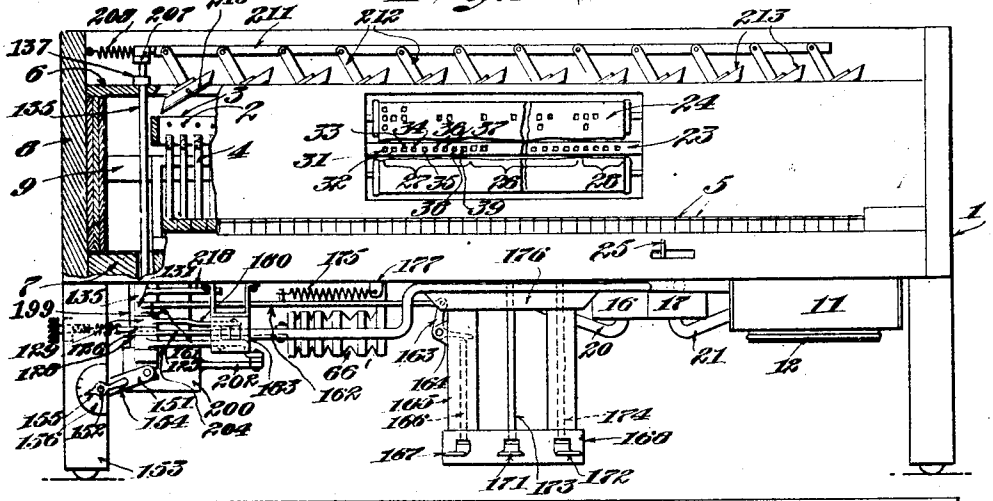
May 14, 1929. J. H. HAMMOND, JR 1,713,125

SUPPLEMENTARY SOUND CONTROL MEANS

Filed Jan. 28, 1926 4 Sheets-Sheet 1

Fig. 1



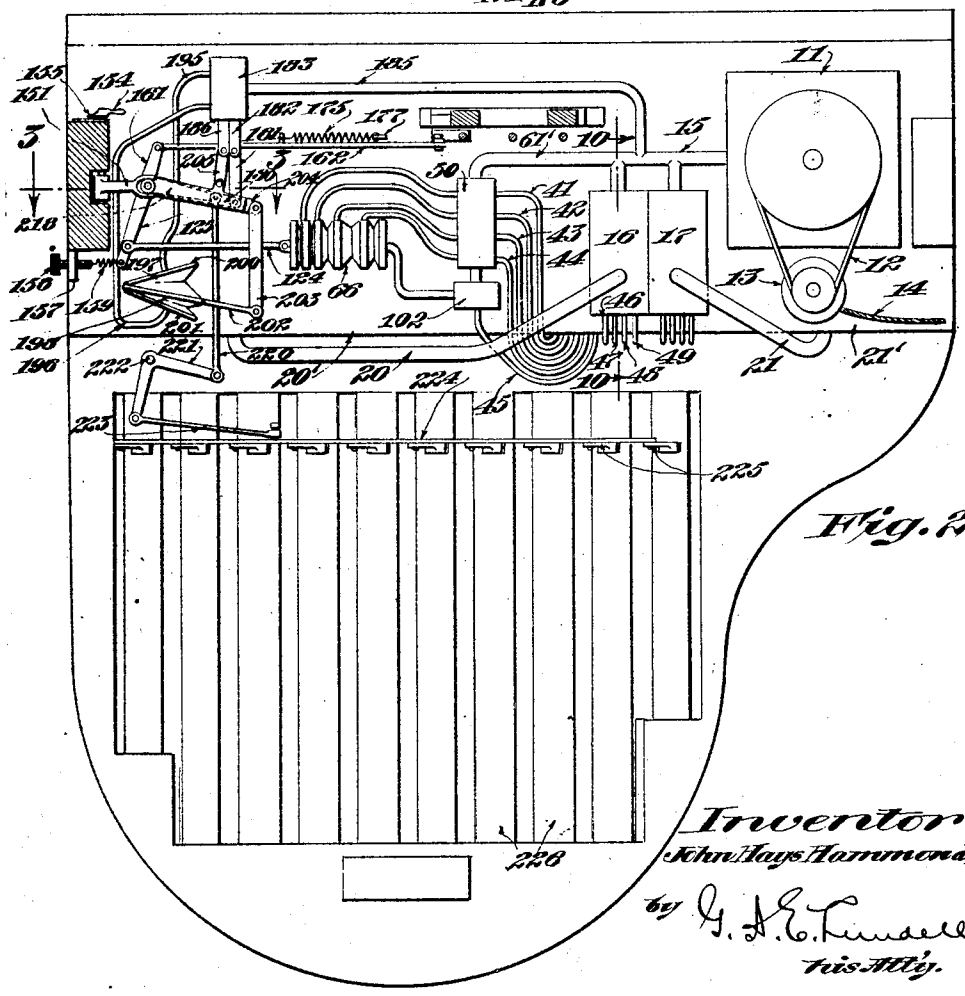


Fig. 2

Inventor
John Hays Hammond, Jr.
by G. A. E. Tindall
his Atty.

May 14, 1929. J. H. HAMMOND, JR 1,713,125

SUPPLEMENTARY SOUND CONTROL MEANS

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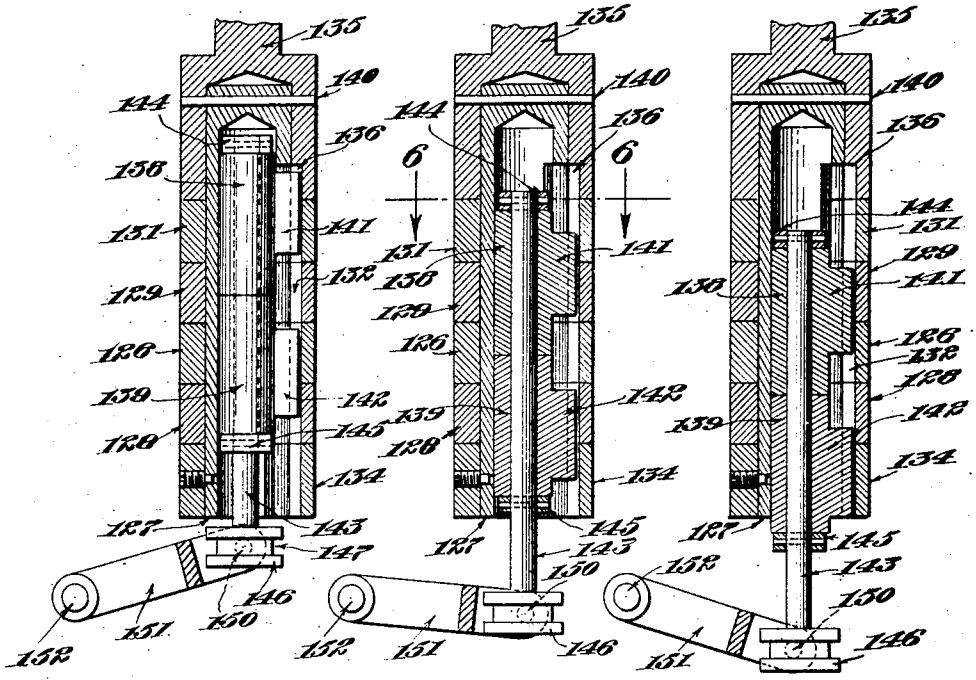

Fig. 3 Fig. 4 Fig. 5

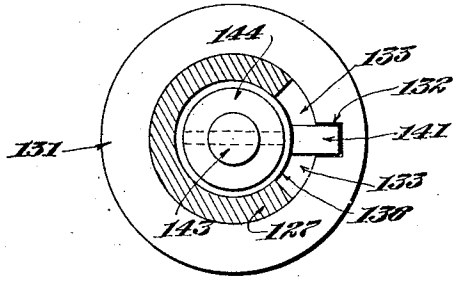

Fig. 6

Inventor
John Hays Hammond, Jr.
by G. A. E. Lundell
his Atty.

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SUPPLEMENTARY SOUND CONTROL MEANS

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Fig. 7a

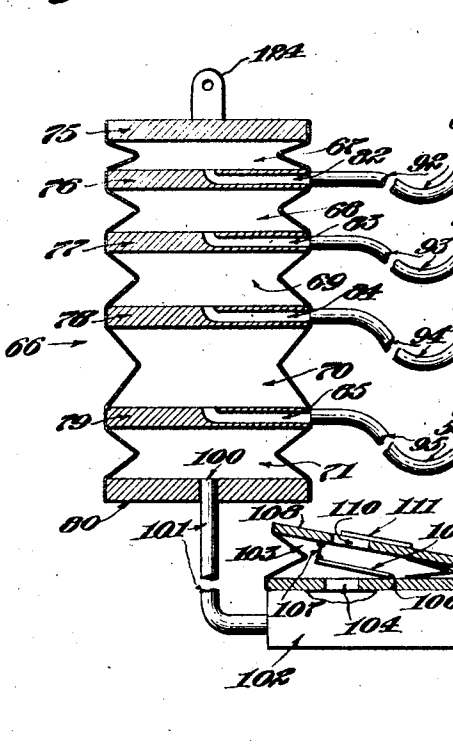


Fig. 7b

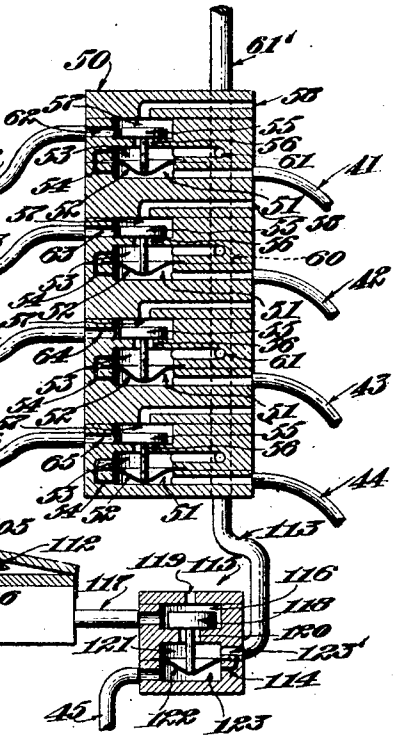


Fig. 8

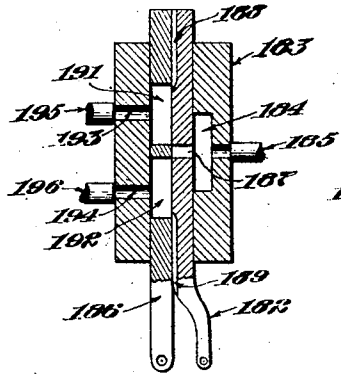
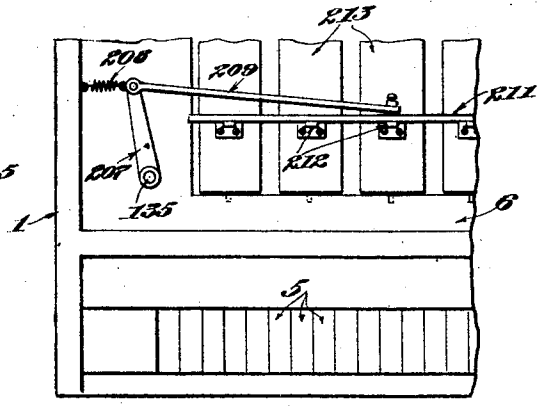


Fig. 9



Inventor
John Hays Hammond, Jr.
by G. A. E. Tunnell
his Atty.

May 14, 1929. J. H. HAMMOND, JR 1,713,125

SUPPLEMENTARY SOUND CONTROL MEANS

Filed Jan. 28, 1926 4 Sheets-Sheet 4

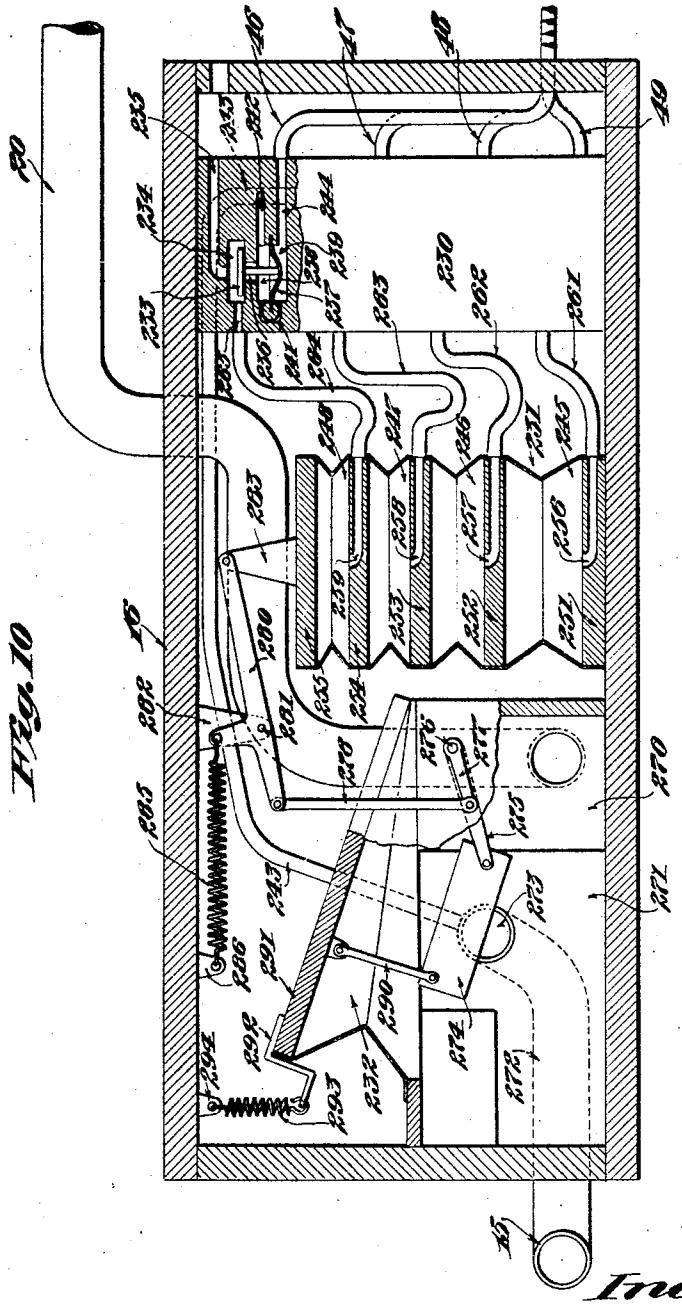


Fig. 10

Inventor
John Hays Hammond, Jr.
by G. A. G. Lundell
his Atty.

Patented May 14, 1929. 1,713,125

UNITED STATES PATENT OFFICE.

JOHN HAYS HAMMOND, JR., OF GLOUCESTER, MASSACHUSETTS.

SUPPLEMENTARY SOUND-CONTROL MEANS.

Application filed January 28, 1926. Serial No. 84,273.

This invention relates to improvements in automatic musical instruments of the piano player type.

One of the objects of this invention is to provide means in connection with an automatic musical instrument for controlling the sound emitted by this instrument by a supplementary means which is entirely independent of the modulating means of the instrument itself, and which may be controlled by additional holes in the tracker bar, directly by means of a pedal, or indirectly by a power controlled means operated by a pedal.

Another object relates to the provision of improved means for producing a tremolo effect from a musical instrument of the percussive type, and which may be automatically controlled.

Other objects will appear from the following description taken in connection with the accompanying drawings in which

Figure 1 is a front elevation partly in section of a piano constructed in accordance with this invention.

Figure 2 is a bottom plan view of the piano shown in Figure 1;

Figure 3, 4 and 5 are enlarged cross sectional views of part of the mechanism shown in Figures 1 and 2 taken on line 3—3 of Figure 2;

Figure 6 is a cross section taken on line 6—6 of Figure 4;

Figures 7^a and 7^b are diagrammatic layouts of part of the mechanism shown in Figures 1 and 2;

Figure 8 is an enlarged cross section of the valve mechanism shown in Figure 2;

Figure 9 is a top plan view of part of the mechanism shown in Figure 1;

Figure 10 is an enlarged view of the modulator 16 taken on line 10—10 of Figure 2;

Like reference characters refer to like parts in the several figures of the drawings.

In the following description and claims, parts will be identified by specific names for convenience of expression, but they are intended to be as generic in their application as the art will permit.

Referring to the accompanying drawings and particularly to Figures 1 to 10, one embodiment of this invention comprises an automatic musical instrument, in this case shown as a grand piano 1 which is provided with tuned strings 2 mounted in a frame 3. The strings are acted upon to produce damped musical sound when desired, by a piano action 4 which may be of any standard construction and which is operated by a key manual 5. The piano also includes a sound proof casing having an upper apertured wall 6, a lower wall 7, and substantially soundproof intermediate boundary walls 8 each having a layer of sound insulating material 10 as shown in Figure 1. A sounding board 9 is provided adjacent the strings, and serves not only as a reasonating element, but also to divide the interior of the casing into two separate resonating chambers. Mounted under the piano 1 is a suction pump 11, driven by means of a belt 12 from an electric motor 13. The motor 13 is connected by an electric cord 14 to any suitable source of power such as the lighting circuit of a house. The pump 11 is connected by means of a pipe 15 to two modulating means 16 and 17, which may be of any desired construction. The outlet side of the modulating means 16 is connected by a pipe 20 to the bass end of the player mechanism 20′ which in this case is divided into two separate units at approximately the middle of the register. The modulating means 17 is connected by a pipe 21 to the treble end of the player mechanism 21′.

Player mechanism 20′ and 21′ may comprise any well known form, for example, that shown in patent to Brand, No. 1,141,607 dated June 1, 1915, and in patent to Newcomer, No. 1,087,176 dated February 17, 1914.

For operating the piano automatically, there is mounted in front of the instrument a tracker bar 23. A strip of perforated paper 24 registers with the tracker bar and is moved to bring its perforations over the holes of the tracker bar successively by means of a motor mechanism of conventional type, the speed of which is controlled in any well known manner by means of a lever 25.

The tracker bar 23 is provided with three groups of holes, 26, 27 and 28; the group 26 consists of a plurality of holes which control the playing of the notes in a well known manner, one hole for each note, and which need not be more fully described herein. Illustrating types of pneumatic player mechanism are disclosed in the patents to Brand and Newcomer above mentioned. The group 27 consists of nine holes 31 to 39, which communicate with nine tubes 41 to 49 respectively, (see Figure 2). The tubes 41, 42, 43 and 44 are connected to a primary 50,

each tube being in communication with a chamber 51 provided in the primary 50 (see Figure 7b). Over each chamber 51 is a pouch 52 which separates it from a second chamber 53. The chambers 51 and 53 are connected by a small bleed hole 54. Resting upon the pouch 52 is a valve 55 the stem of which extends through an opening 56. The opening 56 connects the chamber 53 with a chamber 57 normally open to atmosphere through a vent 58. Each of the chambers 53 communicates with a longitudinal supply duct 60 by means of branch ducts 61. The duct 60 is connected by means of a tube 61' with the pipe 15, (see Figure 2). The four chambers 57 communicate with four ducts 62, 63, 64 and 65 respectively.

The primary 50 connects with a stack of pneumatics 66 which is made up of five bellows, 67, 68, 69, 70 and 71 attached to blocks 75 to 80 respectively, the last of which is rigidly secured to the framework of the piano, as shown in Figure 1. The four bellows 67, 68, 69 and 70 are so constructed that when they collapse they will move through distances which are respectively proportional to the values 1, 2, 4 and 8 approximately. The bellows chamber 71 is of intermediate size, preferably about the size of the bellows 68. The blocks 76 to 79 inclusive are provided with ducts 82 to 85 respectively, which are connected by tubes 92 to 95 to the ducts 62 to 65 respectively.

The block 80 is provided with a duct 100 in communication by way of a connecting tube 101, with a relatively small reservoir 102. Upon the top of the reservoir 102 is mounted a bellows 103 the interior of which communicates with the reservoir 102 by means of an opening 104. Pivotally mounted over the opening 104 is a valve 105 one end of which is pivoted at 106 and the other end of which is connected by means of a link 107 with the top of the bellows 108. Provided in the top 108 is an opening 110 over which is slidably secured a plate 111, which can be so adjusted that the opening 110 can be made of any desired size. A spring 112 is mounted in the bellows 103 and tends to keep it in an open position.

Mounted on the end of the reservoir 102 is a primary valve 115, which consists of a chamber 116 which communicates with the reservoir 102 by means of a tube 117. Mounted in the chamber 116 is a valve 118. The chamber 116 is provided with an atmospheric port 119 and with a circular port 120 which communicates with a chamber 121. This chamber is provided with a pouch 122 which covers a second chamber 123. The chamber 121 is connected by means of a duct 123' to a pipe 113 which is connected to the duct 60 of the primaries 50. A small bleed hold 114 connects the chambers 121 and 123. The chamber 123 is connected to the tube 45 leading from the tracker bar.

Secured to the block 75 of the pneumatic stack 66 is a rod 124 pivotally connected to an arm 125. The arm 125 is integral with a collar 126 loosely mounted upon a sleeve 127. Also loosely mounted upon this sleeve are three additional collars 128, 129 and 131, (see Figures 3, 4 and 5). The collars 126, 128, 129 and 131 are provided with aligned key-ways 132. The sleeve 127 is cut away as shown at 133 in Figure 6, and has rigidly secured to it at its lower end, a collar 134 which is also provided with a key-way similar to the key-ways 132 of the collars already described. The upper end of the sleeve 127 is rigidly connected as by a pin 140, to the bell-shaped end of a shaft 135 which is provided with a key-way 136 and which is rotatably mounted in the framework of the piano and is provided with a collar 137 (see Figure 1) to hold it in a fixed longitudinal position.

Slidably mounted inside the sleeve 127 are two hollow cylindrical members 138 and 139, each of which is provided with a key 141 and 142 respectively which slide in the key-ways 132. The bores of the members 138 and 139 are in alignment and there extends therethrough a rod 143 to which are pinned two collars 144 and 145 for maintaining the members 138 and 139 on the rod. To the lower end of the rod 143 is secured a flanged sleeve 146 having a groove 147 between its flanges. Loosely engaging the groove 147 are two pins 150 which are carried on the forked ends of a bifurcated member 151 secured at its other end to a shaft 152. The shaft 152 is journalled in a recess in the leg of the piano 153 as shown in Figure 2, for rotation in a horizontal plane. The end of the shaft 152 extends through to the front of the leg on which it is mounted, and there is secured thereto a handle 154 provided with a pointer 155 which cooperates with a dial 156 secured to the leg 153.

Mounted on the rear face of the leg 153 is a bracket 157 provided with a threaded hole through which is screwed a thumb screw 158 having attached thereto one end of a spring 159, the other end of which is connected to the arm 125.

Integral with the sleeve 131, (see Figures 3, 4 and 5) is an arm 161 (see Figures 1 and 2) to the end of which is pivoted a rod 162 the other end of which is connected to one arm of a bell crank 163 which is mounted for rotation on a bracket 164, carried by a lyre 165. The other arm of the bell crank 163 engages a rod 166, the lower end of which is connected to a pedal 167 mounted in a pedal block 168. Also mounted in this block are two other pedals 171 and 172 which are connected to two rods 173 and 174 respectively, controlling the usual sostenuto and loud pedal action of the piano.

The pedal block 168 is supported by the lyre 165 and is secured to a block 176 carried by the framework of the piano.

To the rod 162 is secured one end of a spring 175, the other end of which is fastened to a bracket 177.

Integral with the sleeve 129 (see Figures 3, 4 and 5) is an arm 180 to the end of which is pivoted a link 181 (see Figure 2). The other end is connected to a primary valve member 182 slidably mounted in a valve casing 183 (see Figure 8). This casing is provided with a port 184 communicating by means of a pipe 185 with the supply pipe 15 so that it is continually under suction. A secondary valve 186 slides in the valve casing 183. The primary valve 182 is provided with an opening 187 in communication with the port 184. It is also provided with two longitudinal grooves 188 and 189 open to atmosphere.

The secondary valve 186 is provided with two openings 191 and 192 normally in registry with two ports 193 and 194 respectively. These ports communicate with two tubes 195 and 196 which in turn communicate with two bellows 197 and 198 respectively mounted on a bracket 199. The bellows consist of two stationary bases 200 and 201 which are rigidly secured to the bracket 199 (see Figure 1), and a movable member 202 which may be moved either in one direction or the other, depending upon which bellows is deflated. The outer end of the member 202 is pivoted to a link 203 which in turn is pivoted to the end of an arm 204 which is integral with the sleeve 128. Pivoted to an intermediate portion of the arm 204 is a second link 205 the other end of which is pivoted to the secondary valve member 186.

To the upper end of the shaft 135 is rigidly secured an arm 207 (see Figure 1 and 9) to the outer end of which is fastened one end of a spring 208, the other end of which is secured to the casing of the piano 1. Pivoted to the end of the arm 207 is a link 209 which is connected to a bar 211 to which is pivoted a plurality of arms 212 each of which is rigidly secured to a modulating reflector 213. An arm 218 is provided which is integral with the shaft 135 and to the outer end of which is pivotally connected a link 220. The other end of the link 220 is pivotally connected to one arm of a bell crank lever 221 pivoted as at 222 to the lower face of the piano casing 1 (see Figure 2). The other arm of the bell crank lever 221 is connected to a link 223 and thus to a bar 224 to which is pivoted a plurality of arms such as 225 corresponding to the arms 212 of the upper group of modulating reflectors. Each of the arms 225 is rigidly secured to a reflector 226 of the lower group. Each reflector such as 213, 226 is pivotally mounted to rotate about substantially its longitudinal axis, and is provided on its inner surface with a layer of sound reflecting material, such as sheet aluminum or other sheet metal 215.

The modulating means 16 as shown in Figure 10 includes a primary valve block 230, an accordion bellows 231 and a regulator bellows 232.

The primary valve block 230 comprises four primary valve mechanisms each of which consists of a valve 233 located in a chamber 234 which communicates with the interior of the modulator by means of a duct 235. The stem of the valve 233 passes through an aperture 236 and rests upon a flexible leather pouch 237 which is located between two chambers 238 and 239. These two chambers are in communication with each other by means of a small bleed hole 241. The upper chamber 238 communicates by means of a duct 242 with a longitudinal suction supply duct 243. The lower chamber 239 of each valve communicates by means of a duct 244 with the corresponding tube 46, 47, 48 or 49, leading from corresponding holes in the tracker bar 23.

The accordion pneumatics 231 comprise four bellows 245, 246, 247 and 248 which are attached to blocks 251 to 255 respectively. The block 251 is rigidly secured to the base of the modulator 16. The four bellows 245 to 248 are so constructed that when they collapse they will move through distances which are respectively proportional to the values 8, 4, 2 and 1 approximately. The blocks 251 to 254 are provided with duct 256 to 259 which are connected by tubes 261 to 264 to ducts 265 which communicate with the chambers 234 of the primary valve mechanisms respectively.

The regulator bellows 232 consists of a box 270 in which is mounted a block 271 through which passes a duct 272 which communicates with the pipe 15. The inner end of the duct 272 opens to the interior of the box 270 through a port 273. Located adjacent to the port is a knife valve 274 one end of which is pivoted to an arm 275 rigidly secured to a shaft 276. Secured to this rotatable shaft 276 is a second arm 277 to the outer end of which is pivoted one end of a link 278. The other end of the link 278 is pivoted to a rocking lever 280 pivotally mounted at an intermediate portion as at 281 upon a fixed bracket 282. The other end of the lever 280 is pivoted to a bracket 283 which is secured to the block 255. The lever 280 is provided with an ear to which is secured one end of a spring 285 the other end of which is secured to a fixed bracket 286.

The other end of the knife valve 274 is pivoted to one end of a link 290 the other end of which is pivoted to the top 291 of the regulator bellows 232. The interior of this

bellows is in communication with the interior of the box 270. Secured to the outer end of the top 291 is a bracket 292 to which is secured one end of a spring 293 the other end of which is connected to a bracket 294 affixed to the casing of the modulator 16. The tube 243 communicates with the interior of the duct 272 and the pipe 20 communicates with the interior of the box 270.

In the operation of the form of the invention shown in Figures 1 to 10, the group of holes 26 control the playing of the notes when they are uncovered by perforations in the paper strip 24. The four holes 36 to 39 control the operation of the modulating means 16 in a manner to be more fully described.

If none of the holes 36 to 39 are uncovered, the modulating means will be in the position shown in Figure 10 and the suction in the pipe 20 will be determined by the tension of the spring 293 when the valve 274 just closes the port 273, thus if the suction in the pipe 20 drops it will also drop in the box 270 and the bellows 232, thereby allowing the spring 293 to raise the top of the bellows 291. This, by means of the link 290 raises the left hand end of the valve 274 increasing the opening of the port 273 thereby allowing more air to be sucked out of the box 270 which will reduce the pressure therein until the bellows 232 has collapsed sufficiently for the valve 274 to close the port 273. In this manner the suction in the box 270 will be held at a predetermined amount depending upon the position of the right hand end of the valve 274 and the tension of the spring 293.

If it is desired to increase the suction in the pipe 20, a perforation is provided in the paper strip 24 which registers with the hole 36, thus allowing air to enter the pipe 46 and pass through the duct 244 into the chamber 239, thus inflating the pouch 237.

The valve 233 thus closes the atmospheric duct 235 and connects the duct 265 with the chamber 238 by means of the passage 236. As the chamber 238 is constantly under suction being connected with a suction supply pipe 243 by means of the duct 242, air will be sucked out of the bellows 248, thereby collapsing this bellows which will cause the bracket 283 to be moved downwardly a distance proportional to the value 1. This causes the lever 280 to be rotated through a relatively small arc in a clockwise direction thereby rotating the arms 277 and 275 to a corresponding degree in a like direction. This lifts the right hand end of the valve 274.

When this is lifted, it will be seen that in order to close the port 273 the left hand end of the valve 274 will have to be lowered more than previously which necessitates the lowering of the top 291 a proportional amount. This causes the spring 293 to be expanded, thus increasing the force tending to open the bellows. This means that a greater degree of suction will be necessary in the box 270 and the bellows 232 in order to close the port 273. This will maintain a higher suction in the pipe 20 which operates the striking pneumatics, thus causing the notes to be struck with a slightly greater intensity than was previously maintained.

If it is desired to further increase the intensity of the suction in the pipe 20, a perforation is cut in the paper strip 24 to register with the hole 37, thus admitting air to the tube 47 which by means of the corresponding primary valve, collapses the bellows 247 in a manner similar to that described in connection with bellows 248. This causes a further rotation of the lever 280 in a clockwise direction which in turn causes the right end of the valve 274 to be still further lifted. This, in a manner similar to that already described, will cause an increased suction to be maintained in the box 270 and therefore in the pipe 20 which in turn causes the striking pneumatics to deliver a stronger blow.

As already stated, the bellows 245 to 248 when they collapse, move through distances proportional to the values 8, 4, 2 and 1 respectively. It is therefore, evident that by positioning the perforations in the paper strip 24 any one or any combination of these bellows, may be deflated, thereby moving the right hand end of the valve 274 in any one of a plurality of positions. Thus, for example, if bellows 248 is deflated the valve 274 will be moved through a distance proportional to the value 1. If the bellows 247 is also deflated, it will be moved through an additional amount proportional to the value 2, thus making the total motion proportional to the value 3. In this way, any one of fifteen positions may be obtained by collapsing the proper bellows or combination of bellows. In this way it is seen that by cutting the proper perforations in the paper strip 24, any desired force of the striking pneumatics may be obtained within the limits of the mechanism.

The corresponding holes in the group 28 control the modulating means 17 in a similar manner so as to vary the suction in the pipe 21. In this way the force with which the notes are struck may be varied at will by suitably positioning the holes in the paper strip 24.

If it is desired to still further modulate the sound produced by the piano the foot pedal 167 may be depressed, thereby elevating the rod 166 which rotates the bell crank 163 in a counter clockwise direction, thus moving the link 162 to the left which in turn rotates the arm 161 in a counter clockwise direction as seen in Figure 2.

This arm being integral with a collar 131 causes the same to be rotated in a similar direction which by means of the key 141 rotates the shaft 135, thus rotating the arm 207 in a clockwise direction as seen in Figure 9. This causes the link 209 to be moved to the right which in turn moves the bar 211 to the right thereby closing the reflectors 213. Rotation of the shaft 135 also moves the arm 218, link 220, bell crank lever 221, and moves the bar 224 to the right (Figure 2) thereby closing the lower group of reflectors 226. Thus, by moving the pedal 167 the reflectors 213 and 226 may be controlled at will by the foot power of the pianist.

If the pianist finds it difficult to operate the reflectors by foot power he can turn the handle 154 in a clockwise direction so that the pointer 155 points to the second position on the dial 156. This causes the member 151 to be rotated in a clockwise direction from the position shown in Figure 3 to that shown in Figure 4, thus moving the two cylindrical members 138 and 139 to the positions shown in this figure. This causes the key 141 to engage the keyway in the collars 131 and 129, thus locking these collars together. The key 142 then engages the key-way in the sleeves 128 and 134, thus locking these two together. As the collar 134 is rigid with the sleeve 127 which is pinned to the shaft 135, it controls the motion of this shaft. When the foot pedal is depressed it rotates the sleeve 131 as already described, which in turn rotates the collar 129 which being integral with the arm 180, causes it to be rotated in a counter clockwise direction as seen in Figure 2. This, by means of the link 181 causes the primary valve member 182 to be moved upwardly as seen in Figure 8, thus connecting the port 191 with the port 184 by means of the opening 187. This connects the bellows 197 through the pipe 195 to the suction, thereby collapsing this bellows, which, by means of the link 203 rotates the arm 204 in a counter clockwise direction an amount sufficient to move the secondary valve 186 by means of the link 205 into a position so that the partition between the openings 191 and 192 covers the opening 187, thus shutting off the suction from the bellows 197. When the arm 204 is rotated, it also rotates the collar 128 which by means of the key 142 rotates the collar 134 which by means of the sleeve 127 rotates the shaft 135 in a clockwise direction as seen in Figure 9, which as previously described, rotates the reflectors 213 and 226.

It is therefore evident that the pedal 167 thus controls the reflectors 213 and 226 by means of the power mechanism so that the pianist need only exert sufficient force on the pedal to operate the primary valve, and only a very slight force is required for this purpose.

If it is desired to control the reflectors by the paper roll, the handle 154 is rotated an additional amount in a clockwise direction until the pointer 155 points to the third graduation on the dial 156. This causes the member 151 to be rotated in a clockwise direction from the position shown in Figure 4 to that shown in Figure 5. This causes the key 141 to slide into engagement with the key-way in the collar 126, thus locking the collar 126 with the collar 129 and the key 142 slides down in the key-way of the collar 134 and locks the collars 128 and 134 together.

If it is desired to have the reflectors close a small amount, a hole is cut in the paper 24 in such position as to register with the hole 31 thus letting air into the tube 41 which passes to the chamber 51 inflating the pouch 52 and raising the valve 55, thus closing the atmospheric port 58 and connecting the duct 62 with the chamber 53. This causes air to be sucked out of the bellows 67 by means of the duct 82 and the tube 92 thus collapsing this bellows and causing the rod 124 to be moved a relatively small amount to the right (as seen in Figure 2). The arm 125 is thus rotated a small amount in a counter clockwise direction and as this arm is integral with the collar 126 it rotates this collar and by means of the key 141 also rotates the collar 129. This in turn rotates the arm 180, through an angle equal to that through which the arm 125 was rotated. By means of the link 181, the primary valve 182 is moved a slight amount in an upward direction as seen in Figure 2. This, as previously described controls the supply of suction to the bellows 197 and 198 and also causes the arm 204 to be moved through the same angle and in the same direction as the arm 125. This arm, as previously described, causes the shaft 135 and the arm 207 to be moved through an equal angle, thus moving the link 209 and the bar 211 a small amount to the right which will cause the reflectors 213 to be rotated through a small angle. At the same time, the link 220 is moved, the bell crank lever 221 rotated and the reflectors 226 of the lower group rotated through a small angle.

If it is desired to close the reflectors still more a hole may be cut in the paper 24 in position to register with a hole 32 in the tracker bar 23. This admits air to the tube 42, operating the corresponding valve in the primary 50 and deflating the bellows 68 in a manner similar to that just described. This causes the rod 124 to be moved to the right an additional amount and in a manner similar to that just described causes the reflectors 213 and 226 to be closed a proportional amount. If holes in the paper 24 come opposite the holes 33 and 34, air will be admitted to the tubes 43 and 44 to deflate the bellows 69 and 70, thus closing the

reflectors 213 and 226 the full amount. In this way it will be seen that the reflectors 213 and 226 are closed an amount which is proportional to the distance through which the stack of pneumatics 66 have been moved. This in turn depends upon the bellows or combination of bellows which are deflated. As each of these bellows when deflated, moves through different distances which are proportional to the integers 1, 2, 4 and 8, it is seen that by deflating any one or any combination of these, it is possible to produce any one of fifteen steps. Thus, for example, if the bellows 67 is deflated, the first step is produced; if 68 is deflated, the second step is produced; 67 and 68 produce the third step and so on through the fifteen possible steps.

If it is desired to produce a tremolo effect, a hole is cut in the paper 24 so as to register with the hole 35 in the tracker bar 23, thus allowing air to enter the tube 45, which will inflate the pouch 122, thus lifting the valve 118. This closes the atmospheric port 119 and connects the reservoir 102 with the suction by means of the duct 117, chamber 116 and port 120. A suction is thus produced in the reservoir 102 which is in communication with the interior of the bellows 103 by means of the opening 104, thus causing this bellows to be deflated. After this bellows is deflated, a certain predetermined amount, depending upon the length of the link 107, the valve 105 closes the opening 104, thereby shutting off the suction from the bellows 103. Air from the atmosphere enters through the opening 110 and the bellows 103 is inflated under the action of the spring 112. This causes the valve 105 to be opened, thus causing the bellows to be deflated again, resulting in a periodic inflation and deflation of this bellows, which causes an alternation of the intensity of the suction in the reservoir 102. This varying suction is transmitted through the tube 101 to the interior of the bellows 71 and the bellows 71 is opened and collapsed intermittently at the same rate of operation as the bellows 103. This causes the entire stack of pneumatics 66 to be vibrated at this predetermined rate, which in turn vibrates the arm 125 about whatever position it may be in, depending upon which one or combination of the bellows is collapsed. This, in a manner similar to that previously described, causes the reflectors 213 and 226 to vibrate about whatever position they may be in. It is thus seen that a tremolo effect is produced by the reflectors 213 and 226 in whatever position these may be in, thus giving a tremolo effect to the music produced by the piano.

The speed with which this tremolo is produced can be varied as may be desired by varying the length of link 107 and by changing the position of the slide 111 so as to change the effective opening of the port 110.

The invention upon which this application is based is broader than the specific embodiment shown and described for the purpose of illustrating at least one of the ways in which it may be employed. The scope of the invention is therefore to be understood as not being limited by the present specific description. I intend no limitations other than those imposed by the claims.

What is claimed is:

1. A modulating system for a pianoforte comprising the combination with a casing of reflectors movably mounted in the casing for variably controlling musical sound emitted therefrom, power means for operating the reflectors adapted to also operate automatic means for playing the instrument, a power control device interposed between the power means and the reflector and operating means for controlling said reflectors independently.

2. A musical instrument including a plurality of strings forming a sound source, a plurality of percussion actions for causing vibrations of said strings, a casing surrounding said strings having apertures, reflecting devices rotatably positioned in said apertures for controlling the sound emitted therethrough, a source of power adapted to operate automatic playing devices, means operatively interconnecting the power sources and the reflecting devices, and means for variably controlling said last named interconnecting means independently.

3. A musical instrument including a plurality of strings forming a sound source, a sounding board adjacent said strings, a substantially sound proof casing around said board and said strings forming two enclosed resonating chambers, a plurality of reflecting devices for each of said resonating chambers for controlling the sound emitted therefrom, a pneumatically operated bellows for operating said reflectors, a pneumatic pump adapted to supply power for mechanically operating said strings in conjunction with a modulating device and a control device interposed between the pump and said reflector actuating bellows for controlling the operation of the reflectors independently.

4. In a musical instrument a plurality of strings forming a sound source, a plurality of hammers for causing vibration of said strings, a sound insulated casing surrounding said strings and having apertures, a plurality of centrally pivoted metal lined reflecting devices rotatably mounted in said apertures for controlling the sound admitted therethrough, a source of power means for variably controlling the operating of said reflecting device, means interposed between said power source and said reflectors,

moving means for variably controlling the operation of the reflector device independently.

5. In a stringed musical instrument, a plurality of strings tuned to the notes of the musical scale, a sounding board adjacent said strings, a substantially sound proof casing surrounding said board and said strings and forming two resonating chambers, a source of power adapted to pneumatically operate means for vibrating the strings to produce music automatically, a modulating device adapted to vary the intensity of sound produced by the strings, a plurality of reflectors for each of said resonating chambers for controlling the sound emitted therefrom, a pneumatically operated bellows for selectively rotating said reflectors in either direction, and means for controlling the movement of the reflectors independently of said string vibrating means.

6. In a musical instrument of the percussive type, the combination with a casing of reflectors movably mounted in the casing for variably controlling musical sound emitted therefrom, pneumatic means adapted for playing the instrument automatically, pneumatic means for operating the reflectors, a pump for operating both of said pneumatic means, and a control device for controlling the operation of said reflectors independently of the automatic playing means.

7. In a musical instrument of the percussive type, a plurality of strings forming a sound source, a plurality of percussive actions for causing production of sound, a casing surrounding said strings and having apertures, a plurality of reflectors movably positioned in said apertures for controlling the sound emitted therethrough, power means for controlling said reflectors adapted to operate automatic playing devices for actuating the percussive actions to produce music automatically, and means for variably controlling the movement of the reflectors independently.

8. In a stringed musical instrument, a plurality of strings tuned to the notes of the musical scale, a sounding board adjacent said strings, a substantially sound-proof casing surrounding said board and said strings and forming two enclosed resonating chambers, a plurality of rotatable reflecting devices for each of said resonating chambers for controlling the sound emitted therefrom, a pneumatically operated bellows for rotating said reflectors, pneumatic means adapted for setting the strings into vibration, a pneumatic pump, a modulating device connected with said pump for controlling the power used in vibrating said strings, and a control device interposed between the pump and said reflector rotating bellows for controlling the operation of the reflectors independently of said modulating device.

9. In a musical instrument, a sound source, a sound insulated casing surrounding said source and having apertures, a plurality of centrally pivoted metal lined reflectors rotatably positioned in said apertures for controlling the sound emitted therethrough, a pneumatic means adapted for actuating the sound source, a source of power, means for variably controlling the operation of said pneumatic means, means actuated by said source of power for moving said reflectors, and means interposed between said power source and said reflector moving means for variably controlling the operation of the reflecting devices independently of said pneumatic means control.

10. In a musical stringed instrument, a plurality of strings tuned to the notes of the musical scale, pneumatic means adapted for vibrating the strings to produce music automatically, a source of power for actuating said means, a modulating device interposed between said power source and said means for varying the intensity of sound produced by the strings, a plurality of reflectors for controlling sound, a pneumatically operated bellows for selectively rotating said reflectors in either direction, a pneumatic pump for actuating said means and said two-way bellows, and means operated by said pump for controlling the movement of the reflectors independently of said pneumatic means.

11. A modulating system for a pianoforte comprising suction means for controlling the initial volume of sound produced by the strings, pressure means for controlling the volume of sound emitted from the instrument and a single source of pressure difference for operating said suction means and said pressure means.

12. In a musical instrument of the percussive type, the combination with a plurality of resonating chambers of means positioned therein for producing compressional waves, pneumatically operated means for controlling the initial volume of said waves and pneumatically operated means for controlling the emission of the waves from the chamber to produce musical sound.

13. In a musical instrument of the percussive type, a source of power adapted to automatically operate the instrument, a modulating device associated with the source of power for controlling the volume of the compressional waves generated and means operable by said source of power for controlling the emission of compressional waves from said instrument.

14. In an automatic reproducing piano, a casing having a plurality of variable closures, power means for operating said piano, a foot pedal, and means whereby said power means may be caused to automatically directly operate said closures, or said pedal may be caused to directly operate said clo-

sures, or said pedal may be caused to control said power means for operating said closures.

15. In an automatic reproducing piano, a casing having variable closures, power means for operating said piano, a foot pedal and a three-way coupling mechanism whereby said closures may be operated either automatically by said power means, directly by said foot pedal or directly by said power means, said power means being controlled by said foot pedal.

Signed at New York in the county of New York and State of New York this twenty-fifth day of January A. D. 1926.

JOHN HAYS HAMMOND, JR.