

O. H. ARNO.

MUSICAL OR OTHER INSTRUMENT EMPLOYING PERFORATED SHEETS.

APPLICATION FILED NOV. 21, 1903.

3 SHEETS—SHEET 1.

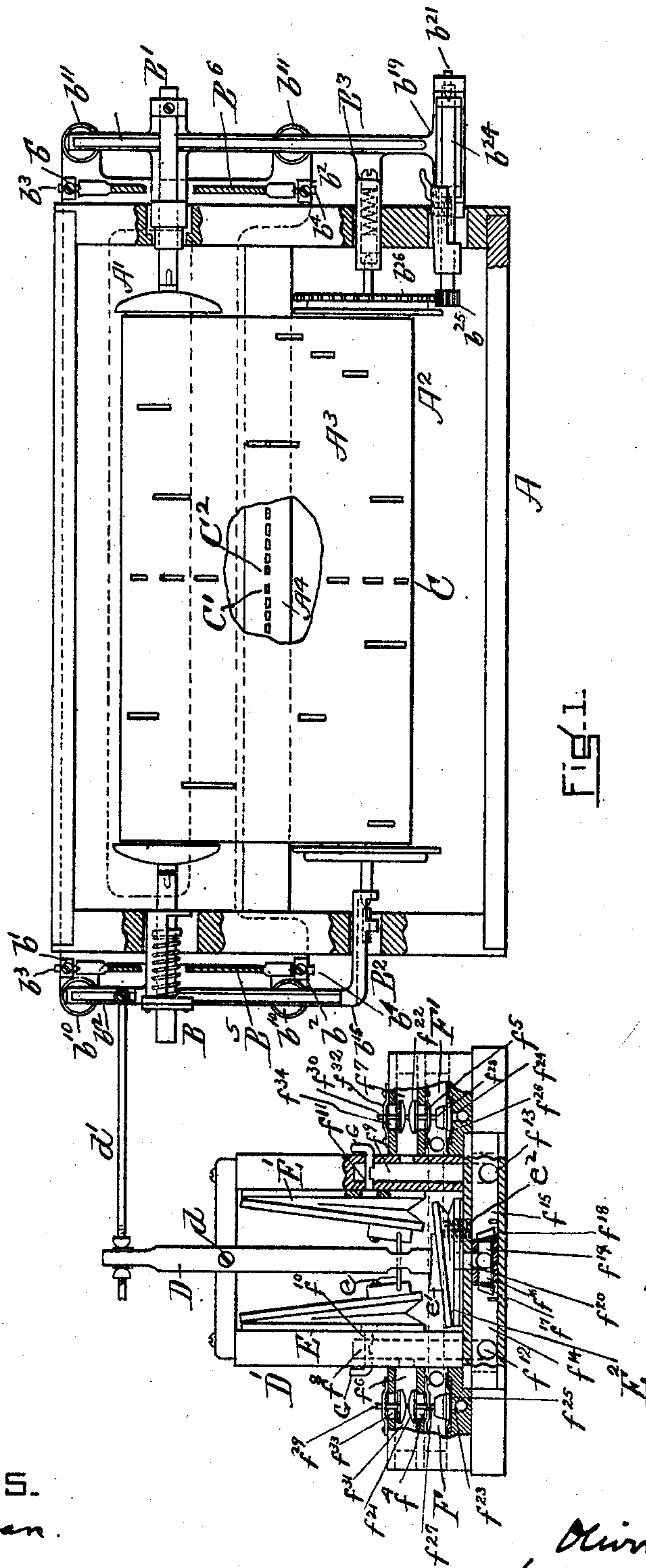


FIG. 1.

WITNESSES.

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3 SHEETS—SHEET 2.

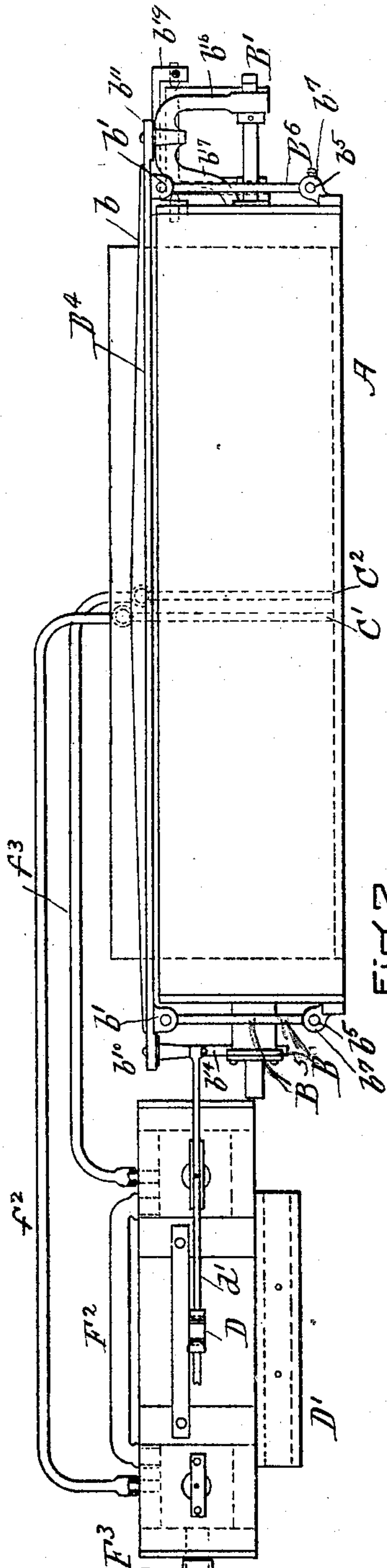


FIG. 2.

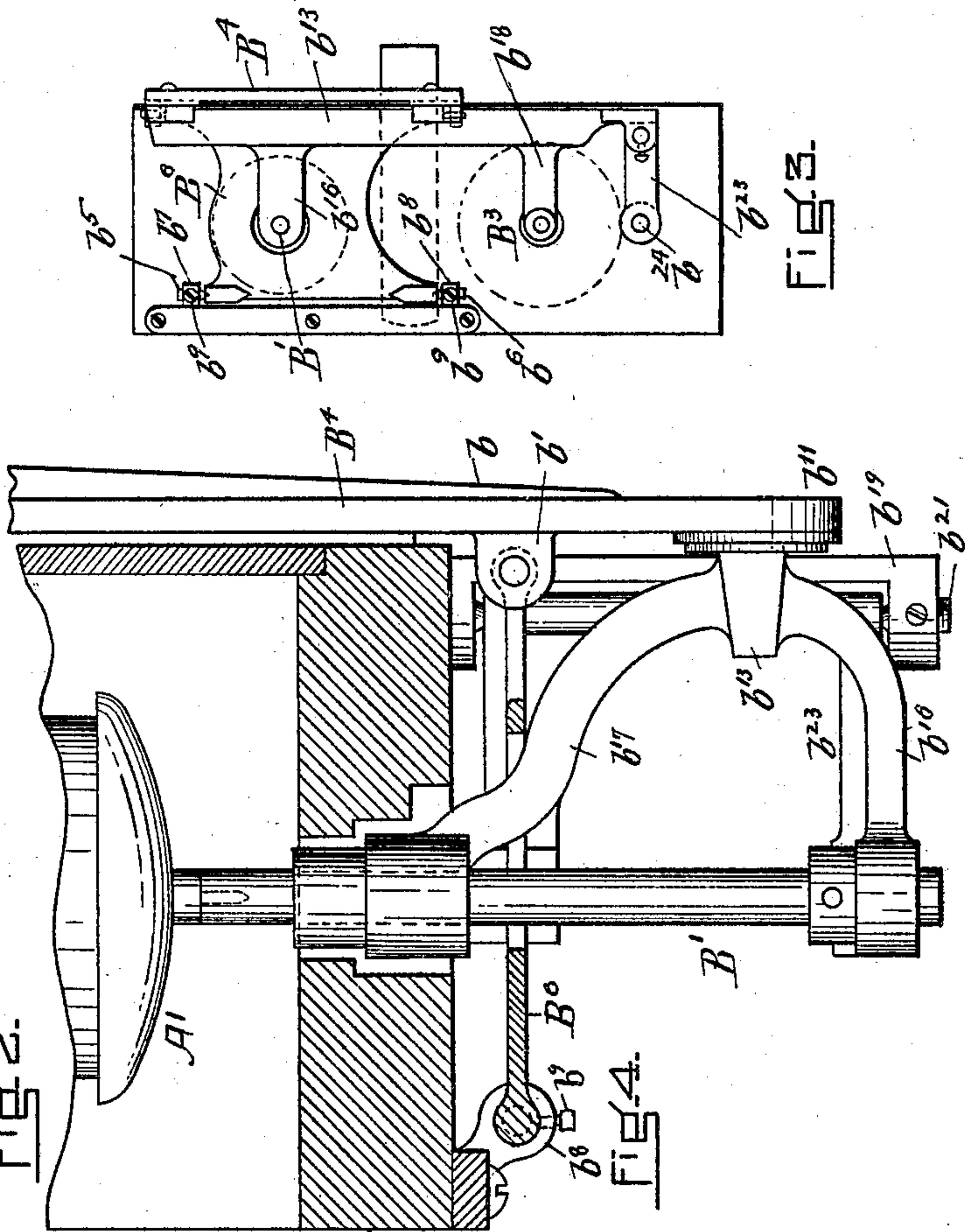


FIG. 3.

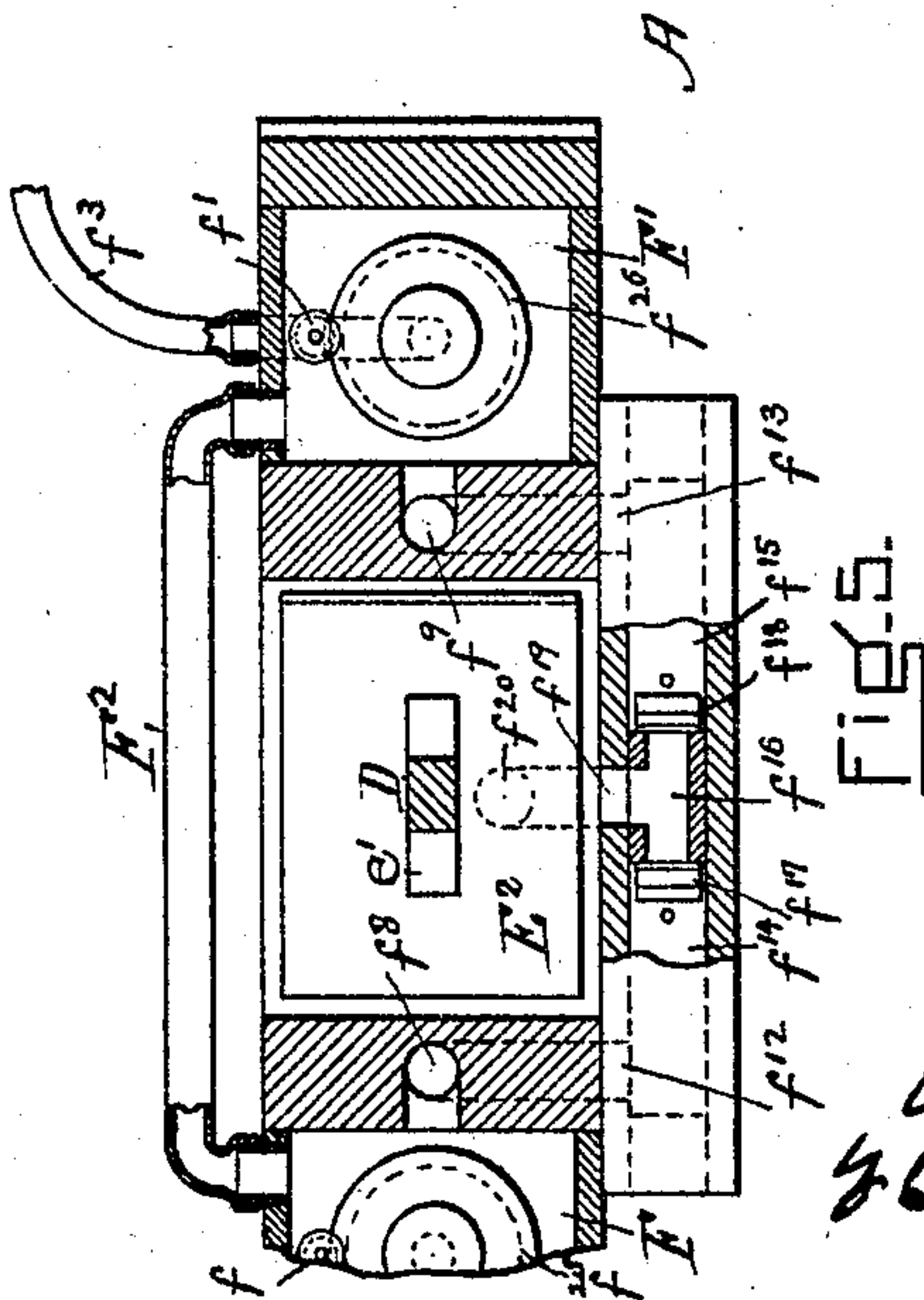


FIG. 4.

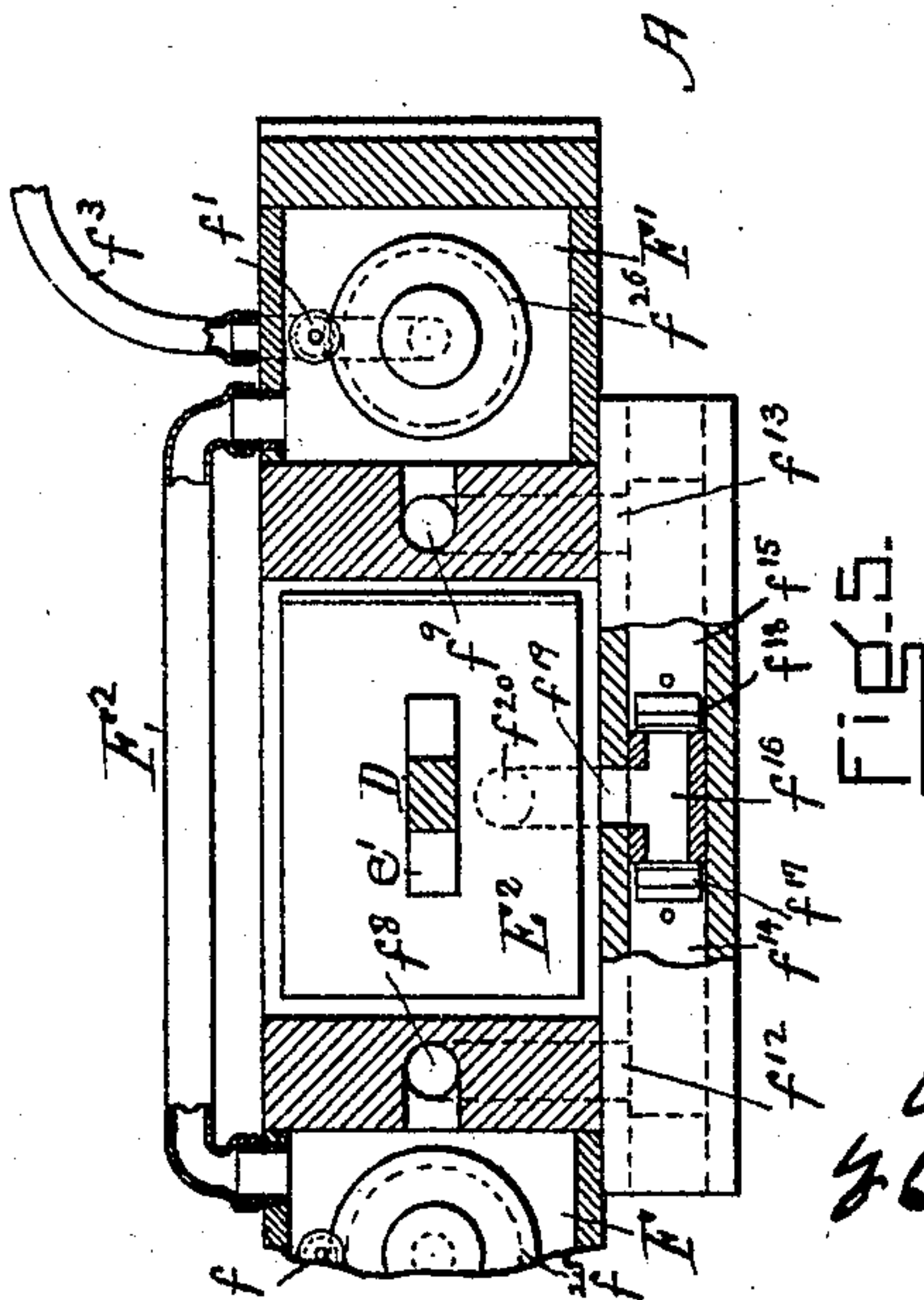


FIG. 5.

WITNESSES.

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No. 795,881.

PATENTED AUG. 1, 1905.

O. H. ARNO.

MUSICAL OR OTHER INSTRUMENT EMPLOYING PERFORATED SHEETS.

APPLICATION FILED NOV. 21, 1903.

3 SHEETS—SHEET 3.

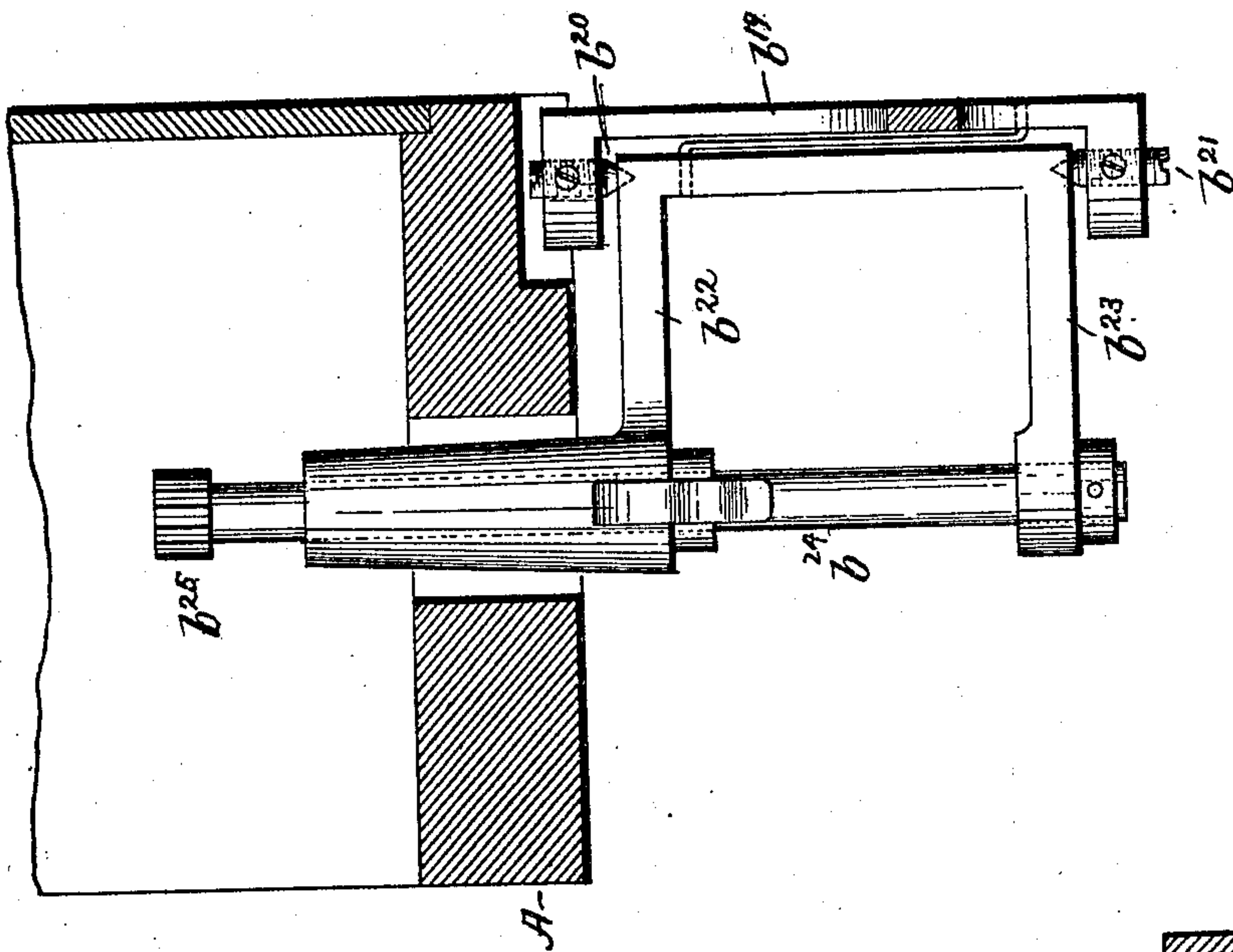


Fig. 7-

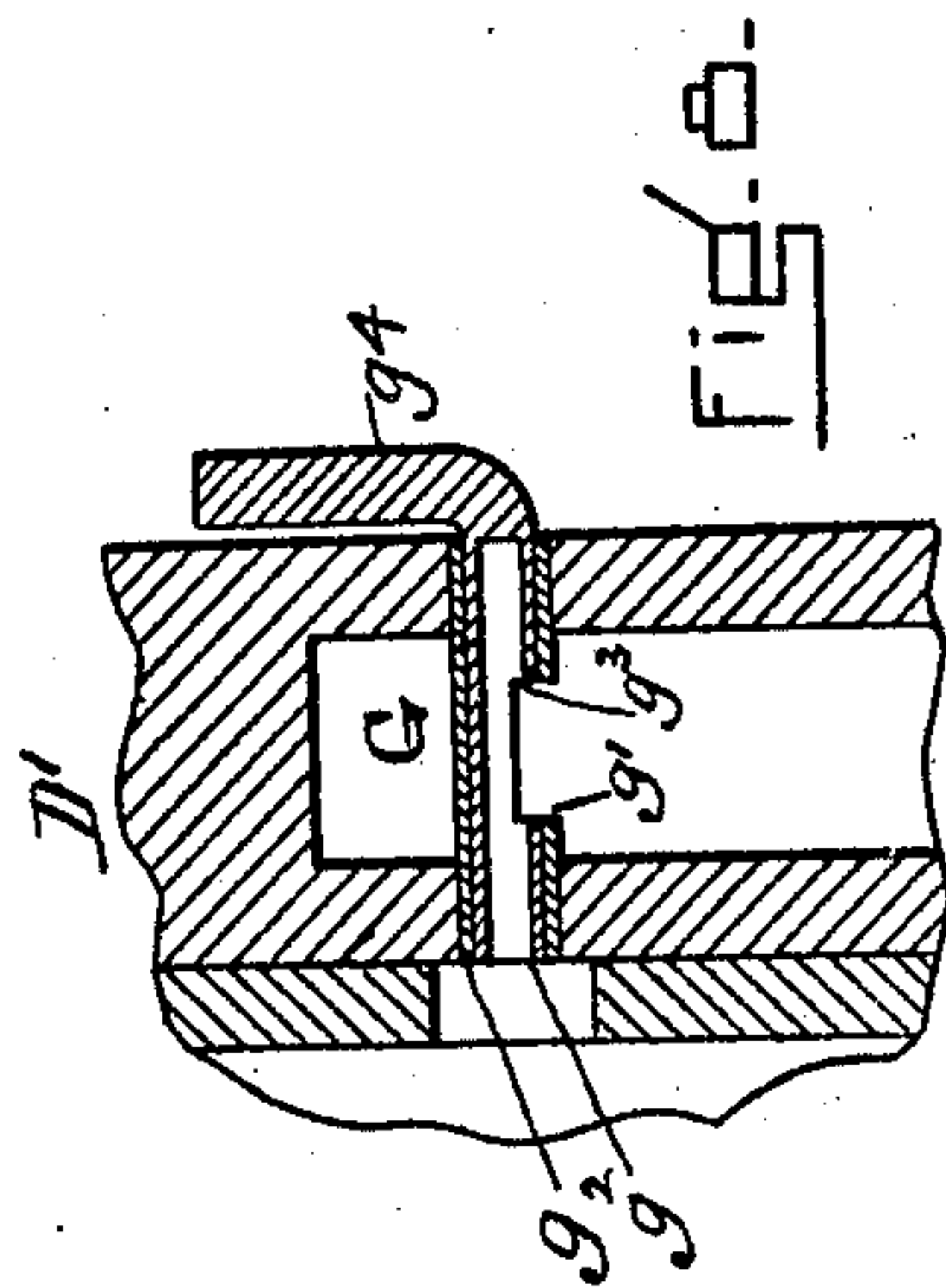
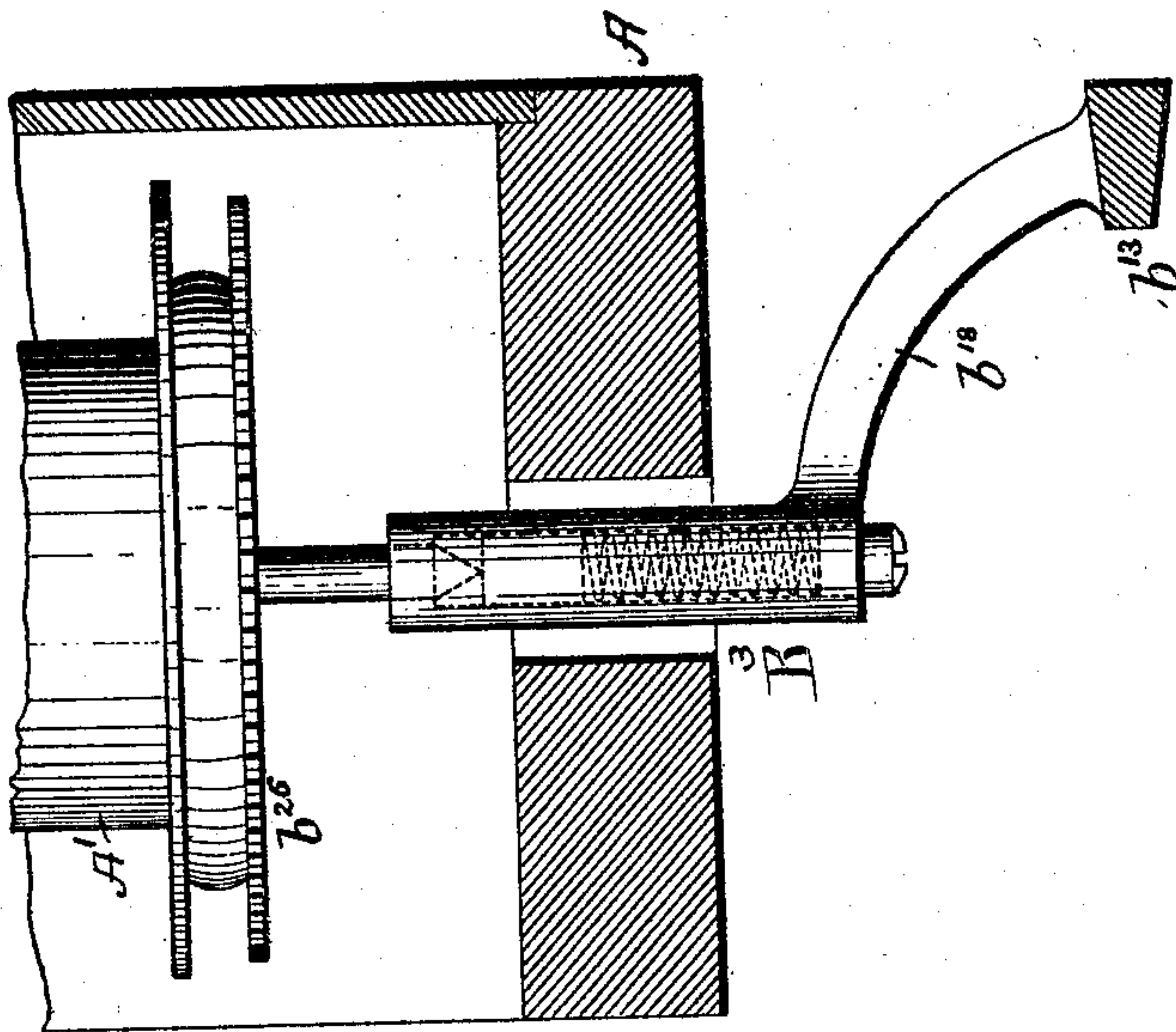


Fig. 6-

Fig. 6-

WITNESSES=

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# UNITED STATES PATENT OFFICE.

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## MUSICAL OR OTHER INSTRUMENT EMPLOYING PERFORATED SHEETS.

No. 795,881.

Specification of Letters Patent.

Patented Aug. 1, 1905.

Application filed November 21, 1903. Serial No. 182,150.

*To all whom it may concern:*

Be it known that I, OLIVER H. ARNO, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Musical or other Instruments Employing a Perforated Sheet, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The invention relates to the herein-described improvement in musical or other instruments employing a perforated sheet in connection with a tracker-board and pneumatic system, all combining for the actuation of said instruments; and it relates with more specific reference to a means or instrumentality for governing the movement of such sheet that upon its lateral displacement it may be restored to and so be maintained at a true normal center of position relatively to the tracker-board, when said sheet will track right with respect to said tracker-board.

Inasmuch as the instrument or device comprising my invention is especially adapted to be used in connection with "piano-players," so called, it is accordingly illustrated in the drawings as combined with such instrument, or rather with such portion thereof as is necessary to show the mode of application. According to the usual mode of operation in instruments of this kind just referred to the perforated or music sheet is unwound from a paper roll or spool, to pass over the end of the tracker-board, and be wound upon a take-up roll or spool, the perforated sheet in its passage being laterally retained by the flanges of the respective spools. Owing to the inaccuracies naturally resulting from such mode of lateral retention, the sheet is very likely to become laterally displaced from its normal true center of position relatively to the tracker-board when its perforations will not track with the wind channels or ways in said tracker-board, and the instrument accordingly fails to operate properly, and this is especially true by reason of the fact that the paper comprising the perforated sheet is extremely sensitive to atmospheric conditions, either swelling or contracting from its normal proportions, when it will either wear against the flanges of the rolls or spools and be displaced thereby, when the paper is swollen, or

upon a contraction of the paper the spool-flanges will become practically inoperative in laterally controlling the paper—that is, in so far as its proper tracking is concerned relatively to the channels in the tracker-board.

In view of such considerations it is within the purpose of my invention to provide the perforated sheet with such auxiliary means of control that it will be maintained to run straight and true relatively to the tracker-board, any tendency to displacement thereof, however occasioned, being accompanied by a counter effect which restores the sheet to its normal true position. Such means with general reference consists in providing the sheet throughout its length with a line of perforations which when the sheet is tracking right relatively to the tracker-board are destined to pass between separate adjacent chambers or wind-passages of those formed therein; but immediately upon the sheet becoming laterally displaced the line of perforations at some point will pass over one or the other of these channels, depending as its displacement is to the one side or the other, with the effect that the one or the other of separate sets of means are thereby pneumatically actuated to move the rolls or spools around which the sheet is passing in a direction counter to the direction of its displacement, which movement of the spools or rolls has of course the effect of restoring the sheet toward its normal true position, and such counter movement of the rolls or spools is continued until the line of perforations in the sheet again track between the adjacent holes or wind-passages in the tracker-board, when further lateral movement of the rolls or spools immediately ceases, and the paper proceeds in its running until its further displacement requires a repetition of such counteracting operation.

My invention in its physical embodiment, together with its various incidents of construction which make the device more perfect, can best be seen and understood by reference to the drawings, wherein—

Figure 1 shows in front elevation a portion of a piano-player fitted with my improved device for governing the perforated sheet thereof, the device showing mainly in longitudinal vertical section. Fig. 2 shows the same in plan. Fig. 3 shows in end elevation a feature of construction, to which reference will hereinafter be made. Fig. 4 shows an



enlarged detail of a portion of the structure shown in Fig. 2, to which reference will hereinafter be made. Fig. 5 shows in horizontal cross-section the pneumatic system, to which reference will hereinafter be made. Figs. 6 and 7 show enlarged details of portions of the structure shown in Fig. 2, to which reference will hereinafter be made. Fig. 8 shows in vertical cross-section a detail of construction, to which reference will also hereinafter be made.

In the drawings, A represents a box which for the purposes of illustration may be designated the "music-box," so called, of a piano-playing instrument.

A' represents the paper-roll, and A<sup>2</sup> the take-up roll, from the one to the other of which runs the perforated or music sheet A<sup>3</sup> over the end of the tracker-board A<sup>4</sup>. The respective rolls A' A<sup>2</sup>, instead of being mounted in the usual manner in bearings relatively fixed to the sides of the music-box, are mounted in bearings laterally movable, wherefore the spools or rolls moving together likewise have a certain degree or amount of lateral play. Such movement is obtained by fixing the respective bearings through a series of connecting-arms to a connecting piece or plate extending crosswise the back of the music-box, and which plate, supported by suitable side pieces or hangers hinged to the sides of the music-box, is capable of a certain degree or amount of lateral play.

The bearings for the music-roll are designated B B' and for the take-up roll B<sup>2</sup> B<sup>3</sup>. These respective bearings do not differ in their construction from those now in use, and their construction is so well known in the art that for the sake of expediency general reference is thus made to them.

B<sup>4</sup> represents the connecting piece or plate to which the respective bearings are joined. The plate B<sup>4</sup> is of a relatively thin structure and has any suitable configuration. It sits in close to the back of the music-box, across which it extends, and its ends extend slightly beyond the same at either side. It also may have to advantage one or more reinforcing-strips b. This plate B<sup>4</sup> is supported to have lateral movement by being pivoted to the swinging sides or hangers B<sup>5</sup> B<sup>6</sup>. It is to be noted that the respective ends of the plate, which extend, as just stated, beyond the sides of the music-box, are provided at the top and bottom with sets of inturned lugs b' b' b<sup>2</sup> b<sup>2</sup>, carrying pins b<sup>3</sup> b<sup>3</sup> b<sup>4</sup> b<sup>4</sup>, between which pins serving as a pivotal connection are hung the respective swinging sides or hangers b<sup>5</sup> b<sup>6</sup>, which are hinged to the sides of the music-box near the front by being hung between sets of pins b<sup>5</sup> b<sup>5</sup> b<sup>6</sup> b<sup>6</sup>, set in lugs b<sup>7</sup> b<sup>7</sup> b<sup>8</sup> b<sup>8</sup>, fixed to the respective sides of the music-box, and it is also to be noted that these pins supporting the swinging sides or hangers are preferably adjustably combined with the respective lugs in which they are contained in order that

there may be a certain adjustment of the members in respect to their relative positions. Such adjustment may be obtained by the simple mechanical expedient of having the pins set into holes in said lugs and held therein by a set-screw, which screw for all the pins may be designated b<sup>9</sup>. It is also to be noted that the bearings B and B' for the roll A' pass through the swinging sides or hangers B<sup>5</sup> B<sup>6</sup>, (see Fig. 1,) the formation of the sides permitting of this passage. Inasmuch as the bearings B<sup>2</sup> B<sup>3</sup> of the take-up roll A<sup>2</sup> come below these swinging sides, no provision need be made. There is no interference.

As said above, the ends of the movable piece or plate B<sup>4</sup> project slightly beyond the line of the sides of said music-box, and these projecting ends of the plate are preferably further extended by portions b<sup>10</sup> b<sup>10</sup> b<sup>11</sup> b<sup>11</sup>, which portions are provided, respectively, with the vertically-extending ribs b<sup>12</sup> b<sup>13</sup>, to which are secured the arms which combine the respective bearings of the rolls with said plate and to which rib b<sup>13</sup>, especially on the one side, are secured other attachments, as will hereinafter be explained. Referring, therefore, to these connections on the one side, the bearing B is joined to the rib b<sup>12</sup> of the movable back piece or plate by a connecting-arm b<sup>14</sup>, (see Fig. 2,) while the bearing B<sup>2</sup> is joined to said rib by the arm b<sup>15</sup>. (See Fig. 1.) On the other side the bearing B' is joined to the rib b<sup>13</sup> of the plate B<sup>4</sup> by the arms b<sup>16</sup> b<sup>17</sup>, (see Figs. 2 and 4,) a wide support being provided by these arms in order that a certain rewinding mechanism which ordinarily connects with such bearing may here be provided, and the bearing B<sup>3</sup> is secured to said rib b<sup>13</sup> by the arm b<sup>18</sup>, this arm practically being extended to form the said bearing or support therefor. Upon the lower extended end of said rib b<sup>13</sup> there is borne crosswise a hanger b<sup>19</sup>, carrying in its turned end pins b<sup>20</sup> b<sup>21</sup>, respectively, (see Fig. 7,) between which pins is hinged the structure comprising the arms b<sup>22</sup> b<sup>23</sup>, which carry the winding mechanism b<sup>24</sup>, having on its end the pinion b<sup>25</sup>, engaging with the gear b<sup>26</sup>, situated upon the take-up roll in the usual manner. There is also provided in connection with this winding mechanism the usual means by which the same turning at the point of its hinged connection, as before mentioned, may be thrown back and the pinion b<sup>25</sup> released from the gear, when the rewinding of the perforated or music sheet may be obtained in the usual manner. In fact, the bearings of the rolls and their various connections are the same as in common use, except that they are hung to have lateral play, which results from a mode of support such as has been described. As we have already stated, the rolls or spools are thus supported to have lateral play in order that they may be moved in one direction or the other to correct any displacement of the perforated sheet



passing between them, the rolls or spools when so moved being adapted to draw or force the sheet to a true normal center of position relatively to the tracker-board. Such restoration of the sheet upon its displacement is pneumatically governed, and this primarily, through a line of perforations C, extending longitudinally the length of the perforated sheet and preferably cut along or near its center. These perforations when the paper is tracking right or running normally true with respect to the ways or channels in the tracker-board are destined to pass, so as not to uncover certain ways or channels C' C<sup>2</sup> therein; but immediately upon the sheet becoming laterally displaced the line of perforations in said sheet will uncover the one or the other of these holes, depending as the displacement of the sheet is to the one side or to the other, with the effect that certain primary impulses are set in operation which through certain intermediate pneumatic instrumentalities have the effect of moving a lever D in one direction or the other. The lever is pivoted at the point *d* to a structure D', preferably containing these pneumatic instrumentalities, and is connected by a suitable arm *d'* with the swinging structure bearing the rolls, wherefore the movement of said lever is imparted thereto to laterally move said rolls in one direction or the other, and so restore the sheet to its proper position relatively to the tracker-board, and it is to be noted that in order for this effect to be obtained the lever must be operated by the pneumatic instrumentalities to have such movement that the rolls affected thereby will move in directions reverse to the direction of the displacement of the perforated sheet, and which movement shall immediately cease upon the sheet's being restored to a correct tracking position. It is also to be noted that the arm *d'* preferably makes an adjustable connection with the end of the lever D and at its other end connects with the swinging support for the rolls by connection with the arm *b*<sup>14</sup> of such structure.

Referring now more specifically to the pneumatic instrumentality or means of pneumatic influence, which operated upon by one primary wind impulse or another, dependent upon the direction of displacement of the perforated sheet, moves the lever D to help effect the restoration of such sheet, and referring to Figs. 1, 2, and 5, where the construction can best be seen, E E' designate pneumatics fixed to the pneumatic structure D' upon either side of the lever D, the movable sides of which pneumatics facing said lever are joined by a link *e*, which by engagement with said lever moves it in one direction or the other, dependent as the one pneumatic or the other is collapsed. The lever D is held at any point of lateral position by the pneumatic E<sup>2</sup>, which pneumatic has upon the top of its movable side a shoe *e'*, which engages with the bottom

end of said lever so holding the same in position, the shoe being normally made to engage with the lever by means of the tension-spring *e*<sup>2</sup>, with which said pneumatic is provided. Of course upon the contraction of this pneumatic E<sup>2</sup> the shoe *e'*, carried thereby, will be withdrawn from the lever D, when the lever is free to move in the direction governed by the pneumatic E or E'. The pneumatics E, E', and E<sup>2</sup> are collapsed or controlled by an exhaust obtained from any suitable source of exhaustion, the pneumatics E and E' being exhausted separately, whereby the lever D becomes moved in the direction of one or the other; but either pneumatic is collapsed simultaneously with the pneumatic E<sup>2</sup>, this in order that the lever D may be freed from the normal engagement of the shoe *e'*, when it may be moved in the direction of the controlling-pneumatic, and, moreover, it is so arranged that the exhaust is controlled to operate or collapse the sets of pneumatics E and E<sup>2</sup> or E' and E<sup>2</sup>, dependent upon the direction of the displacement of the perforated sheet, and this by the line of perforations C therein at some point within their line uncovering one or the other of said channels C' or C<sup>2</sup> in the tracker-board, depending as the sheet is displaced to the right or left when the air in the music-box is permitted to enter said channels normally exhausted of air by connection with the exhaust, and the impulse resulting therefrom operates certain valvular connections which open a passage for the exhaust to either one or the other of said sets of pneumatics, with the effect that the lever D being released is moved in the direction of its controlling-pneumatic and the rolls laterally controlled thereby and tends to restore the sheet to its normal true position. For these purposes, referring first to the chambers and passages of the exhaust, the pneumatic structure is provided with the respective exhaust-chambers F and F', joined by the pipe F<sup>2</sup> and all in communication with any suitable source of exhaust, as through the pipe or connection F<sup>3</sup>. These respective chambers, through by-passages *f* and *f'* and the pipes *f*<sup>2</sup> and *f*<sup>3</sup>, communicate with the respective ways or channels C' and C<sup>2</sup> in the tracker-board, whence said ways and channels and the connections leading therefrom will be normally exhausted of air. Above these respective chambers, through ports *f*<sup>4</sup> *f*<sup>5</sup>, are chambers or passages *f*<sup>6</sup> and *f*<sup>7</sup>, respectively, which lead to the respective vertical passages *f*<sup>8</sup> and *f*<sup>9</sup>, which in turn extending upward lead, respectively, through passages *f*<sup>10</sup> and *f*<sup>11</sup> (which passages are controlled as will hereinafter be explained) to the pneumatics E and E', and extending downward the said channels lead to the channels *f*<sup>12</sup> and *f*<sup>13</sup>, extending horizontally and connecting by the passage *f*<sup>14</sup> and *f*<sup>15</sup> with a common exhaust chamber or passage *f*<sup>16</sup>, controlled by the respective hinged valves *f*<sup>17</sup> and *f*<sup>18</sup>. The common chamber or



passage  $f^{16}$  leads horizontally through a channel  $f^{19}$ , thence vertically by a passage  $f^{20}$  to connect with the pneumatic  $E^2$ . The ports  $f^4$  and  $f^5$ , which connect the exhaust-chambers  $F$  and  $F'$  with the respective chambers  $f^6$  and  $f^7$ , are controlled by the respective valves  $f^{21}$  and  $f^{22}$ , said valves being normally kept closed by the suction of the exhaust, wherefore the exhaust is normally kept shut off from the respective sets of pneumatics  $E$  and  $E^2$  and  $E'$  and  $E^2$  corresponding with said chambers. These valves  $f^{21}$  and  $f^{22}$ , controlling the ports  $f^4$  and  $f^5$ , are opened, however, whereby the exhaust may pass from the one side or the other to the respective sets of pneumatics by the wind impulse coming down through the respective ways or channels of the tracker-board when the one or the other of said channels is uncovered by the displacement of the perforated sheet. By reference to Fig. 1 it will be seen that the respective pipes  $f^2$  and  $f^3$ , which at one end connect with the respective channels of the tracker-board, connect at the other ends directly with the exhaust-chambers  $F$  and  $F'$  by passages  $f^{23}$  and  $f^{24}$ . These passages are closed by diaphragms  $f^{25}$   $f^{26}$ , on which rest or to which are attached the valvular stems or connections  $f^{27}$   $f^{28}$ , joined to the respective valves  $f^{21}$  and  $f^{22}$ , with the effect that when the wind impulse comes down from the one or the other channel in the tracker-board, according to the direction of displacement of the perforated sheet, the air will press upon and raise the diaphragms  $f^{25}$  or  $f^{26}$  corresponding therewith, which diaphragms through the intermediate connections will raise, and so open, the corresponding valves  $f^{21}$  or  $f^{22}$  when the exhaust has free passage to the one or the other of the sets of pneumatics, as before explained. Upon the replacement of the perforated sheet the channel in the tracker-board previously uncovered will again become closed and exhausted of wind by an ordinary bleeder in the diaphragm, when the air-pressure upon the respective diaphragms will be released and the valves  $f^{21}$  or  $f^{22}$  closed, as aforesaid, by the suction of the exhaust and the diaphragms, through the stem connections, pressed down in placement for further operation. It is also to be noted that the valves  $f^{21}$  and  $f^{22}$  carry stems  $f^{29}$  and  $f^{30}$ , upon which are arranged valves  $f^{31}$  and  $f^{32}$ , controlling ports  $f^{33}$   $f^{34}$ , opening through the walls of the respective chambers or passages  $f^6$  and  $f^7$  to the air. These valves just mentioned move simultaneously with the valves  $f^{21}$   $f^{22}$ , becoming closed when said valves are opened, whereby there will be a closed passage for the exhaust to the pneumatics, or becoming opened when said other set of valves becomes closed, whereby the exhaust then shut off from the pneumatics they may be thereupon filled with air and prepared for any further operation.

It is perhaps unnecessary to refer with detailed description to the operation of my de-

vice, inasmuch as the functional relationship of its various parts has already been so specifically explained. The respective rolls are so hung or supported that they will have a certain amount or degree of lateral play in either direction from a normal center of position and so the perforated sheet carried by said rolls be correspondingly moved relatively to the tracker-board and, as said before, apart from this consideration, the respective rolls, their bearings, and, in a musical instrument, the various winding, rewinding, and other attachments are of the usual construction and mode of operation. The rolls in the first instance are adjusted to such lateral position that the perforated sheet will be in a normally correct position relatively to the tracker-board or so as to track right with respect to the channels thereof. When the sheet is in this position, its line of perforations  $C$  will run between without uncovering the channels or ways  $C'$   $C^2$  of the tracker-board. Now immediately upon the sheet becoming displaced from its said normal center of position relatively to the tracker-board, as it may in the running or for reasons before mentioned, one or the other of the said channels in the tracker-board will become uncovered by some portion of the line of perforations. Assuming, for the sake of illustration, that the sheet is displaced to the right, so that the channel  $C^2$  becomes uncovered, at such moment the air in the music-box will pass into said channel normally in connection with the exhaust, as before explained, and the wind impulse so obtained passing through the connecting pipes or channels will raise the diaphragm  $f^{26}$  and through the medium of the connecting-stems open the valve  $f^{22}$  and close the valve  $f^{21}$ , when a clear passage will be obtained for the exhaust in the chamber  $F'$  to operate through the port  $f^5$ , the chamber or passage  $f^7$ , thence through the channel or passage  $f^9$ , upward upon the pneumatic  $E'$  and downward through the passages  $f^{13}$   $f^{15}$ , and through the chamber  $f^{16}$ , (the valve  $f^{18}$  leading to this chamber being drawn open by the exhaust while the complementary valve  $f^{17}$  is drawn closed by the same,) the exhaust then operating from the chamber  $f^{16}$  through the passages  $f^{19}$   $f^{20}$  upon the pneumatic  $E^2$ . Both pneumatics are collapsed by the exhaust, the pneumatic  $E'$ , through the connecting-link  $e$ , acting to operate the lever  $D$ , and the collapse of the pneumatic  $E^2$  permits of such operation by the release of the end of the lever from the retention of the friction-shoe  $e'$ . The lever  $D$  thus operated acts, through the connecting-arm  $d'$ , secured to the movable support or frame for the rolls, to draw the same laterally in a direction contrary to the displacement of the sheet, and they in turn act to correct the displacement of the same relatively to the tracker-board. The action of the exhaust continues as long as the valve  $f^{22}$  is held open



or so long as the perforation in the sheet permits air to pass from the music-box to the controlling-diaphragm. Immediately upon the channel  $C^2$  becoming closed, however, or upon the sheet becoming restored to its normally correct position relatively to the tracker-board the line of perforations  $C$  in the perforated sheet will again run between the channels  $C'$  and  $C^2$  of said tracker-board and the other perforations in the sheet will track right relatively to the other corresponding channels in said tracker-board, and the said channel  $C'$  will again become exhausted of wind and the air shut off from the diaphragm, the valve  $f^{22}$  will become closed, and the valve  $f^{32}$  opened, when the exhaust will be shut off from the pneumatics and air admitted thereto. The pneumatic  $E'$  with the shutting off of the exhaust will then cease to operate the lever  $D$ , and with the pneumatic  $E^2$  restored the said lever will be held to the point to which it has been adjusted by the engagement of the friction-shoe  $e'$  on the spring-pressed movable side of said pneumatic  $E^2$ , which shoe acts as a stop to said lever.

It will be, perhaps, unnecessary to further describe the detail of operation of my device. In case the sheet becomes displaced in a contrary direction to that just referred to then the channel  $C'$  will become uncovered, resulting accordingly in a mere reverse mode of operation—viz., in the actuation of the pneumatic  $E$  operating to move the lever  $D$  in a direction reverse to that previously mentioned and accordingly acting to restore the perforated sheet in a direction reverse to the direction of its displacement, the pneumatic  $E^2$ , carrying the friction-shoe, serving as a stop for the lever, acts simultaneously with the pneumatic  $E$  just as with the pneumatic  $E'$ , with the difference that the exhaust coming from the chamber  $F$  opens the swinging valve  $f^{17}$  at the entrance to the chamber  $f^{16}$ , leading to said pneumatic, and draws closed the valve  $f^{18}$ , a mode of operation just reverse to that previously described. In this connection the expedient of three pneumatics influenced by two primaries is especially to be noted, one pneumatic being susceptible to the influence of two separate primaries, the passage to the pneumatic being controlled by valves which become alternately closed or opened, depending as the exhaust comes from one primary or the other.

In connection with the operation of the device attention is also called to the fact that lest the pneumatics  $E$  and  $E'$  operate too rapidly each is accordingly controlled by a controller  $G$ , placed in the respective passages  $f^{10}$  and  $f^{11}$ , (see Fig. 1,) leading to said respective pneumatics, by which the amount of the exhaust controlling the same may be determined, wherefore the pneumatics may be made to operate by a rapid or slow movement, as may be desired. The controller  $G$  (see Fig.

8) comprises a tube  $g$ , so placed as to completely fill and to so form a portion of the passage from the exhaust to the pneumatic and having an opening  $g'$  in its side through which the exhaust may operate. The tube practically acts as a sleeve, and into this is fitted a tubular arm  $g^2$ , which is closed at one end and open at the other for the passage to the exhaust. This arm has cut through one side an opening  $g^3$ , which when the tubular arm is turned to a certain position registers with an opening in the tube or sleeve, through which opening the exhaust may operate, but which arm when turned into another position may entirely close the opening in the tube or sleeve, shutting off the exhaust, or by partially turning the arm the opening in the tube or sleeve may be partially closed when the passage to the exhaust is commensurately limited. The closed end of the arm is preferably turned to form an operating-handle  $g^4$ . The controller is most efficient for the purpose to which it is put, and it is obvious that it might be used for controlling a wind-passage as well as the passage for an exhaust.

Another point is also to be noted. Reference has already been made to the fact that the line of perforations  $C$  in the perforated sheet are preferably placed longitudinally along the middle of the sheet, and this is for a distinct purpose. Of course when the sheet swells or contracts such contraction or expansion will naturally be equal for both sides of the sheet, so that with the controlling-line of perforations in the sheet placed upon one side thereof the effect would be to correct a displacement of only that side, which would not tend to correct the displacement of the other side of the sheet, but rather to increase the same. By placing the line of perforations in the middle of the sheet, however, it will be held to a true normal center of position, and whatever contraction or expansion there may be will be made equal for both sides.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a perforated sheet running between the rolls, said sheet having a line of perforations, wind-channels over the end of which said perforated sheet is adapted to run and between which the line of perforations therein is adapted to pass when said sheet is running normally true, but which line of perforations upon displacement of said sheet is adapted to uncover one or the other of said wind-channels, and means set in operation by the impulses so obtained acting to restore said sheet to a relatively true position.

2. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a channeled tracker-board and a perforated sheet running between said rolls over



the end of the tracker-board, which sheet is provided with a line of perforations adapted when the sheet is tracking right to run between two adjacent channels of the tracker-board, but upon displacement of said sheet is adapted to uncover one or the other of said separate channels in the tracker-board dependent upon the direction of its displacement.

3. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a perforated sheet running between the rolls, said sheet having a line of perforations along the middle thereof, wind-channels over the ends of which said perforated sheet is adapted to run and between which the line of perforations therein is adapted to pass when said sheet is running normally true, but which line of perforations upon displacement of said sheet is adapted to uncover one or the other of said wind-channels, and means set in operation by the impulses so obtained acting to restore said sheet to a relatively true position.

4. In a musical or other instrument of the character specified, the combination of a paper-roll, a take-up roll, a channeled tracker-board, a perforated sheet, said sheet having a line of perforations along the middle thereof which when the sheet is tracking right relatively to said tracker-board is adapted to pass between two adjacent channels formed therein normally exhausted of wind, but which perforations upon lateral displacement of said sheet at any point of its unwinding are adapted to uncover one or the other of said channels in the tracker-board, dependent upon the direction of its displacement, and means operated by the pneumatic impulse so obtained acting to restore said sheet to its correct position relatively to said tracker-board.

5. In a musical or other instrument of the character specified, the combination with a channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of means operating to restore said sheet at the moment of and continuing during the lateral displacement of said sheet from its normally correct position, as aforesaid, a stop, pneumatically operated, acting at the moment of the restoration of said sheet, and means for operating said stop.

6. In a musical or other instrument of the character specified, the combination of a paper-roll, a take-up roll, laterally-movable hangers or supports for said rolls, a channeled tracker-board, a perforated sheet running between said rolls, said sheet having a line of perforations which when the sheet is tracking right is adapted to run between two adjacent channels of the tracker-board, but upon displacement of said sheet is adapted to uncover one or the other of said separate channels, and means operated upon by the wind

impulses so obtained to move the hangers or supports of said rolls in a direction reverse to the direction of displacement of said perforated sheet, whereby said sheet will be restored to a relatively correct position with respect to said tracker-board.

7. In a musical or other instrument of the character specified, the combination with a channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of a lever for changing in either direction the relative lateral positions of said members, whereby said sheet will be restored to track right with respect to the channels of the tracker-board, upon a displacement of said sheet, pneumatics controlled by wind impulses for operating said lever, and a stop adapted to automatically engage with and hold said lever in different operative positions.

8. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, suitable supports or bearings therefor, a laterally-swinging frame to which the bearings or supports for said rolls are joined, whereby they may be moved laterally in either direction, a lever connected with said frame for moving the same laterally in either direction, a channeled tracker-board, a perforated sheet carried by said rolls adapted when in normally correct position to track right with respect to said tracker-board, means for operating said lever, whereby said frame and rolls carrying the perforated sheet may move in a direction reverse to the direction of displacement of said sheet.

9. In a musical or other instrument of the character specified, the combination with a channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of a lever operating to change in either lateral direction the respective positions of said sheet and tracker-board, so acting to restore the sheet upon displacement thereof, means for operating said lever, and a stop for said lever acting at the moment of the restoration of said sheet.

10. In a musical or other instrument of the character specified, a paper-roll, a take-up roll and suitable supports or bearings therefor, a laterally-movable frame to which the bearings of said rolls are joined whereby they are laterally movable, a channeled tracker-board, a perforated sheet adapted when in normally correct position to track right with respect to the channels of said tracker-board, means for generating wind impulses upon a lateral displacement of said sheet, a lever operating to move said frame in a direction reverse to the direction of displacement of said sheet, and a stop for said lever.

11. In a musical or other instrument of the character specified, the combination with a



channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of a lever for changing in either lateral direction the respective positions of said members, whereby said sheet will be restored to track right with respect to the channels of the tracker-board, upon a displacement of said sheet, a stop for said lever, and pneumatics operating to control said lever and stop dependent upon the position of the perforated sheet.

12. In a musical or other instrument of the character specified, a structure having in combination therewith a paper-roll, a take-up roll, their bearings and attachments, a laterally-movable piece or plate, arms for securing the bearings and attachments of said respective rolls to said piece or plate, and swinging sides or hangers hinged or pivoted to the respective sides of said structure for giving laterally-movable support for said piece or plate, substantially as and for the purposes set forth.

13. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a perforated sheet running between the rolls, said sheet having a line of perforations, wind-channels over the ends of which said perforated sheet is adapted to run and between which the line of perforations therein is adapted to pass when said sheet is running normally true but which upon displacement of said sheet is adapted to uncover one or the other of said separate channels, dependent upon the direction of displacement, pneumatics acting to effect the restoration of said sheet, channels or passages for an exhaust operating said pneumatics, valves normally closing the exhaust from said pneumatics, and means operated upon for controlling said valves.

14. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a perforated sheet running between the rolls, said sheet having a line of perforations, wind-channels over the ends of which said perforated sheet is adapted to run and between which the line of perforations therein is adapted to pass when said sheet is running normally true, but which line of perforations upon displacement of said sheet is adapted to uncover one or the other of said wind-channels, a lever connected to effect the restoration of said sheet upon such lateral displacement, pneumatics controlling said lever, channels or passages for an exhaust for operating said pneumatics, valves normally closing the exhaust from said pneumatics, means operated upon by the wind impulses obtained by the uncovering of said channels for opening said valves at the moment of and during the displacement of the perforated sheet, and a stop for retaining said lever upon the restoration of said perforated sheet.

15. In a musical or other instrument of the character specified, a paper-roll, a take-up roll, a perforated sheet running between the rolls, said sheet having a line of perforations, wind-channels over the ends of which said perforated sheet is adapted to run and between which the line of perforations therein is adapted to pass when said sheet is running normally true, but which line of perforations upon displacement of said sheet is adapted to uncover one or the other of said wind-channels, pneumatics for effecting the restoration of said sheet, chambers and passages for an exhaust for controlling said pneumatics, valves normally closing the exhaust from said pneumatics, passages leading from the chambers or passages of the exhaust to connect with the aforesaid channels, diaphragms closing the entrance to said passages, means connecting said valves and diaphragms, and by-passes leading from said chambers or passages of the exhaust to said passages connecting with said channels.

16. In a musical or other instrument of the character specified, the combination with a channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of a lever for effecting the restoration of said sheet upon a lateral displacement thereof, pneumatics E and E' connected to control said lever, a pneumatic E<sup>2</sup> acting as a stop therefor, chambers and passages for an exhaust operating said pneumatics, and means for individualizing said pneumatics into the set E and E' or E and E<sup>2</sup>, to be operated upon separately by the exhaust dependent upon the direction of displacement of the perforated sheet.

17. In a musical or other instrument of the character specified, the combination with a channeled tracker-board and perforated sheet adapted when in normal position to track right with respect to the channels of the tracker-board, of a lever for effecting the restoration of said sheet upon displacement thereof, pneumatics E and E' combining to control said lever, the pneumatic E<sup>2</sup> acting as a stop therefor, chambers and passages for an exhaust operating said pneumatics, valves operated to control ports leading from the respective chambers and passages of the exhaust to said pneumatics, means for individualizing the pneumatics into the set E and E' or E and E<sup>2</sup>, to be operated upon separately by the exhaust dependent upon the direction of displacement of the perforated sheet, and valves controlling the ports for admitting air to said pneumatics upon the restoration of said sheet to its normal tracking position.

18. In a musical or other instrument, a combination of two pneumatics, means for directly and independently operating said pneumatics, a third pneumatic connected to be directly



operated by the same operating means, and valves likewise directly controlled by said operating means, whereby said third pneumatic may be operated simultaneously with either of said first two pneumatics.

19. In a musical or other instrument, the combination of three pneumatics, exhaust-chambers with separate passages or channels leading to connect with two of said pneumatics

and leading by further extension of said separate channels or passages to connect in common with a third pneumatic, and outwardly-opening valves in said passages for controlling said third pneumatic.

OLIVER H. ARNO.

In presence of—

J. M. DOLAN,

J. E. R. HAYES.