

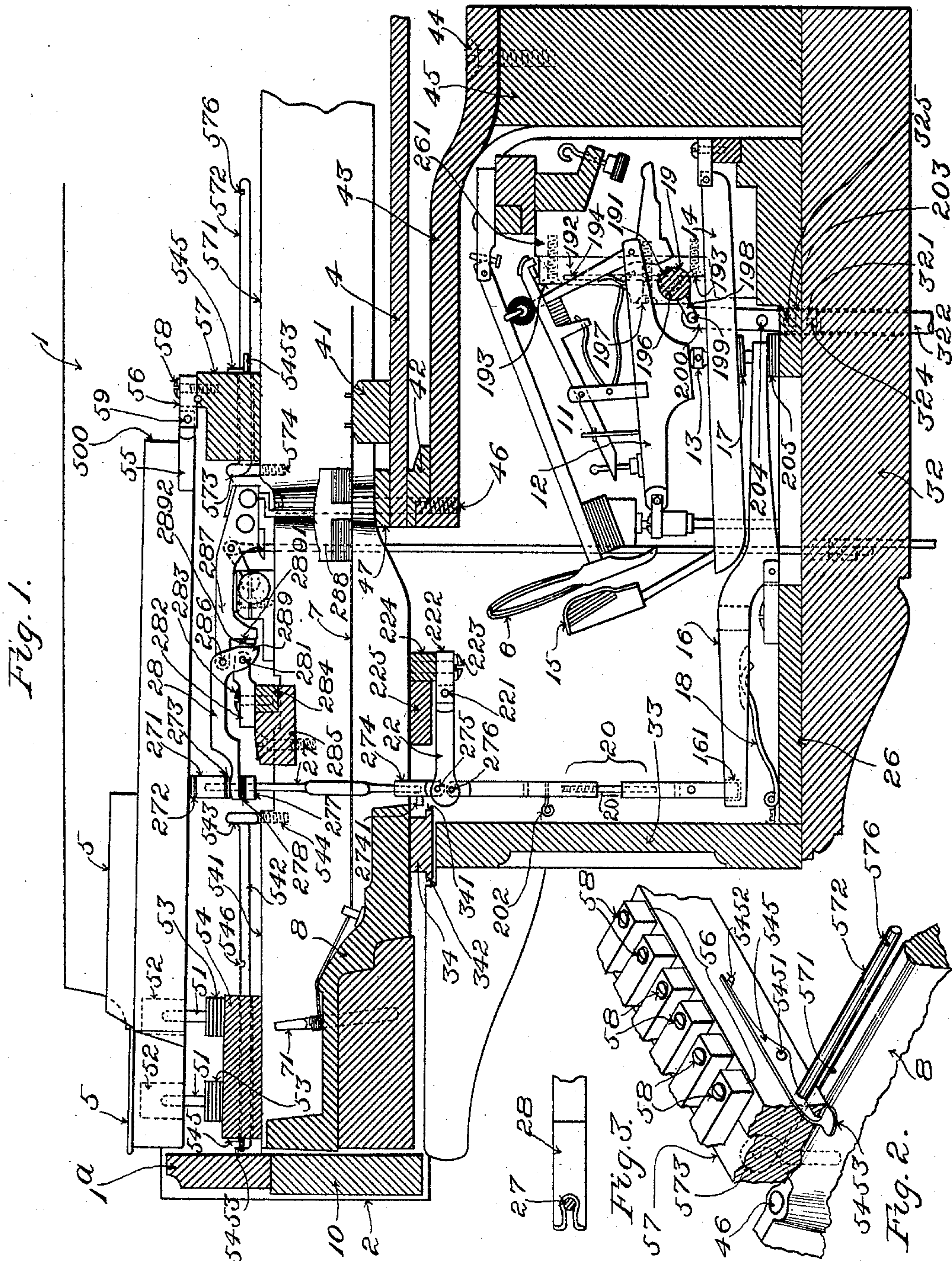
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R. S. BOWEN.
PIANO.

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NO MODEL.



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UNITED STATES PATENT OFFICE.

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PIANO.

SPECIFICATION forming part of Letters Patent No. 775,262, dated November 15, 1904.

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To all whom it may concern:

Be it known that I, ROBERT S. BOWEN, a citizen of the United States, residing at Boston, in the county of Suffolk, State of Massachusetts, have invented a certain new and useful Improvement in Pianos, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention has relation to horizontal pianos, and more especially to pianos of the type in which the keys are located above the strings and the action below the latter, with wires or the like extending down between the strings for the transmission of movement to the action proper. Some of the features thereof, however, are capable of being employed in other pianos.

The invention comprises improved means for transmitting movement from the keys to the action proper; also, an improved combination of parts intended to hold the transmitting connections in position facilitating the withdrawal of the action-frame from the piano-case and the replacement of the said action-frame; also, a novel combination embracing the soft stop; also, a novel combination embracing the belly-bar.

A convenient embodiment of the various features of the invention is represented in the accompanying drawings, in which latter—

Figure 1 is a sectional view, on a vertical plane extending from front to rear, of a piano containing the said embodiment of the invention. Fig. 2 is a view in detail showing portion of the plate, portion of the back key-rail, one of the steadying and guiding rods, and one of the locking devices on the key-rail for engagement with the said rods. Fig. 3 is a detail view showing in plan the free extremity of the upper radius-arm.

Having reference to the drawings, the case in general of the body of a piano is indicated at 1, one of the cheeks thereof being indicated at 2. Two of the keys are shown at 5 5, Fig. 1, a hammer at 6, the strings at 7, a tuning-pin at 71, and the plate at 8. The main parts of the piano, so far as the same are shown in the drawings, are disposed and arranged in a manner intended to reduce the

size of the piano to the utmost limit, as in my application for United States Letters Patent filed August 9, 1902, Serial No. 118,980. Thus, as in the said application, the front edge of the plate 8 is located close to the front of the case, bringing the said edge near the front panel 10. The keys 5 5 are located above the plate 8, and for the purpose of reducing the height of the piano the action is arranged below the plate and strings, the keys above said plate being joined operatively with the said action by means of motion-transmitting connections extending through the spaces between the strings. The action also is set back somewhat from the front of the case, as indicated clearly in Fig. 1, in order to leave a recess below the front portion of the plate 8 and corresponding portion of the case sufficient to admit the knees of the person who plays upon the instrument or to receive a mechanical or automatic player of one of the kinds at present in use. So far as the parts of the action which are more immediately adjacent the hammer are concerned they may be of any improved character. I have shown in Fig. 1 an arrangement which in essential respects is the same as that which is at present in extensive use and needs, therefore, no description herein. The jack, collectively, is designated 11 in the said figure, the jack-bed, forming part thereof, being designated 12 for convenience in referring to the same. The jack-bed 12 is engaged by the capstan-screw 13, carried by the lever 14, the said lever carrying the back-catch 15 and being termed by me the "back-catch lever." The back-catch lever 14 is actuated through the lever 16, which from its general function of causing the jack to be lifted I call the "jack-lifting lever," the rearwardly-projecting arm of the said lever 16 being provided with the button 17, which makes contact with the back-catch lever.

Having reference now to the keys 5 5 and the parts which are immediately adjacent the same, at 51 51 are shown the pins extending upward from the front key-rail, which last is located beneath the front ends of the said keys, the upper portions of the said pins being received in the slots or chambers 52 52,

which are formed in the under side of the keys, as indicated in dotted lines in Fig. 1. At 53 53 are shown the puncheons or disks of felt which cushion the downstroke of the keys.

5 The front key-rail 54, on which the said pins and puncheons or disks are mounted, is supported by the plate 8. The keys are shown mounted in a manner which facilitates turning the same backward to uncover the parts

10 below the same and afford free access to such parts. Thus each of the keys 55 has secured to its rear end, at the under side thereof, a small flange 55. One end of the said flange projects rearwardly beyond the end of the

15 key and enters between forwardly-extending lugs of a flange 56, mounted upon the back key-rail 57, the flange 56 being attached to the said key-rail 57 by means of a screw 58. The flange 55 is connected with the said lugs of

20 the flange 56 by means of a pivot, as 59. This mode of mounting the keys enables them to be swung upwardly and rearwardly upon their pivots 59 until the parts which are located below the keys and more or less covered there-

25 by are exposed and rendered accessible. The keys may be turned back until the center of gravity has been passed, after which they will remain naturally in their elevated and rearward positions. The latter may be determined

30 by contact of the shoulder at 500 on the rear end of each key with the top of the flange 56.

In order, further, to facilitate access to the parts below the keys and key-rails, the key-rails 54 and 57 are mounted with capacity for

35 movement in a direction from front to rear between the cheeks 2. The respective key-rails are supported by the surfaces 571 and 541 of the plate 8, upon which surfaces they rest. For the purpose of steadying and guid-

40 ing the key-rails 57 54 they are fitted to rods 572 and 542, respectively. In connection with each key-rail a series of the said rods is employed, the respective series extending from side to side of the piano. The main portion

45 of each rod extends horizontally, and each of the said key-rails is bored transversely and fitted upon the horizontal portions of the corresponding rods. The rods 572 serve to prevent the back key-rail from tilting under the

50 stresses which are communicated thereto when the keys are struck and depressed in playing the piano.

For the purpose of holding the respective key-rails 54 and 57 in firm contact with the

55 supporting-surfaces 541 and 571 of the plate, so as to prevent the production of noise by the vibration of the parts and also of causing the said key-rails to be held from undesired transverse movement upon the said surfaces

60 by their frictional engagement with the latter when not otherwise locked or held from such movement, the rods 542 and 572 are arranged to be forced by spring-pressure toward the surfaces 541 571, so as to press the under sides

65 of the key-rails 54 and 57 against the said sur-

faces. The spring-pressure may be variously produced and applied; but preferably it is produced and applied by forming each rod with an attaching portion, whereby it is connected with the plate, and arranging so that

70 in use a portion of the rod shall be placed under tension by its engagement with the key-rail, this tension tending to carry the key-rail 54 or 57 into contact with the corresponding surface 541 or 571. In the present case

75 each rod 542 and 572, at the extremity thereof, is bent at right angles to its length and then is formed into a partially-closed loop 543 or 573, the said eye or loop having a depending screw-threaded stem 544 or 574, which is

80 driven into a screw-threaded hole that is tapped in the plate 8. The height of the holes through the key-rails above the bottom surfaces of said key-rails is such that when the key-rails 54 and 57 are caused to rest upon

85 the surfaces 541 and 571 and are fitted upon the horizontal portions of the rods 542 and 572 the said portions of the rods are thereby raised sufficiently from their normal positions to slightly strain the rods at the loops 543 573,

90 thereby bringing the elastic power of the material of the rods at such loops into play. For the purpose of locking the key-rails 54 and 57 positively in place against movement

95 longitudinally of the horizontal portions of the rods 542 572 after having been placed in the desired position suitable locking devices are employed. A convenient form of locking device is illustrated in the drawings, (see

100 more particularly Fig. 2,) it comprising a movable plate or strip, as 545, mounted upon the key-rail by means of a pivot 5451, each of the rods 542 and 572 being notched, as at 546

105 576, to receive the edge of the said locking plate or strip. Each locking plate or strip is movable upon its pivot 5451 on the corresponding key-rail to enable it to move into one of the notches of the rod upon which said key-rail moves, so as to lock the key-rail in a

110 given position, or to be raised from the said notch, so as to render the key-rail movable. The tail of the locking device is reduced in thickness to render it yielding and bears upon the pin 5452. When the engaging end

115 of the locking device rests upon the upper surface of the corresponding steadying and guiding rod, the tail thereof is flexed, and thereby placed in a state of tension, so that when the locking device comes in line with

120 a notch in said rod the said engaging end springs into the notch. A thumb-lug is provided upon the locking device at 5453 for convenience in operating the locking device. Each rod is provided with a notch in posi-

125 tion to be engaged by the locking device of the corresponding key-rail when the latter is in its normal or operative position and with a second notch upon another portion of the rod for the purpose of receiving the locking device when the key-rail has been shifted out of

130

its normal or operative position for the purpose of permitting access to parts below which are covered or more or less concealed by the key-rail in its normal position—as, for instance, in order to permit tuning to be effected. Preferably one end of each of the rods 542 and 572 is left straight and unattached in order to enable the key-rails 54 and 57 to be applied to the rods at such ends or removed thereat. This enables the back key-rail 57 to be removed and again applied whenever required after the overlying parts of the piano have been removed. So, also, the front key-rail 54 may be withdrawn or restored to place after the key-strip 1^a has been removed.

For the transmission of movement from a key 5 to the corresponding jack-lifting lever 16 I utilize a wire 27, a post 20, adjustable as to its length, and radius-arms 28 and 22. To the upper end of the wire 27 is applied a head or button 271, which is furnished with a puncheon or disk 272, of felt or the like, making contact with the under side of the key. The said head or button is rectangular in cross-section in order to get greater extent of bearing within the widths of the key in case the wire should have to be located to one side of the key. The wire is held in vertical position and guided in its movements by means of the radius-arms 28 and 22. The stem of the wire adjacent the said head or button 271 passes through a hole in the free extremity of the radius-arm 28, the puncheon or disk 273, of felt, intervening between the said head and the upper side of the said end of the radius-arm 28. For greater convenience in applying the wire 27 and radius-arm to each other and in separating and again connecting the same after the various parts have been assembled—as, for instance, when it is required to adjust or tighten up the support of the radius-arm 28—the said hole is formed as an open slot extending inward at the end of the radius-arm, the outer portion of said slot being slightly contracted in width, as indicated in Fig. 3, in order that as the wire is passed transversely inward the sides of the slot may be forced slightly apart and may then approach each other sufficiently after the wire has reached the inner and slightly-enlarged portion of the slot to retain the wire in such portion. To the lower end of the wire 27 is applied the foot 274, which is pivotally connected, as at 275, with the free extremity of the radius-arm 22. The upper extremity of the post 20 is pivotally connected, as at 276, with the radius-arm 22, while the lower extremity of the said post is received in a socket 161, which is formed in the forward arm of the jack-lifting lever 16. The radius-arm 28 is pivoted, as at 281, to the flange 282, which last is secured, as by a screw 283, to the iron bar 284, resting in a rabbet of the wooden cross-bar 285, connected with the plate. To the radius-arm 28 is pivotally connected, as at 286, the damper-carrying arm

287. 288 is the damper, which is connected with the said arm. The radius-arm 28 and damper-carrying arm 287 are furnished with opposing shoulders 289 and 2891, a puncheon or disk of felt 2892 being applied to the shoulder 2891. Through the engagement of these shoulders the damper is operated to raise the same from the string on the depression of the key. In order that after the release of the key and after the damper has again seated itself upon the string a sufficient separation may be occasioned between the shoulders 289 and 2891 to produce a certain amount of lost motion between the said shoulders, a collar 277 is secured upon the wire 27 immediately below the extremity of the radius-arm 28, a puncheon or disk of felt 278 intervening between the radius-arm 28 and collar 277. As the key after being released is caused to rise by the ascent of the transmitting connections which is occasioned by the action of the spring 18 under the jack-lifting lever 16, the collar 277 lifts the radius-arm sufficiently to separate the shoulders 289 and 2891 somewhat, as shown, after the damper has come to rest against the string. The lost motion between the shoulders aforesaid enables the depression of the key to be begun without the resistance which is incident to lifting the damper, rendering the touch lighter, the shoulders making contact with each other after the key has descended part way, when the resistance due to lifting the damper will not be felt. The radius-arm 22 is pivoted, as at 221, to the flange 222, which is secured by screw 223 to the iron bar 224, carried by the wooden cross-bar 225, connected with the plate 8. The wire 27 at an intermediate point in its length passes between the strings 7. In those cases in which a key does not lie fairly vertically above the space between strings through which the corresponding wire 27 passes the upper portion of the wire is bent laterally to the extent which may be required in order to place the head or button 271 at its upper end in proper position beneath the said key. In order that the wire 27 may have the requisite stiffness to prevent it, notwithstanding the bend or inclination of the upper part thereof, from springing or becoming further bent by reason of the pressure that is applied to the same by the key when the said key is struck in playing, I form the said wire of a large gage, and in order to enable the same to fit and work between the strings without contact with the strings during the vibrations of the latter I flatten the wire for a sufficient portion of its length to clear the strings when vibrating in all of the usual positions of the wire. By the selection of wire of the proper gage I am enabled to flatten the portion of the same which works between the strings, as just described, and at the same time secure strength and stiffness sufficient to obviate all tendency of the wire to spring or give way even in the

flattened portion of the same. The upper and lower ends of the wire 27 are screw-threaded and are received in screw-threaded holes, which are tapped in the head 271 and foot 274, respectively. The adjustable post 20 is composed of upper and lower sections and an intermediate connecting portion 201, the said connecting portion consisting of a section of wire, one end of which is secured in the lower section, the upper end of said wire being screw-threaded and fitting a screw-threaded hole which is tapped in the lower end of the upper section. Rotation of the said connecting lower portion, so as to screw the wire into or out of the upper section, enables the post to be lengthened or shortened as required in practice.

The action-frame, comprising, essentially, the bottom 26 and cheeks or standards 261, rests upon the action-bed 32 and is introduced into position or withdrawn by sliding it horizontally upon the said action-bed. 33 is a removable panel which is introduced at the front of the space containing the action-frame after the latter has been placed in position and which is removed when it is desired to withdraw the action-frame. The pivotal connection of the posts 20 with the radius-arms 22 and the loose stepping of the lower ends of the said posts in the sockets 161 in the forward arms of the jack-lifting levers 16 facilitates the insertion and removal of the action-frame and action carried thereby. These features of construction enable the lower ends of the posts to be disengaged from the jack-lifting levers 16 by a slight relative vertical movement of the parts sufficient to separate the lower ends of the posts from the sockets of the jack-lifting levers, after which the posts may be swung about the pivots at 276 into a horizontal position in which they will be out of the path of the action and the supports therefor, which are carried by the action-frame, as the latter is withdrawn or re-introduced. For the purpose of facilitating the withdrawal and reintroduction, as aforesaid, means is provided for preventing the wires and their connections after the disengagement of the posts from the jack-lifting lever from descending into the way of the parts which are being removed or inserted. This means consists, mainly, of a horizontally-movable bar, as 34. The said bar 34, which may be termed a "locking-bar," is furnished with a rearwardly-projecting lip 341, which in the normal position of the bar is sufficiently removed from the various parts of the transmitting connections to permit free movement of the latter to take place. When the locking-bar 34 is pushed rearwardly, however, the said lip passes under suitable portions of the transmitting connections—for example, under lugs 2741, projecting forwardly from the feet 274, which are connected with the wires 27. The said locking-bar in this posi-

tion will act to prevent the said wires 27 and connected parts from descending below their normal positions when the posts 20 are disengaged from the jack-lifting levers 16 and deprived of the support vertically ordinarily afforded by the said levers. In addition to providing, as aforesaid, for locking the upper portions of the transmitting connections prior to disengagement of the posts from the jack-lifting levers in order to prevent the same from descending after such disengagement has occurred I provide means for holding the said posts in an upturned or substantially horizontal position during the operations of withdrawing and reintroducing the action-frame. This result may be secured in various ways. I have illustrated one way, it consisting in providing the upper member or section of each post with a yielding catch consisting of an elastic pin 202, projecting forwardly from the said upper member or section, the said pin being constituted of a piece of wire having one end driven or seated in the said upper member or section, the outer or free extremity of the wire being formed with a head or engaging portion which is produced by bending the said extremity to form an eye or loop, the said eye or loop being situated in a vertical plane when the pin is applied to the post. The locking-bar 34 being in its locking position movement of the posts forwardly and upwardly around their pivots 276 will cause the latching-pins 202 to be carried up in front of the front edge 342 of the locking-bar 34. In the rise of the posts the heads of the pins 202 will strike against the front edge 342 of the locking-bar 34 and be deflected forwardly thereby. After the heads have passed the said edge the pins will spring backward, causing the heads thereof to catch over the top of the said edge 342, thereby latching the posts in upturned position out of the way of the action and action-frame in being moved horizontally into and out of working position. To improve the hold of the heads of the latching-pins 202 with the edge 342, the latter may be made slightly beveled, as shown, to form an acute-angled edge.

The soft stop (shown at 19) comprises a roll, as shown, having the body thereof disposed eccentrically with relation to its journals 191. The bearings for the said journals are provided in flanges 192, each of the said flanges comprising a block which is attached by screws 193 193 to the front edge of one of the cheeks 261. The said block is formed with a slit or slot 194, extending into the same from its lower end nearly to the upper end thereof, the bearing for the corresponding journal of the soft stop being provided in the proximate faces of the portions which are separated by the said slit or slot, as shown, the said bearing being bushed, as at 196. At 197 is a screw by means of which the two sides of the bearing are drawn together to secure the desired fit upon the jour-

nal. The soft stop may be operated through any suitable train of connections; but it is necessary that the said train should be capable of ready disengagement, so as to facilitate the withdrawal of the action and action-frame, and should admit of ready and convenient re-connection after the action-frame has been restored to its working position. In the present instance I have shown the roll 19 provided with an arm 198, to which arm is pivotally connected at 199 the depending link 200. The lower end of this link enters a hole 203, that is made vertically through the bottom 26 of the action-frame. A pin 204, projecting laterally from the link 200, limits the descent of the said link, and thereby determines the retracted position of the soft stop by making contact with the upper surface of the felt stop 205 on the bottom portion of the action-frame. The stop 205 and pin 204 prevent the lower end of the link from projecting below the bottom 26 of the action-frame. Hence said link does not interfere with the movement of the action-frame into and out of place. A hole 321 is formed vertically through the action-bed 32. The hole 203 in the bottom of the action-frame registers with the said hole 321 through the action-bed when the action-frame is in its proper working position. A rod or plunger 322 is fitted to this hole 321 in the action-bed and has suitable operating connections by means of which it may be moved vertically. When said rod or plunger is caused to rise, the upper end of the same engages the lower end of the depending link 200 and by raising the latter turns the soft-stop roll 19, so as to raise the jack-beds 12 more or less, and thereby vary the extent of the stroke of the hammers as desired. In order that the link 200 may not become disconnected from the upper end of the rod or plunger 322 in the higher positions of the parts, as in consequence of the curvilinear movement of the upper end of the link 200 following the path of pivot 199, and in order that by preventing such disconnection the lower end of the link 200 may always be caused to descend within the hole 203 in the bottom of the action-bed, a separable pin-and-socket joint is formed on the meeting portions of the rod or plunger and link. Thus the pin 324 projects from the upper end of the rod or plunger, and a socket 325 to receive the said pin is formed in the lower end of the link.

At 4 is the sounding-board, at 41 the sounding-board bridge, at 42 the board-lining, and at 43 the belly-bar. These parts are located beneath the strings, between the strings and the action proper. The hammer rises past the front edges of the belly-bar and sounding-board to strike the strings.

The piano, which is in part illustrated in the drawings, is characterized by the facts that the bridge does not oppose the hammer-action, that the action is reversed in its posi-

tion and has its hammers turned toward the front, and that the belly-bar, together with the action, is located below the strings. One aim of the invention is to enable the hammer-pivot to be located as near as possible to the plane of the strings and yet retain the necessary strength in the construction of the piano. I therefore make the belly-bar of metal and quite thin, so that thereby the strings and hammer-pivots may be brought very close together. In order to secure the greatest strength, the belly-bar is formed as a flat web slightly curved along its rear side, so as to resemble portion of an arch. It is secured by bolts 44 at its rear edge to the transverse beam or stringer 45 and preferably along its front edge also by means of bolts 46, passing through the said edge, the board-lining, the sounding-board, and a transverse bar or strip 47 into the plate. The bar or strip 47 is placed against the under side of the plate between the latter and the sounding-board.

In restringing it may be necessary to remove the key-rails. The construction which has been described herein provides for this removal by enabling the front key-rail to be drawn forward to effect the removal thereof and the back key-rail to be moved in the other direction.

I lay no claim herein to the various features of construction, arrangement, &c., in connection with the keys and the key-rails, inasmuch as these form the subject of my divisional application filed February 26, 1903, Serial No. 145,157.

I claim as my invention—

1. In a piano, in combination, the strings, a key, an action operated therefrom, and transmitting connections comprising, essentially, a post engaging by one end with an arm pertaining to the said action, a radius-arm with which the opposite portion of said post is pivotally connected, a wire passing between the strings, having one portion thereof pivotally connected with the said radius-arm and the other portion thereof receiving the pressure of the key, and a second radius-arm having a hole therethrough within which the said wire is received, substantially as described.

2. In a piano, in combination, the strings, a key, an action operated therefrom, and transmitting connections comprising, essentially, a post engaging by one end with an arm pertaining to the said action, a radius-arm with which the other portion of said post is pivotally connected, a wire passing between the strings, having the portion thereof which works between the strings flattened to obviate contact with the strings, also having one portion thereof pivotally connected with the said radius-arm and another portion receiving the pressure of the key, and a second radius-arm having a hole therethrough within which the said wire is received, substantially as described.

3. In a piano, in combination, the strings, a key, an action operated therefrom, and transmitting connections comprising, essentially a post engaging by one end with an arm pertaining to the said action, a radius-arm with which the opposite portion of said post is pivotally connected, a wire passing between the strings, having one portion thereof pivotally connected with the said radius-arm and the other portion thereof receiving the pressure of the key, and a second radius-arm having an open-ended hole or slot within which the said wire is received, and into or from which it may be passed by lateral movement, substantially as described.

4. In a piano, in combination, the strings, the key, the action, and motion-transmitting connections intermediate the key and action including a wire operated by the key and passing between the strings, a radius-arm by which the said wire is guided at one side of the strings, and a second radius-arm by which the wire is guided at the other side of the strings, the said second radius-arm having an open-ended hole or slot within which the said wire is received, and into or from which it may be passed by lateral movement, substantially as described.

5. In a piano, in combination, the strings, the key, the action, motion-transmitting connections intermediate the key and action including a wire operated by the key and passing between the strings, a radius-arm by which the said wire is guided adjacent the key, said radius-arm working between collars or enlargements on said wire, and a damper-arm operated by said radius-arm with lost motion, substantially as described.

6. In a piano, in combination, the strings, the key, the action, motion-transmitting connections intermediate the key and action including a wire operated by the key and passing between the strings, a radius-arm by which the said wire is guided adjacent the key, said radius-arm working between collars or enlargements on said wire, and a damper-arm pivotally connected with said radius-arm and operated therefrom with lost motion, substantially as described.

7. In a piano, in combination, the strings, the key, the action, motion-transmitting connections intermediate the key and action including a wire passing between the strings, a head applied to said wire and receiving the pressure of the key, a radius-arm by which the said wire is guided in its movements, a collar on said wire between which and said head the radius-arm is received, and a damper-arm operated by said radius-arm with lost motion, substantially as described.

8. In a piano, in combination, the strings, a key, an action operated therefrom, and motion-transmitting connections between said key and action containing a transmitting-wire passing between the strings and having the

portion thereof which works between the strings flattened and thereby reduced in thickness to obviate contact with the strings, and larger in diameter at opposite sides of the strings, substantially as described.

9. In a piano, in combination, the strings, a key at one side of the said strings, an action at the other side of the said strings, and transmitting connections comprising essentially a wire passing between the said strings and receiving at one side of the latter the pressure derived from the key, a post operated by the said wire, located at the opposite side of the strings from the key, and engaging with an arm pertaining to the said action, a radius-arm adjacent the key by means of which the wire is guided in its movements at one side of the strings, and a second radius-arm at the opposite side of the strings by which the wire and post are controlled in their movements, substantially as described.

10. In a piano, in combination, the strings, a key at one side of the latter, an action at the other side thereof, and transmitting connections comprising a wire operated by the said key and passing between the strings, a radius-arm adjacent the key by which the said wire is guided at one side of the strings, a second radius-arm at the opposite side of the strings with which the said wire is connected, and a post pivotally connected with the said second radius-arm and engaging with an arm of the said action, substantially as described.

11. In a piano, in combination, the strings, a key at one side of the latter, the removable action-frame and action at the opposite side of the strings and motion-transmitting connections comprising a wire operated by the key and passing between the strings, guides at opposite sides of the said strings whereby the wire is controlled in its movements, and the post in pivotal connection with the said wire and adapted to be swung about the pivotal point to permit removal and replacement of the action-frame and action, substantially as described.

12. In a piano, in combination, the strings, a key at one side of the latter, the removable action-frame and action at the opposite side of the strings, motion-transmitting connections operated by the key and embracing a member passing between the strings, and a post operatively connecting with the action, the said post having pivotal connection with the adjacent member of said connections and being adapted to be swung about the pivotal point to permit removal and replacement of the action-frame and action, and means to lock said connections to prevent the same, after disengagement of the post from the action from interfering with the withdrawal and replacement of the action-frame and action, substantially as described.

13. In a piano, in combination, the strings, a key, the action, the wire passing between the

strings, the radius-bars at opposite sides of the said strings, the post pivotally connected with one of the said radius-bars, and the locking-bar to engage with a lug or projection connected with the said wire to hold the connections, after disconnection of the post from the action, from passing into position to interfere with the removal or replacement of the action, substantially as described.

10 14. In a piano, in combination, the strings, a key the removable action-frame and action, and motion-transmitting connections comprising essentially the wire passing between the strings and operated by the key, the post in
15 pivotal connection at one end with the wire and at the other engaging with an arm pertaining to the action, and means to latch said post to retain it when turned out of the way of the action-frame and action as the latter are
20 withdrawn and replaced, substantially as described.

15 15. In a piano, in combination, the strings, a key, the removable action-frame and action, a wire passing between the strings and operated by the key, a radius-arm with which the wire is connected at the opposite side of the strings from the key, a post pivotally connected with the said radius-arm and engaging with an arm pertaining to the action, the
30 locking-bar to hold the transmitting connections from passing into the path of the action-frame and action as the latter are being withdrawn and replaced, and the latching device for holding the post swung to one side out of
35 the path of the action-frame and action, substantially as described.

16. In a piano, in combination, the strings, a key, the removable action-frame and action, a wire passing between the strings and operated by the key, a radius-bar with which the wire is connected at the opposite sides of the strings from the key a post pivotally connected with the said radius-arm and engaging with an arm pertaining to the action, the
45 locking-bar to hold the transmitting connections from passing into the path of the action-frame and action as the latter are being withdrawn and replaced, and a latching device for holding the post swung to one side out of the
50 path of the action-frame and action, substantially as described.

17. In a piano, in combination, the strings, a key, the removable action-frame and action, a wire passing between the strings and operated by the key, a radius-bar with which the wire is connected at the opposite side of the strings from the key, a post pivotally connected with the said radius-arm and engaging with an arm pertaining to the action, the locking-bar to hold the transmitting connections
60 from passing into the path of the action-frame and action as the latter are being with-

drawn and replaced, and the latching-pin to engage with the said locking-bar to retain the post when swung out of the path of the action-frame and action, substantially as described. 65

18. In a piano, in combination, the case, the removable action-frame, the action carried thereby, the soft stop also carried by said action-frame, the link 200 connected with the said soft stop, and the rod or plunger, 322, fitted to a hole in the said case and adapted to engage with the said link 200 when the action-frame is in normal position in the case, substantially as described. 70 75

19. In a piano, in combination, the case, the removable action-frame, the action carried by said action-frame, the soft stop also carried by the said action-frame, the link 200 connected with the said soft stop and provided with a stop to limit its descent, and the rod or plunger, 322, working in a hole in the case and adapted to engage with the said link when the action-frame is in normal position in the case, the said plunger and link making pin-and-socket connection with each other to prevent disengagement when the rod or plunger is projected to operate the soft stop, substantially as described. 80 85 90

20. In a piano, in combination, the strings, the plate, the sounding-board and belly-bar intermediate the plate and the action, and the action having the hammer-pivots in a plane which passes vertically through the belly-bar, substantially as described. 95

21. In a piano, in combination, the strings, the plate, the sounding-board and belly-bar intermediate the plate and the action, and the action beneath said belly-bar, substantially as described. 100

22. In a piano, in combination, the strings, the plate, the sounding-board, the flat metal belly-bar below the sounding-board, and the action below said belly-bar and having the hammer-pivots beneath the belly-bar, substantially as described. 105

23. In a piano, in combination, the strings, the plate, the sounding-board, the flat metal belly-bar below the sounding-board, the action below said belly-bar and having the hammer-pivots beneath the belly-bar, the transverse beam or stringer having the rear edge of the belly-bar secured thereto, the bar between the sounding-board and the plate, and the bolts securing the front edges of the belly-bar and sounding-board, the said bar, and the plate together, substantially as described. 110 115

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT S. BOWEN.

Witnesses:

CHAS. F. RANDALL,

WILLIAM A. COPELAND.