

A. G. GULBRANSEN.  
 AUTOMATIC PLAYING PIANO.  
 APPLICATION FILED DEC. 11, 1906.

913,378.

Patented Feb. 23, 1909.

4 SHEETS—SHEET 1.

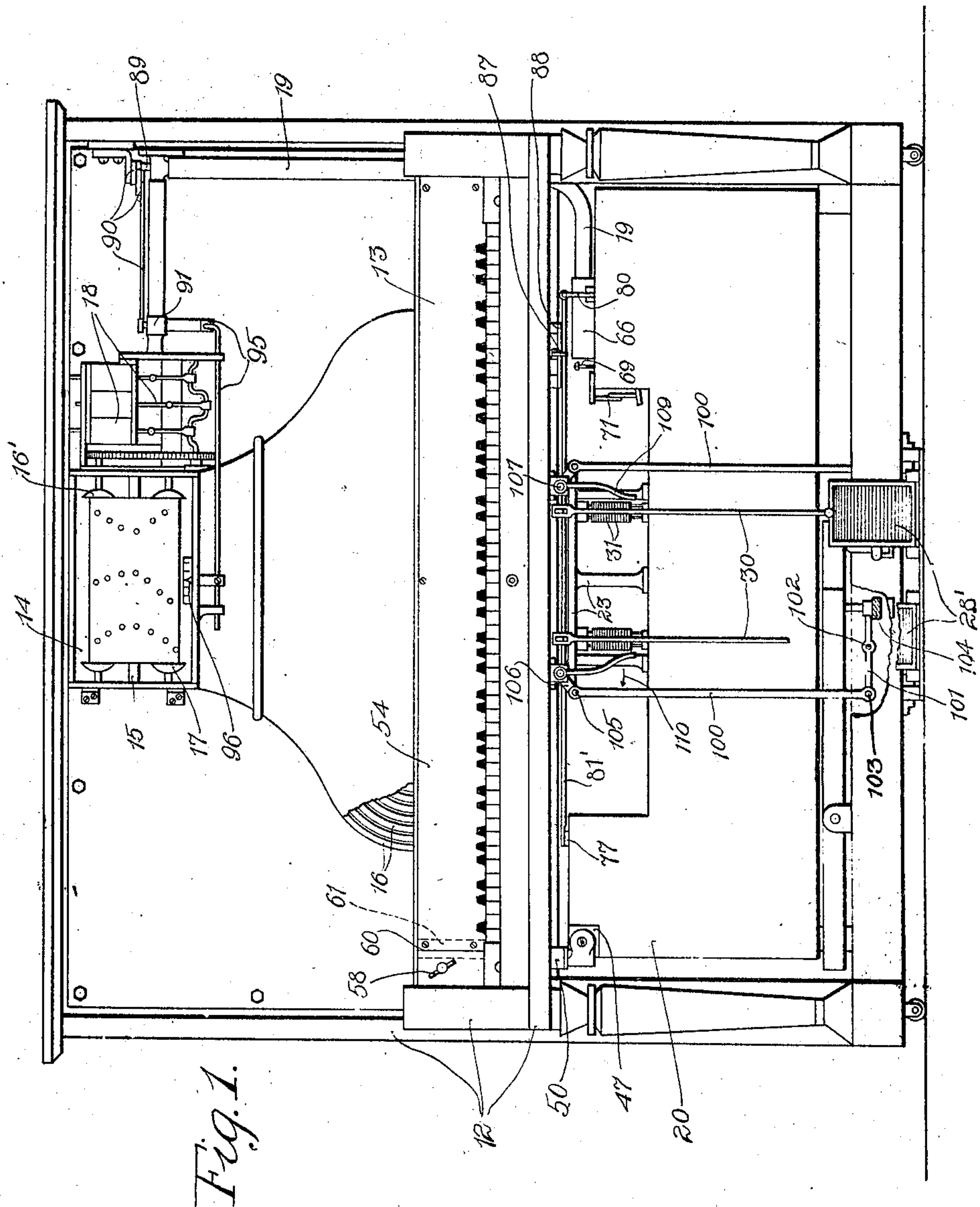


Fig. 1.

Witnesses:

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By

Inventor

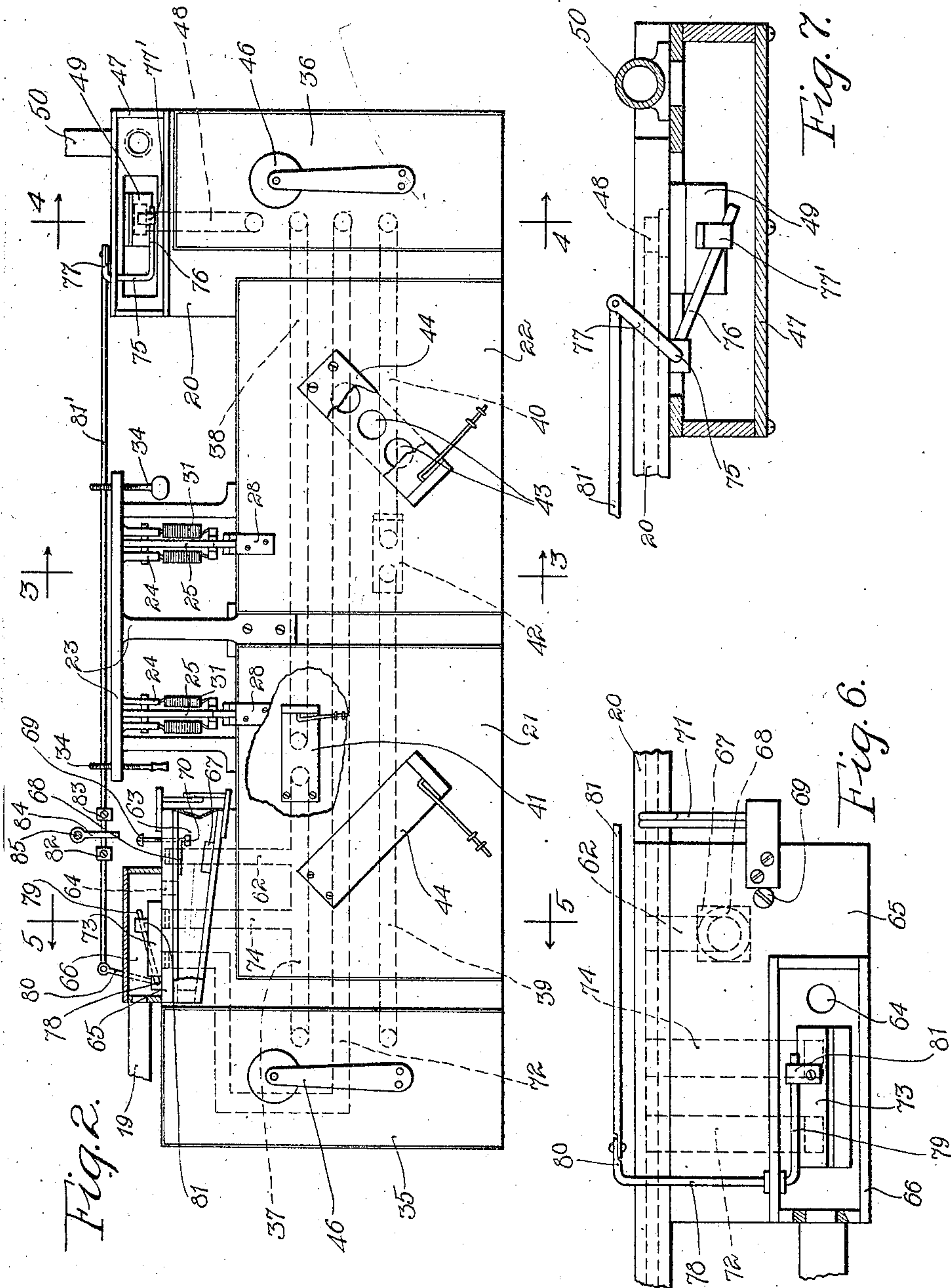
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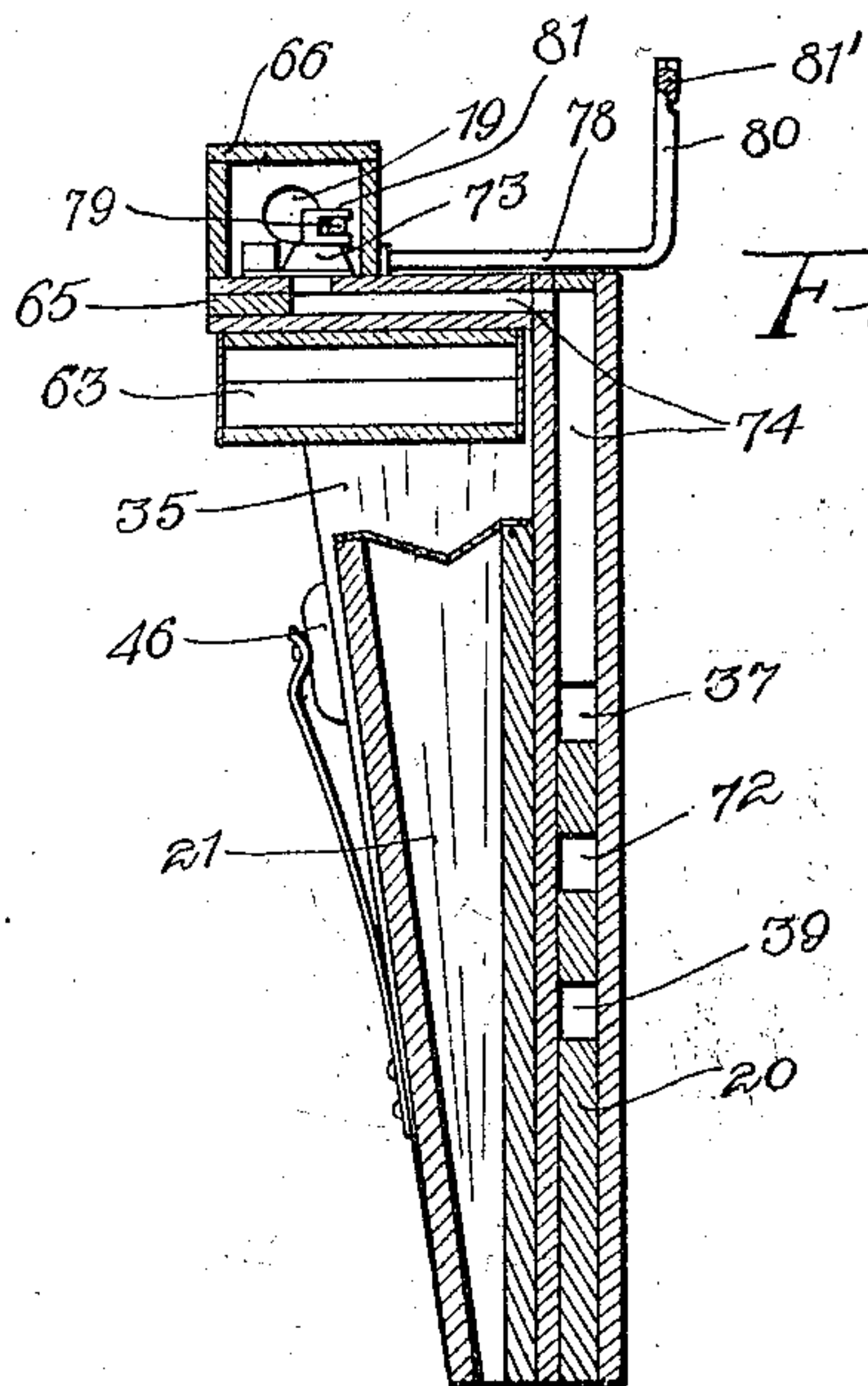
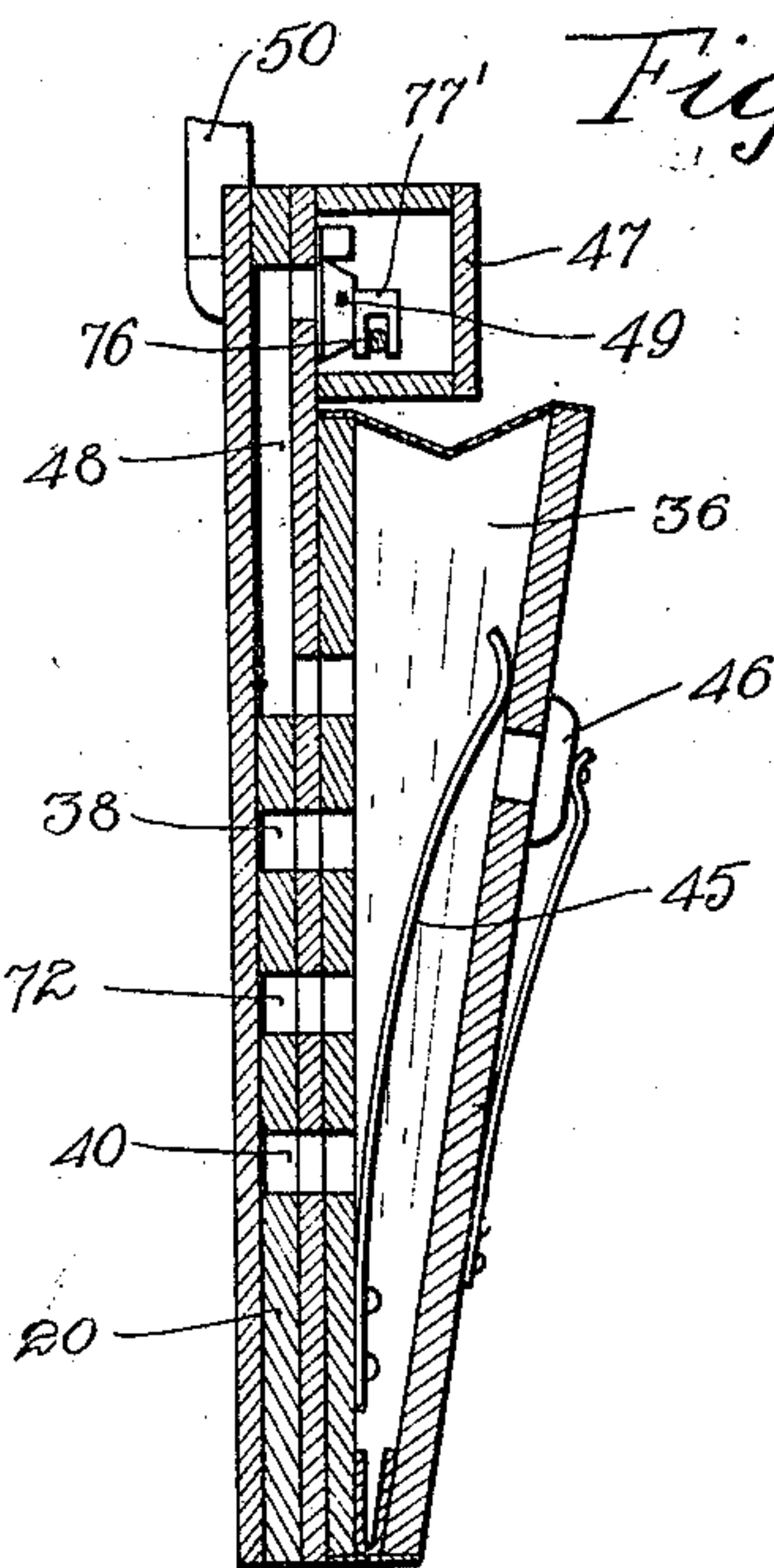
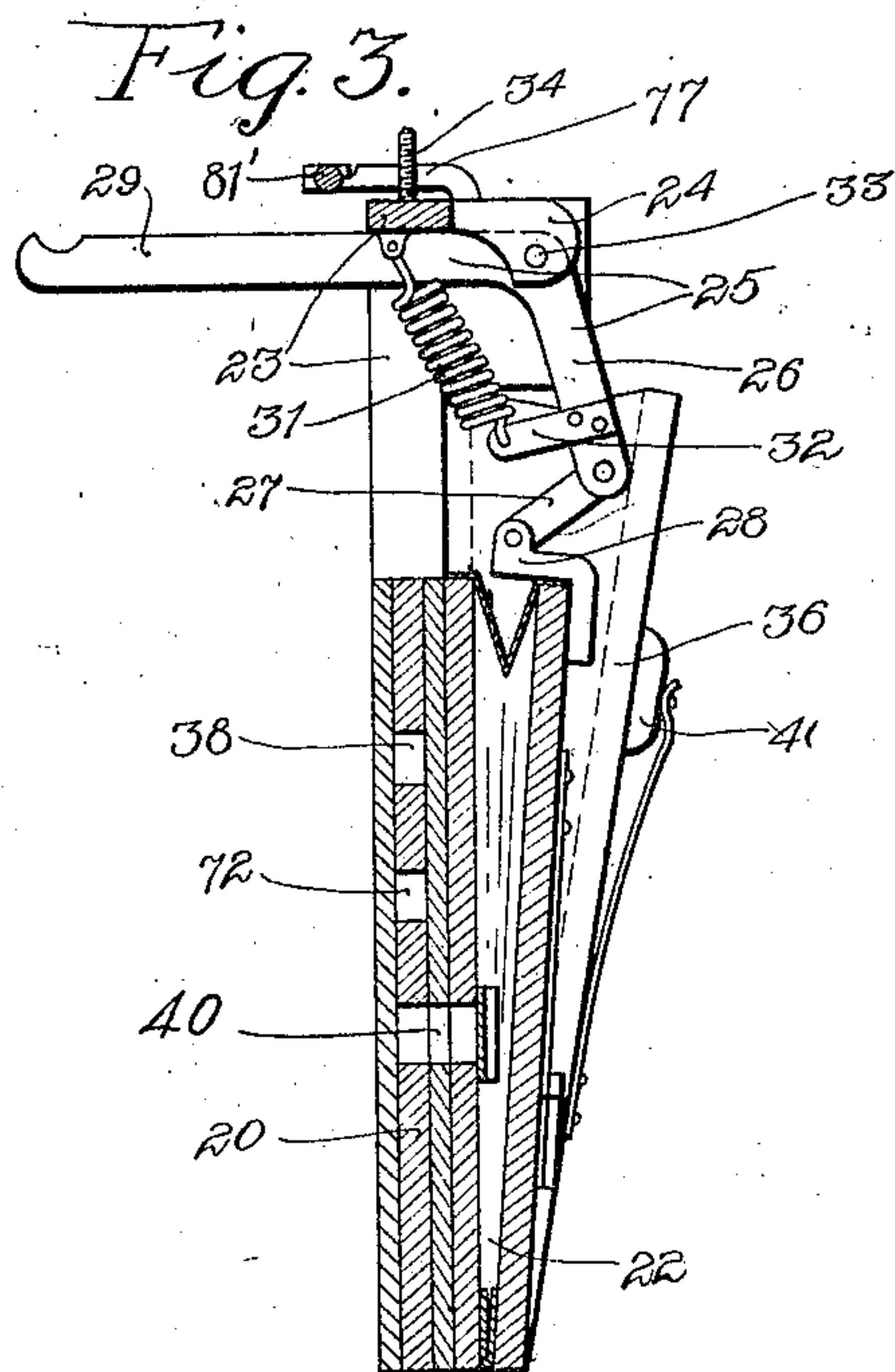
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 4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4

Fig. 8.

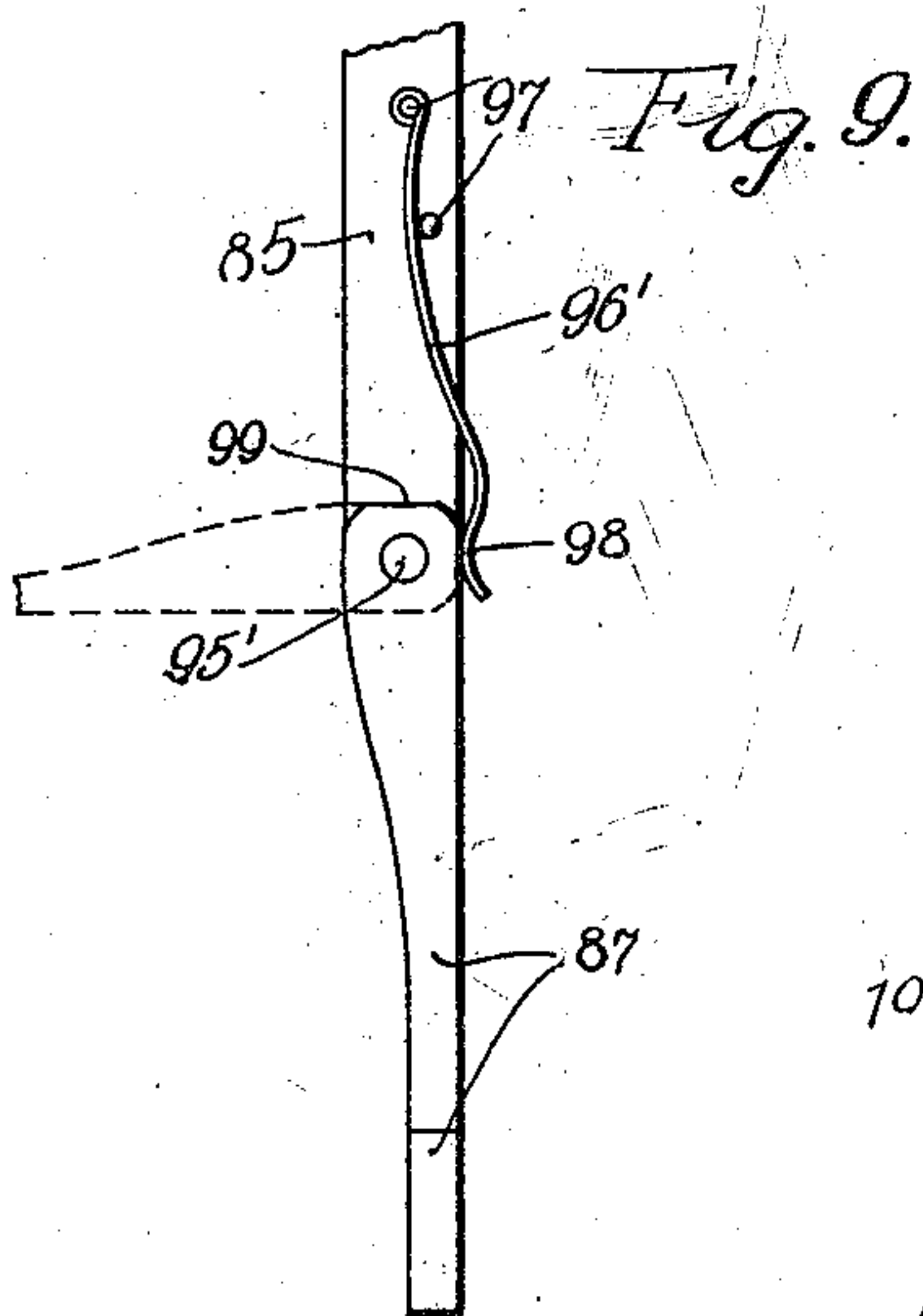
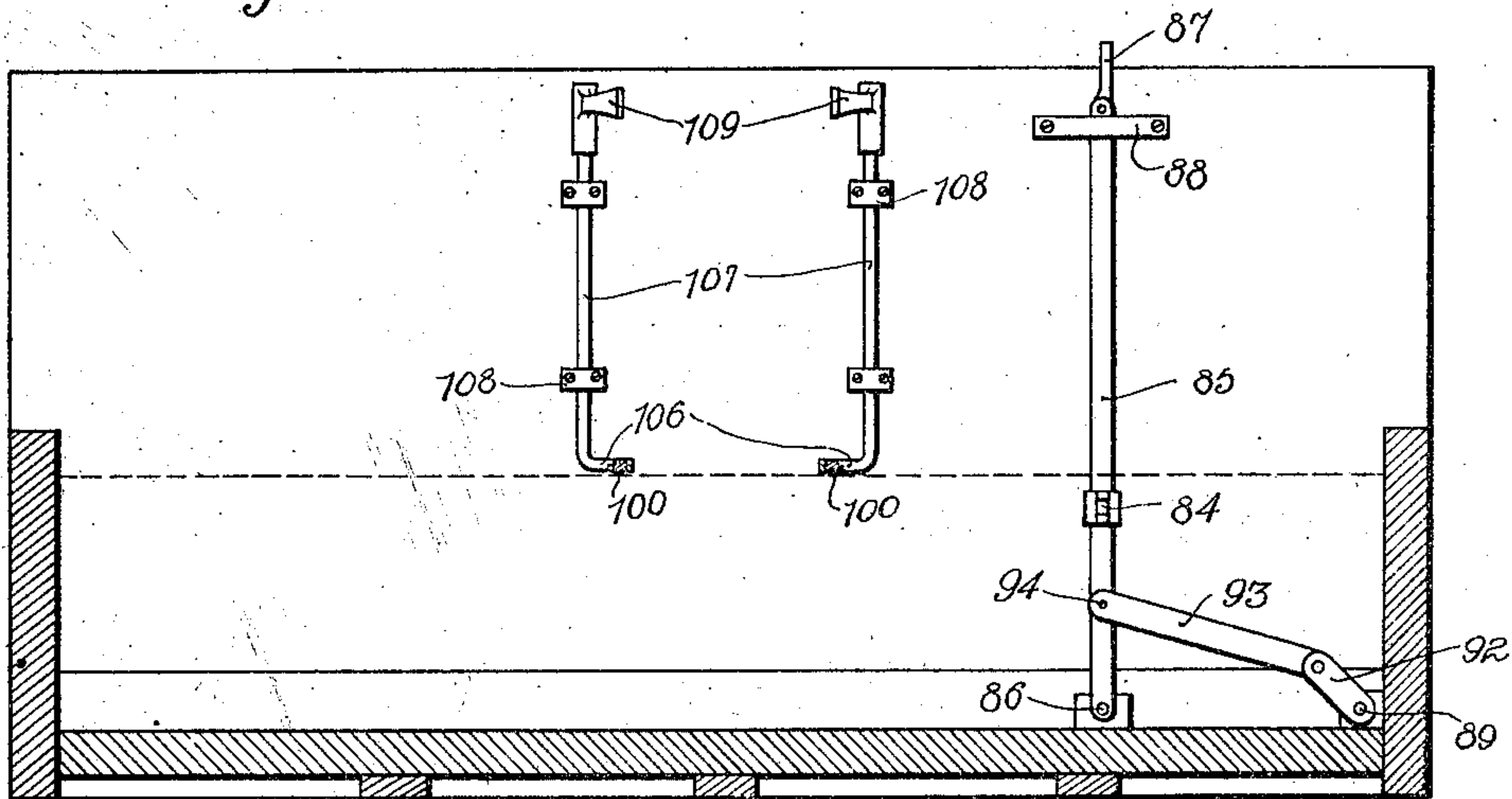
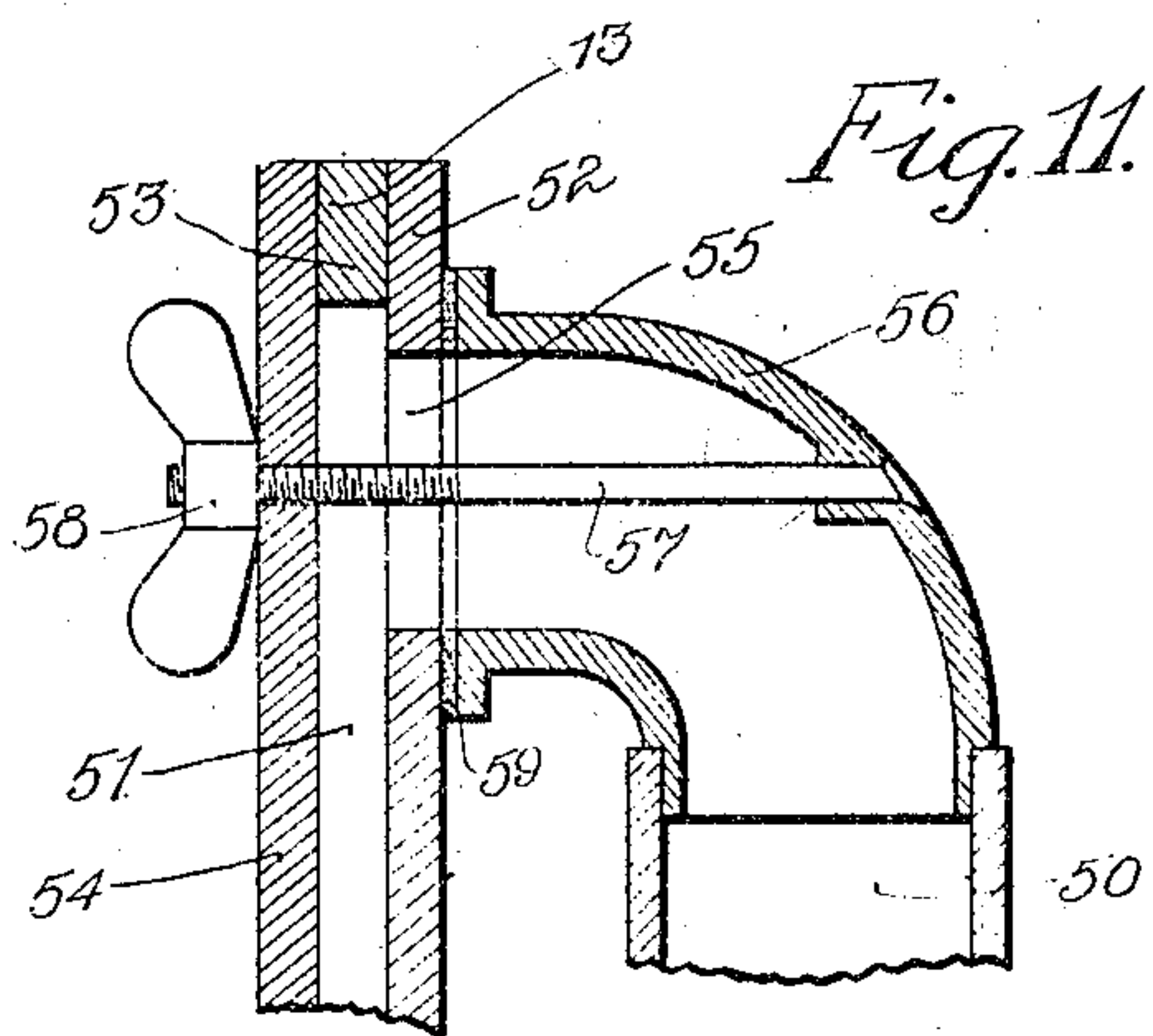
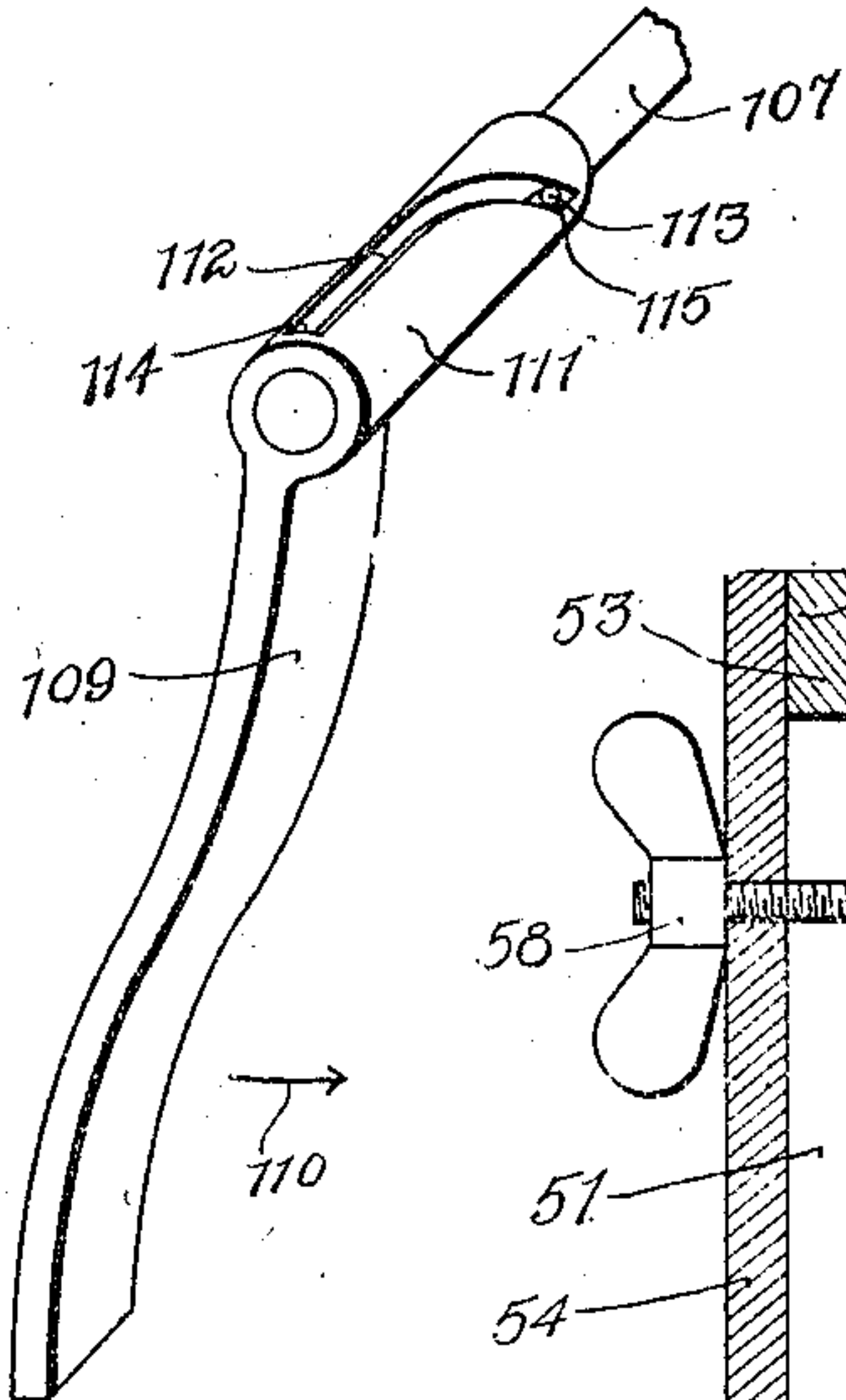


Fig. 10.



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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC PLAYING-PIANO.

No. 913,378.

Specification of Letters Patent.

Patented Feb. 23, 1909.

Application filed December 11, 1906. Serial No. 347,307.

*To all whom it may concern:*

Be it known that I, AXEL G. GULBRANSEN, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Automatic Playing-Pianos, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to automatic playing pianos, more particularly to improved means for regulating and operating the same, and its object is to provide reliable and efficient apparatuses to perform their respective functions which are of simple construction and of such relative disposition that they may be easily assembled and reached in case of necessity of adjustment or repair.

It is one of the primary objects of my invention to provide such apparatus as may be conveniently located within the case of an ordinary size piano without requiring rearrangement or reconstruction of any of the parts of the piano itself. Furthermore, I provide a construction in which by a simple valve and bellows arrangement I so regulate the flow of air from the motor and from the pneumatic action that while a piece of music is being played the motor will operate at a moderate speed, and that when it is desired to rewind the note sheet which is passed over the tracker-board the valves may be so actuated as to close communication between the air exhaust devices and the pneumatic action and to materially increase the amount of air exhausted from the motive device so as to correspondingly increase its speed. I am aware that this feature of increasing the speed of the air motive device when the note sheet is being rewound is known in the art, but the construction of my invention herein described is such that the exhaust of air through the motive device is controlled in an entirely new and novel manner. Broadly this arrangement of my invention consists of a pair of feeder bellows which are each connected to two reservoirs, one of said reservoirs being connected with the pneumatic action, while the other is connected with the motive device, these connections, however, being controlled by valves and controlling mechanism, as will be hereinafter described. While a note sheet is being drawn over the tracker-board in its forward

direction, that is, while the piece of music is being played, one of said reservoirs is effectively connected with the pneumatic action, while the other of said reservoirs is connected with the air motive device through a controlling means, this controlling means being for the purpose of maintaining a constant speed of the motor. When, however, the note sheet is rewound valve mechanism is operated to cut off connection between the pneumatic action and its associated reservoir and at the same time other valve mechanism is actuated whereby both of said reservoirs are connected with the motive device. This, of course, greatly increases the amount of air exhausted through the motive device and its speed is therefore greatly increased. It will appear hereinafter that this valve and controlling mechanism is very simple and efficient and reliable in operation and does not easily become disarranged or disordered. These valves are so disposed that they may be easily reached and adjusted when necessary.

I provide, furthermore, improved means whereby the valves may be actuated by the operator at the front of the piano, this means being of such construction that it will be hidden from view when the automatic playing mechanism is not in use and may quickly and readily be brought into position for actuation when the automatic playing mechanism is employed.

It is one of the important features of this invention that with the construction above described, that is, the feature of having each of the feeder bellows connected with both reservoirs, the tendency for reservoirs to act in a jerky and unreliable manner is entirely eliminated, there being, as will be hereinafter described, a practically steady exhaust therefrom, there being at no time a complete cessation of the exhaust.

Improved means is also hereinafter disclosed for actuating the piano pedal mechanism, which, as is well known, are for the purpose of securing a loud or soft tone. This improved means is such that it may be actuated by the knee of the operator when in position for operating the pedals connected with the feeder bellows.

The other improved arrangements will be hereinafter pointed out, these various constructions being clearly illustrated in the accompanying drawings in which—



Figure 1 is a front view of a piano employing my improved playing mechanism, the front panels being removed; Fig. 2 is a rear view of the bellows board; Fig. 3 is a sectional view on line 3--3 of Fig. 2; Fig. 4 is a sectional view on line 4--4 of Fig. 2; Fig. 5 is a sectional view on line 5--5 of Fig. 2; Fig. 6 is a plan view of the valve and controlling mechanism for regulating the exhaust of air from the motor, parts being removed to more clearly illustrate the construction; Fig. 7 is a top view of the valve mechanism controlling the connection between the pneumatic action and the associated reservoir, parts being removed to disclose the construction; Fig. 8 is a view of the under side of the piano bed illustrating the means whereby the valve mechanism may be controlled from the front of the piano and also the mechanism for actuating the loud and soft pedals; Fig. 9 is a view illustrating the arrangement employed so that the regulating lever for the valve mechanism may be out of view when not in use; Fig. 10 is a detail view of part of the loud and soft pedal controlling mechanism; and Fig. 11 is a detail view illustrating the mode of connecting the air conductor to the pneumatic action chamber.

Like reference characters are applied to like parts throughout the various figures.

The instrument case 12 shown at 12 and the pneumatic action supporting frame indicated at 13 is securely mounted therein the pneumatic action being associated with the abstract rods of the piano action. The pneumatic action does not constitute a part of this invention and may be of any desired construction, for instance like that disclosed in either of my co-pending applications, Serial No. 301,964, filed February 19, 1906, Serial No. 331,230, filed August 20, 1906, or Serial No. 334,241, filed September 12, 1906. A roller box is indicated at 14 and a tracker-board 15 mounted therein is connected with the pneumatic action by means of the air conductors 16, 16. The rollers 16' and 17 are suitably connected with the motive device 18 in any desired manner, this motive device being connected by means of the air conductor 19 with the exhaust device, as will be hereinafter described. The bellows board upon which the various exhaust devices may be mounted and in which connecting channels may conveniently be formed, is shown at 20 and may be rigidly held in the instrument case in any suitable manner. Mounted upon the back of the bellows board are the feeder bellows 21 and 22 which are mechanically connected with the treadles by means of bell crank lever mechanism, as clearly shown in Figs. 2 and 3. The bell crank lever frame is indicated at 23 and may be secured in any desirable manner to the bellows board. Pivoted in the extensions 24, 24' from the frame

23 are the bell crank levers 25, 25. The arm 26 of each bell crank lever is connected by means of a link 27 with a pivot piece 28 rigidly secured to the movable member of the associated feeder bellows. The other arm 29 of the bell crank lever is adapted to be connected with the associated treadle 28' by means of a flexible connecting member 30. The feeder bellows 22 is normally held in a collapsed position by means of a helical spring 31 which is connected between the frame 23 and the extension 32 on the arm 26. This helical spring is so connected relative to the pivot 33 of the bell crank lever that there is very little increase of tension when the treadles are actuated to distend the bellows. I find that a convenient way in which to secure the bellows board in the instrument case is to employ thumb screws 34, 34 which have threaded engagement with the frame 23 and which may be adjusted so as to rigidly engage the under side of the piano bed, thereby holding the bellows board rigidly in position when the bottom of the bellows board is mounted upon blocks in the base of the piano or in any other suitable manner. Associated with the feeder bellows are the reservoirs 35 and 36, each feeder bellows being connected with both of said reservoirs. Thus the feeder bellows 21 is connected with the reservoir 35 by means of a channel 37 and with the reservoir 36 by means of a channel 38. Similarly the feeder bellows 22 is connected with the reservoir 35 by means of a channel 39 and with the reservoir 36 by means of a channel 40. These channels, however, are controlled by means of the flap valves 41 and 42 within the bellows 21 and 22 respectively. The movable members of the feeder bellows are provided with the openings 43, 43 which are governed by a flap valve 44. Thus while the treadles are being actuated both feeder bellows are exhausting air from both of the reservoirs, tending to collapse them. Each of the reservoirs, however, is provided with a flat spring 45 which tends to hold the bellows in a distended position and thus a constant and steady exhaust of air is made from the pneumatic devices connected therewith.

The feature of having each of the feeder bellows connected with both reservoirs is an important one and secures a very efficient and reliable operation of the exhaust devices. In such devices of the prior art it was difficult to secure a steady and constant exhaust from the pneumatic devices connected with the reservoirs on account of the fact that at one moment air was being withdrawn from one of the reservoirs, tending to collapse it, while at the next moment this exhaust ceased and the bellows distended itself. This undesirable feature is entirely eliminated, since as before stated each of the feeder bellows is connected with both reservoirs. It is, of course, the usual practice to



operate the treadles alternately and the feeder bellows are then consequently operated in a similar manner. Thus when one feeder bellows has ceased exhausting air from both reservoirs, the other feeder bellows immediately commences to exhaust air therefrom. There is therefore a constant exhaust from both the reservoirs which in turn overcomes any tendency for the exhaust from the pneumatic devices connected therewith to be other than constant and steady and of proper speed.

The reservoirs are each provided with a safety valve 46 the purpose of which is evident. Mounted upon the bellows board conveniently near the reservoir, which is adapted to be connected with the pneumatic action, is the valve box 47 into which a channel 48 in the bellows board leads from the reservoir 36. The channel 48 is controlled by a valve 49 disposed within the valve box 47, this valve, as will be hereinafter described, being adapted to be actuated by the proper manipulation of mechanism provided at the front of the piano. The valve box 47 is connected with the pneumatic action by means of an air conductor 50, this conductor being secured to the exhaust chamber board of the pneumatic action in the manner shown in Fig. 11. The exhaust chamber is indicated at 51 and is formed by means of the boards 52, 53 and 54. The board 52 is provided with an opening 55 proximate to which is disposed an outlet piece 56 in the form of an elbow. A tie rod 57 is rigidly secured to the outlet piece 56 and is screw-threaded at its outer end where it passes through the board 54 and is engaged by the winged nut 58. A washer 59 of leather or similar material may be provided and when the winged nut 58 is tightened to draw the tie rod an efficient air-tight connection is secured. The various primary pneumatics are connected, in the manner described in the various copending applications herein referred to, to the exhaust chamber 51 and need not be shown specifically here. It is, however, desirable to gain access to the chamber 51 without interfering with the other parts of the apparatus and I therefore split the front board 54 at 60, as indicated in Fig. 1, so that all the front board except that portion to which the outlet piece is secured may be readily removed. A bridge 61, as indicated in dotted lines in Fig. 1, may be provided so that an air-tight connection may be insured.

Leading from the channel 37 is a channel 62 which connects with the regulating bellows 63 conveniently disposed as shown upon the bellows board. The regulating bellows 63 is for the purpose of maintaining a constant speed of the air motive device with which it is connected. An opening 64 in an extension 65 from the bellows board directly

connects the regulating bellows 63 with the valve box 66, this valve box being connected by means of the air conductor 19 with the air motive device. The channel 62 leading into the regulating bellows is controlled as follows: A block 67 is secured to the movable member of the regulating bellows and is so disposed that when the bellows is collapsed it will cover the opening where the channel 62 leads into the bellows. An annular washer 68 is disposed about this opening, this washer being of leather or similar material. Thus when air is exhausted from the motive device therethrough by reason of the action of the reservoir 35, the block 67 will tend to engage the washer 68 so as to close the entrance of the channel 62. Air, however, is permitted to pass because the suction is not enough to entirely close the opening, but it is evident that this opening will be more or less closed according to the strength of the exhaust therethrough. Thus, the stronger the exhaust the closer will the block 67 be drawn against the washer 68 and the smaller the opening through which air may pass. When the strength of the exhaust is decreased the block 67 will drop back correspondingly and will allow a greater volume of air to pass. The size of the opening and the strength of the exhaust, therefore, being inversely proportional, will tend to keep constant the amount of air exhausted through the motive device and the speed of the motor, therefore, will remain constant. In order that the minimum passageway for the exhaust through the regulating bellows may be adjusted, a screw 69 is provided and passes through the board 65 and into the regulating bellows where it is provided with a contact block 70. This contact block is adapted to engage the movable member of the regulating bellows when the bellows is in a collapsed condition and is adapted to be so adjusted that the proper amount of air may pass through the bellows at this time. A spring 71 is provided to keep the regulating bellows normally distended.

It is desirable, as hereinbefore mentioned, to materially increase the speed of the motive device when the note sheet is being rewound. To this end I provide means whereby upon the actuation of a lever terminating at the front of the piano the amount of air exhausted through the air motor will be greatly increased. The reservoir 36 is connected with the valve box 66 by way of the channel 72, this channel, however, being controlled by a valve 73 disposed within the valve box 66. While the piece of music is being played the valve 73 is closed so as to shut off communication between the reservoir 36 and the air motive device, this reservoir, however, being connected with the pneumatic action. An auxiliary channel 74



directly connects the reservoir 35 with the valve box 66, this channel being also under the control of the valve 73. Thus, when the valve 73 is open the reservoir 35 is connected  
 5 directly with the valve box 66 instead of through the regulating bellows 63. A very much greater amount of air is thereby drawn through the motor. As will be hereinafter described means are provided for simultane-  
 10 ously closing the valve 73 and opening the valve 49. When the piece of music is being played the valve 73 is closed and the valve 49 is open. The reservoir 35 is then connected with the air motive device through  
 15 the regulating bellows 63, while the reservoir 36 is connected to the pneumatic action, thus actuating the playing mechanism and operating the motive device at a constant speed. When it is desired to rewind the  
 20 note sheet a lever, hereinafter described, is actuated by the operator of the instrument to reverse the valves, that is, to open the valve 73 and to close the valve 49. When the valves are in this position, as hereinbe-  
 25 fore stated, the reservoir 35 is connected directly to the valve box 66, the reservoir 36 being also connected thereto and disconnected from the pneumatic action. Both of the reservoirs being then directly connected  
 30 with the air motive device, the amount of air drawn therethrough will be considerably greater than that drawn therethrough when the valves were in their reverse positions and the speed of the motor is correspondingly  
 35 increased.

In order that the valves 73 and 49 may be properly controlled by the operator so as to secure the desirable results hereinbefore de-  
 40 scribed, means are provided whereby these valves are so mechanically connected together that upon the opening of one of the valves the other will simultaneously be closed. Associated with the valve 49 is the  
 45 crank rod 75 which has the crank arms 76 and 77. The crank 76 engages in the bifurcated end of an extension 77' on the valve 49. Similarly, the valve 73 has associated with it a crank rod 78 which has the crank arms  
 79 and 80, the crank arm 79 being in engage-  
 50 ment with the bifurcated end of an extension 81 on the valve 73. The crank arms 77 and 80 of the respective crank rods have their ends connected together by means of  
 55 an actuating rod 81' and the various mechanically associated cranks are by this means so connected that when the actuating rod 81' is shifted in one direction the valve 73 will open and the valve 49 will close, and  
 60 when shifted in the reverse direction the valve 49 will open and valve 73 will close. The actuating rod 81' is provided with the adjustable collars 82 and 83 between which a fork 84, which extends downwardly from an actuating lever 85, is adapted to engage.  
 65 The actuating lever, as clearly shown in Fig.

8, is pivoted at 86 and is provided at its forward end with the handle 87 which, as will be described, is collapsible or folding so that it may be hidden from view when the auto-  
 70 matic playing mechanism is not in use and may be placed in position where it can be actuated when the playing mechanism is employed. The lever 85 rests in the guide 88 secured to the under side of the piano bed. A suitably pivoted rod 89, the upper end of  
 75 which is connected by crank and link mechanism 90 with the tempo valve 91, is provided at its lower end with the crank 92 which is connected by means of the link 93 to the pivot pin 94 on the actuating lever 85.  
 80 Thus the movement of the actuating lever controls the motor valve 91 and further connecting means 95 may be employed for actuating indicating mechanism 96 in the roller box 14 whereby the speed of the motor and  
 85 the direction of its rotation may be clearly indicated.

While a piece of music is being played the lever handle 87 may be in one of its extreme  
 90 positions, for instance the left-hand position, as indicated in the drawings. The various levers and cranks which it controls are then in position to cause the proper direction of rotation of the motive device and to have the valve 91 in position to allow the  
 95 minimum flow of air, and its connection with the actuating rod 81' by way of the fork 84 and the collars 82 and 83 is such that the valve 73 is then closed while the valve 49 is opened. As before described, these valves  
 100 are then in position to allow the operation of the pneumatic playing mechanism and the operation of the motive device maintains the motor at a constant speed. As is well known in the art, however, it is desirable  
 105 to regulate the motor valve 91 while the piece of music is being played so as to secure the proper and most effective speed. This adjustment of the motor valve must, it is evident, be accomplished without changing  
 110 the positions of the valves 49 and 73, and in order to secure this desirable result the collars 82 and 83 are spaced so as to permit the movement of the lever 85 to actuate the  
 115 valve 91 from its minimum to its maximum position without the engagement of the fork 84 with either collar.

When it is desirable to rewind the note sheet the lever 85 is thrown over to its extreme opposite position from that just de-  
 120 scribed, the latter part of this movement causing, as will be pointed out, the reversal of the direction of the motive device and the reversal of the position of the valves 49 and 73. When the lever is shifted to the right  
 125 (Fig. 1) the latter part of the motion causes, by reason of the proper adjustment of the collars 82 and 83 with reference to the fork 84, a sufficient movement for the opening of the valve 73 and the closing of the valve 49,  
 130



this latter movement causing also the reversal of the gearing at the motive device to reverse its direction. Thus, simultaneously the direction of the motor is changed and its speed is greatly increased, connection between the reservoir 36 and the pneumatic playing mechanism being also cut off. The note sheet may, therefore, be rewound very rapidly, the pneumatic action then remaining at rest. When it is desired to again start the instrument to playing another piece of music the lever 85 is again thrown over to its extreme left-hand position, the latter part of this movement causing the movement of the actuating rod 81' by reason of the engagement with the collar 83 by the fork 84, thus closing the valve 73 and opening the valve 49. Considering again the effect of the lever 85 upon the actuating rod 81', it should be noted that when the rod is in either position the movement of the lever 85 in the direction tending to bring the rod 81' into the opposite position, does not affect the rod 81' until near the end of the movement, the remaining motion, however, being sufficient to secure the proper operation of the valves 49 and 73. The motion of the lever 85, which is lost to the actuating rod 81', secures the manipulation of the motor valve 91 whereby its speed may be properly regulated.

The construction of a collapsible handle is shown in Fig. 9, the various parts being lettered according to the letters applied to similar parts in the other figures. The handle 87 is pivoted at 95' to the lever 85 and a spring 96' is secured to and held in position upon the lever 85 by means of the studs 97. The handle 87 has the flat surfaces 98 and 99, and the spring 96' is adapted to bear upon either one of these surfaces so as to securely hold the handle 87 in either of two positions. Thus, when the handle 87 is adapted to be actuated, that is, while the playing mechanism is in use, it extends forwardly so that it may be reached by the operator and is held in such position by the spring 96' bearing upon the surface 98. When it is desired to hide the handle 87 from view it is turned about the pivot 95' against the drag of the spring 96' until it reaches the position where the spring 96' will bear upon the surface 99, this position being indicated in dotted lines in this figure. The handle 87 is thus held in this position precisely as it was held in its other position, as has been described.

In order that the operator may properly operate the loud and soft pedals of the piano while he is actuating the treadle mechanism, auxiliary means, as shown in Figs. 1, 8 and 10, is provided. Each of the pedals has associated with it a reciprocating rod 100 which is connected therewith by means of a pivoted lever 101. This lever is pivoted at 102 to the instrument frame in any suitable man-

ner and is pivotally connected with the rod 100 at 103. The other end of the lever rests upon the inwardly extending portion 104 of the pedal. The other end of the reciprocating rod 100 is pivoted at 105 to a crank arm 106 of the pivoted rod 107, this rod being mounted in blocks 108, 108 secured to the under side of the piano bed. The forward end of the pivoted rod 107 is provided with the crank member 109, this member being so disposed that it may be actuated by the knee of the operator while the treadle mechanism is in use. It is evident from the various figures that when the crank member 109 is thrown over in the direction of the arrow 110 the reciprocating rod 100 will be lifted to cause corresponding movement of the lever 101, thereby depressing the pedal piece 104 in precisely the same manner as is usual in the operation of ordinary pianos.

In order that the crank member 109 may be out of view when the playing mechanism is in use the means particularly shown in Fig. 10 is provided. The hub portion 111 from which the member 109 extends is rotatably mounted upon the pivoted rod 107. The hub 111 is provided with a slot 112 into which a stud or pin 113, extending from the rod 107, projects. This slot 112 is so formed and disposed that when it is desired to remove the members 109 from view they may be lifted and moved rearwardly, being thus held in position by reason of the engagement of the pin 113 with the end 114 of the slot 112. The member 109 may be thus hidden beneath the piano bed. When it is desired to bring this mechanism into use the member 109 may be thrown outwardly and will drop downwardly, as shown in the figures, by reason of the characteristics of the slot 112, the pin 113 being then adapted to engage the other end 115 of the slot. On account of this engagement the lever may be moved about in the direction of the arrow 110 to secure the desired operation of the pedal mechanism.

I thus provide efficient means whereby the speed and tone of the music may be regulated while the pedal mechanism is being actuated.

The exhausting devices herein disclosed are such as to secure efficient and reliable operation of the various parts and the controlling mechanism described is so constructed and so associated therewith that the various desirable features hereinbefore pointed out are easily and readily obtained.

While I have herein shown and described but one embodiment of my invention, it is evident that changes and modifications could be made by those skilled in the art without departing from the spirit or scope thereof. I do not wish, therefore, to be limited to the precise construction herein set forth.



I claim as new and desire to secure by Letters Patent:

1. In an automatic playing instrument, the combination of a motor, a reservoir for connection with the motor, pneumatic mechanism, a second reservoir for connection with the pneumatic mechanism, a valve controlling the connection of said second reservoir with the pneumatic mechanism, a connection between the second reservoir and the motor, a second valve controlling said connection to the motor, a tempo valve at the motor for directly controlling the exhaust from the motor, and common lever mechanism connected with all three valves for controlling the operation thereof.

2. In an automatic playing instrument, the combination of a motor, a reservoir for connection with the motor, pneumatic mechanism, a second reservoir for connection with the pneumatic mechanism, a valve controlling the connection of said second reservoir with the pneumatic mechanism, a connection between the second reservoir and the motor, a second valve controlling said connection to the motor, a tempo valve at the motor for directly controlling the exhaust from the motor, common actuating mechanism connected with all three valves for controlling the operation thereof, and means whereby the tempo valve may be adjusted

by the common actuating mechanism independently of the other valves.

3. In an automatic playing instrument, the combination of a motor, pneumatic playing mechanism, a reservoir, a valve controlling the connection of said reservoir with the motor, a second reservoir, a second valve controlling the connection of said second reservoir with the pneumatic mechanism, a tempo valve at the motor, and common lever mechanism connected with all three valves for controlling the operation thereof.

4. In an automatic playing instrument, the combination of a motor, pneumatic playing mechanism, a reservoir, a valve controlling the connection of said reservoir with the motor, a second reservoir, a second valve controlling the connection of said second reservoir with the pneumatic mechanism, a tempo valve at the motor, a common actuating member for said valves and means whereby the tempo valve may be adjusted by said actuating member independently of the first and second valves.

In witness whereof, I hereunto subscribe my name this 5th day of December A. D., 1906.

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Witnesses:

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ARTHUR H. BOETTCHER.