

No. 640,922.

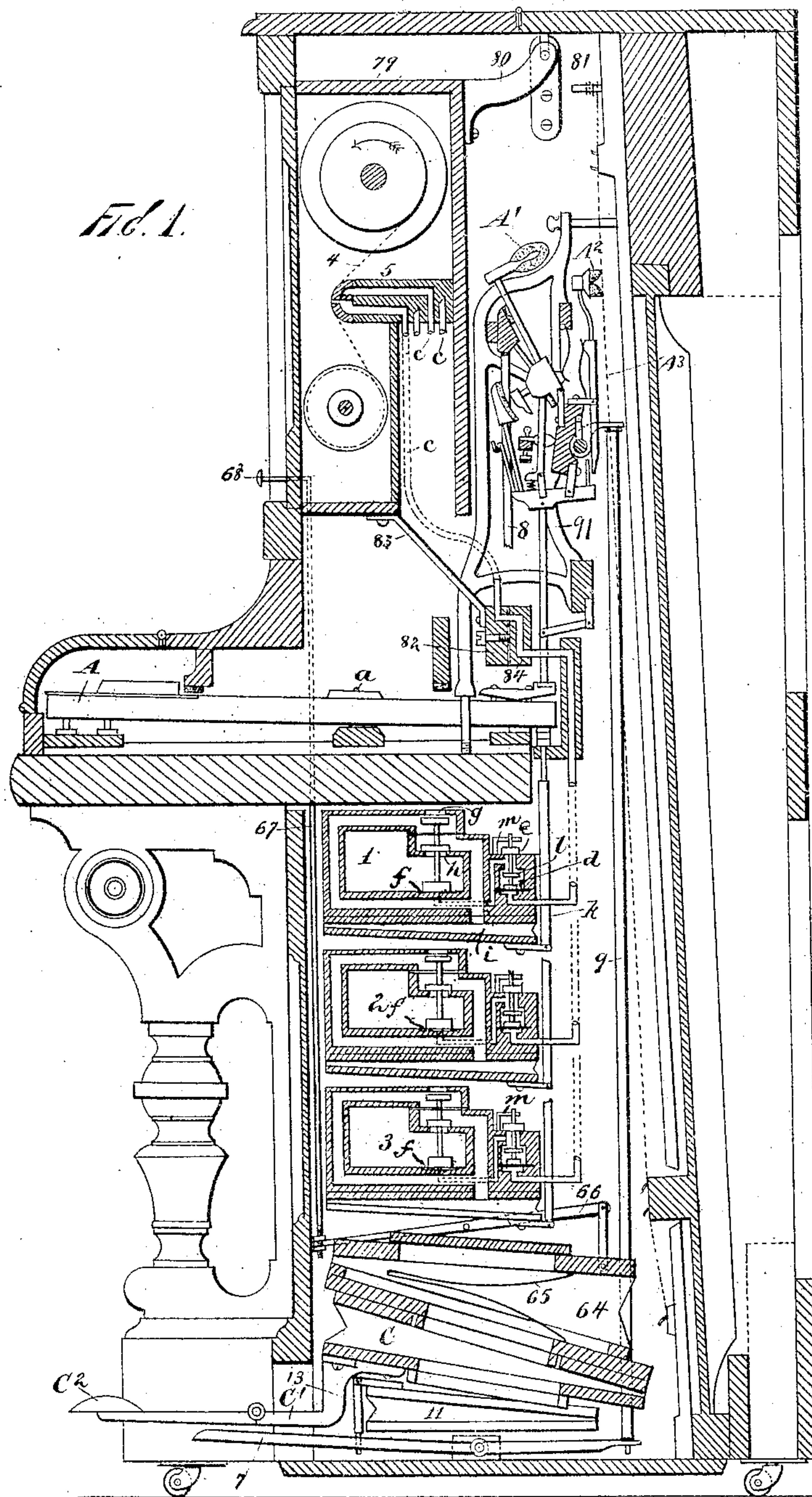
Patented Jan. 9, 1900.

C. A. KUSTER.
MECHANICAL MUSICAL INSTRUMENT.

(Application filed Nov. 11, 1895.)

(No Model.)

7 Sheets—Sheet 1.



Witnesses:
John Buckler,
L. H. Osgood

Inventor:
Chas. A. Kuster,
Wm. Osgood,
Attorney

No. 640,922.

Patented Jan. 9, 1900.

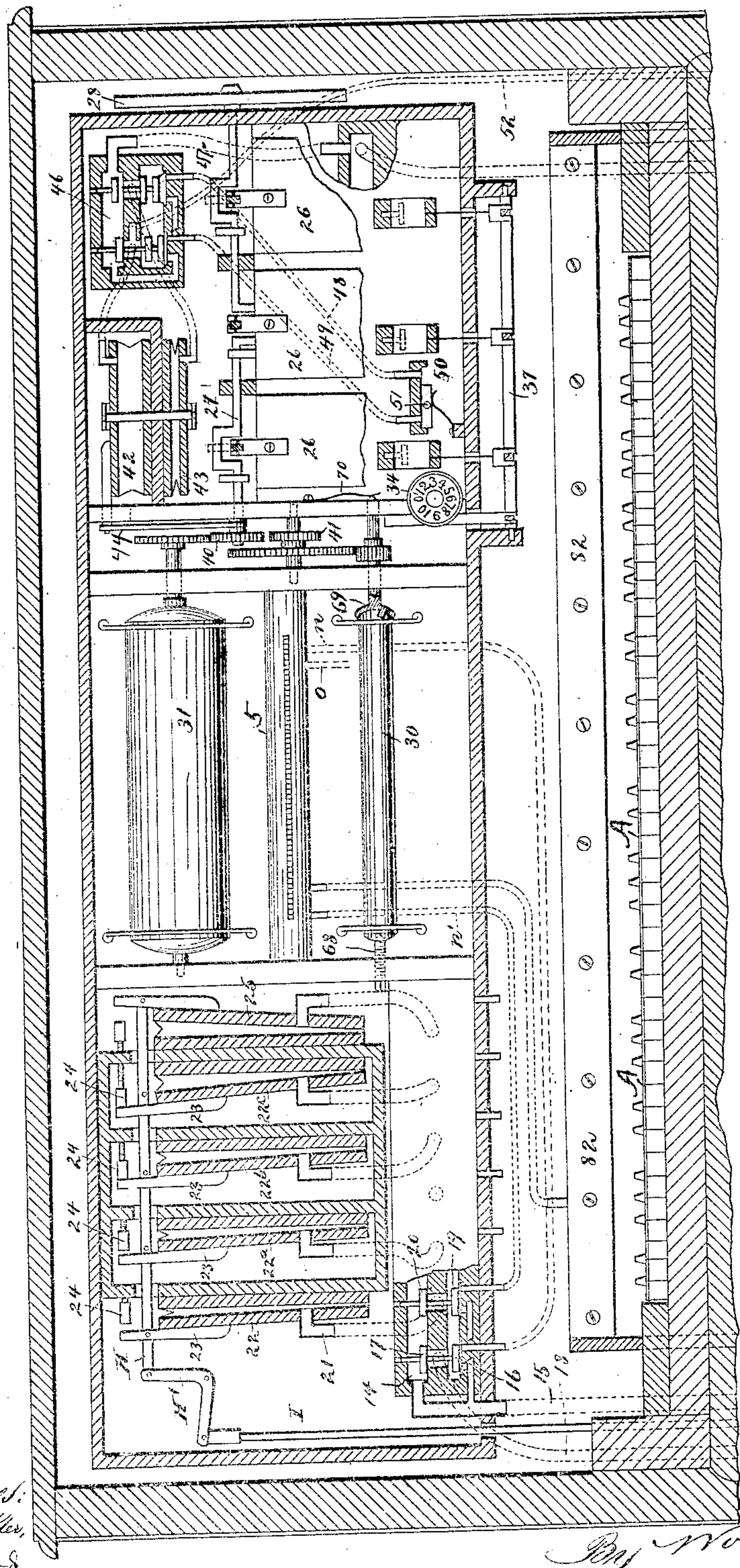
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(No Model.)

7 Sheets—Sheet 2.

Fig. 2.



Witnesses:
Chas. Kuster,
L. H. Orgood.

Inventor:
Chas. A. Kuster
By *Wm. North* Attorney.

No. 640,922.

Patented Jan. 9, 1900.

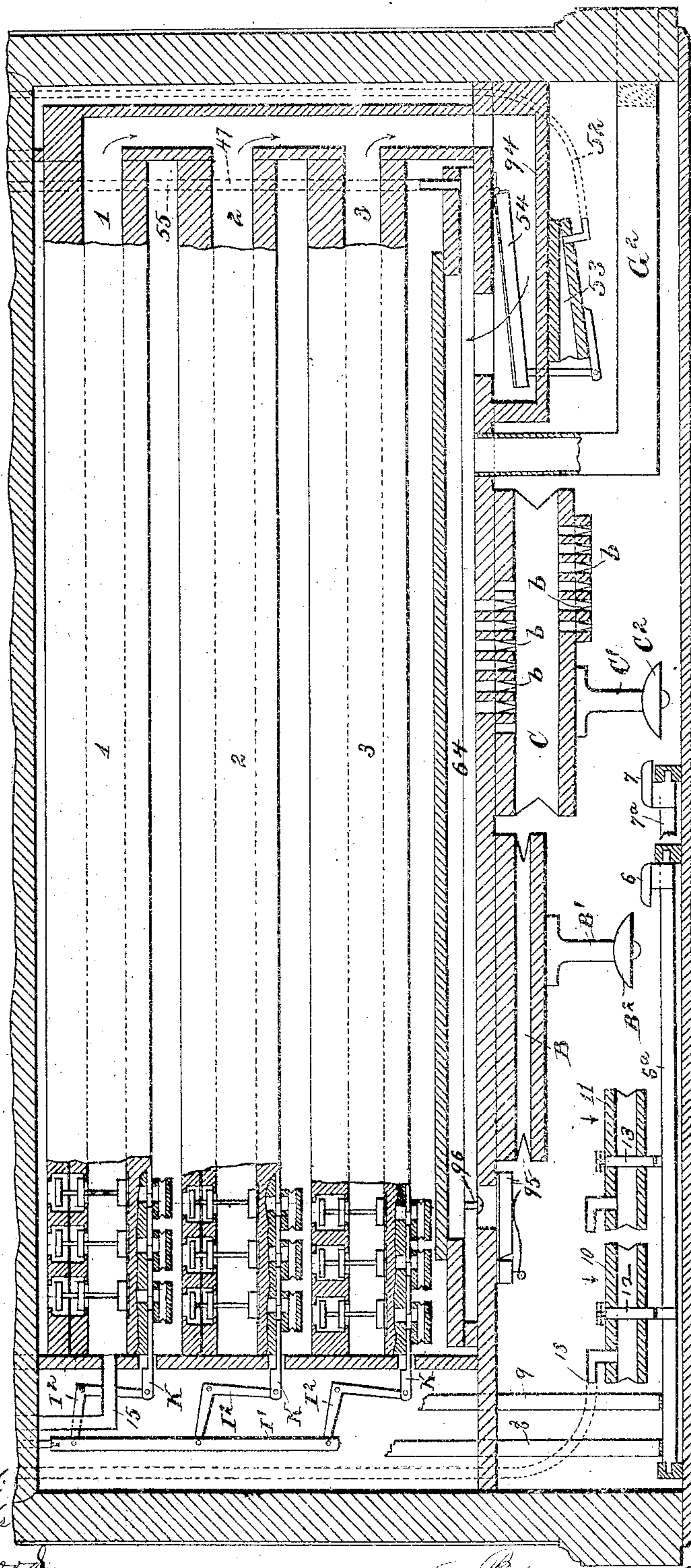
C. A. KUSTER.

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(Application filed Nov. 11, 1895.)

(No Model.)

7 Sheets—Sheet 3.



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Witnesses:
 Alvin Buckler
 L. H. Osgood,

Inventor,
Chas. A. Kuster,
at Grand
Rapids.

No. 640,922.

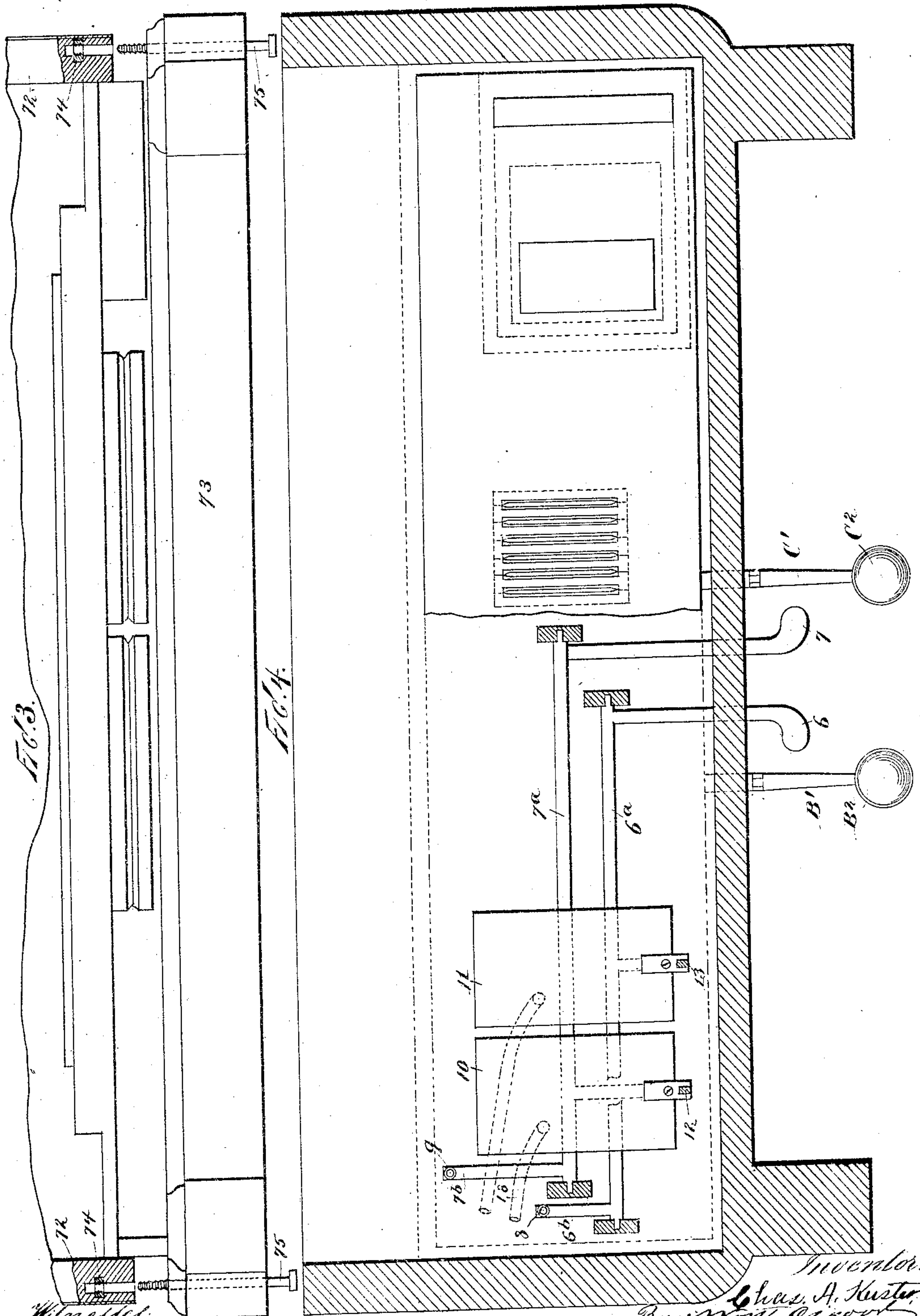
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MECHANICAL MUSICAL INSTRUMENT.

(Application filed Nov. 11, 1895.)

7 Sheets—Sheet 4.

(No Model.)



Witnessed:
John Buckley
L. H. Cargill

Inventor:
Chas. A. Kuster
By *Wm. C. Cargill*
Attorney

No. 640,922.

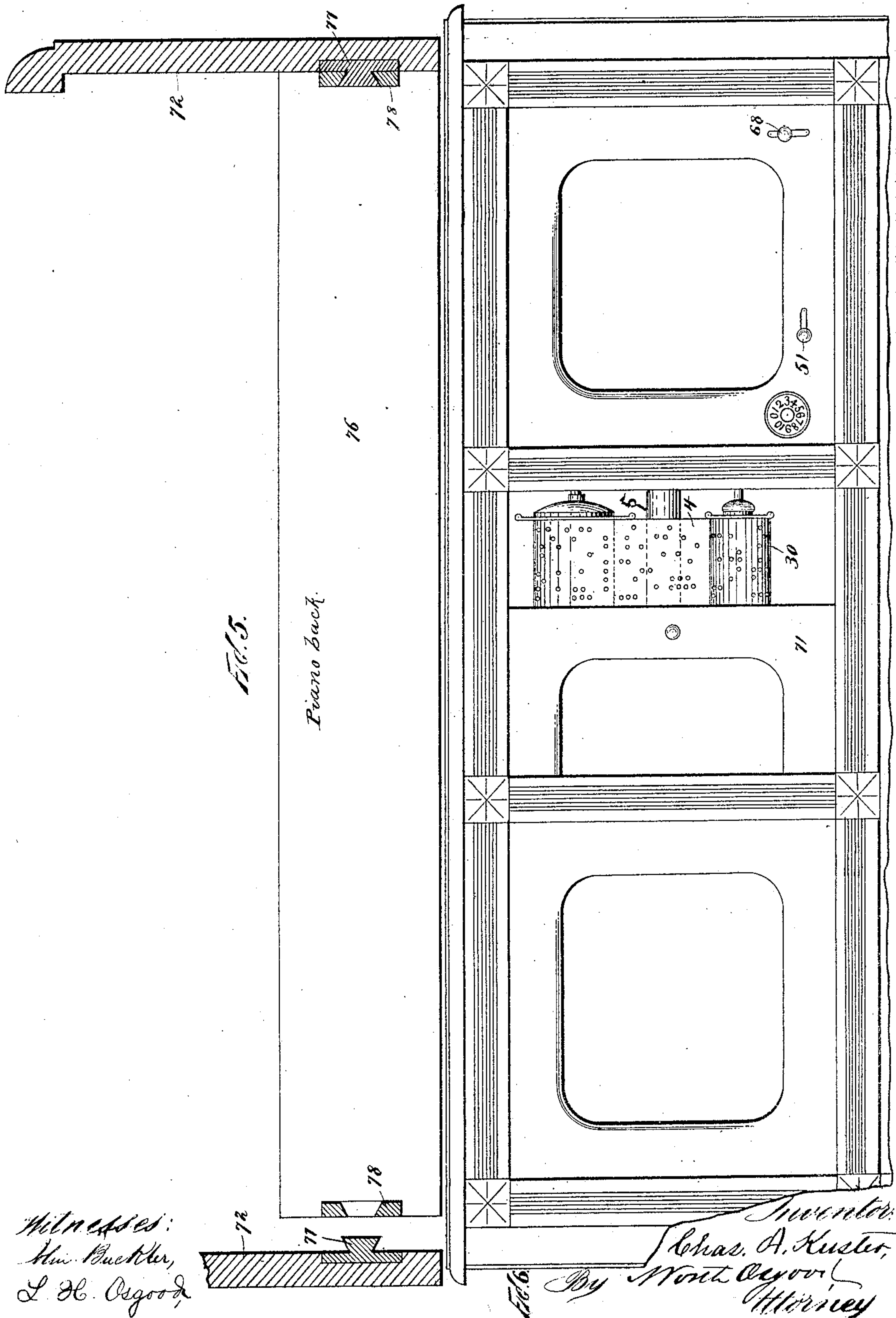
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(Application filed Nov. 11, 1895.)

(No Model.)

7 Sheets—Sheet 5.



No. 640,922.

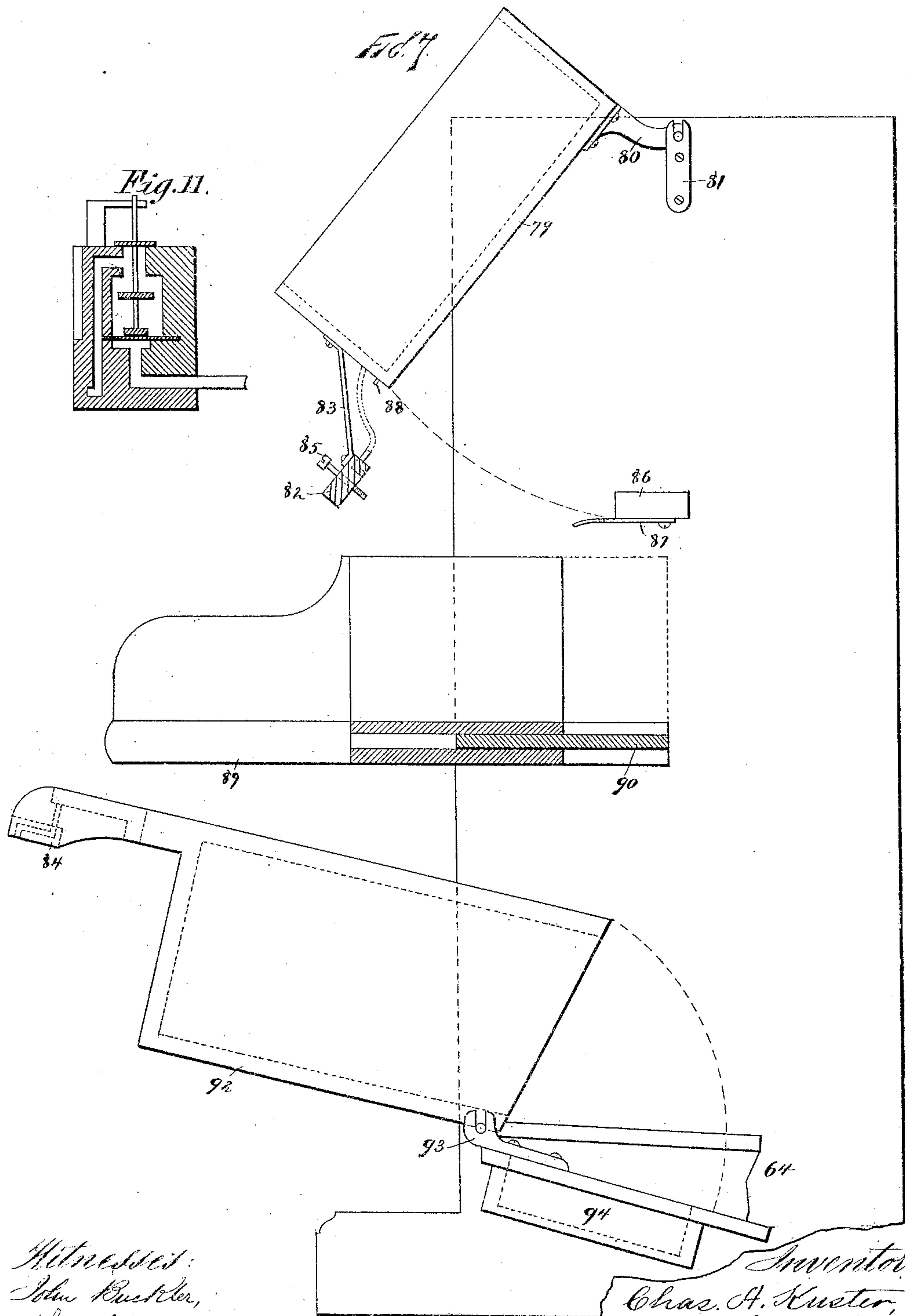
Patented Jan. 9, 1900.

C. A. KUSTER.
MECHANICAL MUSICAL INSTRUMENT.

(Application filed Nov. 11, 1895.)

(No Model.)

7 Sheets—Sheet 6.



Witnesses:
John Kusler,
L. H. Osgood

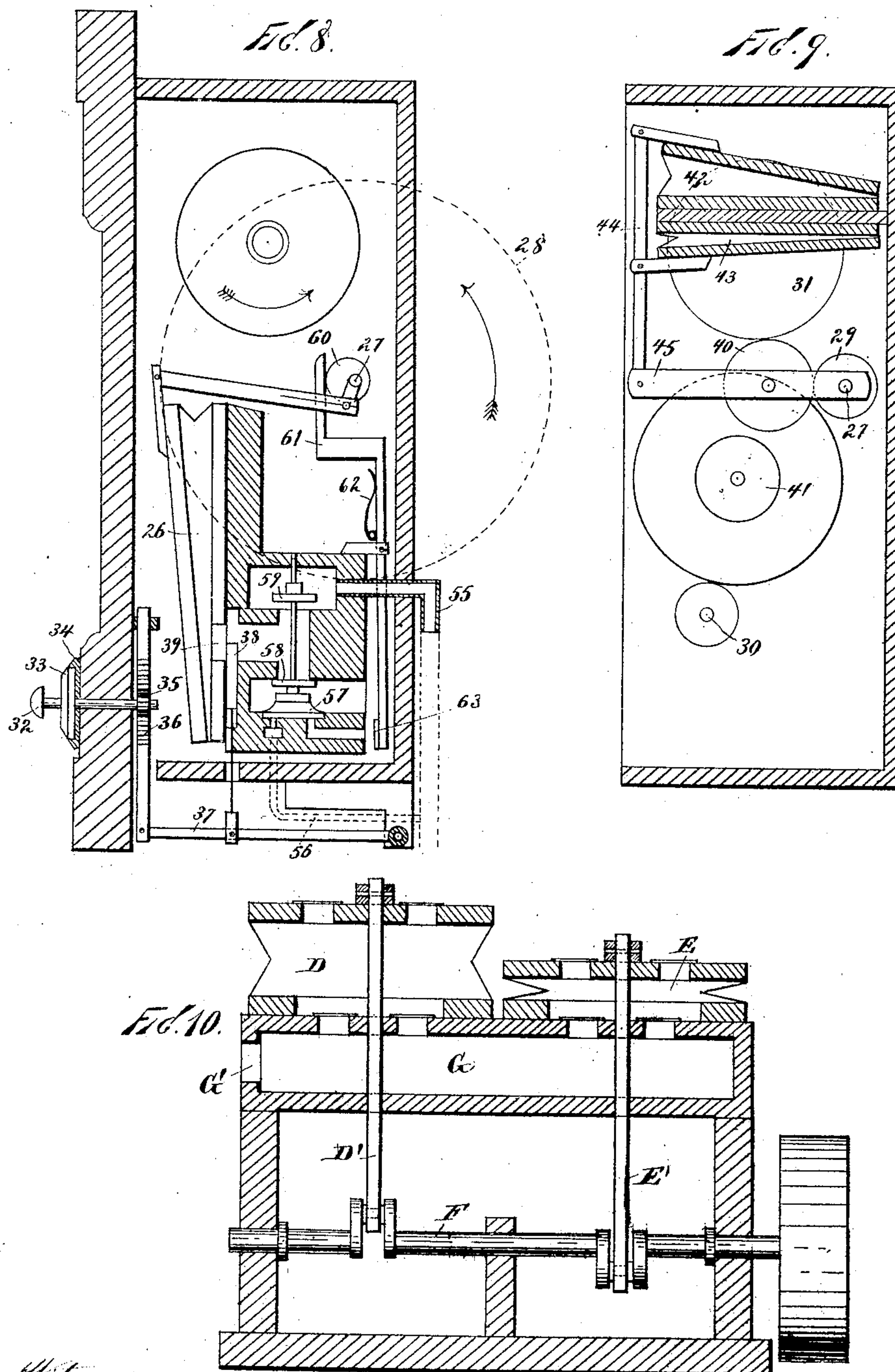
Inventor:
Chas. A. Kuster,
By Mont Osgood
Attorney.

C. A. KUSTER.
MECHANICAL MUSICAL INSTRUMENT.

(Application filed Nov. 11, 1895.)

(No Model.)

7 Sheets—Sheet 7.



Witnesses:
John Buckler,
L. H. Osgood.

Inventor
Chas. A. Kuster,
By Worth Osgood,
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES A. KUSTER, OF NEW YORK, N. Y., ASSIGNOR TO THE WELLINGTON MANUFACTURING COMPANY, OF SAME PLACE.

MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 640,922, dated January 9, 1900.

Application filed November 11, 1895. Serial No. 568,620. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. KUSTER, a citizen of the United States, and a resident of New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Mechanical Musical Instruments, of which the following is a specification.

My invention relates to mechanical musical instruments, and particularly to that variety wherein the keys of an ordinary piano or organ or other similar keyed instrument are operated by suitable mechanism through the medium of air-currents controlled or regulated by the movements of a sheet of paper or other suitable material properly perforated for the purpose.

The chief object of my invention is to provide or produce an apparatus by which the keyed instrument may be operated by mechanical means with accuracy and perfection in every respect the same as by the hand of a musician, but without in any way interfering with the use of the instrument for hand-playing when required.

Subordinate objects are to improve the construction and arrangement of the operating mechanism throughout its various details; to render it perfect in action, easy to operate and keep in repair, accessible, compact, and simple; to dispose the various parts of the operating mechanism so that other parts of the instrument may be easily reached for tuning or repairs or such changes as may be required and to arrange and locate the whole within one casing, differing from the ordinary casing of the instrument only in a small increase in depth, and to unite the parts of the casing so they will be solid and substantial and yet easily taken apart or assembled.

To accomplish these various objects and to secure other and further advantages in construction, convenience, operation, and use, my improvements involve certain new and useful arrangements or combinations of parts and peculiar features of invention, as will be herein first fully described and then pointed out in the claims.

In the drawings, Figure 1 is a vertical section and elevation of a musical instrument having my improvements applied thereto, the

view being taken upon a plane at right angles with the face of the instrument. Figs. 2 and 2^a are vertical longitudinal sectional views and partial elevations—Fig. 2 of the upper part, and Fig. 2^a of the lower part, of the instrument—the two figures being separated as required by the scale to which they are drawn, but intended to be viewed together, as if upon one sheet, constituting a complete view. Fig. 3 is a front view, partly in section and partly in elevation, showing a fragment of the casing and the base part of the instrument, the two parts being slightly separated and the manner of coupling and securing them being plainly indicated. Fig. 4 is a horizontal section and plan view corresponding in size with Fig. 3, representing the manner of hanging and locating the pedals, the hinged treadles, and other details. Fig. 5 is a horizontal section and partial plan showing the manner of uniting the piano-back with the end pieces so they may be easily disconnected. Fig. 6 is a front elevation of the upper part of the instrument, showing the sliding door partially opened, exposing a portion of the music-sheet and its rollers in the space which the door is intended to close. Fig. 7 is an elevation, with fragments in section, representing the manner in which the main portions of the instrument are hinged and arranged to be moved in order to afford access to the interior for tuning or repairs, &c. Fig. 8 is a sectional elevation upon a scale larger than previous figures, illustrating the means employed for effectuating, regulating, and indicating the movements of the paper or music-sheet roll; and Fig. 9 is a similar view showing the manner and means of changing the movement of the rolls to wind or unwind, as may be required. Fig. 10 is a sectional elevation showing the construction and arrangement of the main pumps by which the instrument may be operated by power when the foot-treadles are dispensed with or not required to be used. Fig. 11 is a detail view of one of the disks with its diaphragm on a larger scale than previous figures.

In all the figures like letters and numerals of reference indicate corresponding parts wherever they occur.

The improvements are herein shown in con

nection with the casing and action of an upright piano.

The striking mechanism may be of any approved pattern. $A A$ represent the usual finger-keys, which are pivoted at points between their extremities, as at a , and A' is one of the hammers or strikers actuated by the finger-keys through any suitable connecting parts, as those shown in Fig. 1. A^2 is one of the dampers calculated to limit or vary the vibration of the string after it has been struck by the hammer, and the dotted line A^3 in Fig. 1 represents one of the piano-strings. For each key throughout the piano these parts are practically the same, and hence it is only necessary to represent one key with its striking and damping attachments, and to show the manner of producing one stroke according to my invention suffices for all.

Beneath the bank of keys and in the lower front part of the casing are shown three horizontal chambers, as 1 2 3, and these are compactly bestowed, so as to occupy the space to advantage. The number of these chambers may be increased or diminished, according to the size of the instrument, it being only necessary that accommodation shall be afforded for the necessary number of "pneumatics" for operating the instrument. From the chambers the air is kept under constant exhaustion while the instrument is being played—that is, the air is continually being exhausted by the main pumps, the degree of exhaustion being in all as nearly uniform as possible. The chambers are located in a casing or trunk, as best shown in Fig. 2^a.

Beneath the chambers 1 2 3 and midway of the length of the instrument are alternating pumps B and C, calculated to be worked by the feet of the operator when other power is not available, and that these may be effective and calculated to employ the foot-power to best advantage they are of peculiar construction and are peculiarly connected with the treadles. The pumps are in the form of bellows, the upper part being stationary and the lower part movable. To the lower part are attached arms B' and C' , and on these are hinged the foot-pieces B^2 and C^2 in a manner substantially as shown, so that they may be turned up against the casing and out of the way when not required for use. The upper and lower plates of these pumps are supplied with openings of any number desired, and these openings are valved in such a way that when the lower plate is depressed air will be drawn into the pump from the top, excluded from entering elsewhere, and be expelled through the bottom openings upon elevating the lower plate, being at the same time prevented from finding its way back through the upper openings. For the valves I supply each opening with a thin piece of rubber or other suitable yielding material, the same depending and having a central aperture which normally remains closed by the elasticity of the material, but which will open when air is drawn or

forced down through it and close when its tendency is to travel in the opposite direction. These valves are represented at $b b$, Fig. 2^a. They make an effective seal for the pumps, and in this position are preferred to the ordinary flaps or flap-valves. The improved form of valve is totally noiseless and cheap and easy to apply.

In situations where mechanical power is available the instrument should be capable of being operated by it, and I therefore supply a sufficiently-powerful pump of the character represented in Fig. 10. In this the bellows D E are operated from the crank-shaft F through connecting-rods D' E' and the air is exhausted from chamber G in a manner which will be readily understood. This chamber is placed in communication with the trunk from which pumps B and C might exhaust the air, and when the power-pump is required to be used the connection is made through the opening G' and a pipe G², specially provided for the purpose and located within the casing of the instrument.

The pump, Fig. 10, may be large and powerful, and it is not therefore required to be so sensitive in action as pumps B C; but the parts are made heavy and strong, the base especially being of sufficient stability, so that the pump may be simply set down at any convenient point or place and is then ready to receive the power-belt and to be connected with the instrument, requiring no special setting, as in other forms.

The pipe G² should of course be closed, as by a plug shown in dotted lines, Fig. 2^a, when the pumps B and C alone are used; otherwise air would enter this pipe and prevent the pumps from doing their proper work of exhausting air from the trunk.

The perforated music-sheet is represented at 4 in Figs. 1 and 6. This is made to travel at a regular rate of speed over and in contact with a device called the "tracker," (indicated at 5.) The tracker is supplied with the requisite number of perforations and with separate tubes or conduits for each leading to the proper pneumatic, located in one of the several chambers above described. These tubes are represented at $c c$, only one of which is completely shown in Fig. 1. A perforation in the music-sheet registering with a port in the tracker admits atmospheric air, which passes along duct c and, arriving at the diaphragm-pneumatic under disk d , inflates the same and, raising the two valves l and e , shuts off exhaust and admits atmosphere under disk f , inflating it, and, raising valves h and g , shuts off atmosphere and establishes communication between the interior of the pneumatic-bellows i and the exhaust, which bellows collapses and lifts the rod K.

The pneumatics are of peculiar and novel construction and operation. Air being admitted to the under side of disk d , which closes the port into which tube c enters, forces that disk to rise, and thus a valve l is closed

and the port under valve *e* is opened, admitting air from the exterior through the channel shown to the under side of a similar disk *f*, which then rises, closing the exterior port *g* and opening port *h*. Exhaustion then takes place or extends through port *h* to the interior of bellows *i*, which instantly closes, carrying with it the push pin or rod *k*, which is adjusted to strike the inner end of key *A* upwardly with the same effect as if its outer end were struck downwardly, as in playing with the fingers. Thus the striking movement of the key is effected. When an imperforate part of the sheet covers the tracker-duct, a reversal of the position of all the parts in the train ensues, the inflated disk-pneumatics being emptied of air by a small leak like that caused by the branch exhaust 56 under the disk-pneumatic 57, Fig. 8. The opening of the bellows is assisted by the weight of the rod *k* and the bottom plate of the bellows. The opening action is instantaneous, same as the closing action, and thus the finger-stroke perfectly imitated.

The stems which carry valves *l* and *e* and the other similar valves are preferably guided in their up and down movements by being passed through perforated arms, as *m m*; but these are not always necessary.

From the foregoing it will be observed that the parts which go to make up the complete pneumatic for operating each key are three in number, and hence I term this form a "triple" pneumatic. The parts are the first set of valves and disk which are brought into action by the venting produced by the perforated music-sheet, the second set of valves and disk brought into action by the venting produced by the first set above named, and the bellows. This triple pneumatic permits me to employ a bellows of ample capacity and power to strike the blows as required. A single set of valves and a bellows would not accomplish the desired object, for the reason that the perforations through the music-sheet are too small to permit ventilation enough to directly act upon the bellows, so I employ the smaller set of valves to ventilate the larger set. All the disks that are operated by air-currents from the ducts involve flexible diaphragms made air-tight around the edges of their seats above the air-ducts leading to their under sides.

6 and 7 are two pedals such as are usually employed in pianos to vary the expression; but they are arranged and hung differently, so as to accommodate other parts and enable them to be worked by my improved means, as well as by the player's feet when required. When the soft pedal is depressed, the hammers are carried closer to the strings, thus softening the blow or stroke, and when the loud pedal is depressed the dampers are carried away from the strings, thus allowing them to vibrate freely. The pedals 6 and 7 are connected with or form part of rocking shafts 6^a 7^a, having rearward extensions 6^b 7^b, from

which rise rods 8 and 9. The rocking shafts 6^a 7^a are journaled in blocks on the piano-base, and extend beneath the interior fittings to one end of the casing, so that rods 8 and 9 may be carried up without interfering with the working parts.

10 and 11 are two pneumatics calculated to work the pedal-shafts, and they are connected with these shafts in such way as to allow them to be moved by the feet when required without disturbing the pneumatics. From the top plates of these pneumatics 10 and 11 (the bottom plates being fast) rods, as 12 and 13, extend down and embrace or pass through arms on the rocking shafts, so when the pneumatics are closed by reason of air being exhausted therefrom they will operate the pedals. The music-sheet is perforated on one margin according to the expression desired. Tubes *n* and *o* lead from the corresponding openings in the tracker back to the valves which govern the communication between the air-exhausting apparatus and the interior of pneumatics 10 and 11. One of these tubes is indicated in Fig. 2, as is also one set of the valves, the other being omitted because the two are similar.

The chamber represented at 14 is exhausted of air through pipe 15, having two branches, as shown. As soon as air enters tube *n* it ventilates the space under disk 16, forcing that disk to rise and open valve 17, which establishes communication between pipe 15 and pipe 18, the latter (18) entering the space between valves 16 and 17 and leading to the interior of pneumatic 10. As soon as the communication is established pneumatic 10 closes and carries the pedal-bar, as will be seen. The bar is returned to its normal position after having been thus moved by the springs of the dampers and by the weight of the rod 8, which acts upon arm 6^b as upon a lever, and being thus returned it carries up the top plate of pneumatic 10, leaving it in position to be operated again. The pneumatic 11 is operated upon the same general plan. The music-sheet having moved far enough to close the opening to tube *n*, ventilation under disk 16 is arrested and then the exhaustion through the lower branch of pipe 15 causes exterior air to force the disk to descend to its normal position and closes the valve 17 ready for the next movement.

The force of the blow with which the keys are struck or the touch is regulated and controlled in a peculiar manner by specially-provided pneumatics. The music-sheet is properly perforated at the points where the touch is to be varied, and tubes, as *n'*, lead from the tracker to the proper pneumatics. Only one of these tubes is indicated in place, Fig. 2, the others being similar and leading to like pneumatics for like purposes. Tube *n'* leads to the under side of a disk 19, which on the admission of air is forced to rise, opening a valve 20 and permitting exhaustion to take place through tube 21, leading to the interior of a bellows or pneumatic 22, which

thereupon closes. This pneumatic is connected with and carries a sliding bar H as it opens and closes. The sliding bar H is connected with a rod I by a bell-crank lever H' and the rod I in turn through a jointed portion I' with bell-crank levers I² I² I², and these latter with slide-valves K K K. The slide-valves K, as indicated, govern the area of openings leading to the pneumatics, which accomplish the strokes upon the keys, and thus control the rapidity and force with which the air may be withdrawn from them, and consequently the rapidity and force with which the striking of the keys may be effected.

22^a, 22^b, and 22^c are other pneumatics like 22, having tubes leading to their interiors and arms, as 23, arranged to strike against pins in the bar H or to be struck by said pins when the bar is moved. Stops, as 24, are provided, against which arms 23 abut, and these stops are adjusted so as to limit the movements of the pneumatics 22, 22^a, 22^b, and 22^c so they will close to varying degrees. When either of these pneumatics closes, it affects the opening movement of all valves K according to the degree which it is permitted to close, and hence effects the power of the stroke accordingly. For a slight decrease of force the pneumatic 22^c may be closed, for a slightly greater decrease pneumatic 22^b, and so on to the one 22, which moves farthest and closes the valves most.

To resume the normal strength of playing, the valves K must be returned to their original positions, and for this purpose a pneumatic 25 is employed. This closes in the opposite direction from the others and is connected with the bar H, so as to move it in the opposite direction to cause the valves K to move back or open. It is operated from the tracker through a suitable tube like n' and by employment of a disk and valve, like 19 and 20. The music-sheet is of course perforated at the point where it is desired to restore the stroke to its original force.

The traveling of the music-sheet is effected by air-pumps in the form of bellows, as 26, the same being connected with a crank-shaft 27, Figs. 2, 8, and 9, on which is a fly-wheel 28 to preserve uniformity of motion and a gear 99 to transmit the movement. This gear does not appear in Fig. 2, being behind the shifting-gear, which it turns.

30 is the cylinder on which the paper is originally wound, and 31 the one to which it is transferred as the playing progresses. The cylinder 30 being located in place, one end of the sheet is connected with cylinder 31, which is turned by the mechanism above described, being drawn in contact with the tracker. The rapidity of this movement, and consequently the time in which the music is rendered, is regulated by turning the indicator-knob 32, the same being supplied with index-plate 33, moving in contact with a fixed plate 34, Figs. 2 and 8. Upon the shaft of the knob is a

gear 35, engaging with a rack 36, adjustable up and down. The rack is pivoted to a lever-bar 37, which carries sliding valves 38, calculated to regulate the amount of air which may be drawn from bellows 26 by increasing or decreasing the size of the opening 39 leading therefrom, and thus regulating the time of playing.

After the sheet has been unwound it is necessary to rewind it upon the original cylinder. To do this, the connection between the motor-bellows 26 and the cylinder 31 is interrupted and connection made with the gear on cylinder 30 by swinging the gear 40 on its hinged arm down to connection with a gear 41, which turns a larger or multiplying gear always remaining in mesh with the gear on cylinder 30. The employment of the multiplying-gear enables the rewinding to be accomplished at a greater speed than the unwinding.

The adjustment for unwinding or rewinding is effected by pneumatics in the form of bellows 42 43, the movable plates of these two being connected, so that they must move together, one opening while the other closes, and the reverse. The plates move a bar 44, which is pivoted to the hinged arm 45, carrying the shifting-gear 40, the latter being always in mesh with gear 29. Two sets of valves are located in a compartment 46, from which air is exhausted through a tube 47, and these valves are operated upon the same general plan as similar valves previously described. Venting-tubes 48 49 are provided with a slide-valve 50, held to its seat by a suitable spring and having a handle or stem 51 projecting through to the exterior of the casing, Fig. 6. By moving the valve 50, as indicated in Fig. 2, the space under the disk connected with corresponding pneumatic in compartment 46 will be ventilated and air exhausted from bellows 43, causing it to close, carrying gear 40 up, so as to effect the unwinding of the music-sheet. Upon shifting valve 50 to the opposite position the bellows 42 will be closed, carrying shifting-gear 40 down and into mesh with gear 41, thus effecting the rewinding.

When the rewinding is commenced, it is necessary to cut off exhaustion from the chambers containing the pneumatics which operate the keys, as otherwise the strings would be struck as the music-sheet traveled back over the tracker. To accomplish this cutting off, a tube 52 leads down from between the valves in compartment 46, through which the rewinding movement is indirectly effected, to the interior of a pneumatic 53 in the base of the instrument. When this pneumatic closes, as it will do on the instant the said valves are shifted, it carries up and closes a valve 54, which will then shut off all communication between the exhausting-pumps and the trunk with which the chambers or channels 1 2 3 communicate. Whenever the said valves are reshifted the pneumatic 53 is ven-

tilated and automatically opens, allowing valve 54 to open.

Each of the pneumatics 26 is supplied with a peculiar valve and disk pneumatic, as shown in Fig. 8. Exhaustion takes place through tube 55 and its branch 56. The bellows 26 being open, the under side of disk 57 is ventilated from the exterior, compelling it to rise and carry up valves 58 and 59, whereupon the bellows 26 is collapsed, being vented through exhaust-tube 55. Then as the crank-shaft 27 continues to move or turn an eccentric cam 60 on this shaft turns so as to permit the bearing end of pivoted arm 61 to approach the shaft under the influence of its spring 62. This movement of arm 61, on the opposite end of which is a valve 63, causes said valve to close the ventilating-port, whereupon the exhaustion through the lower branch 56 of tube 55 will cause the disk 57 to draw down, carrying valves 58 and 59 down, 58 opening and 59 closing. Then the bellows 26 is free to be opened as the crank-shaft turns, the cam 60 opening the valve 63 at the same time, and thus the movements are continued. The three pneumatics 26 are connected with the crank-shaft, as shown, so that no two of said pneumatics shall occupy the same position at the same time.

The pumps B and C are mounted beneath the lower fixed plate of a chamber 64 in the form of a bellows, of which the top plate is movable. This chamber is of considerable capacity and extends about the length of the trunk, as shown in Fig. 2^a. Springs, as 65, are employed to keep this chamber open when the pumps are not at work, and against the force of these springs the pumps must draw the air from the chamber, which operates to carry a sufficient vacuum to compensate for any minor irregularities in the movements of the pumps after the manner of a balancing-chamber. To indicate to the operator the degree of exhaustion throughout the instrument, and consequently its condition for playing, a pivoted arm 66 is connected at one end with the movable edge of top plate of chamber 64 and at the other end carries a rod 67, leading up to a position above the bank of keys and provided there with a projecting arm and button 68. The position of the button will indicate the position of the top plate of chamber 64 and therefore the degree of exhaustion.

The cylinders 30 and 31 are made of metal to insure permanent accuracy and, being made hollow, are light and at the same time durable and not liable to be damaged. Each is supplied with metallic end flanges to keep the music-sheet in proper line, the flanges being beaded on the edges to prevent possibility of catching the paper. The cylinder 31 is mounted in the machine and intended to remain there, but the other, 30, must be removable. It is centered at one end, as on an adjustable pin 68, and at the other end is held by a clutch 69. This clutch is provided with one or more

projections, which enter corresponding recesses in the metallic head of the cylinder, and constitutes a part of the axis on which the cylinder turns. Its shank is movable longitudinally in its bearings, being held in working position by a spring 70, and carries the gear with which the multiplying-gear engages. This clutch 69 has also an enlarged head recessed to receive the projecting end of the cylinder. The end is thus easily, quickly, and accurately located in proper place without the usual necessity of careful adjustment.

To remove the cylinder 30, with the music-sheet rewound thereon, it is only necessary to crowd it toward and against the action of spring 70 far enough to release it from pin 68, when it may be dismantled and another one put in its place. To adjust the next one, its end is set properly in the clutch 69 and borne, with the clutch, toward spring 70 far enough for the opposite end to clear pin 68. Then when properly centered the spring will carry it up to its working position.

The cylinders, tracker, and music-sheet are located in a compartment at the central part and back of the front casing of the instrument, and this compartment is closed by a sliding door 71, which may be easily opened, exposing fully all the parts in the compartment, which may then be reached at will. When this door is closed, all the main working parts are effectually concealed and the instrument has the appearance of an ordinary upright piano.

The end pieces 72 72 of the casing (see Fig. 3) must be firmly connected with the base part 73 and in such a way that they may be removed when required for packing and shipping. For this purpose nuts, as 74 74, are let into the end pieces and bolts 75 75 passed up through the base 73 to engage in the nuts, suitable channels being provided to admit the bolts. The bolts are turned from the under side of the base, and when properly tightened they hold the end pieces down in the desired rigid manner.

The piano-back (represented in outline at 76, Fig. 5) is united with the end pieces and made detachable therefrom. This back carries the straining-plate, with the strings, and is generally quite heavy. The end pieces 72 are provided each with a dovetail plate 77, suitably anchored in place, and the piano-back 76 with corresponding plates 78 78, anchored thereto. To remove the piano-back, the top of the instrument is first dismantled and then this part moved up on the ways provided by the dovetail joint. The connection is solid and rigid when the parts are in place, and it admits of ready disunion when required.

The music-rolls, tracker, winding and unwinding pneumatics, and the expression-pneumatics are mounted in a box or frame 79, which is intended to be swung up and back and may rest on the piano-back when the cover of the piano-casing is removed, so

it will expose the upper parts of the strings and action free to be reached when required, as for tuning. For this purpose the box 79 is mounted on hinge-arms 80, (see Figs. 1 and 5 7,) and these are journaled or axled in open blocks 81, which permit them to be withdrawn when required, so the box, with all its interior fittings, may be bodily detached or lifted out from the instrument. To admit of 10 this, the various tubes leading from the tracker and other parts within the box 79 are connected with one section 82 of a bar suitably perforated to receive them, and this section is connected with box 79 by suitable 15 braces, as 83, so as to move therewith. The section 82 registers with a corresponding section 84, having similar perforations from which the tubes lead to the parts below, forming continuations of the tubes above 20 when the two sections are together. The union of the two sections is required to be quite close, and for this reason they are properly faced and the section 82 supplied with a number of screw-bolts 85, which pass 25 through between the perforations and engage with the other section. On disconnecting these bolts, disuniting or dismounting the parts I and I' of the rod which moves the expression-dampers, and disconnecting tubes 30 47, 18, 15, and 52 the box may be turned up. A stop 86, with a spring 87, Fig. 7, arrests the box in its downward movement, and the spring engages a suitable pin 88 in the box to hold it against accidental movement, as 35 when the piano is being moved about.

The bank of keys may be withdrawn, and for this purpose the piece 89 on which it is mounted is provided with grooves on its ends, and these ride or slide upon stationary flanges 40 90, suitably anchored to the casing. The hammers and dampers, with their connecting-pieces, called the "piano-action," are mounted on frames 91, as usual. It may be removed, when the bank of keys will be free to be displaced by drawing it out on the slides. The 45 chambers 1, 2, and 3 are mounted in a trunk, before referred to. This is indicated in outline at 92, Fig. 7, and is hinged or journaled in open brackets 93 on bottom plate of chamber 64, so it may be turned down or lifted 50 out of place after the bank of keys is out of the way and after box 79 has been swung out of the way. The trunk 92 carries with it the section 84 of the registering bar or plate.

In Figs. 7 and 2^a the part 94 represents the box, which contains the valve 54 and with which the trunk 92 must register when it is down, as indicated in Fig. 2^a.

At 95, Fig. 2^a, is a safety-valve held closed 60 by a suitable spring. When the chamber 64 is drawn down to its proper limit, a pin 96, carried by the upper plate, strikes valve 95 and opens the same, allowing air to enter the chamber, and thus preventing damage by undue exhaustion.

Being constructed and arranged substantially in accordance with the foregoing ex-

planations, the improved instrument is compact, its parts easily dismantled as required, the valves are noiseless, the imitation of 70 hand-playing is quite perfect, and the instrument may be played with the hands precisely as if other adjuncts were not present.

Having now fully described my invention, what I claim as new herein, and desire to secure by Letters Patent, is—

1. In a mechanical musical instrument, the combination with the balancing-bellows 64, of the alternating pumps, B, C, having upper plates fixed to the side of said bellows and 80 having movable lower plates and arms applied upon the front margins thereof, said arms carrying the hinged treadles, substantially as shown and for the purposes set forth.

2. In combination with the pumps having 85 fixed upper plates and movable lower plates, of the arms B' and C' applied upon the edges of the movable plates of the pumps, and the foot-pieces B² C² hinged upon the arms and arranged to be turned up against the front of 90 the casing through which they project, substantially as shown and for the purposes set forth.

3. In combination with the upper and lower plates of the pumps provided each with a series of perforations as set forth, the noiseless 95 valves located in said perforations, the same being composed of flexible strips which close against each other and automatically open, substantially as shown and described. 100

4. In combination with the bar operated by the expression-pneumatics, the pneumatic for returning the said bar to its original position, substantially as shown and for the purposes 105 set forth.

5. The combination with the sliding bar H, of the bell-crank levers, the slide-valves K and the jointed connecting-rod I I', substantially as shown and described.

6. In combination with the two rolls carrying the perforated music-sheet, the crank-shaft, the pneumatics applied to said shaft, a gear for transmitting the motion, and a shifting-gear hinged as explained and arranged 110 to transfer the movement from one roll to the other, the air-exhausting apparatus, the valves for regulating the degree of exhaustion, the knob and rack for moving said valves, tube 52, pneumatic 53 and valve 54, arranged 115 and operating to control the time of movement of the music-sheet, substantially in the manner shown and described. 120

7. The pneumatic 26, tube 55 with branch 56, disk 57, valves 58, 59, crank-shaft, eccentric cam, pivoted arm, spring and valve 63, 125 the parts being arranged and combined substantially as shown and for the purposes set forth.

8. In a mechanical musical instrument, the metallic cylinder 30 for carrying the perforated music-sheet, said cylinder having metallic end flanges, one of which is intended to receive the projections upon the clutch, the same being combined with the recessed clutch 130

69, centering-pin 68, and spring 70, substantially as shown and described.

5 9. The box or frame 79 hinged as explained and combined with the instrument-casing as set forth, so it may with its contents be turned up and back to expose the parts, substantially as shown and described.

10 10. In combination with box 79 carrying the section, 82, of the connecting-bar and the instrument-casing, the hinge-arms 80 and open blocks 81, substantially as shown and for the purposes set forth.

15 11. In combination with box 79 hinged as explained, the section 82 of the connecting-bar, said section being mounted on and made movable with the box, substantially as and for the purposes set forth.

20 12. The sections 82 and 84 of the connecting-bar combined with each other and with the hinged parts on which they are mounted, the two sections being arranged to be united, substantially in the manner and for the purposes set forth.

25 13. The trunk 92 containing chambers 1, 2 and 3, said trunk being mounted on hinge-

arms journaled in stationary blocks and arranged to be turned down with its contents and attachments, the parts being combined and arranged substantially as shown and described.

30 14. In combination with trunk 92, the section 84 of the connecting-bar, said section being mounted on and made movable with the trunk, substantially as and for the purposes set forth.

35 15. In a mechanical musical instrument, the hinged removable box and trunk, the bank of keys arranged to slide on the ways provided for it, the detachable end pieces, piano back and base, all being arranged and combined to be assembled and disconnected substantially as and for the purposes set forth.

40 Signed at New York, in the county of New York and State of New York, this 8th day of November, A. D. 1895.

CHARLES A. KUSTER.

Witnesses:

W. J. MORGAN,
WORTH OSGOOD.