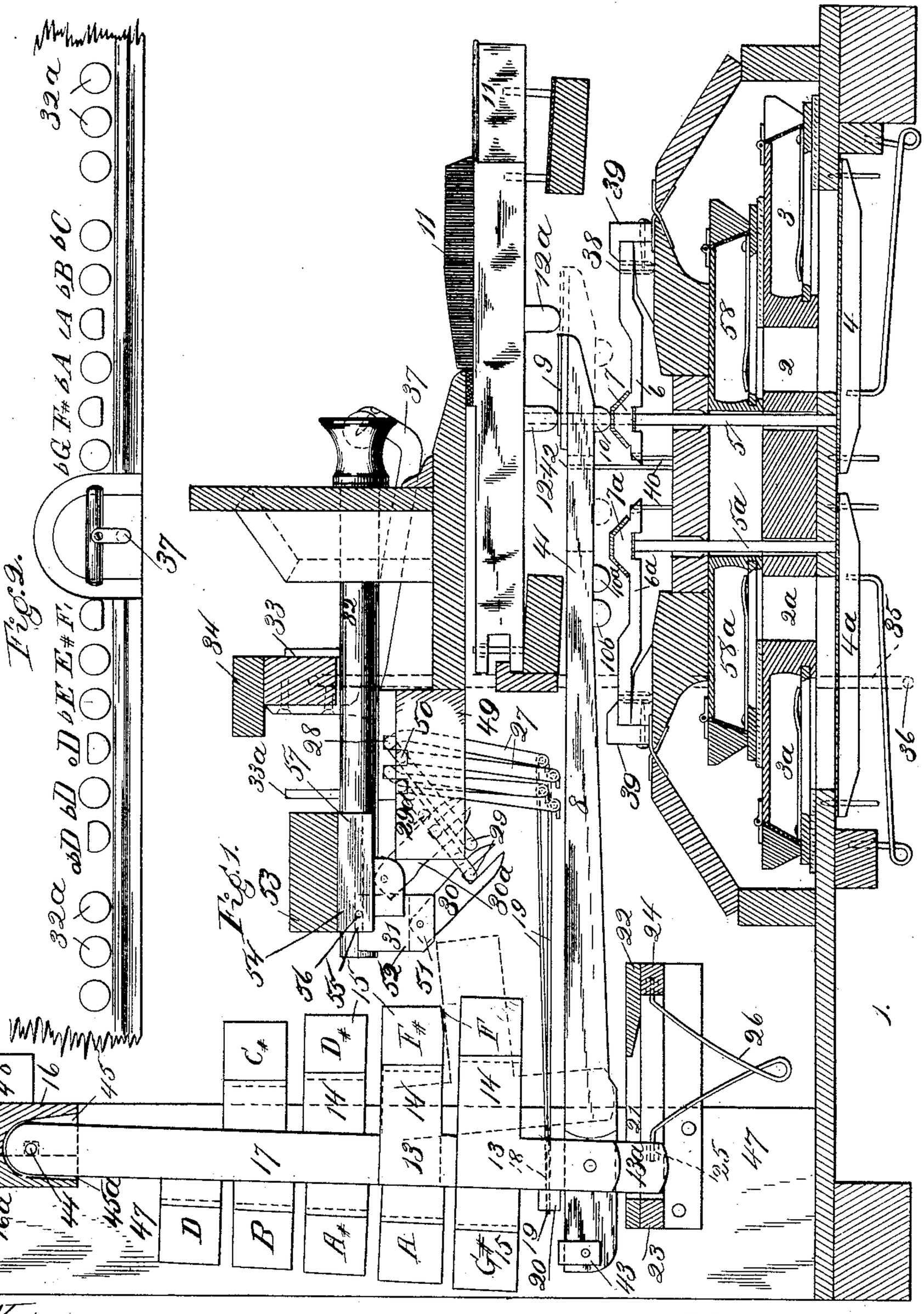
(No Model.)

4 Sheets—Sheet 1.

L. ORSER.

HARMONIC ORGAN.

No. 497,056. Patented May 9, 1893.



Witnesses:
Chas. E. Burnap
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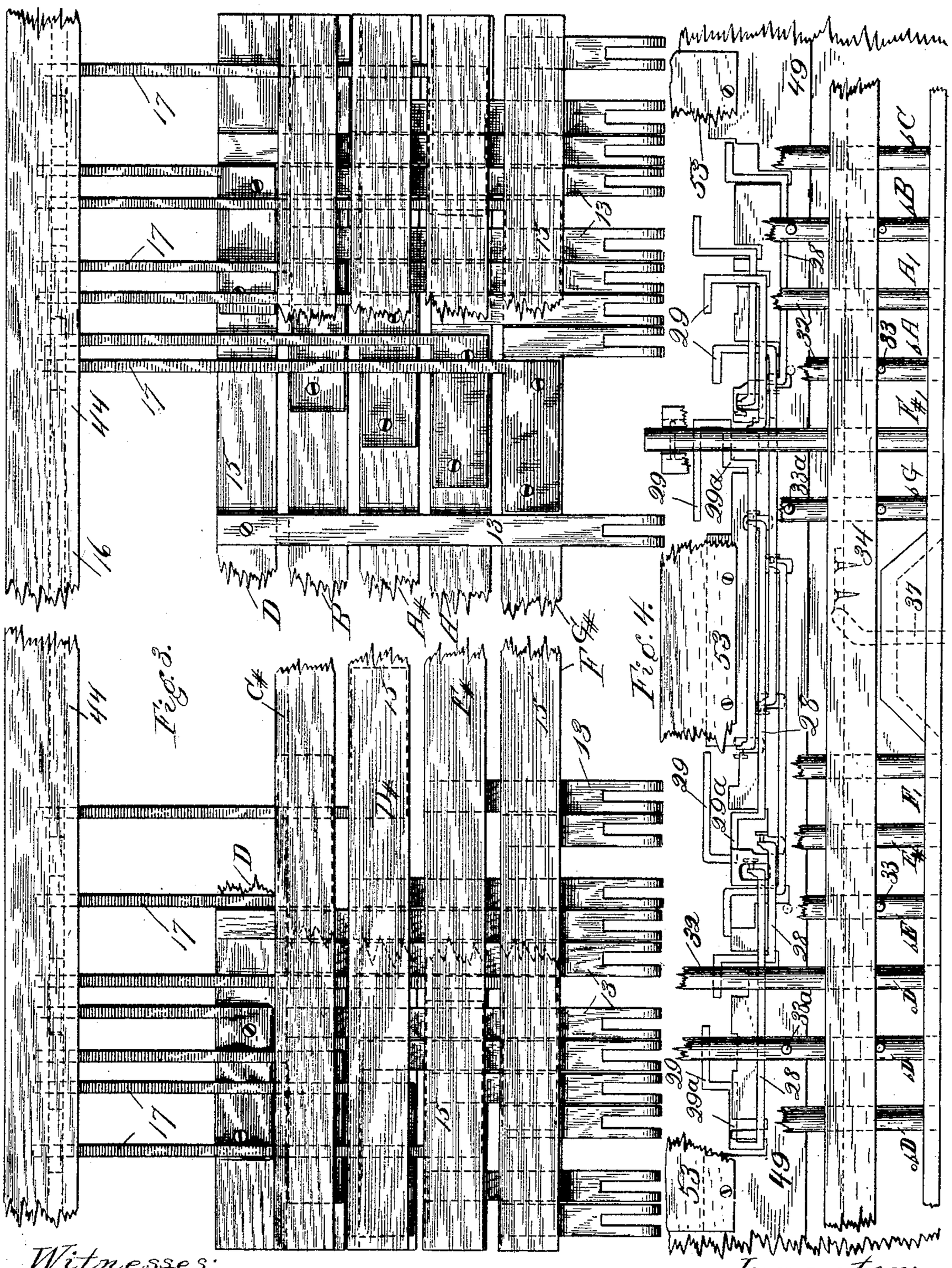
(No Model.)

4 Sheets—Sheet 2.

L. ORSER.

HARMONIC ORGAN.

No. 497,056. Patented May 9, 1893.



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(No Model.) 4 Sheets—Sheet 3.

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HARMONIC ORGAN.

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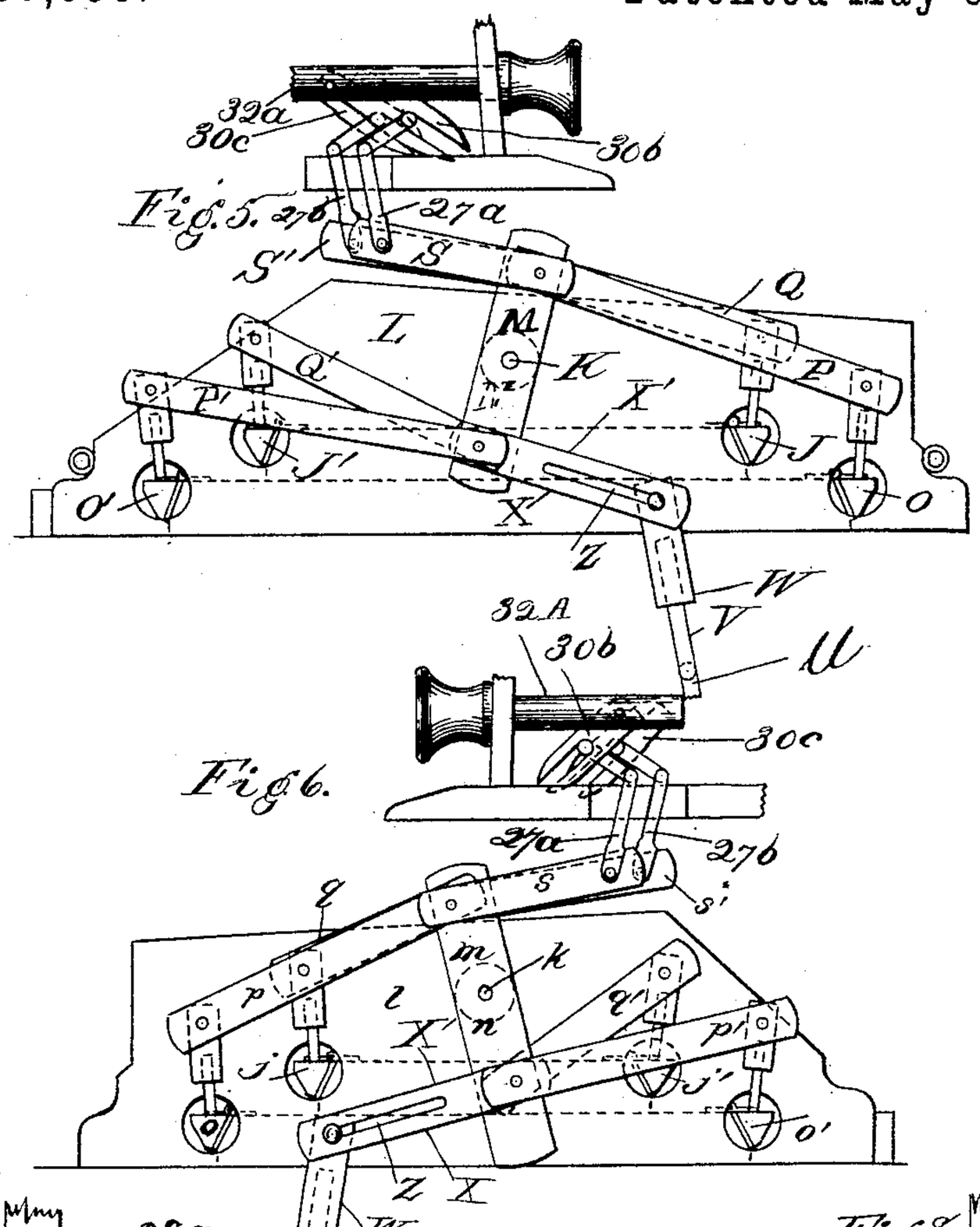

Fig. 5.

Fig. 6.

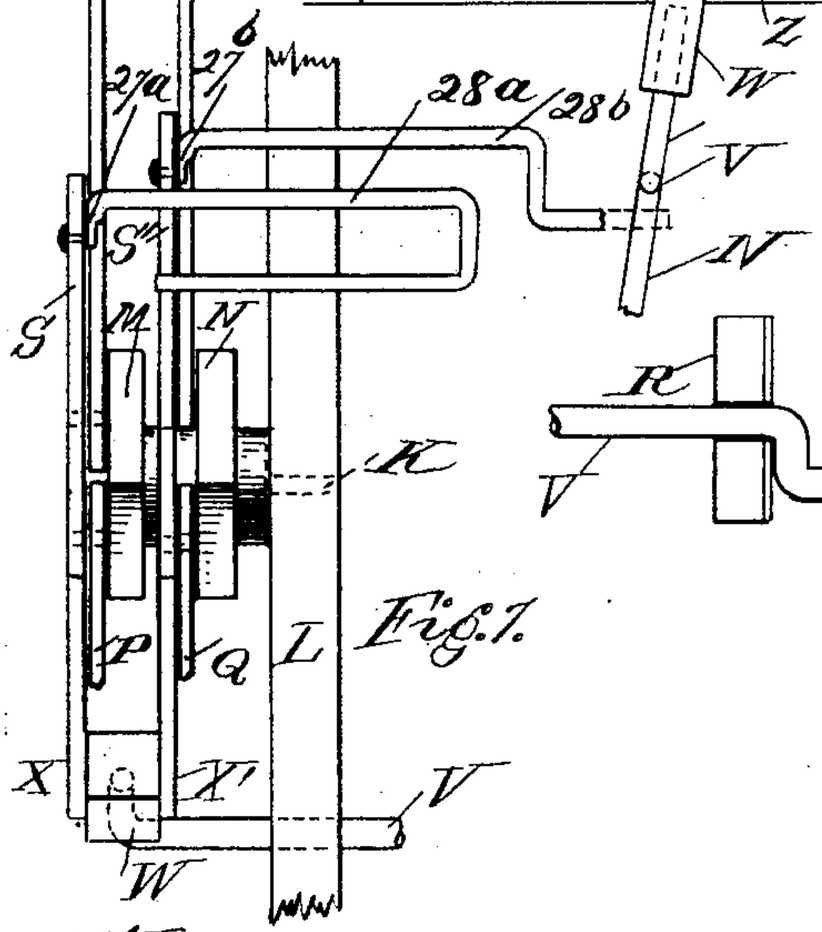

Fig. 7.

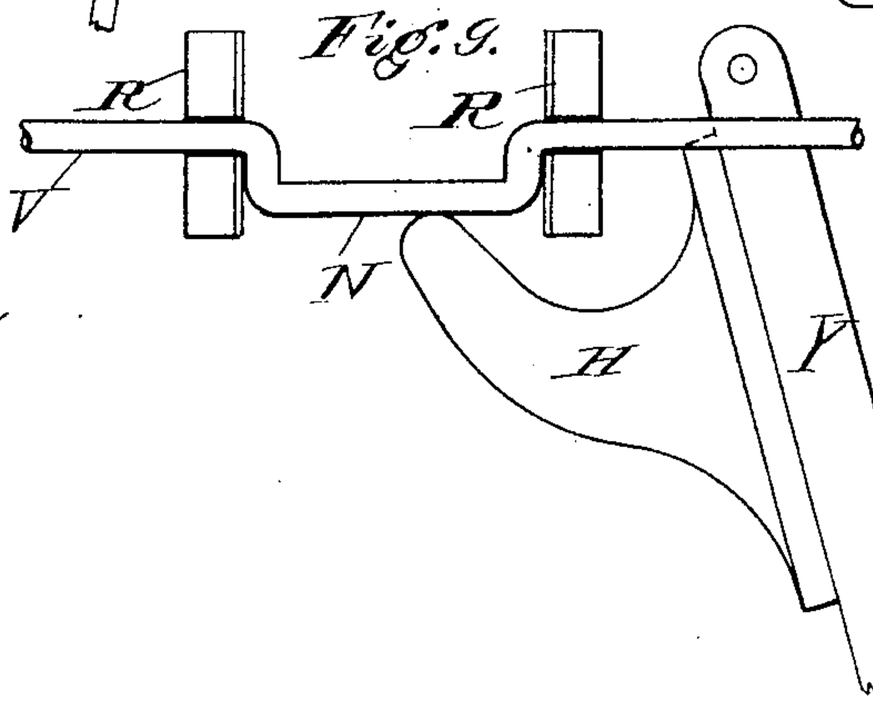

Fig. 9.

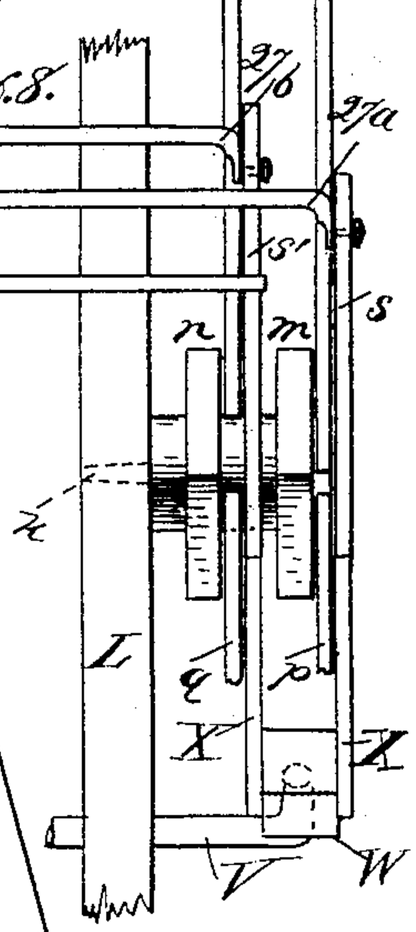

Fig. 8.

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4 Sheets—Sheet 4.

L. ORSER.

HARMONIC ORGAN.

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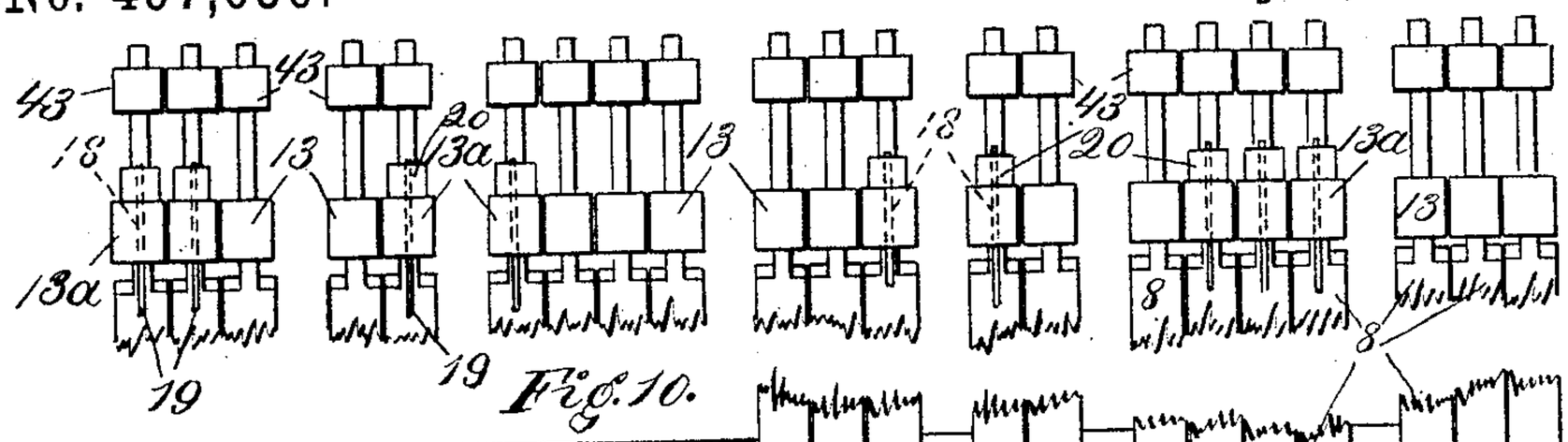
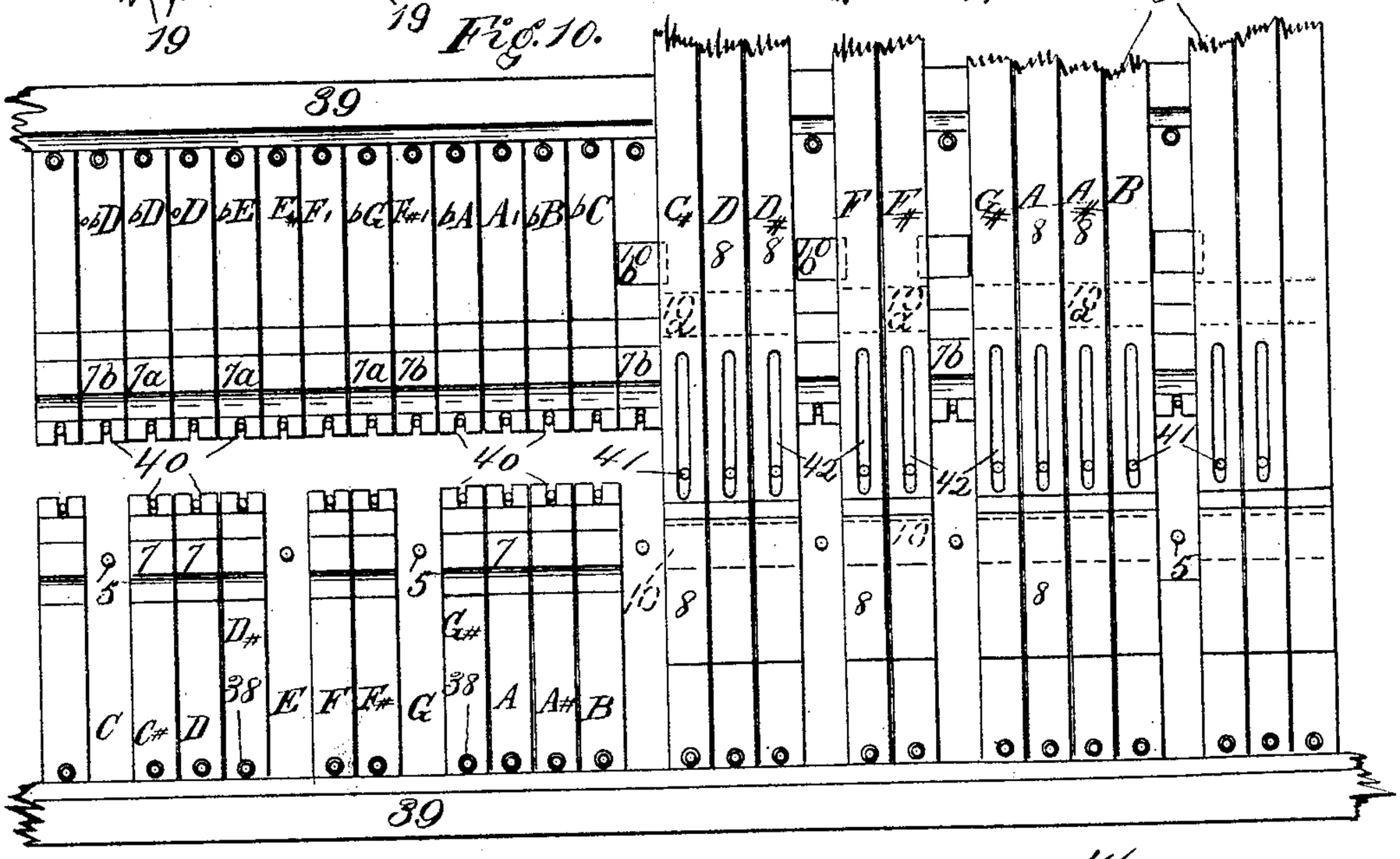


Fig. 10.



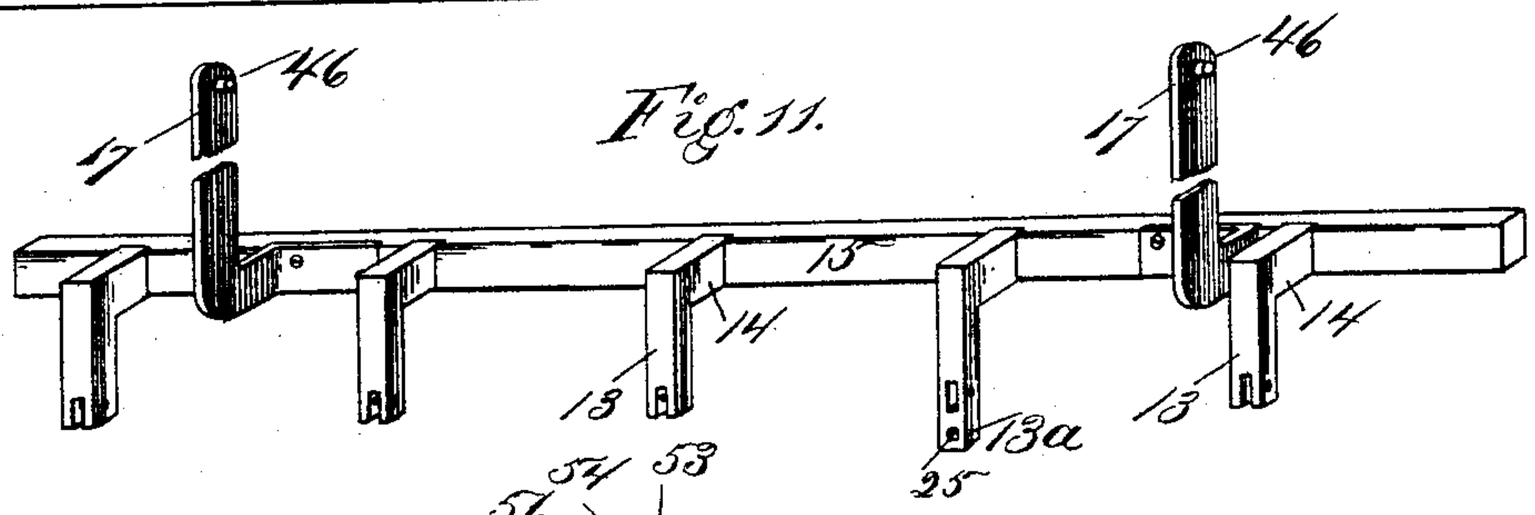


Fig. 11.

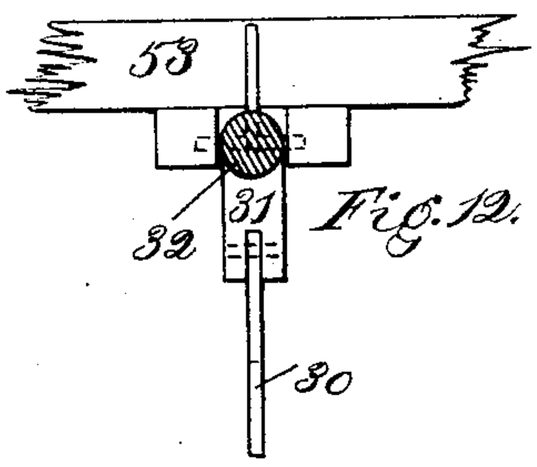


Fig. 12.

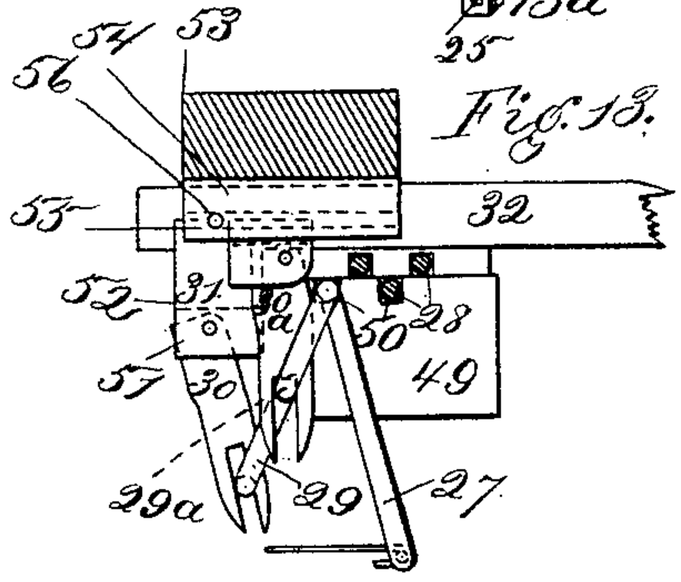


Fig. 13.

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Inventor:
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UNITED STATES PATENT OFFICE.

LEVI ORSER, OF GALVESTON, TEXAS.

HARMONIC ORGAN.

SPECIFICATION forming part of Letters Patent No. 497,056, dated May 9, 1893.

Application filed April 23, 1892. Serial No. 430,438. (No model.)

To all whom it may concern:

Be it known that I, LEVI ORSER, a citizen of the United States, and a resident of Galveston, county of Galveston, State of Texas, have invented a new and useful Improvement in Organs, of which this is a specification.

The organs now in use have only twelve notes to the octave and consequently cannot render a single interval of any scale correctly; that is, cannot play a single note in tune. The seven white keys of the key board which should play the seven tones of the natural diatonic scale do not play either of these tones correctly except the first and the five raised or black notes each of which nominally serves for the sharp of the tone below or the flat of the tone above them are actually neither the one nor the other.

The object of this invention is to provide the instrument with a sufficient number of tones, so that all the tones may be tuned correctly and to provide simple means whereby the performer may cause either of the keys to sound the several tones which it has at different times to represent so that by the use of a simple stop action, the performer plays the true tones where he has hitherto played only substitutes for them, without making any change in the key board or the manner of playing.

In the present instance, the invention is shown as adapted to an organ with twenty-four keys to each octave, each of which is provided with an independent valve. All the tones in the key board except those corresponding to the first, third and fifth, operate upon the switches which in turn operate upon one or another of tones according to the position of the switches. The switches are pivoted to racks; each rack carries a switch for the corresponding tone in each octave, so that by merely changing the position of the rack the corresponding tone is changed throughout the whole instrument, the racks being operated by stop actions. By means of a harmonic switch, the five stops corresponding to the five raised or black keys of the key board are simultaneously changed from sharp to flat or vice versa, at the same time leaving either of these stops free to be moved, independently.

The instrument is provided with a simple and effective mute action and grand organ action suitable to its requirements, all of which will now be fully described.

Referring to the drawings, Figure 1 is an elevation view partly in section of the action near the bass end of the instrument; Fig. 2 a front elevation of the name board showing the harmonic and mute stops. Fig. 3 is a front elevation of the racks showing the bass and treble ends with the hangers, the central portion being broken away; Fig. 4 a plan view of harmonic action with harmonic stop rods and guide board broken away showing harmonic action rods, bar and handle; Fig. 5 an elevation view of bass end of instrument showing mute action and grand organ connection; Fig. 6 a treble end view of same; Fig. 7 a plan view of mute action, bass end, showing mute action, rods and grand organ connection; Fig. 8 a treble end view of same; Fig. 9 a plan view of knee swell connection; Fig. 10 a plan view of switches, part of the switches being broken away so as to show a plan view of the tracker pin levers; Fig. 11, a perspective view of one of the racks with part of the hangers broken away; Fig. 12 a front elevation of one of the harmonic stop rods showing part of guide board cleats, guide pin and forked lever; Fig. 13, a side elevation of harmonic action rod with harmonic stop rods drawn out showing the auxiliary forked lever in its vertical position while holding corresponding rack in its forward position.

The wind chest is shown at 1, Fig. 1; reed board at 2; 2^a front half of the sets of reeds 3 and 58; rear half 3^a and 58^a; valves 4, 4^a; tracker pins, 5, 5^a; tracker pin levers 6, 6^a; having shoulders 7, 7^a and 7^b; switches 8 with rest 9; bearings 10, 10^a and 10^b; keys 11; bearings 12 and 12^a.

The switches 8 are pivoted at their rear ends to racks consisting of vertical studs 13, having shoulders 14, by which they are attached to horizontal bar 15 (Fig. 3). These horizontal bars are pivoted to a support 16 by hangers 17, being thereby free to swing back and forth. The horizontal bars carry a vertical stud 13 for each octave in the instrument (see Fig. 11). One of the vertical studs 13^a of each of the racks has a hole 18. Through

this hole passes a connecting rod 19, having a thread cut upon it to which a wooden nut 20 is screwed. The vertical studs 13ª to which the connecting rods are attached as shown, extend below the switches passing through openings 21 made for them in the rest board 22 on the under side of which are cleats 23 and 24. Near the end of the studs 13ª are holes 25 made to receive one end of the springs 26. The other ends of the springs project into holes made for them in the cleat 24. These springs operate to force the studs 13ª back against the cleat 23, thus holding the rods back to their furthermost limit. The forward ends of the connecting rods 19 are bent hook-shaped so as to engage with the shanks 27 of the action rods 28. These action rods are made similar to those now in common use consisting of a longitudinal part 28 with a shank 27 on one end and a crank 29 on the other, (Fig. 4,) except that the cranks 29 turn downward as shown at Figs. 1 and 4. The cranks 29 are operated by forked lever 30 pivoted in shoulders 31 of the stop rods 32.

The harmonic mechanism will now be described. By the plan view of the switches (Fig. 10) it will be seen that there are no switches for the first, third and fifth notes of the scale. Consequently the tracker pins of these tones extend up to and are operated upon by their corresponding keys in the usual way. There is a switch for each of the other keys or nine switches to the octave. Referring to Fig. 1, it will be seen that if one of these keys be pressed down, the bearing 12 will press down the switch 8 and the bearing 10 of the switch will press down the tracker pin lever 6. If the chromatic scale be now played, it is obvious that the front sets of reeds will all be sounded the keys acting on the first, third and fifth tones direct and on the others through the switches 8. If a stop rod 32 be now drawn out it will operate to move the crank downward and forward Figs. 11 and 13 which by means of the shank 27 and connecting rod 19 will draw the corresponding rack forward. The effect of this will be to move all the switches carried by the rack forward into the position shown by the dotted lines (Fig. 1). If the corresponding key be now pressed down, the bearing 12ª will operate upon the switch causing the bearing 10ª to act upon the tracker pin lever 6ª. If the corresponding stop rods be drawn out so as to move all the switches forward, it is obvious that the keys will now operate through the switches playing all the tones 3ª (or rear half of the set) except the tones opposite the first, third and fifth in the front half of the set. These three tones are played as follows: The three switches C sharp, F and F sharp are provided with auxiliary bearings (10ᵇ Figs. 1 and 10). The action rods 28 which operate the three racks C sharp, F and F sharp are provided with two cranks 29 and 29ª (Figs. 1, 4, and 13). The cranks 29ª are just half the length of the cranks 29; therefore when these cranks are operated by the forked lever 30ª, they move the action rod and its corresponding rack double the usual distance, the effect of which is to move these series of switches into position as shown by dotted lines (Fig. 1). If the keys C sharp, F and F sharp be now pressed down, the auxiliary bearings 10ᵇ of the corresponding switches will act upon the tracker pin levers 7ᵇ. Thus by drawing the proper stop rods, the performer may play any of the twenty-four tones which he may require at any time. In changing from sharp to flat or vice versa the five stops corresponding to the five raised or black keys of the key board must all be changed at once. For this purpose, these five stop rods 32 are provided with pins 33 and 33ª. A harmonic bar 34 extends transversely across the instrument having downward projecting arms 35 pivoted at 36 (Figs. 1 and 4), the harmonic bar 34 being thereby held in position over the stop rods and being free to move back or forth. A handle extends through the name board, by which the bar is moved. When the handle 37 is pulled out the bar strikes the pins 33 and draws all the stops out which are provided with the pins. When the handle is pressed back, the bar strikes against the pins 33ª and pushes all the stops back. The distance between the pins 33 and 33ª is sufficient to allow either of the stops to be moved independently.

The mute action will now be described:— Of the twenty-four reeds or sounds which constitute each set, twelve are located in the front part 2 of the reed board and are covered by valves 4 and twelve are located opposite to them in the rear part of the key board and are covered by valves 4ª. The instrument may be provided with as many sets of reeds or tones as may be desired. In the present illustration there are two sets 3, 3ª and 58, 58ª (Fig. 1). The mutes covering the front and rear halves of a set of reeds must be raised simultaneously. For this purpose a pivot screw K (Fig. 5) is set into the end block L, in a central position with reference to the several mutes which are to be lifted. Mounted loosely upon this pivot are pivoted levers M and N (Figs. 6, 7, and 8). The upper end of the lever M is attached to the mute O by connecting rod P and the lower end to the mute O′, by connecting rod P′. In like manner, the lever N is attached to mutes J and J′ by connecting rods Q and Q′. The upper end of the lever M is attached to the shank 27ª by the connecting rod S and that of N to the shank 27ᴮ by the connecting rod S′. By the action of the forked lever 30ᵇ on the action rod 28ᴬ, the shank 27ᴮ is forced back operating through the lever M and its connections to open the mutes O and O′. In like manner the forked lever *c* on the action rod 28ᵇ operates through the lever N and its

connections, to open the mutes J and J′. A similar action at the treble end of the instrument opens the corresponding treble mutes. (See Fig. 6.) To produce the grand organ effect, all these mutes, bass and treble must be lifted at once. For this purpose, a rod V fastened by cleats to the under side of the foundation board extends transversely from the bass to the treble end of the instrument. The ends of the rod V are bent upward and have blocks W, *w* fastened on them. The block W at the base end is attached to the lower end of the two levers M and N by connecting rods X and X′ and the block *w* at the treble end is connected to the two levers *m* and *n* by the connecting rods *x* and *x′*. The rod V is bent downward to form a crank U. The knee swell Y has a bearing H adapted to engage with the crank *u* of the rod V. When the knee swell is pushed to the left, the bearing H forces the crank U backward which turns the rod V causing the blocks W, *w* to move forward (Fig. 9) and these through their connections with the levers M and N at the bass and *m* and *n* at the treble (Figs. 5, 6, 7 and 8) operate to open all the mutes, both bass and treble simultaneously. Slots Z, *z* in the connecting rods X, X′ and *x*, *x′*, allow these rods to move independently when not acted upon by the blocks W, *w*.

The tracker pin levers 6, 6ª (Figs. 1 and 10) are pivoted on pins 38. The rails 39 and pins 40 serve to hold them in position. A slot 41 in the switches in connection with guide pins 42 serves to hold the forward ends of the switches in position. When the switches are moved forward, the rests 9 pass clear of the bearings 12 and engage with the bearings 12ª of the keys 11. By this means the switch acts a little more so as to press the rear tracker pin levers down as much as they do those in the front (6). The rear ends of the switches extend back a little farther than the vertical studs 13 and to this projection, a counterpoise 43 is attached heavy enough to balance the weight of the switch so as to equalize the action. The support 16 consists of a longitudinal bar of wood in which there is a groove 44 cut through the whole length of the piece; gouges 45 are cut transversely into the bar to admit the hangers 17, the pivots 46 of which rest in the groove 44. A strip 16ª having gouges 45ª cut in it corresponding to the gouges 45 is fastened by screws to the support 16. Thus the hangers are held firmly in their places by pivots 46, the gouges 45 and 45ᴬ being deep enough to allow the supports to swing back and forth (Figs. 1 and 11). The support 16 is held in position by posts 47 attached to the ends of the wind chest 1 and also by rests 48 which are attached to the case (Fig. 1). The arrangement of the action rods 28 on the action board 49 is shown at Figs. 1 and 4. Grooves 50 are cut in the board in which part of the action rods 28 are laid, the others being laid on top of the board and all are held in place by cleats in the usual way. The action rods 28 are so arranged as to allow the stop rods 32 to stand in the order of the pitch, from the lowest to the highest of the notes which they represent, Fig. 4.

The forked levers 30 have a heel 51 adapted to strike the rest 52, when by the action of the rods 32 the forked lever is brought into its vertical position Figs. 1 and 13. By this construction the forked lever holds the crank 27 firmly in position. At 53 (Fig. 1) is shown the guide board having cleats 54 on its under side in which are grooves 55. Passing through the stop rods 32 are guide pins 56, the ends of which project into the grooves 55 and slide back and forth therein, thus serving to hold the stop rods 32 in proper position (Figs. 12 and 13). Buffet blocks 57 fitted in the grooves 55 limit the forward motion of the stop rods 32.

Directions for tuning the instrument: The instrument is provided with twenty-four tones to the octave consisting of the following:—First, the seven tones of the natural diatonic scale (here called primary tones); second, sharps of all but the seventh and flats of all but the fourth (here called secondary tones); third, tones flatter than the flat second, and second, and tones sharper than the fourth, fourth sharp, and sixth. The above five tones are here called auxiliary tones and are indicated by writing an "o" before or an "l" after the sign used to indicate the tone to which they are related. These twenty-four tones are here called the harmonic scale. The vibration numbers of one octave of the tones of the scale are here given beginning with middle "C." C, 264; C♯, 275; oD♭, 281.6; D♭, 285.12; oD, 293.33; D, 297; D♯, 309.375; E♭, 316.8; E, 330; E♯, 343.75; F, 352; Fl, 356.4; F♯, 366.66; F♯l, 371.25; G♭, 380.16; G, 396; G♯, 412.5; A♭, 422.4; A, 440; Al, 445.5; A♯, 458.33; B♭, 475.2; B, 495; C♭, 506.88.

As shown at Fig. 10, the arrangements of the tones are as follows: Front part of the set—C, C♯, D, D♯, E, F, F♯, G, G♯, A, A♯, B. Rear part of the set—o♭D, ♭D, oD, ♭E, E♯, Fl, ♭G, F♯l, ♭A, Al, ♭B, ♭C.

If the tuner is provided with a set of twenty-four forks giving the number of vibrations per second as shown above, it is only necessary to tune the octave of tones beginning with middle C in unison with the forks and the other octaves from that. If the tuner is not provided with a set of forks, the instrument should be tuned as follows:—The seven primary and twelve secondary tones should all be tuned perfect and the five auxiliary tones as follows:—Tune the o♭D to make a perfect fourth for the key of ♭A major. It will also be a perfect sixth for F and fourth for ♭A minor; oD to make a perfect sixth for F major. It will also be a perfect fourth for A major; sixth for F♯ and fourth for A minor; Fl, to make a perfect third for ♭D major. It

will also be a perfect second for ♭E seventh for ♭G fifth for ♭B major and second for ♭E fifth for ♭B third for D and seventh for G minor; F1, to make a perfect third for D major. It will also make a perfect second for E, seventh for G fifth for B major and third for D♯, fifth for B second for E and seventh for G♯, minor; A1, to make a perfect fifth for D major. It will also be a perfect seventh for ♭B, second for G major and fifth for D, second for G and seventh for B, minor.

Thus turned, the instrument will render all the intervals of the following scales perfect: C, G, A, E, ♭E, ♭A major, and A, E, C♯, G, C, ♭E minor, C, ♭E, E, G, ♭A, and A major; A, G, C♯, ♭E, E, and G minor, and the intervals of all the other scales with but a few slight discrepancies. Indeed so close is the approximation as to amount practically to perfect intonation in all the key-major and minor. Directions to perform upon the instrument: When the harmonic stop is pushed back, the raised or black keys play C sharp, D sharp, F sharp, G sharp, A sharp. When E sharp is wanted draw the E sharp stop and it will be switched onto the F key. When the harmonic stop is drawn out, the black keys play ♭D, ♭E, ♭G, ♭A, ♭B. When ♭C is wanted, pull the ♭C stop and it will be switched onto the B key. The following table shows in what keys the auxiliary tones are to be used in playing in those keys. The corresponding stop or stops should be drawn out when the auxiliary tone will be switched onto the keys of the tones to which they are related:

Major keys.	Auxiliary stops.	Minor keys.
	oD	A
G	A1	
"	F♯1	E
D	F♯1	B
"	A1	"
A	oD	F♯
E	F♯1	
B	F♯1	G♯
	F♯1	D♯
C♯ F♯	E♯	A♯D♯

Major keys.	Auxiliary stops.	Minor keys.
F	oD F1	D
	A1	"
♭B	F1	G
"	A1	"
♭E	F1	
♭A	o♭D	F
♭D	F1	♭B
♭G	F1	♭E
	o♭D	♭A
♭C ♭G	♭C	♭E♭A

Caution. The E sharp, C♭ and auxiliary stops must always be kept pushed back except when their respective tones are wanted. For accidental notes no rule is here given. The musical ear is a sure guide sounding the tone and its auxiliary; the ear will at once decide which is wanted.

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

1. A harmonic organ having the ordinary stationary key board consisting of twelve keys to each octave and being provided with twenty-four more or less notes or sounds to each octave or more notes than there are keys in the key board levers 6, for each of the notes having shoulders 7 and being pivoted on pins 38 and held in position by guide pins 40 and rails 39, to operate in connection with switches 8, to counteract the lateral thrust of said switches when moving back and forth and to transmit the vertical motion of said switches to the sound producing mechanism by any suitable connections.

2. In a harmonic organ, having more notes than there are keys in the key board, switches 8 having rests 9 and bearings 10, 10^a and 10^b, slot 41 and guide pin 42 and counterpoise 43 and being pivoted at their rear ends, the bearings 10, 10^a and 10^B, being adapted to act upon one or another of the levers 6 according to the position in which the switches are held, and in connection therewith, bearings 12, 12^a, on the under side of the keys 11, so arranged as that one or the other will engage with the rest 9 of the switch 8, substantially as described.

3. In a harmonic organ having more notes than there are keys in the key board, racks, consisting of vertical studs 13 attached by shoulders 14 to longitudinal bars 15 which are pivoted to support 16 by hangers 17, each of the studs 13 having one of the switches 8 pivoted to its lower end and being so proportioned in distance from one to the other, as to carry a switch for the corresponding note of each octave throughout the instrument, substantially as described; and in connection with the foregoing rest board 22, springs 26 connecting rod 19, downward projecting cranks 29, shoulders 31, with rest 52, heel 51 of forked lever 30 to move the racks forward and hold them in that position substantially as described; and in connection therewith, action board 49, with grooves 50 and the arrangement of the action rods 28 thereon, so that the stop rods 32 may stand in the order of the pitch from the lowest to the highest of the notes which they represent substantially as described.

4. In a harmonic organ having more notes