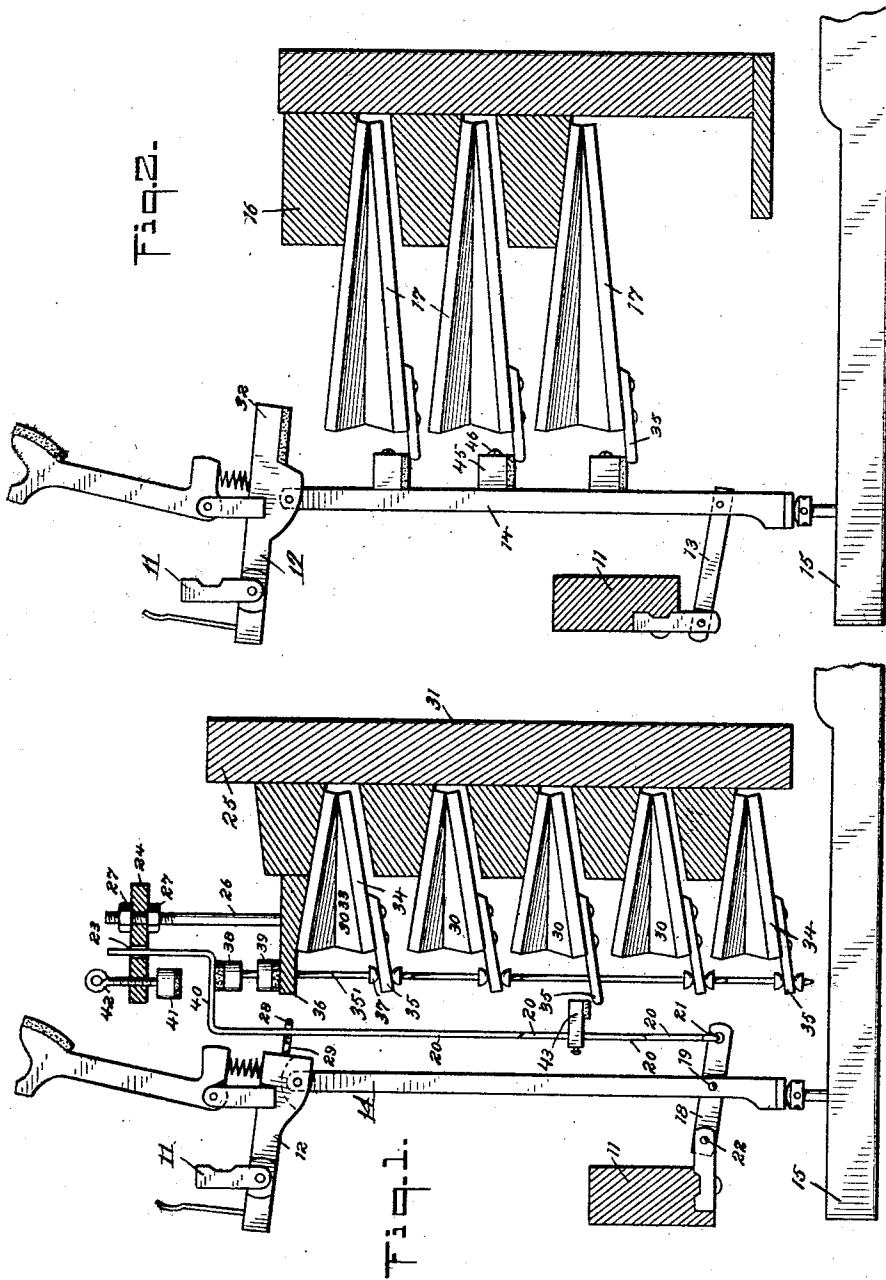


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PNEUMATIC HAMMER ACTION.  
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1,266,965.

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# UNITED STATES PATENT OFFICE.

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## PNEUMATIC HAMMER-ACTION.

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Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, FRANK G. LYNDE, a citizen of the United States, residing in the city of Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Pneumatic Hammer-Actions, of which the following is a specification.

My invention relates in general to an improvement in player pianos and specifically relates to a unitary organization of hammer action and actuating pneumatic thereof in player pianos.

In player piano construction it has been usual to retain as far as possible, the hammer actions as they have been worked out for a long time in connection with the old manually played pianos and to provide pneumatics of a power sufficient to act on these old forms of action. In other words, the hammer actions which were primarily designed to develop a delicate "touch" required in manually played pianos have been adopted bodily for use in mechanical players without regard to the necessities of the new situation.

In prior devices pneumatics sufficiently large to actuate these "manual" hammer actions have been designed to engage under the wippen the lower abstract link, or to engage an extension on the sticker, to lift some movable part of the action on its actuating stroke. These pneumatics therefore have had to possess a certain size to develop the power necessary to lift the overbalancing weight of these old actions and the player actions now known are of a greater depth from front to rear than the old manual players due to the necessity of providing space for these large pneumatics. Further there is a commercial demand for a small upright player about four feet in height, which, due to the large pneumatics used cannot be made at present except with an unsatisfactory arrangement of two-rows of pneumatics.

Accordingly, one of the objects of the invention is to provide a hammer action, which will retain all the advantages of sudden at-

tack, retreat from the strings and the other advantages incidental to the old "manual" action but in which the desirability of "touch" has been subrogated to a structure designed to be actuated by relatively small pneumatics.

I attain this object in general by retaining the weighted leverage effect of the old hammer action and may even increase the weight of the parts to be raised, but I localize the center of mass of the action relatively close to the fulcrum of the lever and apply the lifting force to the action at a point far removed from the fulcrum. This simply means that I shorten the usual link at the bottom of the hammer actions to reduce the length of the work arm, thus permitting the removal of the sticker and associated parts back away from the "front" of the action.

Further I increase the length of the pneumatically actuated power arm acting on the hammer action so that a less powerful and therefore smaller pneumatic may be used.

Another object of the invention is to provide an engagement between each of the pneumatics and its hammer action which engagement will be a direct straight-line attack of the pneumatic on the hammer action part and free of sliding movement between the parts.

A further object of the invention is to provide a simple form of adjustment for limiting the throw of the pneumatics and of the part of the hammer action engaged thereby.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying my invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

Referring to the accompanying drawings:—

Figure 1 is a vertical sectional view taken

transversely through the front portion of a player piano having a depth approximately that of the old manually played pianos, showing a preferred embodiment of my invention installed therein; and

Fig. 2 is a similar view of a conventional form of player piano scaled for comparison with the showing in Fig. 1.

In the drawings, reference will first be made particularly to the showing in Fig. 2, for the reason that the hammer actions, the pneumatics and the relative size and arrangement of parts therein illustrated are intended to represent the portion of similar parts common in player piano constructions now in general use. In this figure there is shown merely sufficient parts of a hammer necessary to this disclosure, it being understood that all parts not fully shown are of conventional design.

There is shown a suitable support 11 to which is pivoted a wippen 12 and a link 13 connected by means of a vertically extending sticker 14, the lower end of which is adapted to be engaged by the manual playing key 15, all as is usual in hammer actions of the manually actuated type. A unit 16 including three vertically disposed banks of pneumatics 17 are positioned in advance of the sticker and arranged to actuate the hammer action as is well known in player actions.

Now referring to the disclosure in Fig. 1, it is noted that the portion of the lever 18 between the support 11 and the pivotal connection 19 thereof with the sticker is very much shorter than the corresponding length of the lever 13 and in one physical embodiment of the machine the length of this portion of the lever 18 is approximately one half the length of the lever 13. The lever 18 is extended beyond the pivotal connection 19 to form a connection with a lifting rod 20 pivotally connected to the outer end of the lever 18 at 21. By this construction it is seen that the distance between the fulcrum 22 and the pivotal point 19 constitutes the work arm of the action and the distance between the fulcrum 22 and the pivotal point 21 constitutes the power arm of the lever. In this showing the power arm is approximately the length of the work arm 13 in Fig. 2. The lifting rod 20 extends upwardly from the lever 18 substantially parallel to the sticker 14 and is suitably guided in position by extending through an aperture 23 in a guide board 24. In the device illustrated the guide board is fastened to the pneumatic action unit 25 by means of the screw 26 which passes through the board 24 and held thereto by lock nuts 27. However, it is immaterial as to how the lifting rod 20 is guided and it is apparent that the guide board 24 may be fixed directly to the piano casing. For the purposes of economy in

construction, it is cheaper to pass the rod 20 through the eye 28 of a screw 29 threaded into the end of the wippen, as shown in Fig. 1, or into the adjacent end of the pneumatic action 25. It is to be understood that the pneumatics 30 are materially smaller than the pneumatics shown in Fig. 2 and therefore the front board 31 can be moved toward the sticker 14 from the position shown in Fig. 2 to the position shown in Fig. 1, thus reducing the depth from front to rear of the inclosing casing. The usual extension 32 of the wippen is cut-away in Fig. 1, thus utilizing the space in advance of the wippen and permitting the installation of five banks of pneumatics 30, the upper pneumatic 33 of which is positioned in advance of and on a level with the wippen 12.

The pneumatics each include a movable side 34 provided with a finger 35 extending therefrom and vertically movable on the actuating stroke of the pneumatic. A vertically movable plunger 35' is slidably mounted in an extension 36 of the action 25 and is provided at its lower end with a head 37 normally resting on the extension 35. The upper end of the plunger 35' is provided with a head 38 threaded thereto so as to adjust the length of the plunger. The portion of the plunger 35' above the extension 36 is surrounded by a cushioning block 39 resting on top of the extension and adapted to cushion the fall of the head 38. The rod 20 is bent forwardly adjacent the upper end thereof to form a laterally extending plunger engaging portion 40 positioned in the path of movement of the head 38 and adapted to be engaged thereby to lift the rod and to act through the power arm to actuate the hammer action.

For the purpose of limiting the upward movement of the rod 20, the guide strip 24 is provided with a stop block 41 positioned above the extension 40 and in the path of movement thereof and adjustable relative to the normal position of the extension 40 by means of a thumb screw 42.

Instead of bending the rod 20 to form the plunger engaging member 40, an obvious mechanical change is to fasten a finger 43 to the rod 20 just above the normal position of any of the extensions 35, thus eliminating the plunger 35'.

In the construction as thus described it is considered that the pneumatic action 25 is built into the casing and constitutes, in effect, a complete unit with the hammer actions.

In operation, it is to be understood that the action of this device is substantially that of well known devices now on the market, except that as the plunger 35' moves vertically and the rod 20 moves vertically there is a direct straight line attack of the head 38

on the extension 40 and the objectionable sliding movement hereinbefore present in such devices is eliminated. The rebounding of the extension 40 from the set block 41 acts to assist the return of the hammer action to its normal position.

Reducing the length of the work arm 13 of the conventional structure, obviously destroys the carefully worked out balancing of the hammer action parts, but in those cases where it is desired to restore the "touch" when the device is played manually, the fulcrum of the key 15 is shifted so as to compensate for the fore-shortening of the lever 13 and in this way the device can possess the same manual "touch" characterizing the old manually actuated pianos. The old balancing of the hammer action is further destroyed by the addition of the extension of the lever 18 forwardly of the sticker and by the weight of the rod 20 and its associated parts acting on this extension. However, the extension of this lever is utilized to form, in effect, an extension of the movable side of the actuating pneumatic, so that while the pneumatics themselves are smaller than the conventional size, this long leverage effect of the power arm is sufficient to actuate the hammer action.

As these pneumatics are of small air-containing capacity the piano can be played on light wind, thus contributing to the perfection of an easy acting piano. This ease of action is essential especially in connection with pedal actuated pianos intended to be operated by women and children. As most of the power is consumed in actuating the player pneumatics the small capacity pneumatics herein disclosed conserve the available air supply and uses an amount of air power just sufficient to actuate the hammer actions.

By means of the adjustable block connection between the pneumatic extensions and the hammer actions, the full available pressure in the pneumatics is utilized to effect just the necessary length of stroke to actuate the hammer action, thus again economizing in power necessary to work the piano. If a longer or shorter stroke of the pneumatic is desired the block 45 or finger 43 may be adjusted in the necessary direction and the finger 44 or 50 adjusted to receive and raise the extension 35 as the action is slid into its position in the casing.

Having thus described my invention, I claim:—

1. In a player piano, a combination of a hammer action including a wippen, a relatively short link pivotally supported at one end below the wippen, a lifting rod pivoted directly to the opposite end of the link, a sticker having its upper portion attached to the wippen and having its lower portion

pivoted to the link at a point substantially equi-distant from the pivotal support of the link and from the pivotal connection of the lifting rod therewith, the axes of relative movement between the link and its support, between the link and the sticker and between the link and the lifting rod being parallel to each other, and a pneumatic for raising said lifting rod.

2. In a player piano, the combination of a hammer action including a sticker and a lever pivoted at one end with the lower end of the sticker engaging the same in advance of its pivoted end, an actuating pneumatic having a movable side positioned above the lever, a plunger guided for vertical movement and actuated by said movable side and a lifting rod having a portion positioned in the path of the movable plunger and pivoted to said lever in advance of the sticker.

3. In a player piano, the combination of a hammer action including a sticker and a lever connected to the sticker to lift the same, an actuating pneumatic having a movable side, lifting means actuated by said movable side, means pivoted to the lever so as to move therewith and disposed in the path of movement of said lifting means and means for guiding said pivoted means.

4. In a player piano, the combination of a hammer action including a sticker and a lifting rod disposed parallel to each other, a lever connecting the sticker and lifting rod, and a pneumatic provided with a plunger for engaging said lifting rod to raise the sticker.

5. In a player piano, the combination of a hammer action, a lift rod connected thereto and provided with a power receiving portion, means for guiding said rod, a pneumatic including a movable side having a lifting action, a plunger guided for vertical movement and disposed between said movable side and said portion for transmitting the lifting action of said movable side to lift the hammer action on its actuating stroke and adjustable means for limiting the lifting movement of said lift rod.

6. In a player piano, the combination of a hammer action, a pneumatic including a movable side having a lifting action, a connection between said movable side and said hammer action, said connection including two vertically guided members, one of said members constituting a plunger disposed above the movable side to be lifted thereby, and the other member attached to the hammer action and having a portion overlapping said plunger and raised thereby, said overlapping portion and said plunger inter-engaging at a place fixed during the entire engagement thereby to prevent any relative sliding movement.

7. In a player piano, the combination of a hammer action including a wippen, a sticker and a link, a bank of actuating pneumatics positioned in advance of the sticker  
5 and with the upper pneumatic disposed opposite the wippen, a lifting rod connected to the action and having an upper portion positioned above the wippen and upper pneumatic and a lifting connection between one of the pneumatics and said upper portion of the lifting rod.

Signed at Newark in the county of Essex and State of New Jersey this nineteenth day of December, A. D. 1917.

FRANK G. LYNDE.

Witness:

ANTHONY J. GUENTHER.

Copies of this patent may be obtained for<sup>4</sup> five cents each, by addressing the "Commissioner of Patents, Washington, D. C."