

S. B. LOCKLIN.
PNEUMATIC PIANO PLAYER.

(Application filed Aug. 10, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

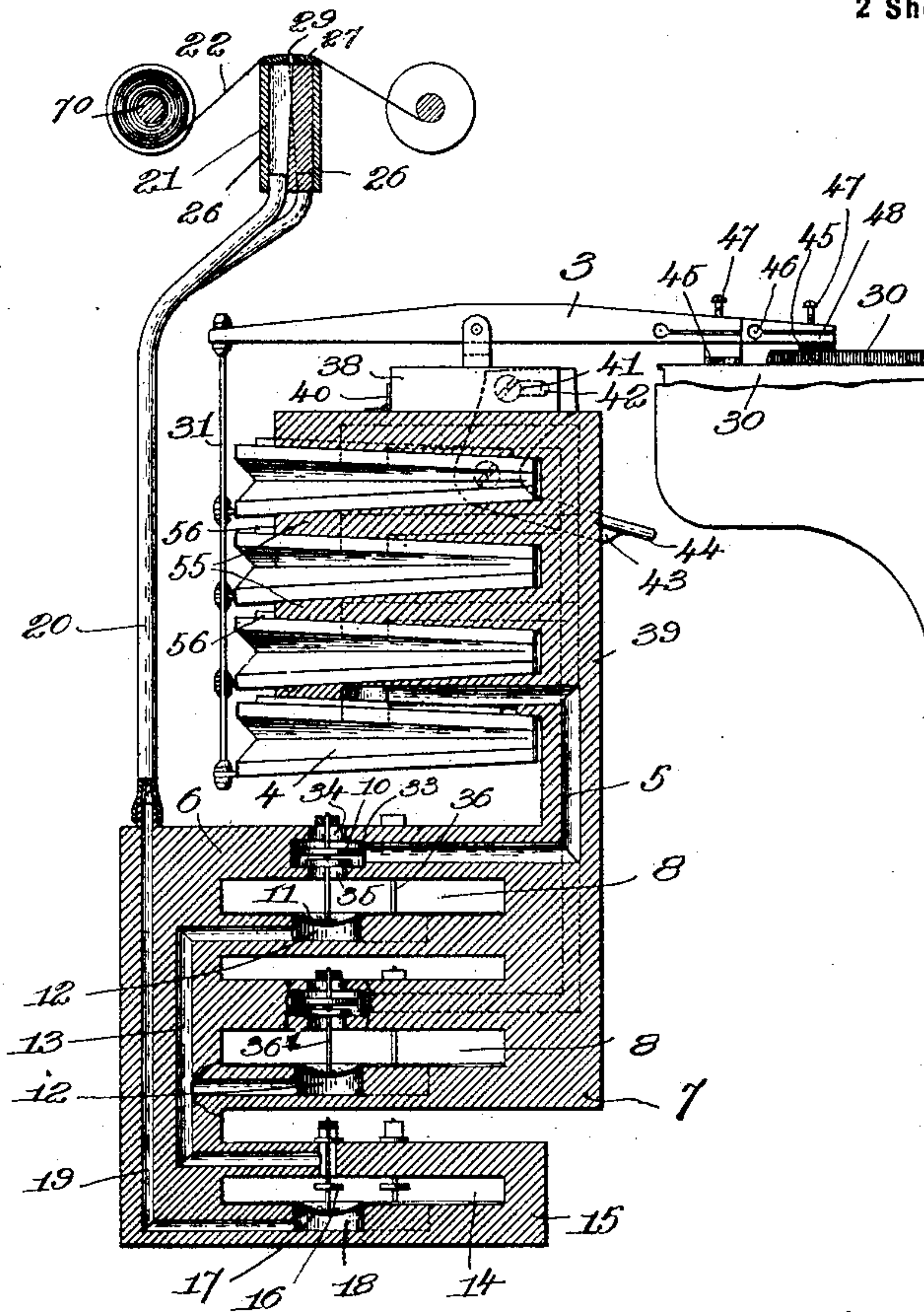


Fig. 4.

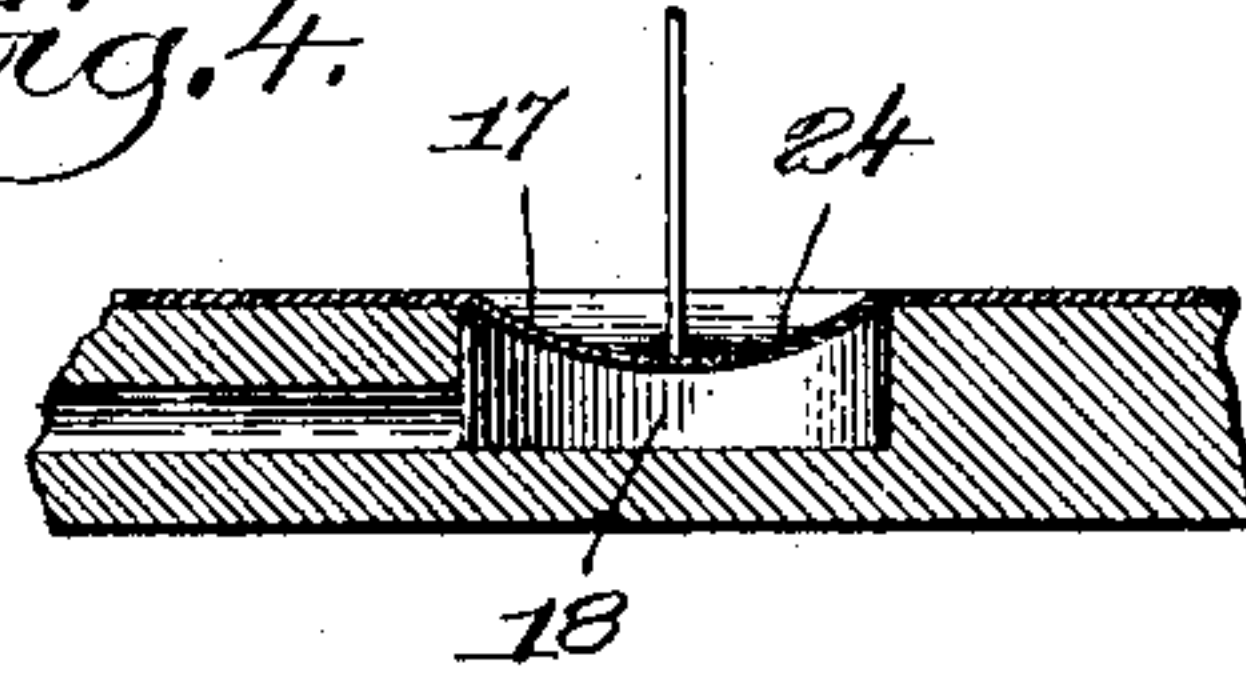


Fig. 2.

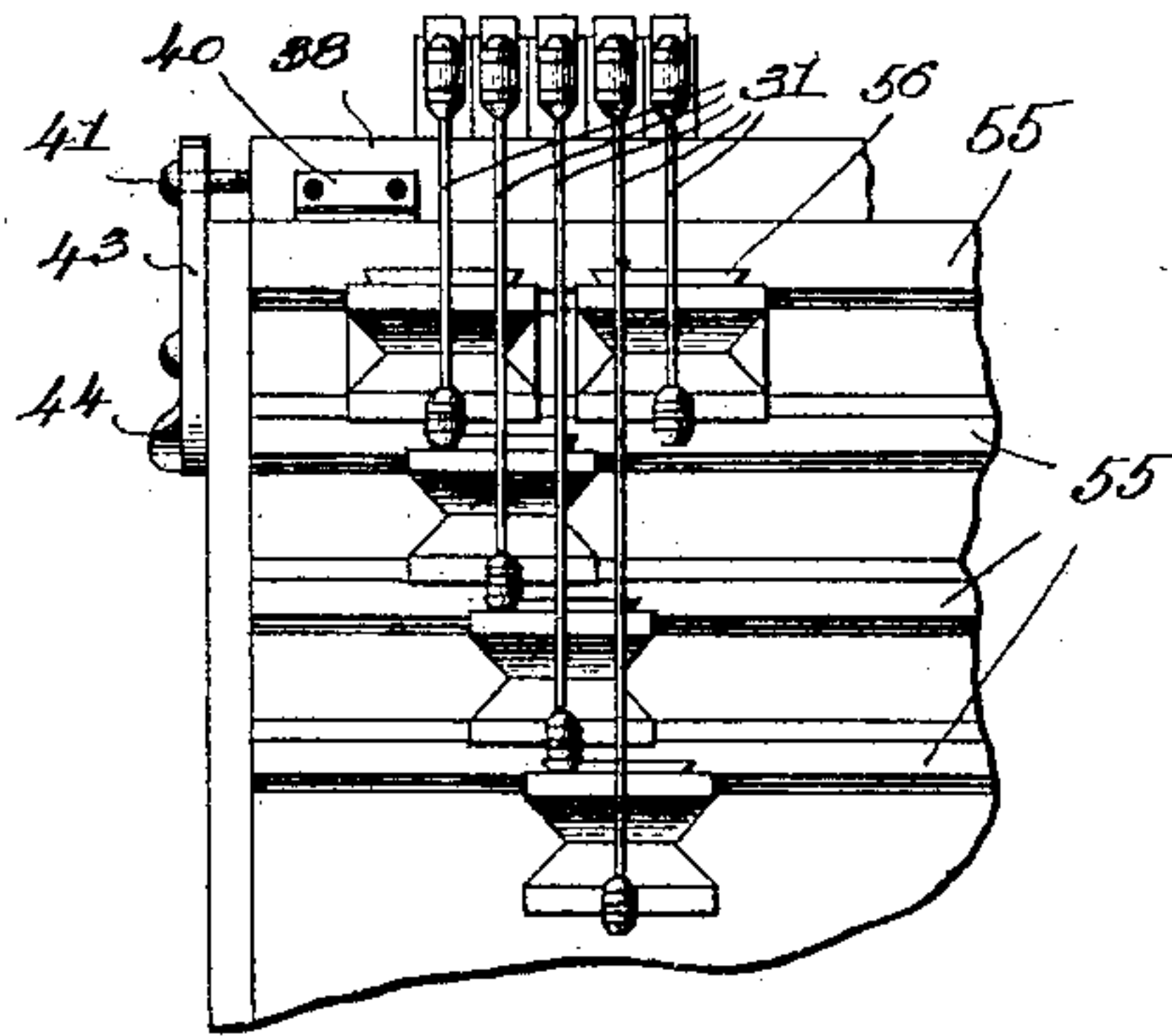
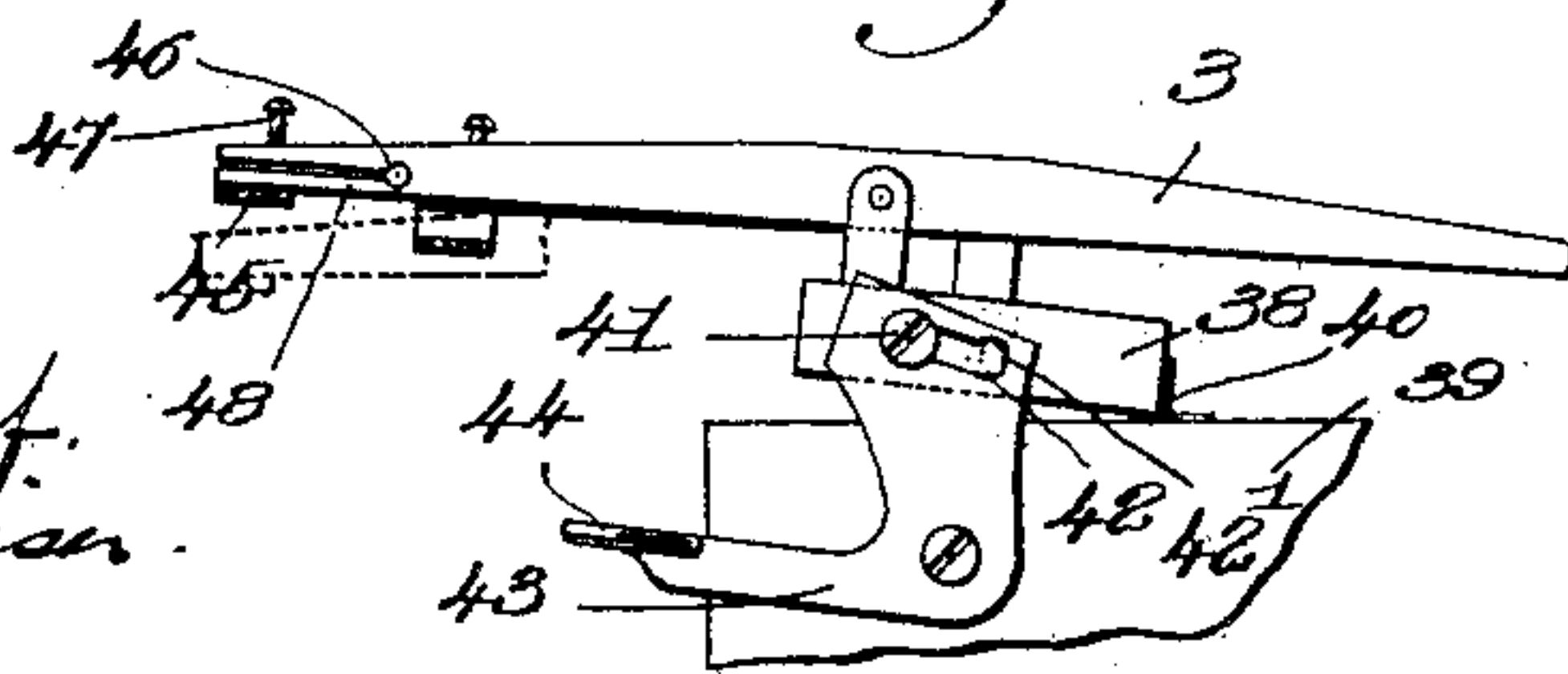


Fig. 3.



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No. 706,574.

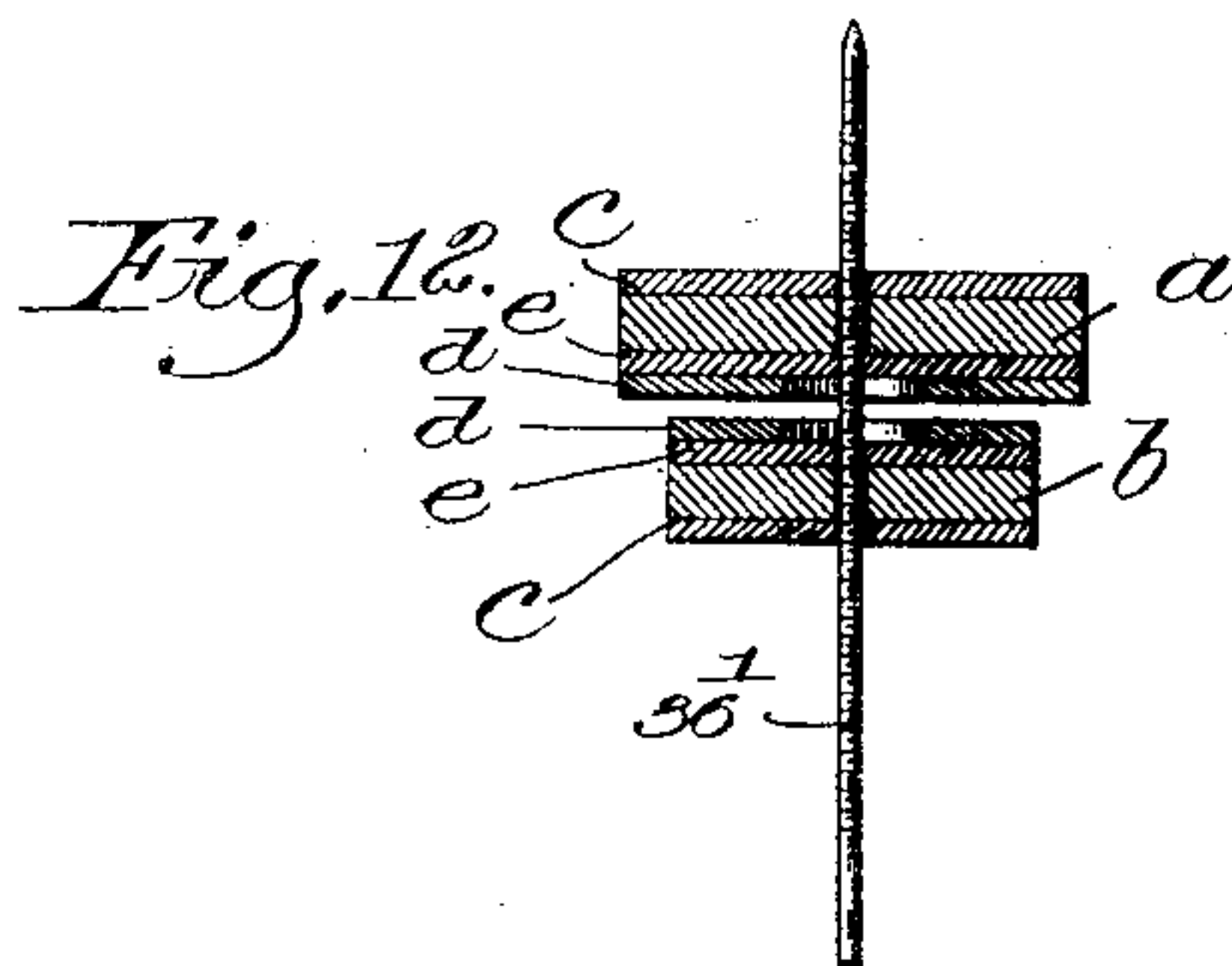
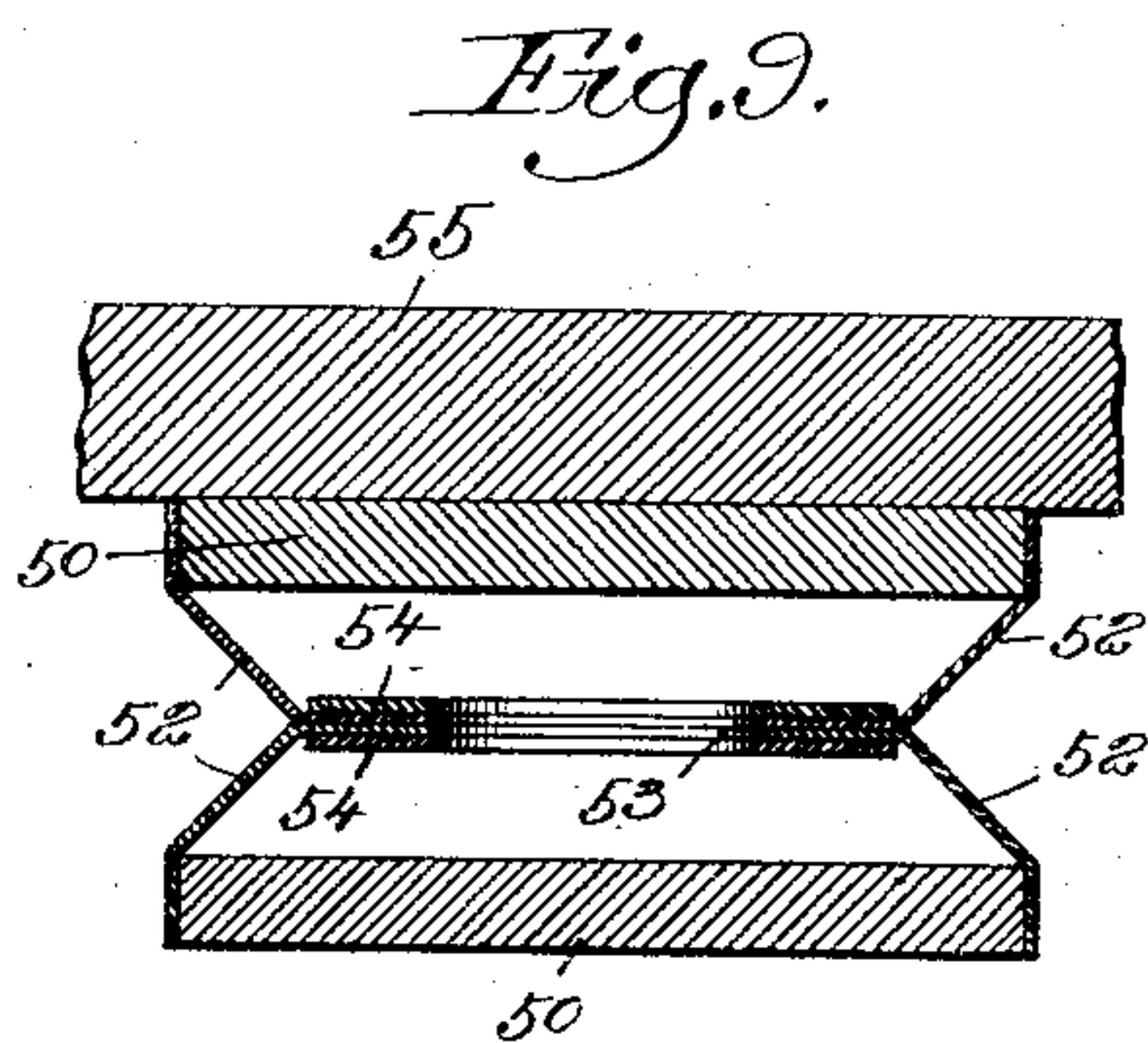
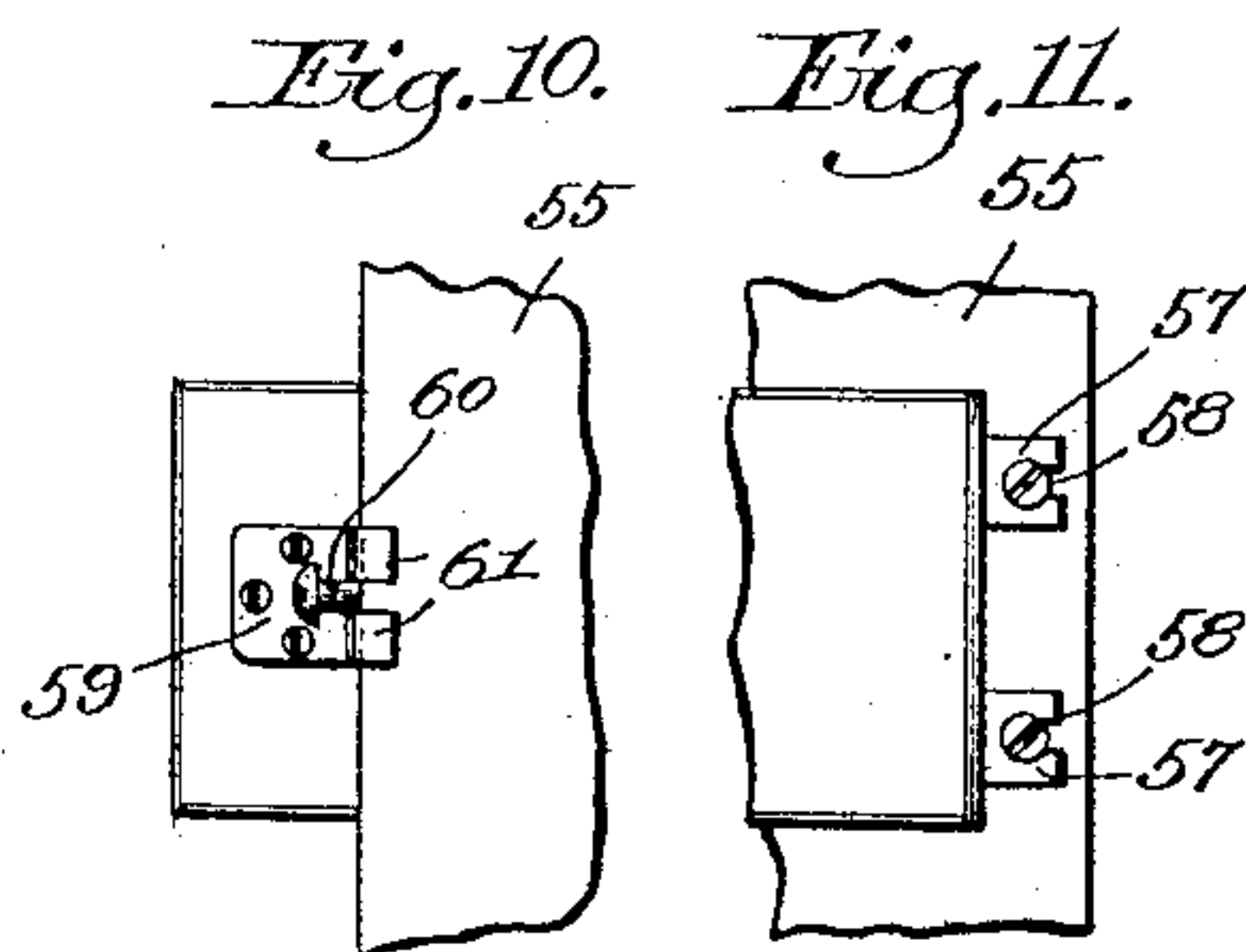
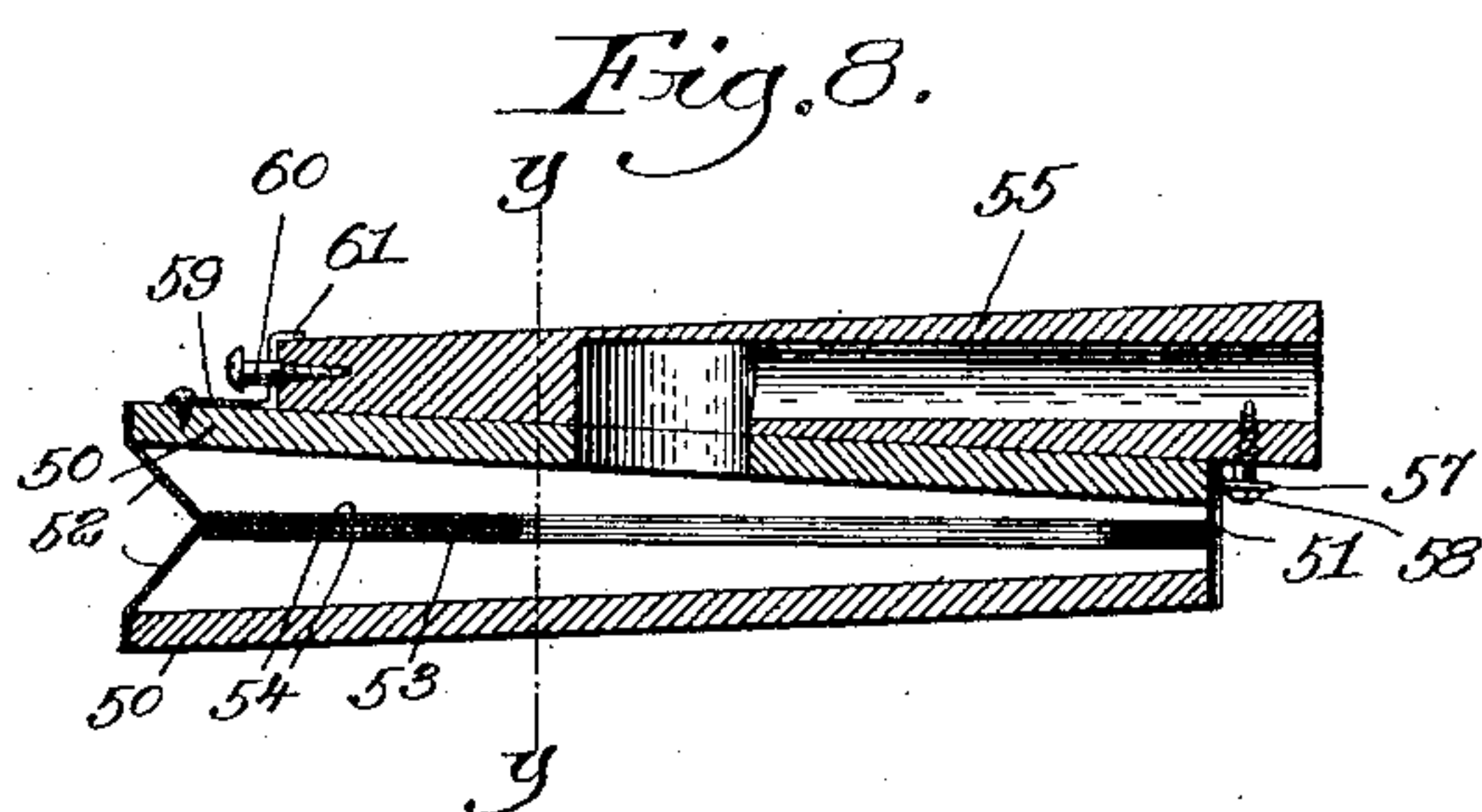
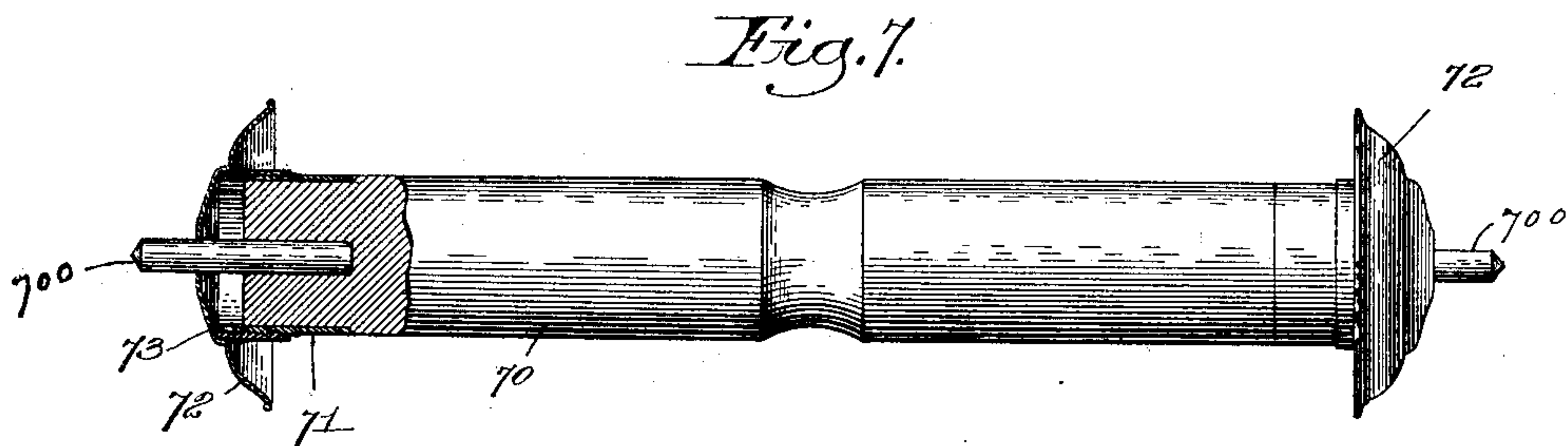
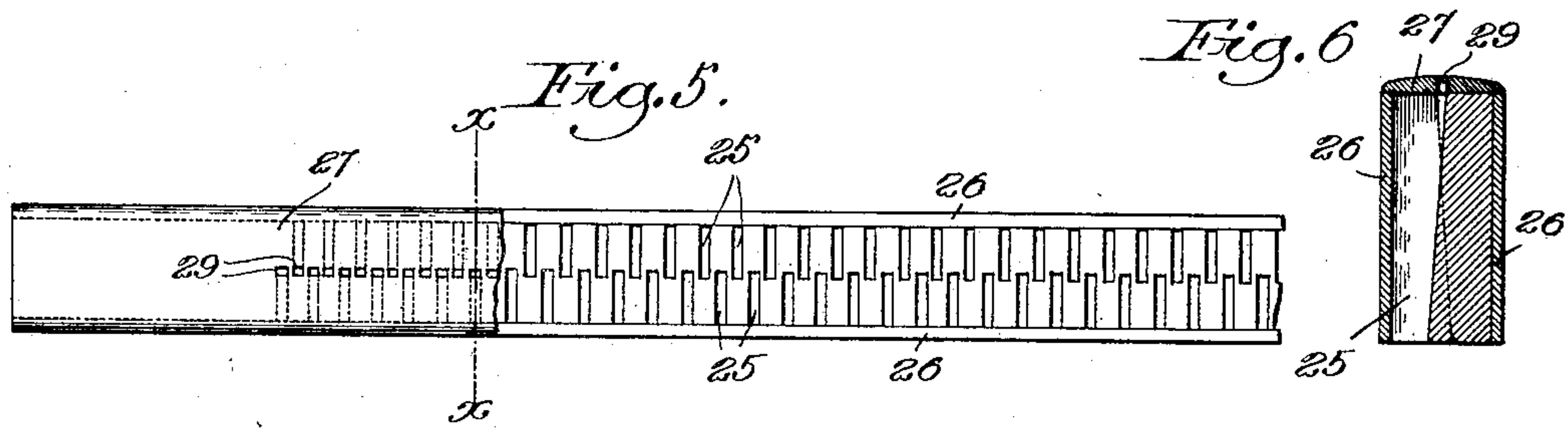
Patented Aug. 12, 1902.

S. B. LOCKLIN.
PNEUMATIC PIANO PLAYER.

(Application filed Aug. 10, 1901.)

(No Model.)

2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

SAMUEL B. LOCKLIN, OF BOSTON, MASSACHUSETTS.

PNEUMATIC PIANO-PLAYER.

SPECIFICATION forming part of Letters Patent No. 706,574, dated August 12, 1902.

Application filed August 10, 1901. Serial No. 71,595. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL B. LOCKLIN, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Pneumatic Piano-Players, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to pneumatic piano-players which comprise in their construction a series of fingers adapted to engage and operate the keys of the piano or other instrument and a series of pneumatics which control the action of the fingers, the action of said pneumatics in turn being controlled by a perforated sheet of music, which passes over the usual tracker; and the object of my invention is to improve this class of devices in various particulars, as hereinafter described, and pointed out in the claims, to render the same more reliable and quicker in its action.

In the drawings, Figure 1 shows a section of so much of a pneumatic piano-player embodying my invention as is necessary to understand the operation of the device. Fig. 2 is a front view of a portion of Fig. 1, showing the arrangement of the pneumatics. Fig. 3 is a detail showing the manner of mounting the fingers. Fig. 4 is a detail of one of the air-pockets in the boxes. Fig. 5 is a plan view of my improved tracker, a portion thereof being removed to better show the construction. Fig. 6 is a section on the line *xx*, Fig. 5. Fig. 7 shows my improved spool for the sheets of perforated music. Fig. 8 is a longitudinal section of the pneumatic I employ. Fig. 9 is a section on the line *yy*, Fig. 8. Figs. 10 and 11 are detail views showing one way of detachably securing the pneumatic to its support, and Fig. 12 is a detail of the improved pocket-valve.

The fingers, which are adapted to engage and operate the keys 30 of the piano or other instrument, are designated by 3, the said fingers being pivotally mounted, as hereinafter described, and being connected by means of suitable links 31 to pneumatics 4.

The pneumatics are shown as arranged in series of four (see Fig. 2) and in staggered arrangement, this arrangement being desir-

able because it allows the adjacent fingers to be the requisite distance apart to operate the corresponding keys on the instrument.

Each pneumatic is connected by a suitable duct 5 to a pocket or valve-chamber 33, there being one such valve-chamber for each pneumatic, and said valve-chamber has a pocket-valve 10 therein, controlling ports 34, leading to the atmosphere, and 35, leading to the interior chamber 8 of the secondary boxes 6 or 7. In this embodiment of my invention two such secondary boxes are shown, the duct 5 for one pneumatic leading to a valve-chamber in the box 6, while the next succeeding pneumatic communicates by a similar duct with the valve-chamber in the secondary box 7, the third pneumatic communicating by a similar duct with a valve in box 6, the stem of which valve is shown at 36, and the fourth pneumatic leading to a valve-chamber communicating with box 7, &c. The chambers 8 of the secondary boxes are connected to a suitable wind-chest, (not shown,) from which the air is exhausted by any suitable bellows mechanism, (not shown,) as usual in this class of devices. The pocket-valves 10 have their stems 36' connected to a diaphragm 11, which covers an air-pocket 12 in the secondary boxes, the said air-pocket being connected by ducts 13 with the chamber 14 in the primary box, the said chamber 14 also being connected to the wind-chest, whereby air is exhausted therefrom. The ducts 13 are controlled by any suitable or usual valve mechanism 16, shown as in the form of a double puppet-valve, which is adapted to establish communication between the duct 13 and the chamber 14, as shown in Fig. 1, or to close said communication and open the communication between said duct and the atmosphere, according to the position of the diaphragm 17, to which the stem of said valve 16 is connected, the said diaphragm covering an air-pocket 18 in the primary box. The air-pockets 18 are connected by individual ducts 19 and tubes 20 to the respective ducts or air-passages 25 through the tracker 21, said ducts 25 being controlled by the perforations in the sheet of music 22.

The operation of the devices above described, which constitute the features ordinarily found in the devices of this class, will be readily understood and is as follows: The

exhausting-bellows establishes a vacuum in the chambers 8 and 14 and also in the ducts 19, the air in said ducts being drawn out through vents 24 in the diaphragms 17. When
 5 now an aperture in the perforated music 22 passes over any duct or air-passage in the tracker, air is allowed to enter said air-passage and pass through duct 19 into the air-pocket 18, thereby exploding the same and
 10 lifting the valve 16 from the position shown in Fig. 1 to close the communication between the chamber 14 and the duct 13 and to open communication between said duct and the atmosphere. The air then rushes in through
 15 the duct 13 and explodes the air-pocket 12, thereby lifting the valve 10 and closing the normally open port 34 between the duct 5 and the atmosphere and opening the port 35, whereby said duct is brought into communi-
 20 cation with the chamber 8 of the secondary box. The air in the pneumatic is thereupon exhausted suddenly and the pneumatic collapsed, whereby the finger controlled there-
 25 by is operated to strike the corresponding key on the instrument.

The particular features wherein my invention resides will now be described.

The operating mechanism for the fingers 3 is, as stated above, usually inclosed in a suitable casing independent from the piano,
 30 which casing may be set in position in front of the piano, with the fingers resting on the keys when it is desired to play the instrument. It frequently happens, however, that
 35 when the casing is being placed in position the ends of the fingers 3 strike the ends of the keys 30 on the piano, thereby damaging the fingers. To prevent this, I pivot my
 40 fingers 3 in any usual or suitable way upon a plate or carrier 38, which extends the length of the casing and is hinged to the frame or support 39 for the pneumatics and boxes in any suitable or usual way, as at 40.

Suitable means are provided to turn the
 45 carrier 38 about its hinge 40 to thereby simultaneously lift the hammer end of all the fingers 3 above their normal position, so that when the casing inclosing the operative parts is moved into position in front of the piano
 50 there will be no danger of the finger ends striking the keys.

As illustrated in Figs. 1 and 3, the end of the carrier 38 has a stud 41 projecting therefrom, which plays in a suitable inclined or
 55 cam slot 42 in an actuating elbow-lever 43, pivoted to the support portion 39, said lever being provided with a finger-piece 44. The slot 42, it will be seen, is eccentric to the pivot of the actuating-lever, and therefore by rais-
 60 ing the finger-piece, as shown in Fig. 3, the fingers 3 will all be raised, and after the casing is in operative position the lever 43 may be depressed, thereby bringing the fingers down into their operative position, with their
 65 ends resting on the keys 30. (See Fig. 1.) It will be seen that the end of the slot 42 has at one end a seat 42', in which the stud 41 rests

when the fingers are in their operative position, and the relation between the pivot or fulcrum of the lever 43, the stud 41, and the
 70 slot 42 is such that when the lever is depressed to bring the carrier 38 into the dotted-line position, Fig. 3, said carrier becomes locked and cannot be raised by a lifting pressure applied to the fingers 3. 75

It is important that when the fingers 3 are in their operative position the hammer ends thereof just rest upon the keys of the piano; but oftentimes the piano-keys are not in perfect alinement, some of them being slightly
 80 raised or depressed below the others. To compensate for this unevenness in the keys, I have made the hammer ends of my fingers 3 adjustable vertically, whereby after the fin-
 85 gers are in operative position the hammers thereon may be brought into engagement with the various keys. One convenient way of accomplishing this is to split the ends of the
 90 fingers, as shown at 46, one branch 48 of the split or forked end having the usual hammer 45 secured thereto and the other having an adjusting-screw 47 passing therethrough and
 95 engaging the branch to which the hammer 45 is connected. The branch 48 is resilient, while the other branch, through which the set-screw 47 passes, is comparatively rigid, so that by
 100 adjusting the set-screw 47 the resilient branch may be made to yield and the position of the hammer thereby varied to compensate for unevenness in the keys.

By splitting the end of the fingers, as shown, the entire hammer end of the fingers is rendered somewhat elastic, so that when the finger is operated the blow struck thereby on
 105 the piano-key will be somewhat in the nature of a yielding blow, whereby the action of the instrument is more like that of a person playing a piano.

Another feature of my invention relates to the pneumatics 4. As ordinarily constructed
 110 these pneumatics comprise opposed side pieces of stiffened material which are hinged together at one end, the said side pieces being connected by suitable flexible material, where-
 115 by the pneumatic may be expanded or collapsed. When the pneumatic is collapsed, the flexible bellows portion folds together in an indiscriminate way, and frequently at the
 120 end of the pneumatic where it is connected to the rods 31 the fold in the flexible material will extend outward to be engaged by the said rods 31, and after a short time the rods
 125 wear through the fold in the flexible material, thereby rendering the pneumatic inoperative.

My pneumatics are so constructed that the
 130 flexible material will fold in a certain definite way. As illustrated in Figs. 8 and 9, they comprise the usual stiffened side pieces 50, which are hinged together at one end 51 in any suitable or usual way. Secured to the
 135 edges of the side pieces 50 in any usual way are the strips 52, of flexible material, the said strips having their inner edges 53 folded in toward the center of the pneumatic and glued

or otherwise fastened together. Connected to the inside of each of said inner edges 53 is a flat stiffening-piece 54, of cardboard, leather-board, or other suitable material, said stiffening-piece being glued or secured to the inside of the inner edges 53 in any suitable way. The stiffening-pieces 54 have a central aperture therethrough, as shown in Figs. 8 and 9. When, now, the valve 10 is operated to connect the pneumatics 4 with the vacuum-chambers 8 and the air is drawn out of said pneumatics, they will collapse, the two side pieces 50 coming together, and since the inner edges 53 of the strips 52 are held in the position shown in Figs. 8 and 9 the flexible portion of the pneumatic will fold in between the two side pieces 50 in a regular way.

My pneumatics 4 are made detachable from their supports 55, and, as shown in Figs. 1 and 2, the said pneumatics are provided at the upper sides with the dovetailed rib 56, which engages a corresponding groove in the support 55.

In Figs. 8, 10, and 11 I have illustrated another form of detachable connecting means for the pneumatics, and as shown the hinged end of said pneumatics each have the forked projection 57, which is adapted to embrace studs 58, preferably in the form of screws, in the support 55. The opposite end of the pneumatic has connected to the upper side thereof a suitable forked clip 59, said clip being bent, as shown, at right angles to the pneumatic and having the ends of the forked portion bent over to engage the top of the support 55. A screw or other stud 60 is mounted in the end of the support 55, said screw being situated between the forks of the clip 59.

To disconnect the pneumatic from the support 55, it is moved horizontally to the left, Fig. 8, until the projections 57 become disengaged from the studs 58, at which time the upright portion of the clip 59 engages the head of the stud 60 and the bent ends 61 of the clip are disengaged from the top of the support 55. By moving the pneumatic downwardly then the forked clip 59 is withdrawn from the stud 60 and the pneumatic is completely disconnected.

Heretofore it has been common to make the pocket-valves 10, which are seated in the valve-chamber 33, in the nature of a single valve having a double face which is rigidly connected to the valve-stem. It frequently happens, however, that one side of the valve gets worn more than the other, so that the valve does not seat perfectly. To overcome this objection, I employ the form of valve shown in Fig. 12, wherein 36' indicates the screw-threaded valve-stem, which is connected at one end to the diaphragm 11 and upon which the valve is mounted.

I prefer to make my pocket-valve in two sections *a* and *b*, which are independent from each other, each of said sections having a screw-threaded engagement with the valve-stem 36', whereby they may be independently

adjusted to compensate for wear. I also flexibly connect the valve-sections to the valve-stem, so that they may have a tilting or rocking movement relatively to the valve-stem in order to allow the said valve to seat perfectly even though the face thereof is worn or the valve-chamber becomes warped. To accomplish this, I construct each valve-section with a facing and body portion *c* of some suitable material, such as felt, and provide a backing *d* of some stiffened material—such as cardboard, leather-board, &c.—the said backing having an enlarged central aperture therein through which the valve-stem passes. Between the backing and the body or facing of the valve is an intermediate layer *e*, of leather or similar tough fibrous flexible material, which has a screw-threaded engagement with the valve-stem. The intermediate layer *e* must be of such a quality that its screw-threaded engagement with the valve-stem will be sufficient to provide for adjusting the valve-section longitudinally of the valve-stem, for the aperture through the body or face portion *c* of the valve-section will be slightly larger than the valve-stem. Since the intermediate layer *e* is flexible, it will be obvious that each valve-section may have a tilting motion transversely of the valve-stem, whereby the valve will be accurately seated even though the face thereof becomes worn.

My improved tracker-board comprises a body portion 26, in which are the usual air-ducts 25, and a cap portion 27, secured thereto and over which the sheet 22 of perforated music passes, said cap portion having an aligned series of apertures 29, registering with the ducts 25 and adapted to register with the perforations in the sheet of music. Heretofore it has been common to make the tracker with all the ducts 25 therethrough in one continuous aligned row; but it has been found that this structure weakens the board. To strengthen the tracker, I construct the ducts 25 therethrough in two rows, the successive ducts alternating in the said rows, thereby giving the ducts a staggered relation, as seen in Fig. 5. Each duct is preferably made wider at the upper portion than at the lower portion thereof, the widened upper portions of said ducts overlapping the central line of the tracker-board and registering with the corresponding aperture in the cap-plate 27, as seen in Figs. 5 and 6. The lower ends of the ducts 25 are connected by suitable flexible sections 20 to the air-ducts 19, which lead to the pockets 18 in the primary boxes, as usual.

By making the ducts 25 tapering, as shown, I secure a better action, because as soon as an aperture in the sheet of music is brought to register with the aperture 29 in the cap-plate and air is drawn in through said aperture the column of air driven through the intermediate air-duct will be condensed at the lower portion thereof and will move with greater force and rapidity, thereby giving a quicker and surer action. I also find that the

action of the device is improved by making the ducts between the tracker 21 and the pneumatics 4 of progressively-increased diameter—*i. e.*, the duct 19 will be the smallest 5 and will be slightly larger than the aperture 29 through the cap-plate of the tracker.

The duct 13 between the primary and secondary boxes will be larger still than the duct 19, while the air-duct 5 between the secondary 10 box and the pneumatics will have a still larger cross-sectional area.

When an aperture in the sheet of music registers with the aperture 29, the air is drawn with great velocity through said aperture 29, 15 and as it passes into the larger ducts 20 and 19 it can expand therein somewhat and move freely into the pocket 18 to explode the same. This operation, as will be understood, raises the valve 16 to close communication between 20 the intermediate duct 13 and the vacuum-chamber 14 in the primary box and allows air to pass from the atmosphere into said larger intermediate duct 13, this column of air moving with greater velocity and rapidity, 25 owing to the size of the duct, and quickly filling or exploding the air-pocket 12. When this occurs, the valve 10 is operated to connect the duct 5 with the vacuum-chamber 8, and owing to the size of the air-duct 5 the 30 air in the pneumatic 4 will be instantly withdrawn and said pneumatic collapsed to give a quick blow upon the piano-key.

Another feature of my invention relates to the spool upon which the sheets of music are 35 wound. It is well known that hygrostatic changes in the atmosphere affect the perforated paper which is carried by the spools, the said paper swelling and becoming wider in damp moist weather and shrinking and 40 becoming slightly narrower in dry weather. It is obvious that if a spool having a fixed and definite distance between the flanges thereof were used the sheets of paper would be too wide for the spool, and in winding the 45 paper onto the spool the edges thereof would be curled by their contact with the spool-flanges, while in dry weather the paper would be narrower than the distance between the flanges and in winding thereon might have a 50 slight traverse. When this is the case, it will be seen that as the music is unwound from the spool it will not track perfectly—*i. e.*, the perforations therein will not register exactly with the apertures in the tracker. 55 It also frequently happens that different makers cut their sheets of paper to different widths, so that different lengths of spools are required. To obviate these difficulties and to provide a spool which is good for all conditions of weather and for different widths of 60 paper, I have provided the compensating spool illustrated in Fig. 7, in which the central or core portion 70 may be of any suitable or usual shape or material and has at 65 its ends journal-pins 700. The flanges of the spool are made adjustable lengthwise there-

of, and, as illustrated, the ends of the core of the spool are screw-threaded, and the flanges have screw-threaded engagement therewith. Each end of the spool will preferably have a 70 ferrule or ring 71, of some suitable metal, having a screw-threaded exterior, and the flange 72, which will preferably be a concavo-convex, as illustrated, will be provided with the screw-threaded socket 73, which 75 screws onto the ferrule 71.

Whenever the width of the paper varies from any cause, it will be obvious that the distance between the flanges 72 may be adjusted to compensate for variation in the 80 width of the paper.

While I have illustrated my device as adapted for a pneumatic piano-player, yet it will be obvious that many parts or features of the same can be used in connection with 85 automatic organ-playing devices or automatic organs, such as æolians. It will be obvious also that various changes may be made in the structure of my device without in any way departing from the spirit of my inven- 90 tion as expressed in the appended claims.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an automatic piano-player, a series of 95 fingers adapted to operate the keys of the piano, and automatic finger-operating mechanism, each of said fingers having integral therewith a yieldable projection carrying a hammer, and an adjusting device in the end 100 of each finger constructed to adjust the said projection relative to the finger.

2. In an automatic piano-player, a series of fingers adapted to operate the keys of the piano, and automatic finger-operating mech- 105 anism, each of said fingers being divided at the hammer end, a hammer secured directly to one part of each of said fingers, and means to adjust that portion of the finger to which the hammer is attached relative to the body 110 of the finger.

3. In an automatic piano-player, a series of fingers adapted to operate the keys of the piano, and automatic finger-operating mechanism, the hammer ends of each of said fin- 115 gers being forked, a hammer secured directly to one arm of the fork, and an adjusting-screw in the other arm thereof and engaging the first-named arm, whereby the hammer may be adjusted vertically relatively to the 120 finger.

4. In an automatic piano-player, a series of fingers adapted to operate the keys of a piano, and automatic finger-operating mechanism, the hammer end of each finger being forked, 125 one arm of said fork having a hammer secured directly thereto, and an adjusting-screw in the other arm of the fork and engaging the first-named arm, whereby each hammer may be adjusted vertically relatively to its sup- 130 porting-finger.

5. In an automatic piano-player, a series of

fingers to operate the piano-keys, a hinged carrier to which said fingers are pivoted, means to positively turn said carrier about its pivot to raise all of the fingers bodily from the piano-keys, said means comprising an actuating-lever pivoted to a fixed support, and having a cam-slot eccentric to the pivot of the lever, and a stud on the carrier engaging said slot, the turning of the lever about its pivot operating to positively turn said carrier about its axis.

6. In an automatic piano-player, a series of fingers to operate the piano-keys, a hinged carrier to which said fingers are pivoted, means to positively turn said carrier about its pivot to raise all of the fingers bodily from the piano-keys, said means comprising an actuating-lever pivoted to a fixed support, and having a cam-slot eccentric to the pivot of the lever, and a stud on the carrier engaging said slot, said slot having a locking-recess at one end into which the stud enters, the construction being such that the turning of the lever about its pivot operates to positively turn said carrier about its axis, the said stud when the carrier is in its operative position entering the locking-recess to lock the carrier in such position.

7. In an automatic piano-player, a series of fingers to operate the piano-keys, a hinged carrier to which said fingers are pivoted, a lever having an inclined slot therein and pivoted to a fixed support, and a stud on the carrier engaging the slot, whereby the carrier may be turned to raise the hammer end of all the fingers from the keys simultaneously, said slot operating to lock the carrier in its operative position.

8. In an automatic piano-player, a series of fingers to operate the piano-keys, a hinged carrier to which said fingers are pivoted, and means to positively turn said carrier about its pivot to raise all of the fingers bodily from the piano-keys, said means comprising an actuating-lever pivoted to a fixed support and having a pin-and-slot connection with the carrier, the turning of the lever about its pivot operating to positively turn the carrier in either direction.

9. A pneumatic for a pneumatic piano-player, comprising two opposed side pieces of inflexible material movable toward and from each other, and a strip of flexible material secured to the edges of each of said side pieces and extending inwardly toward the center thereof, the inner edges of said strips being secured together, and a frame-like stiffener connected to said inner edges, said stiffener being smaller than the side pieces.

10. A pneumatic for a pneumatic piano-player, comprising two opposed side pieces of inflexible material hinged together at one end, a strip of flexible material extending around each side piece and secured to the edges thereof, said strips extending inwardly from their point of attachment with the side pieces, the inner edge of one strip being secured to that

of the other strip, to make an inwardly-extending fold.

11. A pneumatic for a pneumatic piano-player, comprising two pieces of inflexible material hinged together at one end, a strip of flexible material extending around each side piece and secured to the edges thereof, said strips each being folded inwardly toward the center of the pneumatic, a part of the inwardly-extending portion of one strip being secured to that of the other strip, and an apertured stiffening-piece secured to the inward edges of said strips, said stiffening-piece being smaller than the side pieces.

12. In an apparatus of the class described, a series of pneumatics, a flat-faced support for the same, headed studs in the flat face of said support, a forked projection on one end of each pneumatic adapted to embrace one of said studs, a slotted clip on the other end of each pneumatic, to embrace the end of the support, and also a headed stud therein, whereby each pneumatic may be detached from the said support.

13. In an apparatus of the class described, a series of pneumatics, means to support the same, each of said pneumatics having at one end forked projections embracing headed studs on the supporting means, and at the other end a clip to embrace the end of the support, whereby said pneumatics may be detached from the supporting means.

14. In an apparatus of the class described, a series of pneumatics, supporting means therefor, each of said pneumatics having at one end forked projections embracing headed studs on the supports, and at the other end a slotted clip embracing a stud in the end of the support, the end of said clip being bent over the upper edge of the support.

15. A valve for a pneumatic piano-player comprising a screw-threaded stem and a valve screw-threaded thereon, said valve comprising a facing of yielding material such as felt, and a backing of some suitable stiffened material, said backing being out of contact with the valve-stem, and an intermediate layer of tough flexible material which has a screw-threaded engagement with the stem, whereby said valve may have a bodily movement transversely to the stem.

16. A valve for a pneumatic piano-player comprising a screw-threaded valve-stem, and two independent valve-sections adjustably secured thereto, said valve-sections each comprising a facing of yielding material, a backing of stiffened material, said backing having an enlarged aperture through which the stem passes, and an intermediate layer of fibrous flexible material, said intermediate layer having a screw-threaded engagement with the valve-stem, whereby said valve may have a bodily movement transversely of the stem.

17. A compensating spool for perforated music comprising a body portion having screw-threaded ends, journal-pins extended

from the ends thereof, and concavo-convex flanges or heads having screw-threaded sockets engaging said screw-threaded ends and central apertures through which said
5 journal-pins project.

18. A compensating spool for perforated music comprising a body portion having screw-threaded ends, concavo-convex flanges or heads having screw-threaded sockets to re-
10 ceive said screw-threaded ends, and means in-

dependent from the heads for supporting the spool for turning movement.

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

SAMUEL B. LOCKLIN.

Witnesses:

LOUIS C. SMITH,
GEO. H. MAXWELL.