled by said last-mentioned primary pneumatics, and connections by which the secondary pneumatics control the motor-pne-



matics which operate the keys of the pedal-base.

13. In an automatic player for a keyed instrument, in combination with motor-pneumatics which operate the manual-keys, primary pneumatics which control them respectively; secondary pneumatics controlled by a lower or base-range portion of the system of said primary pneumatics; motor-pneumatics controlled by said secondary pneumatics and operating the pedal-keys of the instrument; the connection between said primary and secondary pneumatics by which the former control the latter comprising the slide, U<sup>3</sup>, flexible tubes leading from its ports respectively, to the secondary pneumatics; and suitable means for adjusting the slide to register or not register with the air-passages controlled by the valves operated by the primary pneumatics.

14. In a pneumatically-operated automatic player for an instrument having manual-keys and pedal-stops, in combination with the wind-chest, motor-pneumatics for operating the pedal-stops and mechanical connections therefrom to such pedal-stops; primary pneumatics which control said pedal-stop motor-pneumatics; vent-valves for the primary pneumatics, and manual-stops for operating such vent-valves.

15. In combination with an instrument having a system of pedal-keys, the system of thrust-rods, X', and the frame in which they are mounted, secured in fixed relation to the pedal-keys, and an automatic player having motor-pneumatics arranged to overhang and operate upon the thrust-rods, respectively.

16. In combination with an instrument having a system of pedal-keys, the system of thrust-rods, X', the frame in which they are mounted secured in fixed relation to the pedal-keys; the automatic player having motor-pneumatics which are arranged to act upon the thrust-rods respectively, said rods having adjustable terminals to receive the action of the motor-pneumatics.

17. In combination with an instrument having a system of pedal-keys, the system of thrust-rods, X'; the frame in which they are mounted, secured in fixed relation to the pedal-keys; springs which tend to uphold

the thrust-rods respectively; the automatic player having motor-pneumatics arranged to act upon the thrust-rods, said thrust-rods having adjustable terminals at their lower ends to reach and act upon the pedal-keys respectively.

18. In an automatic player for an organ, a system of pneumatics for operating the manual-keys of the organ; a wind-chest from which they derive their air tension; means for supporting the player in adjustable relation to the manual of the organ, and a flexible tube connecting the wind-chest of the player and arranged to be connected to the wind-chest of the organ.

19. The combination, in an instrument having a horizontal bank of manual-keys, of an automatic player for the same, arranged to be located in front of the manual-breast, vertically-adjustable supports for such player on the instrument being provided, comprising a horizontal arm projecting from the frame of the player under the manual-breast of the instrument, and lodgment for such arm mounted on the instrument.

20. An automatic player for a manual-keyed instrument, arranged to be located in front of the manual-breast of the instrument with the means for operating upon the keys overhanging the same, and having a rigid arm or extension of its frame projected under the manual-breast, in combination with lodgments for such arm, securably and vertically adjustable on the case of the instrument to be played.

21. The combination with an instrument having a horizontal bank of manual-keys of an automatic player for the same arranged to be located in front of the manual-breast of the instrument and having a rigid arm or extension of its frame projected under the manual-breast, and lodgments for such arm secured and vertically adjustable on the case of the instrument.

In testimony whereof I have hereunto set my hand, at Chicago, Illinois, this 27th day of November, 1899.

MELVILLE CLARK.

Witnesses:

CHAS. S. BURTON,  
ADUA H. BOWEN, Jr.