

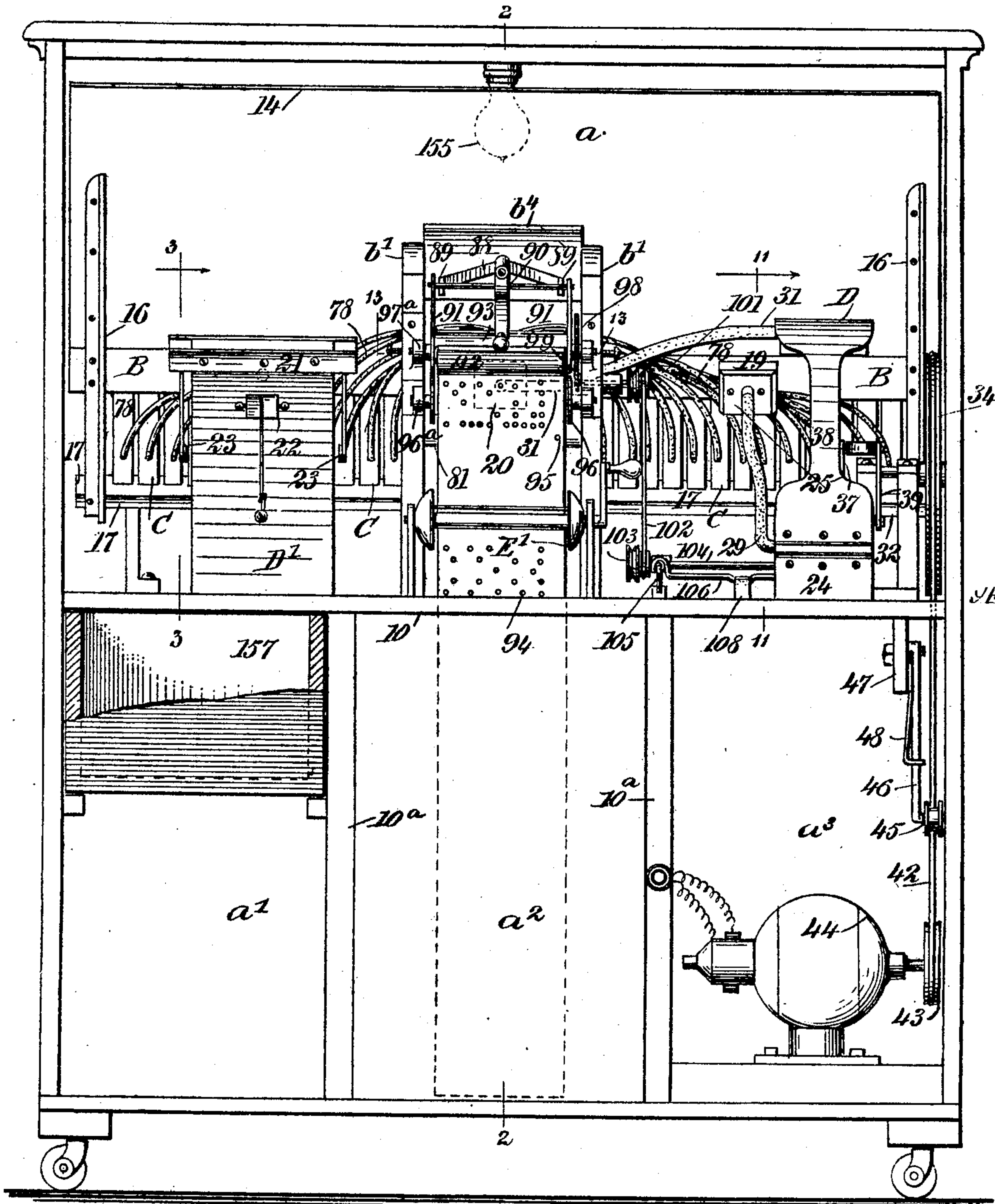
No. 795,278.

PATENTED JULY 25, 1905.

F. R. GOOLMAN.
METALLOPHONE.

APPLICATION FILED JAN. 29, 1904.

6 SHEETS—SHEET 1.



WITNESSES:

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Fig. 1

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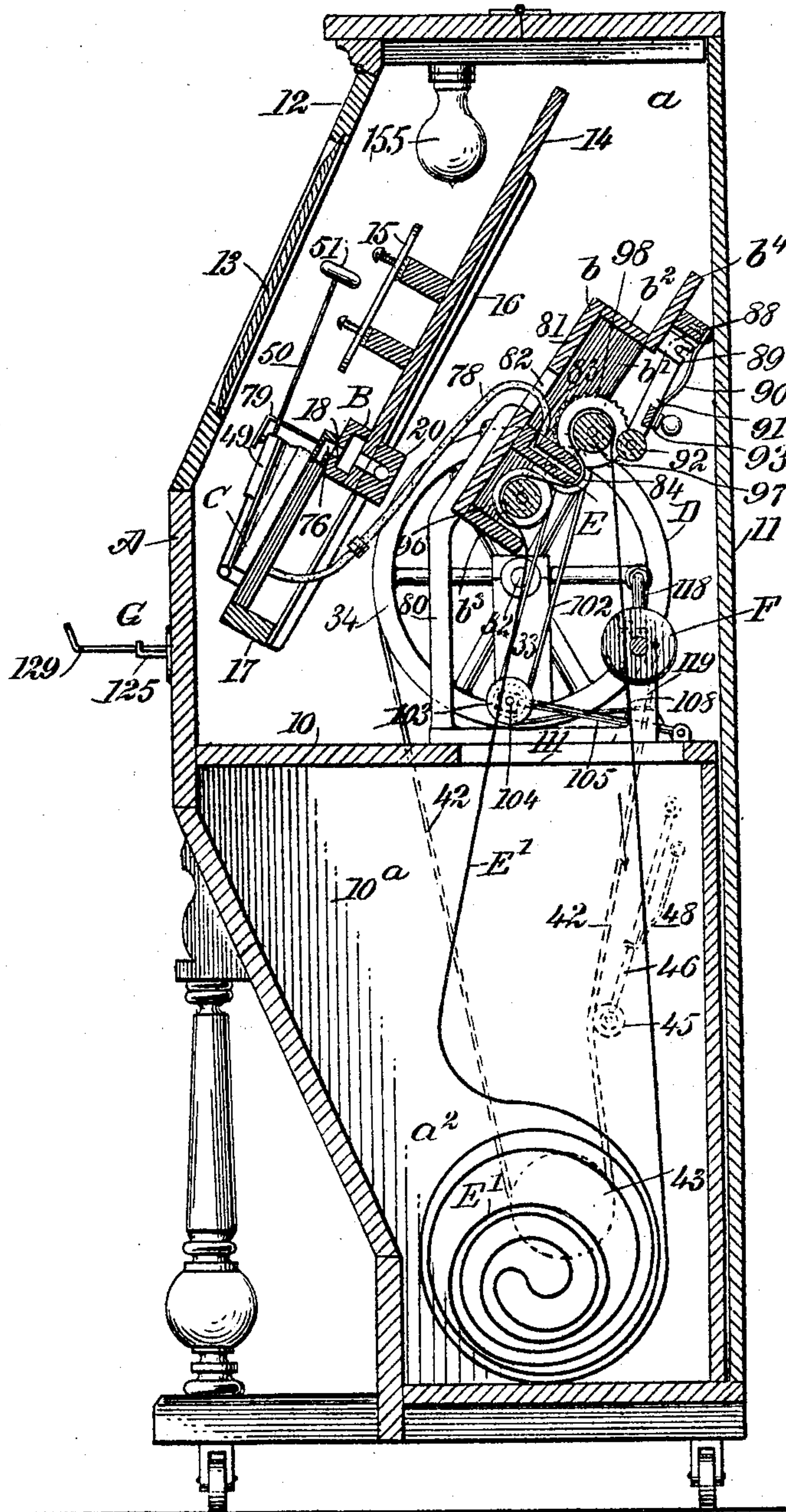
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6 SHEETS—SHEET 2.



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Fig. 2 *Frederick R. Goolman*

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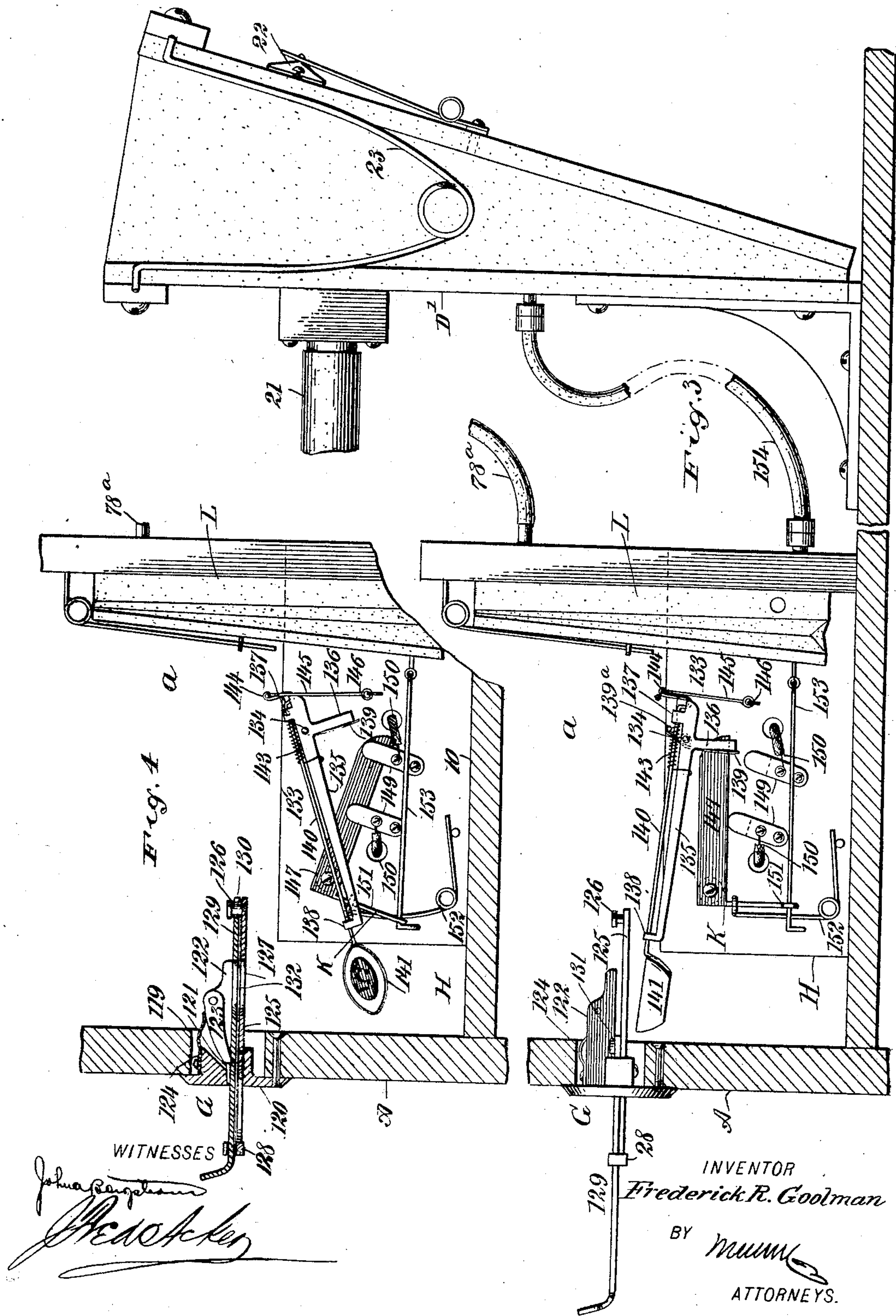
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6 SHEETS—SHEET 3.



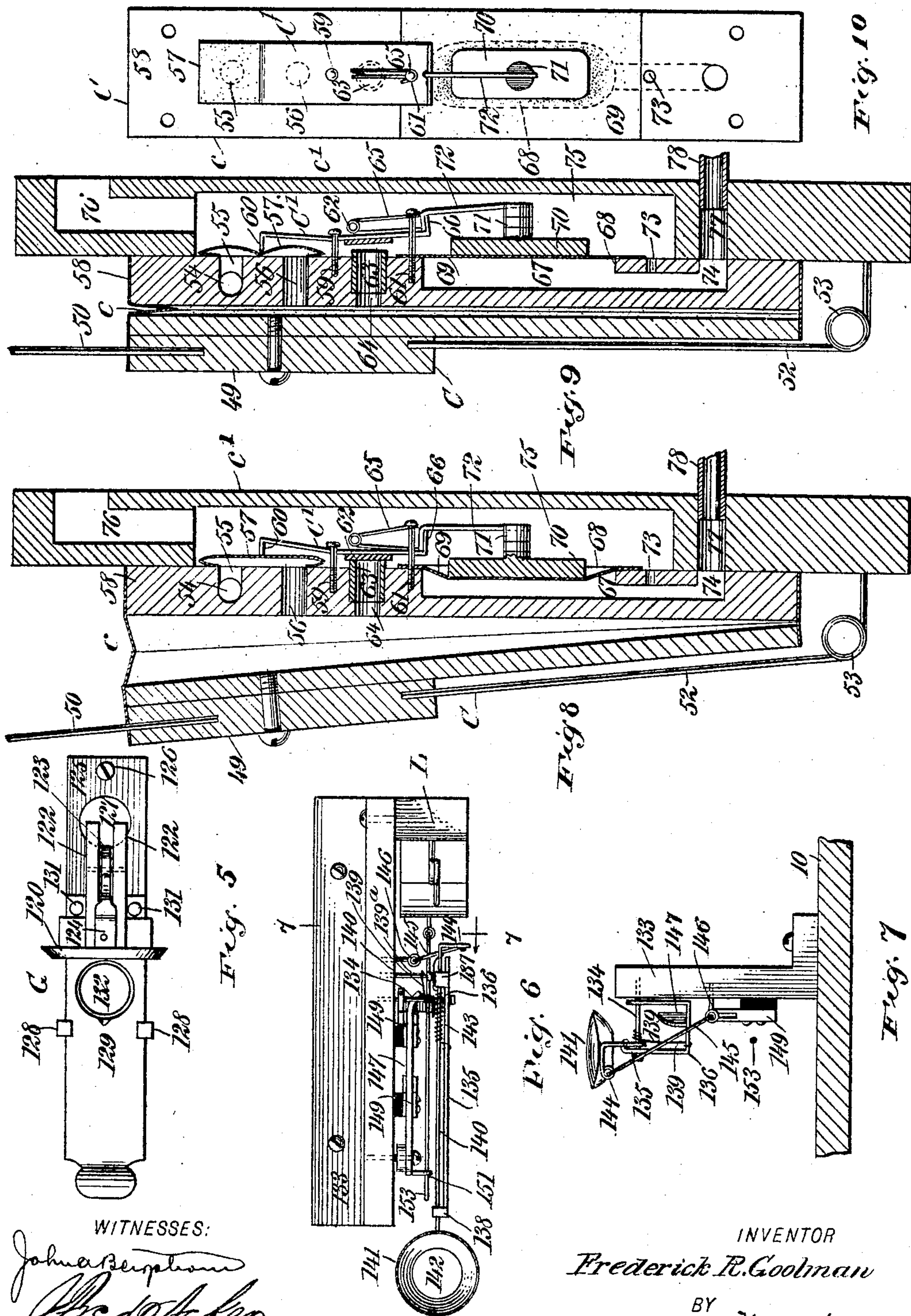
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6 SHEETS—SHEET 4.



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6 SHEETS—SHEET 5.

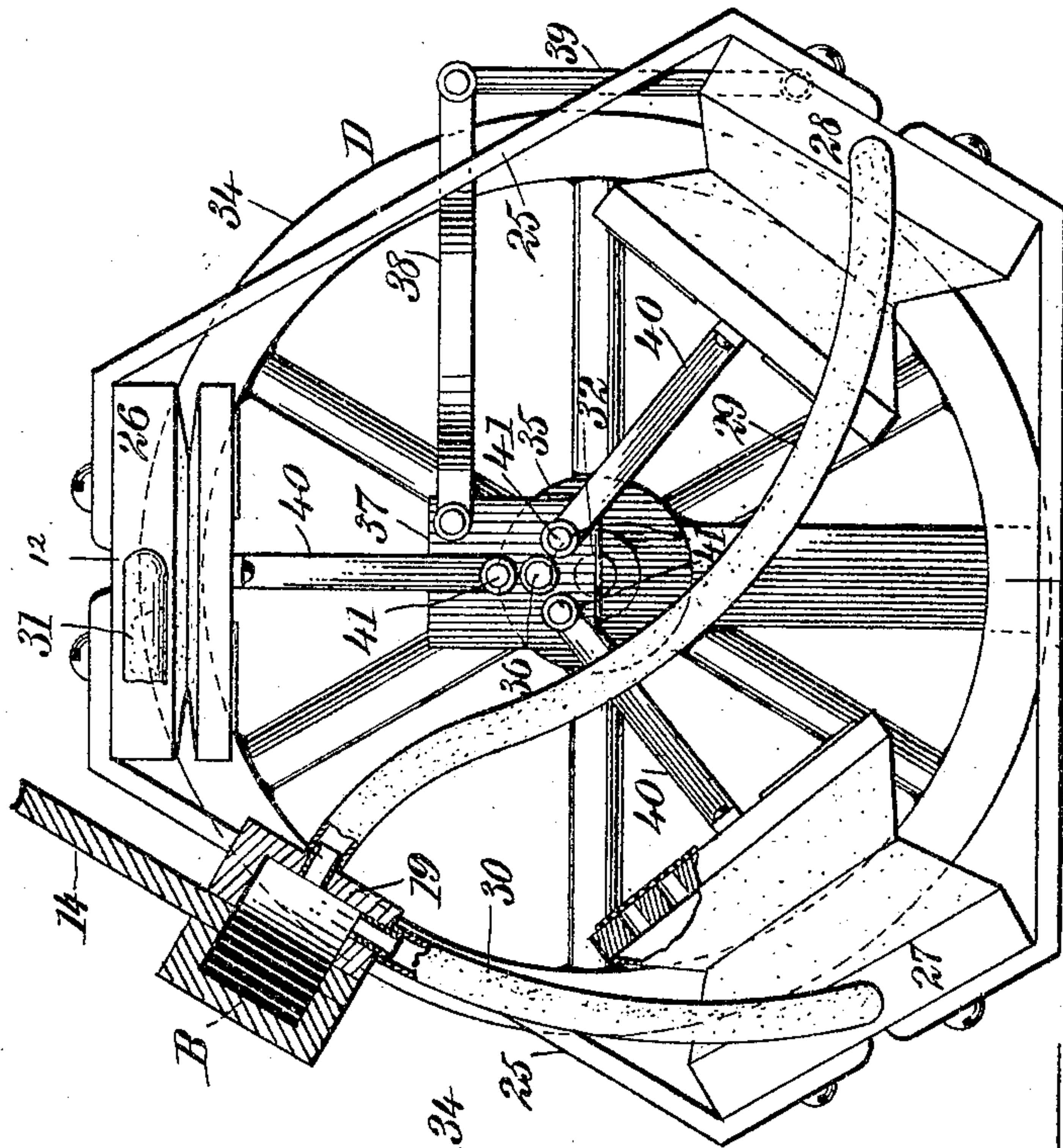


Fig. 11

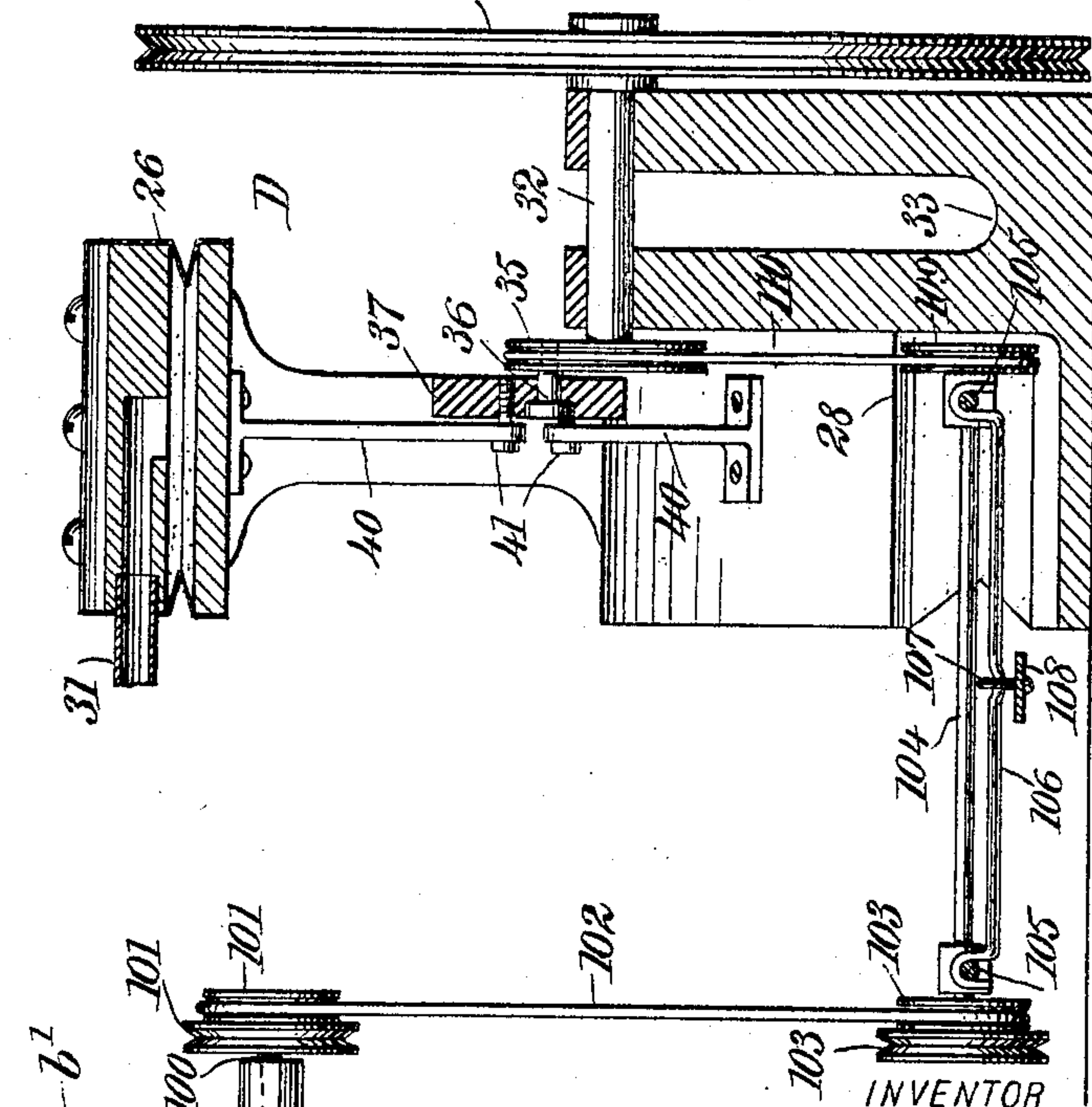
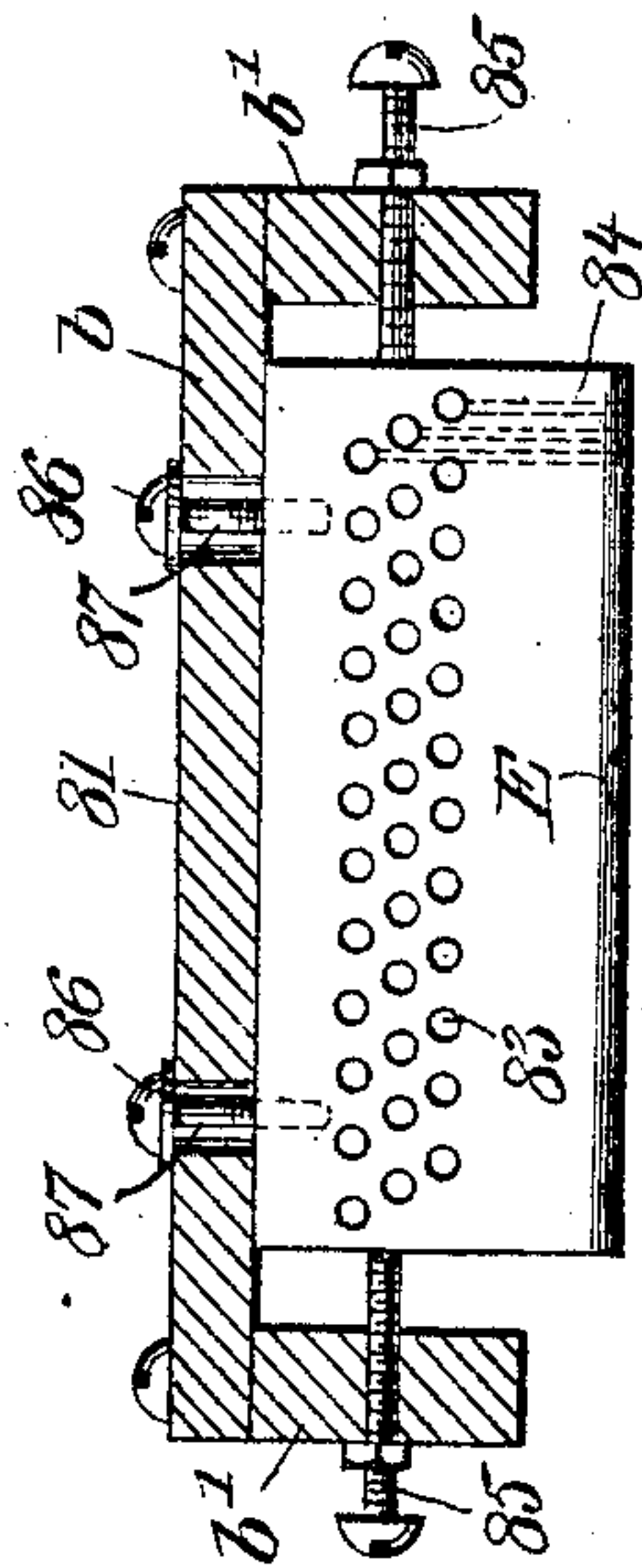


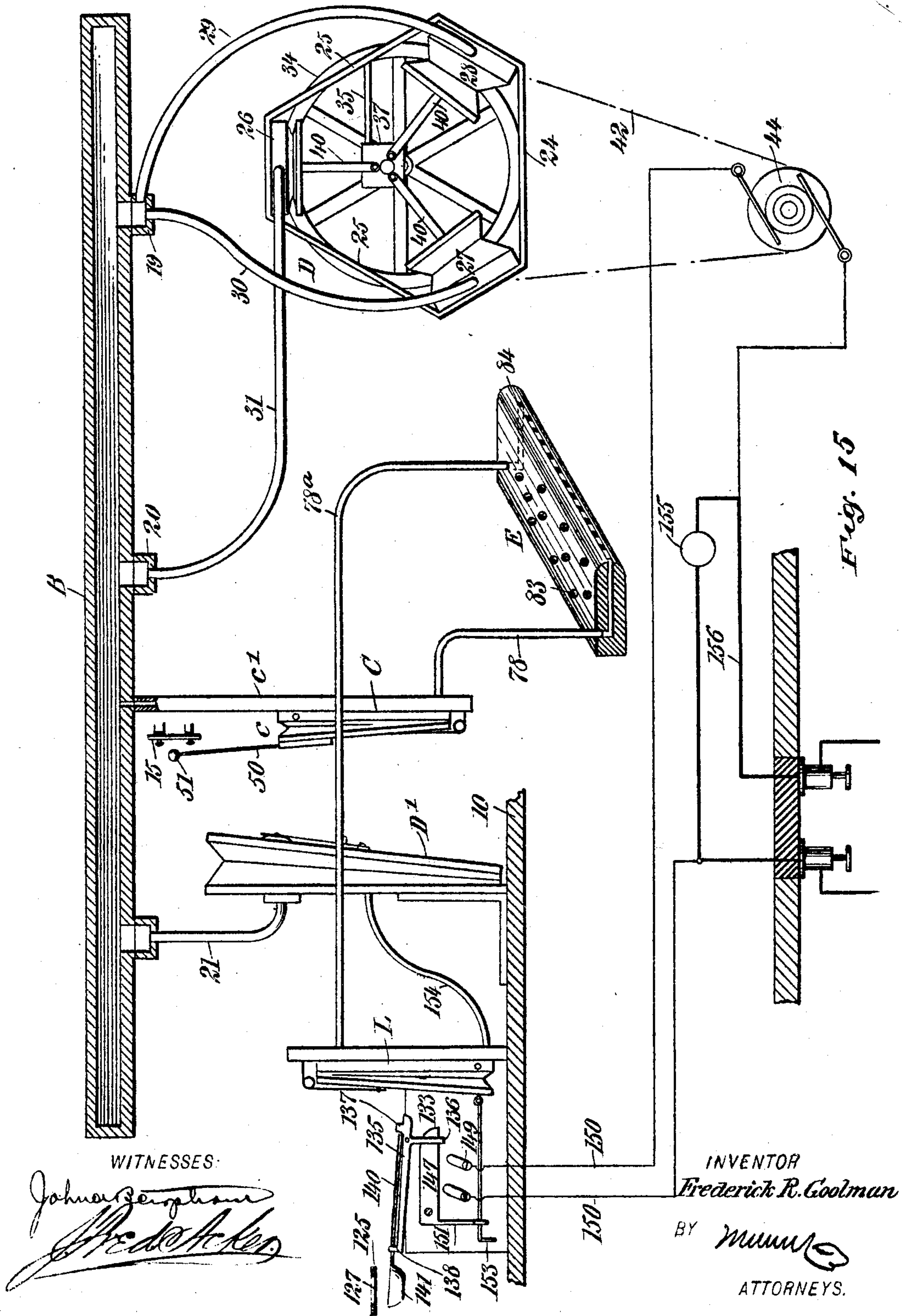
Fig. 12



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APPLICATION FILED JAN. 29, 1904.

6 SHEETS—SHEET 6.



UNITED STATES PATENT OFFICE.

FREDERICK ROOT GOOLMAN, OF BINGHAMTON, NEW YORK.

METALLOPHONE.

No. 795,278.

Specification of Letters Patent.

Patented July 25, 1905.

Application filed January 29, 1904. Serial No. 191,102.

To all whom it may concern:

Be it known that I, FREDERICK ROOT GOOLMAN, a citizen of the United States, and a resident of Binghamton, in the county of Broome and State of New York, have invented a new and Improved Metallophone, of which the following is a full, clear, and exact description.

The purpose of the invention is to provide a metallophone or an instrument in which the sound-producing devices consist of metal scale-bars operated upon by hammers and to so construct the instrument that the hammers will be pneumatically controlled and the pneumatic devices brought into action by connection with a suitable electric motor and to provide means for automatically starting the motor when a coin of predetermined dimensions is dropped into the instrument and for automatically stopping the instrument when the end of a piece of music or its repeat is reached.

A further purpose of the invention is to so construct an instrument of the above-named character that it will be simple, durable, and reliable and so that perforated ribbons or rolls of paper or like material will represent the musical composition to be rendered, which rolls or ribbons can be conveniently and expeditiously changed or removed from the instrument whenever desired.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a rear elevation of the instrument, the back having been removed. Fig. 2 is a central vertical section taken practically on the line 2 2 of Fig. 1. Fig. 3 is an enlarged transverse vertical section taken practically on the line 3 3 of Fig. 1, illustrating the coin-operated mechanism for starting the motor, the parts being in normal position, also showing the bellows connections for restoring the mechanism to its normal position after it has been tripped and the motor operated for a predetermined length of time, and likewise illustrating the equalizing-bellows, which is shown in side elevation. Fig. 4 is a transverse section taken practically on the same line as the section shown in Fig. 3, the equalizing-bellows being omitted and the coin-operated mechanism being shown in operating position. Fig. 5 is a detail plan view of the

coin-slide. Fig. 6 is a plan view of the coin-operated mechanism also shown in Figs. 3 and 4, which coin-operated mechanism is adapted to receive a coin from the slide shown in Fig. 5, the said coin-operated mechanism being likewise adapted to make and break the circuit in which the motor is located. Fig. 7 is a transverse section taken practically on the line 7 7 of Fig. 6. Fig. 8 is an enlarged longitudinal section through one of the pneumatic devices for operating a hammer and which carries the hammer, the said figure illustrating the parts of the device in their normal position. Fig. 9 is a view corresponding to the construction shown in Fig. 8, the parts being in operating position. Fig. 10 is a rear elevation of the parts shown in Figs. 8 and 9, the rear or box section having been removed from the front or bellows section. Fig. 11 is a sectional side elevation of the pumping device on the line 11 11 in Fig. 1. Fig. 12 is a vertical section taken practically on the lines 12 12 of Fig. 11. Fig. 13 is a horizontal section taken practically on the line 13 13 of Fig. 1, showing the apertured bridge in plan view. Fig. 14 is a sectional side elevation of one of the reels upon which is to be wound the music or perforated ribbons before such a ribbon or music is removed from the instrument; and Fig. 15 is a diagrammatic view of the main portions of the instrument, illustrating their operation.

The casing A of the machine may be of any desired shape. As shown in Fig. 2, it is provided with a horizontal partition 10 and a removable back 11, the partition 10 dividing the casing into an upper main chamber a and a lower chamber, which is subdivided into three parts a' , a'' , and a''' by suitable upright partitions 10^a. The upper front portion of the casing A is preferably given an upward and rearward inclination from a point near its center, and at the said upper inclined front portion of the casing A a door 12 is located, extending, preferably, from end to end of the casing. The said door is usually hinged to open upward and is provided with a transparent panel 13, which renders visible a sounding-board 14, located within the upper chamber a and having a corresponding inclination to the front upper portion of the casing, as is shown best in Fig. 2. Upon the front of this sounding-board 14 any desired number of metal bars 15 are located, of varying size, each bar representing a given note in a musical scale, and these bars may be arranged in one or in a number of octaves, as may be

desired. Ordinarily the sounding-board 14 is supported by brackets 16 at its back, extending downward to an engagement with a cross-bar 17, attached to the ends of the said upper compartment *a* of the casing at its front lower portion, or the said cross-bar may be otherwise supported, if found desirable.

An air-duct or vacuum-chamber B is constructed at the bottom front portion of the sounding-board 14, extending from end to end of the board, and this vacuum-chamber or air-duct B is closed at its ends, but is provided at its front portion with a number of apertures 18, corresponding in location and in number to the location and number of the music plates or bars 15, and each of these apertures 18 in the air-duct or vacuum-chamber B is placed in communication with a pneumatic device C. (Shown in position in Fig. 2 and in detail in Figs. 8, 9, and 10.) Each of these pneumatic devices C is adapted to carry a hammer to be hereinafter described, the hammers being adapted to strike the music bars or plates 15 from the front. These pneumatic striking devices C are supported upon the lower cross-bar 17 and are attached in any suitable or approved manner to the front of the air-duct or vacuum-chamber B.

Preferably a cap-block 19 is located at the rear of the vacuum-chamber or air-duct B, being located near the right-hand end viewed from the back, as is shown best in Fig. 1, and a second cap-block 20 is located at the rear central portion of the said duct or chamber B in communication therewith, as is shown in dotted lines in Fig. 1, while near the left-hand end of the said air-duct or vacuum-chamber B an equalizing-bellows D' of any suitable construction is connected by means of a suitable tube 21, which bellows is shown in Figs. 1 and 3, and the said equalizing-bellows is provided with the usual spring-controlled outlet-valve 22 at its rear for the escape of a superabundance of air when necessary. The members of the bellows are normally held separated by means of properly-located springs 23. A vacuum is created in the said air-duct or chamber B through the medium of a pump D. (Shown in position in Fig. 1 and in detail in Figs. 11 and 12.) This pump consists of a frame of any suitable shape attached in any desired manner to the partition 10, being located within the upper chamber *a*. Usually the frame of the pump is constructed as shown in Fig. 11, in which it comprises a lower member 24 and side members 25, the side members being connected by an upper bellows-pump 26 and the side and bottom members by lower bellows-pumps 27 and 28. Under this construction the bellows 26, 27, and 28 are triangularly arranged with reference to each other. The bellows 28 is connected by a pipe 29 with one portion of the cap-block 19, while the bellows 27 is connected with another portion of the same cap-block by means

of a pipe 30. The upper bellows 26 through the medium of a pipe 31 is connected with the centrally-located cap-block 20.

A shaft 32, journaled in suitable bearings 33, extends centrally within the frame of the pump device D, as is shown in Fig. 12. At the outer end of this shaft 32 a large pulley 34 is secured, and a smaller pulley 35 is attached to the inner end of the said shaft. The smaller pulley 35 is provided with an eccentrically-located wrist-pin 36, and this wrist-pin pivotally carries an upwardly-extending block 37, which is shown of rectangular construction, but may be of other desired shape. This block is held in the position shown and described while the bellows-pumps are acting and while the shaft 32 is revolving by means of links 38 and 39, the link 38 being horizontally located and pivoted to the upper side portion of the block 37, while the link 39 is vertically disposed and is pivoted to the outer end of the link 38 and to the stationary portion of the bellows-pump 28, as is shown best in Fig. 11.

Stems 40 extend inward from the movable portions of the bellows-pumps 26, 27, and 28, and these stems 40 are pivoted to the block 37 by means of wrist-pins 41 or suitable pivot-pins, which are arranged eccentrically with respect to the wrist-pin 36, pivoting the block 37 on the smaller pulley 35, so that while the block 37 during the revolution of the shaft 32 occupies practically an upright position it has sufficient reciprocating movement to operate the various movable sections of the bellows-pumps, operating simultaneously the two lower bellows-pumps 27 and 28 and next the upper bellows-pump 26. In this manner a vacuum is obtained in the vacuum-box or air-duct B.

A driving-belt 42 is carried over the larger pulley 34 and downward through the partition 10 of the casing A into the lower compartment *a*³. This driving-belt 42 is likewise carried over a driving-pulley 43, attached to the drive-shaft of preferably an electric motor 44, located also in the said lower compartment *a*³. The belt 42 is kept automatically tightened by a device, which is shown in Figs. 1 and 2, consisting of a grooved pulley 45, which engages with a strand of the said belt, the pulley being mounted upon the horizontal member of an arm 46, which arm at its upper end is pivoted upon an extension 47 from the lower part of the partition 10 or from any other suitable support. The pulley 45 is held in engagement with the belt 42 by means of a spring 48, at one end having bearing against the arm 46 in direction of the belt 42, the other end of the spring being attached to any suitable support.

The pneumatic devices C, adapted to act to produce a musical sound, are of like construction, each being preferably made as is shown in Figs. 8, 9, and 10. These devices consist,

primarily, of a bellows-section *c* and a box-section *c'*, secured to the rear face of the bellows-section in any desired and air-tight manner, and the box-section *c'* extends usually above and below the said bellows-section *c*.

At the front upper portion of the bellows-section *c* of a pneumatic striking or operating device C a block 49 is preferably secured in any suitable or approved manner, and an upwardly-extending stem 50 is attached to this block, terminating at its upper end in a hammer 51, wherewith to strike the musical bar or plate 15 to which the hammer may be assigned. The bellows-section *c* is normally held in an open position by means of a spring 52, usually attached at one end to the lower portion of the block 49, the said spring extending down below the bottom of the bellows-section, where it is provided with a coil 53 and is then carried to an engagement with the lower portion of the box-section *c'* of the said pneumatic striking device.

In what may be termed the "rear board" of the bellows-section *c*, at the upper portion of said board, a passage 54 is horizontally produced, being in communication with the atmosphere within the box-casing, and the passage 54, which extends through from an outer side of the rear board 58, connects with a transverse passage 55, extending from the rear face of the said board, as is shown in Figs. 8 and 9. Below the said connected passages 54 and 55 a lower transverse passage 56 is produced, extending through the said rear board 58, having communication with the space within the bellows cloth or material of the device. A diaphragm 57, of a flexible material, fabric being preferably used, is secured to the rear face of the rear board 58 of the bellows-section *c*, being attached at its top, bottom, and side edges to the said board by glue, cement, or an equivalent material, and the said diaphragm 57 is rendered more or less full in its construction and embraces or incloses the combined passages 55 and 54 and the through-passage 56.

A cut-off *C'* is adapted to control the upper diaphragm 57. This cut-off usually consists of a plate more or less angular extending longitudinally of the back board 58 of the bellows section *c* at its rear, and at the upper end of the said cut-off a forwardly-extending flange 60 is formed, adapted to engage with the upper diaphragm 57 at a point about centrally between the connected passages 54 and 55 and the lower through-passage 56. The cut-off *C'* is pivoted at or about its center through the medium of a pin 59, usually passed through the cut-off and secured in the back board 58, and a guide-pin 61 is provided for the lower end of the cut-off, which lower end of the cut-off has free movement on the said guide-pin. The cut-off *C'* carries a valve 62 at its forward face below its pivot 59, and this valve in the normal posi-

tion of the cut-off *C'* closes the rear end of a preferably elastic tube 63, inserted in a second through-passage 64 in the back board 58, being in communication with the space between the bellows cloth or material. A spring 65 normally tends to hold the cut-off *C'* in its normal position, which is shown in Fig. 8, and in such position of the cut-off the upper diaphragm 57 is in such position that communication is freely established between the passages 54, 55, and 56. This spring 65 is usually secured to the guide-pin 61 and is in the shape of a bow-spring extending in an upwardly direction, having its upper portion over the valve 62, and at the lower end of the said cut-off *C'* an outwardly-extending horizontal flange 66 is formed. At the lower portion of the back board 58 of the bellows-section *c* a vertical or longitudinal chamber 67 is produced, having an extended longitudinal opening 68, which is carried through the rear face of the said back board, as is shown in Figs. 8 and 9. This opening 68 is entirely closed by a flexible diaphragm 69, having sufficient slack to be pressed forward within the said opening 68 and into the chamber 67, which position is the normal position of the diaphragm.

A block 70 is secured to the rear or outer face of the diaphragm 69, where it is carried over the opening 68 for the chamber 67. This block 70 is provided with a central stem 71, having a shank 72 attached thereto and to the lower flange 66 of the cut-off *C'*, so that the movement of the diaphragm 69 and attached block 20 controls the movement of the cut-off *C'*. A small vent-opening 73 is made in the said back board 58 of the bellows-section *c* of the pneumatic device C near the lower end of the chamber 67, communicating with the said chamber and extending through the rear face of the said back board, and at the bottom of the said chamber 67 in the back board 58 another passage 74 is formed, which likewise extends out through the back or rear face of the said back board 58.

The box-section *c'* of each of the pneumatic striking devices C is provided with a long longitudinal or vertical chamber 75, which extends from a point near its bottom to a point near its top. This chamber 75, while it does not extend out through the rear face of the box-section *c'*, does extend through its forward section, and the said chamber 75 is of such length as to embrace or include all of the diaphragm, valve, and cut-off mechanisms which have been described in connection with the bellows-section *c*, as is clearly shown in Figs. 8 and 9.

At the upper portion of the box-section *c'* an angular passage 76 is formed, and this passage is in direct communication with one of the forward openings 18 in the vacuum or air-box B, as is shown in Fig. 2. Below the said main chamber 75 in the box-section *c'* a hori-

horizontal or transverse passage 77 is formed, extending through from front to rear, and this passage 77 is in direct communication with the lower passage 74 in the bellows-section *c*. A flexible tube 78, which may be called a "connecting-tube" and which is preferably of a flexible material, such as rubber, has one of its ends introduced into the said passage 77, and each of the pneumatic striking devices *C* is provided with such a tube 78. These tubes 78 all lead to a bridge *E*, which is located at the central portion of the upper chamber *a* of the casing *A*, located some distance from the back of the sounding-board 14, as is best shown in Fig. 2; but this bridge is shown in detail in Fig. 13, and it is provided with a series of apertures or openings 83, extending from its top a predetermined distance in a downward direction. Each of the said apertures or openings 83, which are vertical, is in direct communication with corresponding horizontal or transverse openings or apertures 84, which extend out to the rear longitudinal edge of the bridge, as is shown in Figs. 2 and 13. In each of the vertical openings or apertures 83 the rear end of a connecting-tube 78 is introduced in an air-tight manner. This bridge *E* is adjustably secured in a frame 81, which is supported above the partition 10 in an inclined position by means of brackets 80, the inclination of the frame 81 corresponding to the inclination of the sounding-board 14, as is shown in Fig. 2. This frame 81 consists of a front board or member *b*, in which a transverse slot 82 is made, side members *b'*, a top member *b''*, a bottom member *b'''*, the top and bottom members extending in direction of the rear of the casing, and an auxiliary rear member *b⁴*, which extends upwardly and rearwardly from the upper main member *b''*, as is shown in Figs. 1 and 2. It is necessary that the bridge *E*, which is substantially horizontally supported in the said frame, should have accurate adjustment in order that the outlets to the passages, channels, or openings 84 may be brought in proper registry with apertures 94, produced in an endless tape or ribbon *E'*, as when one of these apertures 94 is in exact registry with one of the transverse channels or passages 84 the pneumatic striking device in communication with that channel or passage will be instantly brought into operation to strike one of the musical plates or bars. Such an adjustment of the bridge *E* is usually accomplished as is shown in Fig. 13, in which it will be observed that the bridge *E* is not positively attached to its supporting-frame 81, being carried by side adjusting-screws 85, passed through the side members *b'* of the said adjusting-frame 81, and forwardly-extending adjusting-screws 86, which have lateral movement in slots 87, produced in the front or main member *b* of the said frame 81. It may be here stated that all of the connecting-tubes 78 are passed through

the horizontal slot 82 in the forward member of the said frame 81, as is shown in Fig. 2, so that no matter what the length of the sounding-board may be the connecting-tubes connected with all the pneumatic striking devices *C* are assembled at the rear central portion of the machine, as is shown in Fig. 1.

A bracket 88 is secured to the rear face of the upwardly-extending auxiliary member *b⁴* of the frame 81, as is shown in Figs. 1 and 2. This bracket 88 has an offset central portion and is provided with bearings 89 at its ends. At the offset central portion of the bracket 88 a crank-arm 90, of spring material, is mounted to turn, being adapted to be carried to an upper or to a side or to a lower position, as occasion may demand. The bearings 89 of the bracket 88 are adapted to support what may be termed a "swinging frame" 91, composed of an upper bar, which enters the said bearings 89, as is shown in Fig. 1, suitable downwardly-extending side bars, between which at their lower ends a roller 92 is journaled, and a cross-bar 93, which connects the side bars of the swinging frame 91 and against which the lower end of the spring crank-arm 90 has forcible and forward bearing when the said crank-arm is in its lower position. (Shown in both Figs. 1 and 2.)

Referring back to the endless tape or perforated ribbon *E'*, containing the apertures 94, which are adapted to register with the horizontal channels or passages 84 in the bridge *E* to produce an action of a hammer 51, it may here be stated that when the end of the series of apertures is reached a single aperture 95, (shown in Fig. 1,) which is located near one margin of the said tape or ribbon *E'*, is adapted when brought in registry with a proper channel or passage in the bridge *E* to cause the motor to automatically stop, as will be hereinafter described, as well as the manner in which the motor is automatically started. The endless perforated tape or ribbon *E'*, controlling the action of the hammers, after being passed across the perforated rear edge of the bridge *E* is carried over a roller 96, removably journaled in bearings 96^a, attached to the rear edges of side members *b'* of the frame 81, the roller 96 being located below the bridge, as is shown in Fig. 2, and the said endless perforated tape or ribbon *E'* is then carried over a roller 97, located above the bridge *E*, as is also shown in Fig. 2, being also removably journaled in suitable bearings 97^a, secured to the rear edges of the side members *b'* of the frame 81. This upper roller 97 is provided at one end with a gear 98, which meshes with a pinion 99. (Shown in Figs. 1 and 12, more particularly in the latter.) This pinion is mounted on a short shaft 100, journaled in suitable bearings formed in a side member *b'* of the frame 81, and at what may be termed the "outer" end of the shaft 100 two pulleys 101 are secured of different diameters. Either

one of these pulleys is connected by a belt 102 with one or the other of correspondingly-formed pulleys 103, secured to one end of a shaft 104, which shaft is mounted in bearings 105, said bearings preferably consisting of spring-rods having suitable eyes, and the rear ends of these rods are secured in any suitable or approved manner to the central partition 10 over the compartment a^3 , in which the motor 44 is located. A tension-bar 106 is provided with hooks at its ends adapted to extend over the bearings 105 at or near their free ends, as is shown in Fig. 12, and a spring 108 of suitable tension is secured at one end to the partition 10 or other support, and the free end of this spring 108, as is shown in Figs. 1 and 12, has a hook 107, which has bearing upon the central portion of the tension-bar 106, so that automatically the belt 102 will always be kept taut. The said shaft 104 is provided at its opposite end with a pulley 109, and the said pulley 109 is connected with the pulley 35 on the shaft 32 by means of a belt 110, as is shown in Fig. 12. In this manner the shaft 104 is driven from the motor 24.

The endless perforated tape or ribbon E' passes down into the central compartment a^2 of the casing through an opening 111, as is shown in Fig. 2. This endless perforated tape or ribbon may be of any desired length and may be coiled at its lower portion at the bottom of the said compartment a^2 , as is also shown in Fig. 2. When the endless perforated ribbon or tape E' has been properly placed in the instrument, as is shown in Fig. 2, the spring crank-arm 90 is carried to the lower position, (shown in Figs. 1 and 2,) thus forcing the roller 92, carried by the swinging frame 91, against that portion of the perforated ribbon or tape E' which passes down at the rear of the upper roller 97, thus insuring the perforated tape or ribbon E' traveling properly over the said rollers and across the perforated edge of the bridge E as the shaft 104 is revolved.

It is desirable to have the perforated tape or ribbon E' suitably wound up before it is removed from the instrument, so as to prevent the possibility of the tape or ribbon being torn when stored away, as when wound up it may be placed compactly in roll form in any available compartment of the casing. To that end I have constructed a reel F , (shown in detail in Fig. 14,) consisting of a body portion 112, having a fixed head 113 and an opposing detachable head 114, while a rod 115 extends from head to head, being suitably recessed therein. This reel is provided with a trunnion 116 at one end and a crank-handle 117 at the opposite end, the handle being attached to the fixed head 113, and that portion 118 of the head 117 adjacent to the said head of the reel constitutes a trunnion therefor. These trunnions of the reel are mounted to

turn in suitable bearings 119, extending upward from the partition 10 of the casing, as is shown in Fig. 2. In the operation of this reel F the perforated tape or ribbon E' is bent upon itself and carried between the rod 115 and the body 112. The handle 117 is then turned, causing the perforated tape or ribbon to wind up upon the body 112, the rollers 96 and 97 having been removed from their bearings and disengaged from the said tape or ribbon. When the tape or ribbon has been entirely wound up upon the reel F , the detachable head 114 is removed from the body of the reel and the rod and body of the reel are withdrawn from the roll thus formed.

In the operation of the pneumatic device C when the outlet of any one tube 78, connecting the device C with the bridge E , is uncovered air is sucked therein by the action of the pumping device D , which in operation exhausts the air from the vacuum-box B . Therefore the air will enter the device through the channels 77 and 74 and will pass into the chamber 67 with sufficient force to carry the diaphragm 69 outward or rearward from the position shown in Fig. 8 to the position shown in Fig. 9, causing the cut-off C' at its upper flange 60 to press forward the upper diaphragm 57 and cut off connection between the passage 54 in connection with the atmosphere and the passage 56 in communication with the bellows, as is also shown in Fig. 9, and as the cut-off takes the position shown in Fig. 9 the valve 62 is opened, and the suction induced by the action of the pump device D through the vacuum-box B through the medium of the passage 64 will draw the bellows together and will cause the hammer 51 of the pneumatic striking device C acted upon to strike the music plate or bar to which it belongs. The suction or vacuum overcomes any air that may be admitted to the chamber 75 of the box-section c' through the passage 73, and as soon as the outer end of the communicating or connecting tube 78 is closed the supply of air to the chamber 67 ceases and the vacuum is complete in the box-chamber 75, whereupon the spring 65 immediately acts to restore the cut-off C' to its normal position, and the air from the outside atmosphere entering through the passages 54 and 55 will enter the bellows through the passage 56 and will open the same, assisted by the spring 52. This action is so quick as to prevent the hammer muffling the bar or plate it strikes after the blow has been delivered, and the bellows-sections of the pneumatic striking devices C are limited in their forward movement by angle guide-bars 79, extending from the upper front portions of the box-sections of the said devices C downward to an engagement with their bellows-sections, as is shown in Fig. 2.

The instrument is adapted to be coin-operated, and a coin-slide G is usually located near one of the front central side portions of the

casing, at which point an opening 119 is made, closed by a cap 120. This cap is provided with a central slot 121, enlarged at its upper rear portion and provided with inwardly-extending cheek-pieces 122. A forwardly-extending pawl 123 is pivoted between the cheek-pieces 122, as is best shown in Fig. 4, held in a lower position by a spring 124. At the bottom portion of the slot in the cap 120 an outwardly and inwardly extending plate 125 is firmly secured, provided with a central pin or stud 126 at its inner end, an opening 127 near its inner end within the casing and adapted for the downward passage of a coin, and loops 128, formed at the outer end of the said fixed plate. A second plate 129 is held to slide upon the fixed plate 125, having a handle at its outer end, and said sliding plate passes loosely through the loops 128 and has a recess 130 at its inner end, which recess when the sliding plate is in its innermost position receives the stud or pin 126 of the fixed plate. The said sliding plate 129 is further provided with side guides 131, engaging with the cheek-pieces 122 and which limit the outward movement of the sliding plate, together with a coin-receiving opening 132 so located that when the sliding plate is in its outer position (shown in Fig. 5) the opening 132 will be over the outer portion of the fixed plate and in position to receive and hold a coin. When the sliding plate is in its inner position, said opening 132 will register with the opening 127 in the fixed plate to discharge the coin into the machine, which coin is adapted to be received by a receiving device H, (shown in Figs. 3, 4, 6, and 7,) the said receiving device by its action being adapted to make and break the circuit in which the motor 44 is located. This receiving device H is located beneath the coin-slide G and consists mainly of an upright 133, upon which an arm 135 is fulcrumed by a suitable pin 134 at its heel or inner end portion. Just below the fulcrum or the said pin 134 for the said arm a downwardly-extending stirrup 136 is formed, and at the upper portion of the heel end of the arm 135 a bearing 137 is constructed, while a second bearing 138 is located at the outer or longer end of the said lever-arm 135, as is shown in Figs. 3 and 4. The lever-arm 135 is normally held in an upper position (shown in Fig. 3) by means of a spring 139, which is usually attached to a pin 139^a, (shown in Fig. 6,) being coiled around the pivot-pin 134 and attached at its opposite end to the bottom of the stirrup 136; but the said spring may be otherwise applied to normally hold the said lever-arm in the upper position. A shaft 140 is journaled in the bearings 137 and 138, and this shaft at its forward end has a cup 141 attached thereto, adapted to receive a coin when dropped from the slide G. This cup 141 has an opening 142 in its bottom, so that if a coin is of less size than the coin

determined upon to operate the machine the smaller coin will drop through the opening 142 and will have no action upon either the shaft 140 or the lever-arm 135. A spring 143 is coiled around the shaft 140 near its rear end, being attached, for example, at one of its ends to the lever-arm 135, and at its opposite end the said spring is attached to an upwardly-extending crank-arm 144. This crank-arm 144 is pivotally attached to a link 145, the said link being also pivotally attached to a keeper 146, extending from the upright 133, so that when a coin of suitable size is dropped into the cup 141 the weight of the coin will carry the lever-arm 135 downward to the position shown in Fig. 4 and at the same time the link 145 will cause the shaft 140 to turn in a manner to carry the cup so far sidewise as to spill out the coin it contains. In connection with the said lever-arm 135, the shaft 140, and the cup 141 a knife-contact K is employed consisting of a blade 147, pivoted to the upright 133 at one end, its free end being outwardly curved, which blade 147 is adapted to enter clip-contacts 149, also secured to the upright 133, and wires 150 lead from these contacts 149 to engagement with proper binding-posts on the motor 44, as is shown in Fig. 15. Normally the blade 147 would engage with the contacts 149, as at the pivot end of the blade 147 a downwardly-extending arm 151 is formed, terminating in an eye, and a spring 152, carried by the upright 133, has such connection with the said upright and with the said arm 151 as to tend to force the free end of the blade 147 downward; but normally the free end of the blade 147 of the said knife-contact is made to rest in the stirrup 136, and is thus held out of engagement with the spring or clip-contacts 149. The blade 147 is raised to break the circuit by means of a slip-link connection 153 between the lower end of the arm 151 and a bellows L, which is of like construction to the pneumatic striking devices C heretofore described; but instead of the wider portion of the bellows being uppermost such wider portion is at the lower part of the bellows. This bellows L is provided with a tube 78^a, corresponding to the tube 78 in the devices C, and connects with similar passages within the bellows, and this tube 78^a is carried to the end passage in the bridge E, over which the extreme end and lowermost aperture 95, heretofore referred to as located in the perforated tape or ribbon E', would register, while a tube 154 is connected with the equalizing-bellows D' and through the said bellows with the vacuum-box B.

Supposing the coin-receiving device H to be in its upper position and the blade of the knife-contact held in its upper position, as shown in Fig. 3, if a suitable coin is placed in the slide G and the upper plate is slid inward properly the coin would drop into the

cup 142 and force the lever-arm 135 downward, thus releasing the blade 147, which would then instantly drop to an engagement with the clip-contacts 149, thereby closing the circuit 150 and setting the motor and other operative parts of the instrument in motion. These parts, including the motor, will continue to revolve and the instrument to play until the final and isolated aperture 95 registers with the end passage in the bridge E, whereupon the bellows L will contract under the same conditions as has been described with reference to the pneumatic devices C, and in contracting or closing the bellows will draw the arm 151, connected with the blade 147, toward it, and thus will raise the blade 147 until its free end shall have entered the stirrup 136, thereby breaking the circuit and stopping the motor, and consequently the operation of the machine, and the air entering the bellows L through the opening therein in communication with the atmosphere will cause the bellows to again expand or assume its normal position.

An electric light 155 is preferably placed in the upper portion of the casing A in front of the central part of the sounding-board 14, as is shown in Figs. 1 and 2, and this light 155, as shown in Fig. 15, is within a shunt-circuit 156. Electricity may be applied by means of a small dynamo or by a battery in the customary manner, as may be desired. When the coin drops from the cup 141, it is preferably made to pass through a suitable opening in the partition 10 into a drawer 157 in the lower compartment *a'* of the casing.

I desire it to be understood that what I have designated a "bridge" E in the foregoing portion of the specification is practically a tracker-board and in the claims will be so denominated and that the pneumatic striking or hammer-carrying devices C and the corresponding device in direct communication with the make-and-break mechanism K in the electric circuit of the motor will be referred to in the claims as "pneumatics." The perforated sheet E' will also be hereinafter designated as the "note-sheet."

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

1. In a pneumatic in combination, an exhaust-chamber, means for maintaining a partial vacuum therein, a bellows, said exhaust-chamber having an opening communicating with the interior of said bellows, and a second opening leading to the outer air, a flexible diaphragm loosely inclosing a space connecting said openings, a cut-off adapted to engage said diaphragm between said openings,

and pneumatic means for controlling said cut-off.

2. In a pneumatic in combination, a bellows, an exhaust-chamber having an opening communicating with said bellows and a second opening leading to the outer air, a flexible diaphragm disposed over said openings, cutting off a portion of the interior of said exhaust-chamber and establishing communication between said openings, a cut-off adapted to engage said diaphragm to press the same against the wall of said exhaust-chamber, a valve carried by said cut-off and controlling communication between said exhaust-chamber and said bellows, and means for actuating said cut-off.

3. In automatic musical instruments, a pneumatic consisting of a spring-controlled bellows-section, a hammer attached to the bellows-section, a box-section secured to the bellows-section, the bellows-section where it connects with the box-section being provided with a passage in communication with the outside atmosphere, and a chamber in the box-section, the bellows-section being also provided with a lower passage extending from the chamber in the box-section to the interior of the bellows, a diaphragm extending from one passage to the other within the chamber of the box-section, covering both passages at the said box-chamber, a third passage extending from the chamber in the box-section into the bellows, a longitudinal chamber formed in the lower portion of the bellows-section, having a vent therein leading into the chamber in the box-section, and an opening facing the chamber in the box-section, the diaphragm covering the said opening, a block connected with the diaphragm, a spring-controlled cut-off, provided with a valve adapted to normally close the intermediate passage in the bellows-section, one end of the cut-off being in engagement with the upper diaphragm between the upper and intermediate passages in the bellows-section, a connection between the cut-off and the block of the lower diaphragm, a tracker-board, a tubular connection between the tracker-board and the lower chamber of the bellows-section of the said pneumatic, a vacuum-box, and a connection between the vacuum-box and the chamber in the box-section of the pneumatic, as described.

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

FRED. ROOT GOOLMAN.

Witnesses:

F. W. WELSH,

K. E. TURNER.