No. 687,606. Patented Nov. 26, 1901.

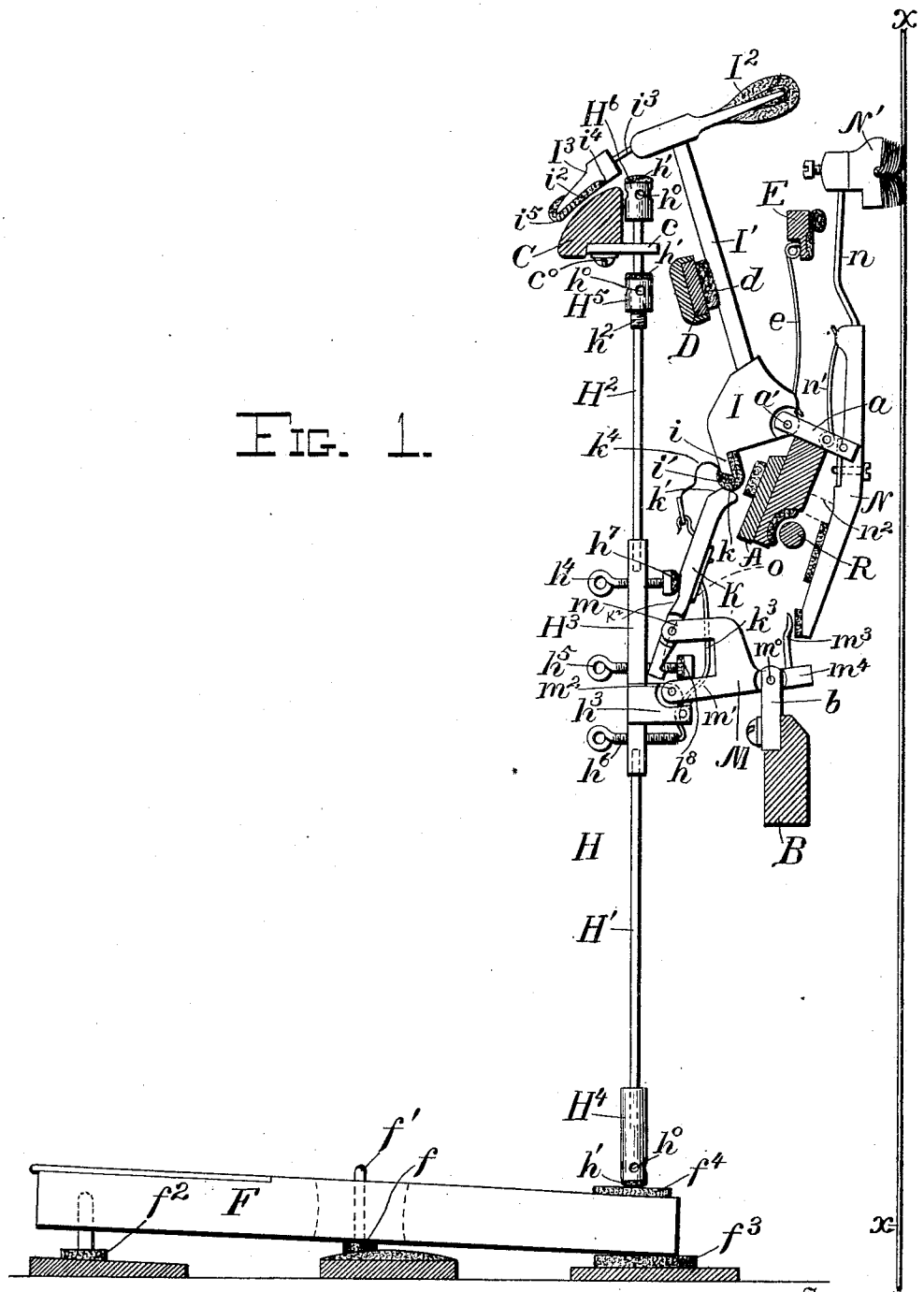
J. W. DARLEY, JR.

REPETITION PIANO ACTION.

(Application filed Sept. 23, 1895.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.



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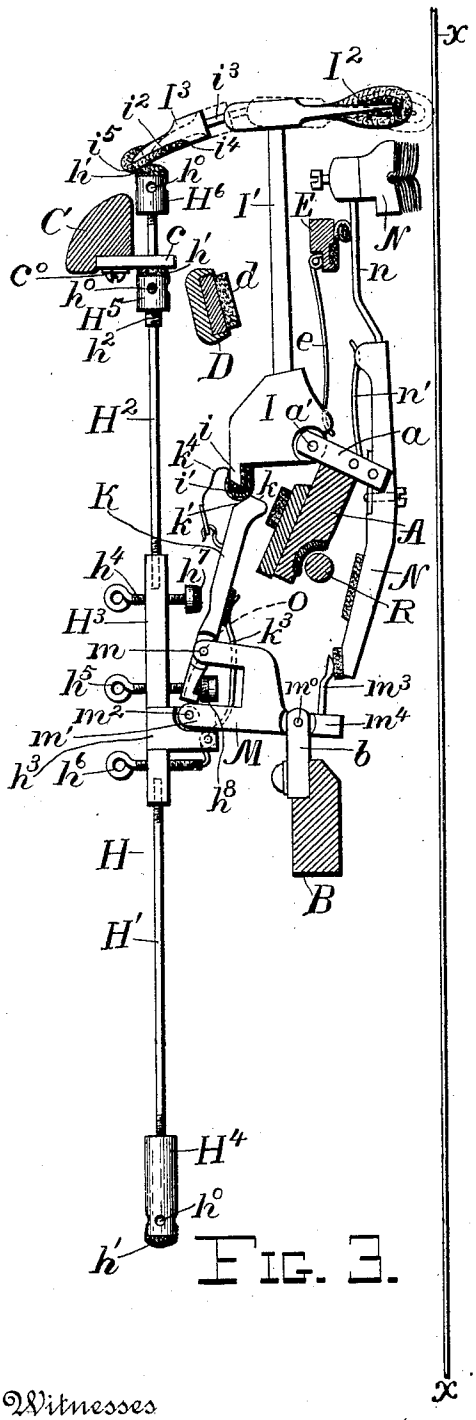

FIG. 3.

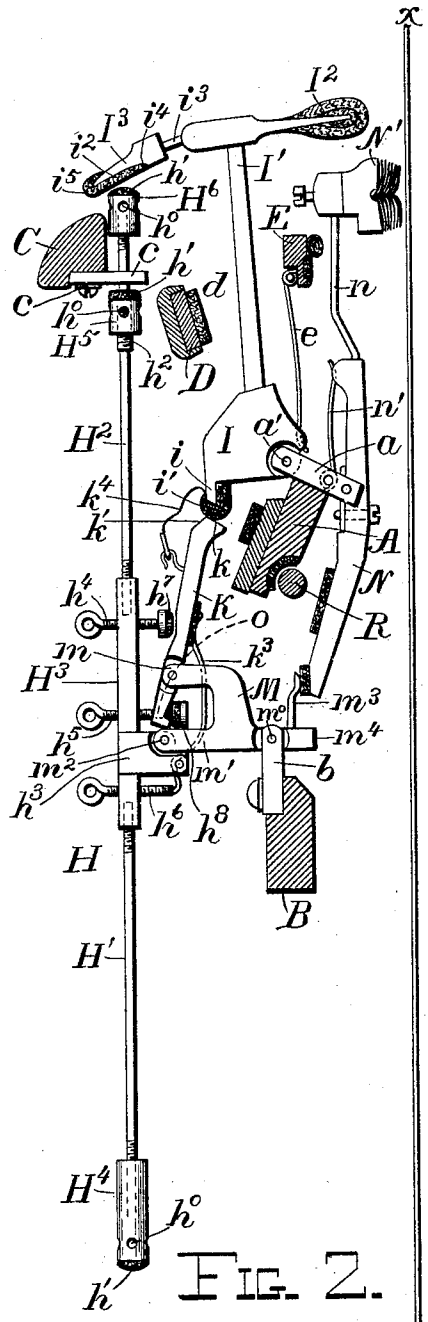

FIG. 2.

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UNITED STATES PATENT OFFICE.

JOHN W. DARLEY, JR., OF BALTIMORE, MARYLAND, ASSIGNOR OF ONE-HALF TO MICHAEL HOLZMAN, PHILIP HAMBURGER, AND LEON HAMBURGER, OF BALTIMORE, MARYLAND.

REPETITION PIANO-ACTION.

SPECIFICATION forming part of Letters Patent No. 687,606, dated November 26, 1901.

Application filed September 23, 1895. Serial No. 563,365. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. DARLEY, Jr., a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Repetition Piano-Actions; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in piano-actions, and especially in those actions which are designed to enable the operator to strike the same note repeatedly and in rapid succession.

The present invention is intended to cover certain improvements upon the device described in my application, Serial No. 524,997, filed October 5, 1894; and it consists in certain novel features, which will be hereinafter fully described and claimed.

Reference is had to the accompanying drawings, wherein the same parts are indicated by the same letters throughout the several views and in which for the sake of clearness the supporting-frames are omitted.

Figure 1 represents a side elevation of a piano-key and the various parts connected thereto, showing the parts in their normal position with the hammer at rest and in its position farthest from the string, the supporting-rails being shown in sections. Fig. 2 represents a similar view of the action, the key being omitted, showing the parts in the position assumed when the key has been pressed about two-thirds down, the hammer not having struck the string. Fig. 3 represents a similar view of the action, showing the parts in the position assumed immediately after the hammer has struck the string and while the key is held down.

Throughout the description and drawings I have described and shown only one piano-key and the mechanism operated thereby, it being understood that the same mechanism is duplicated for each key and string, excepting in the case of the treble-strings, where the damper is dispensed with; but even in this instance the damper-lever is retained to equalize the feeling upon the keys.

A, B, C, D, and E designate the supporting-rails, which extend across the piano and support the several parts, as is usual. The various rails and other parts of the piano-action are faced with felt or other similar material wherever they are likely to be struck by any of the moving parts, and all centers are bouched with a cloth in the well-known way, the effect of the whole being to prevent rattling and to deaden all sounds except of the strings which have been struck.

x designates one of the many strings of the piano.

F designates the key, pivoted, as at f, on the pin f' and having the usual cushions f^2 and f^3 beneath the ends thereof and also a cushion f^4 on the upper side of its inner end for the lower end of the operating-rod H to rest upon. The rod H is formed of two rods H′ and H², each screw-threaded at its ends and screwed into a central piece H³. The lower section H′ of the rod has a head H⁴ screwed thereon to rest upon the cushion f^4 on the key. The upper end of the rod H slides through and is supported in a horizontal piece c, projecting from the supporting-rail C and secured thereto by the screw c^9. On the upper end of the rod H is screwed a head H⁶ for a purpose to be hereinafter explained, and a sleeve H⁵ is screwed on an enlarged screw-thread h^2 just below the piece c, through which the rod moves, the purpose of which sleeve is to limit the upward movement of the rod H, the inertia of which when the key is pressed down quickly might carry it up too high. The enlarged screw-threaded portion h^2 enables the sleeve H⁵ to be slipped over the upper end of the rod H² and then to be adjusted in place below the piece c. The pieces H⁴, H⁵, and H⁶ are each provided with cushions h' to deaden the sound, while the cushion on the piece H⁶ also serves as a friction-cap, and each has holes h^9, into which a suitable instrument may be inserted to turn the pieces, and thus adjust their position on the rod H. The central part H³ of the rod H is provided with a bracket h^3 and screw-rods h^4, h^5, and h^6 for a purpose to be hereinafter explained.

The supporting-rail A has a cross-piece a,

in one end of which is pivoted, as at a', the hammer-butt I, from which extends the stem I', carrying the hammer I^2, made of buckskin or other suitable material. When in the normal position, the stem I' rests upon the hammer-rail D, which is cushioned, as at d, to receive it, the rail D being operated by the soft pedal in the usual manner. From the rail E depends the hammer-spring e, which presses the hammer away from the wire. A depending lug i is formed on the lower corner of the hammer-butt, cushioned, as at i', to receive the thrust of the jack K.

A tailpiece I^3 is secured to the hammer by means of a short screw-rod i^3 and arranged in such a position that the inner end i^4 will be a little nearer to the fulcrum-point a' of the hammer than the other end i^5. The purpose of the tailpiece is to check the movement of the hammer as it rebounds from the string, which it does by coming in contact with the friction-cap in the head H^6, which moves upward as the hammer moves toward the string and is in position to receive the said tailpiece as it rebounds, as will be hereinafter described. The tailpiece is cushioned, as at i^2, to deaden the sound and to increase the friction when it strikes the friction-cap on the head H^6.

From the supporting-rail B is an upwardly-projecting piece b, in the upper end of which is pivoted a lever M, the forward end of which is bifurcated to form the two arms m and m', which arms are also bifurcated vertically, and the lower arm is pivoted upon the bracket h^3, as at m^2. In the bifurcated end of the upper arm m is pivoted the jack K, the lower end of which is bifurcated to straddle the screw-rod h^5. The upper end of the jack K is formed with a flat surface k and an inclined surface k', and when in the normal position, as shown in Fig. 1, the flat surface k rests under the lug i of the hammer-butt I and the polished surface k^2 rests against the cushioned stop h^7 on the screw-rod h^4. A recovery-spring k^3 is secured in the lower part of the bracket h^3, the lower end of which spring extends below the bracket h^3 into the recessed inner end of the screw-rod h^6, which gives adjustment to the spring. The upper end of the recovery-spring k^3 presses against the jack K to hold the same in its normal position. A flexible connection k^4 is made between the jack K and the hammer-butt I to prevent the hammer from moving too far from the said jack K; but this may be omitted, if desired.

N designates the damper-lever, which is pivoted in the rear end of the cross-piece a and is actuated by a spoon m^3, which extends upwardly from the rear end m^4 of the lever M, pivoted at m^0. From the upper end of the damper-lever extends the stem n, carrying at its upper end the damper N', which is of the usual construction. A spring n' extends upwardly from the cross-piece a and presses against the damper-lever to normally hold the damper against the string x. On the high-treble strings no damper is required; but the lever N and the spring n' are preferably retained in order to give these keys the same "feeling" as the others. When the damper is removed from any of the damper-levers, a cushion n^2 (shown in dotted lines in Fig. 1) is placed on the lever to rest against the rail A when the said lever is in its normal position, and thus limits its movement.

R represents a cross-section of the rod, connected with the loud pedal.

Throughout this specification the word "feeling" is to be taken as meaning the resistance encountered by the performer's finger during the motion of the key from the initial position to the point at which the lower portion of the jack K strikes the button h^8. The word "release" applies to the resistance encountered from this point to point when the top of the jack slides from under the lug i of the hammer-butt I, and the words "after touch" apply to the resistance encountered during the remainder of the motion of the key.

The operation of the invention is as follows: When the front of the key is depressed, its inner end will move upward, carrying with it the rod H. The upward movement of the rod H will move the bifurcated end of the lever M upward, the upper arm m thereof moving in the arc of a circle, as shown by the dotted line O, and carrying the jack K upward also, causing it to thrust against the lug i of the hammer-butt I and throw the hammer toward the string. The movement of the upper arm m will also cause the jack K to turn slightly on the stop h^7 as a fulcrum. This movement is provided in order that the top portion k of the jack K may have substantially the same locus throughout its motion as the coöperating portion i' of the hammer-butt I, and when the key has been depressed about two-thirds of the way the lower end of the jack K will abut against the cushioned stop h^8 on the screw-rod h^5. At this time the parts assume the position shown in Fig. 2, the jack K being against both of the stops h^7 and h^8, the flat end k thereof pressing against the lug i of the hammer-butt and the damper having commenced to move away from the string by reason of the pressure of the spoon m^3 on the lower end of the damper-lever N. Further pressure on the key will raise the rod still higher, and this will move the lever M, carrying its arm m farther around in the dotted arc O. This movement will turn the jack K on the stop h^8 as a fulcrum and pull the top under the lug i. This causes the key to suddenly drop to the lowest point of its movement, the hammer in the meantime striking the string, as shown in dotted lines in Fig. 3, and then rebounding to the position shown in the said figure, the upper headpiece H^6 of the rod H having moved upward far enough to receive the tailpiece I^3 of the rebounding hammer, which will be held from further movement thereby as long as the

key is held down, the spoon m^3 at the same time holding the damper away from the string. If now the key be released, the first effect will be to cause a separation of the headpiece H^6 of the rod H and the tailpiece I^3 of the hammer, when the pressure of the recovery-spring k^3, acting through the inclined surface k' of the jack K upon the lug i of the hammer-butt I, causes a relative motion between these two parts and quickly brings the flat surface k of the jack K under the lug i of the hammer-butt I, when the various parts are in operative position for another blow, and this effect obtains whenever the key is raised sufficiently to allow the checking portions H and I^3 to disengage. By this construction a quick sharp blow is produced on the string and the movement of the hammer is instantly arrested, thus preventing any vibration of the hammer and allowing the strokes to be made with the utmost rapidity.

It will be noticed that the point i' of the hammer-butt I, against which the top k of the jack K impinges, is considerably below the intersection of a line through the pivot m^0 and point of contact k with the line drawn at right angles thereto through the pivot a' of the hammer-butt I. Hence it will be seen that the point i' during the motion of the hammer toward the string traverses a locus consisting of vertical and horizontal elements, the effect of which is to cause the driving leverage of the jack K upon the hammer-butt I to increase, and consequently the amount of pressure required upon the key to decrease. Thus the touch would be heavy at the beginning and get lighter toward the end of the stroke were there no damper-lever motion to be effected.

It will be noted that the spoon m^3 stands slightly off the abutting damper-pad. The amount of this space and the position of the point i' may be so adjusted by experiment as to cause the pressure required upon the key to remain absolutely equable from the beginning of motion to the point when the lower end of the jack K strikes the pad h^8—that is, until the release commences. Thus it will be noted a soft easy touch is provided, as the performer feels no additional resistance when the damper motion commences, as has been the case in all piano-actions heretofore. The small leverage on the hammer at the beginning of the stroke is very desirable, for the initial velocity imparted to the hammer is what in practice determines the quality of the hammer-blow, since there is practically no retardation on the hammer. The increase of leverage as the hammer advances relieves the fingers of any loaded feeling and also gives a lighter blow when the soft-pedal rail is used. By reference to Fig. 3 it will be seen that after the blow has been struck the inclined surface k' of the jack K coincides substantially with a line drawn through the point of contact i' of the lug i with said inclined surface and the center of gyration a' of the hammer-butt I. Hence it is evident that the leverage at which the force imparted to the hammer by recovery-spring k drives the hammer-butt I during the operation of recovery is equal to the distance from the center a' to the point of contact i' of the lug i with the inclined surface k' of the jack K. By comparing this length with the various lengths of the leverages at which the jack K acts upon the hammer-butt I when striking a blow it will be found that the recovery leverage is much longer than any of the direct leverages. Thus when all the parts are at rest the jack has a certain initial leverage upon the hammer-butt, and this leverage increases sufficiently to compensate for the additional resistance of the damper, thus giving an easy direct touch, as explained above. Then the release commences and flexure of the spring k^3 takes place, and since in order to obtain quick repetition this spring must be strong enough to cause relative motion between the jack and hammer-butt it follows that by allowing the spring to act at a long leverage, as explained above, a much lighter spring may be used, and thus a free elastic release and after touch are obtained.

It will be seen that after taking out the pivot m^0, disengaging the strip k^4, and unscrewing the screw c^0 the whole piano-action, except the hammer and damper-lever, may be removed. Moreover, by having the screws h^4, h^5, and h^6 all placed in front and also having the pieces H^4, H^5, and H^6 all readily accessible from the front the various adjustments may be readily effected without disarranging any of the parts of the instrument.

These and the various other advantages of the herein-described apparatus will readily suggest themselves to any one skilled in the art.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a piano-action, the combination with a key, a hammer-butt and damper-lever moved thereby, of means for decreasing the resistance of the hammer-butt to the movement of the key to approximately compensate for the resistance of the damper-lever to such movement, substantially as described.

2. In a piano-action, the combination, with a key, a hammer-butt and damper-lever moved thereby, of means for increasing the leverage of the key upon the hammer to approximately compensate for the resistance of the damper-lever to such motion, substantially as described.

3. In a piano-action, the combination of a key, and a jack operated thereby, a hammer-butt operated by said jack, a recovery-spring and means for causing the force imparted to the hammer-butt by the jack when acted on by the recovery-spring to act upon said hammer-butt at a leverage greater than that

through which force is imparted by the jack when acted on by the key, substantially as described.

4. In a piano-action, the combination of a key, a rod operated thereby, a jack operated by said rod, a hammer-butt operated by said jack, a recovery-spring carried by said rod and bearing on said jack, and means for causing the force imparted to the hammer-butt by the jack when acted on by the recovery-spring to act upon said hammer at a greater leverage than that through which force is imparted by the jack when acted on by the key, substantially as described.

5. In a piano-action, the combination with a key, of a pivoted jack operated thereby, provided with a flat top terminating in a rearwardly-inclined edge, adjustable stops in either side of said pivot adapted to regulate the operation of said jack, and a hammer operated by said jack, substantially as described.

6. In a piano-action, the combination with a key, of a jack operated by said key, adjustable stops on either side of the pivot of said jack and adapted to regulate the operation thereof, and a hammer-butt operated by said jack, substantially as described.

7. In a piano-action, the combination with a key, of a jack operated by said key, an adjustable pad adapted to serve as a fulcrum for said jack independent of its pivot, a hammer-butt operated by said jack, and means for regulating the point of withdrawal of the jack from driving said hammer-butt, substantially as described.

8. In a piano-action, the combination with a key, of a jack operated by said key, a screw carrying a pad located at a distance from the pivot of said jack and adapted to serve as a fulcrum for said jack independent of its pivot, and a hammer-butt operated by said jack, substantially as described.

9. In a piano-action, the combination with a key, of a pivoted jack operated by said key, a screw carrying a pad located in front of said jack and above the pivot thereof, and adapted to serve as a fulcrum for said jack independent of its pivot, a second screw also provided with a pad and adapted to engage the lower end of said jack near the end of the stroke, and a hammer-butt operated by said jack, substantially as described.

10. In a piano-action, the combination with a key, and a pivoted jack operated by said key, a screw carrying a pad located in front of said jack and adapted to serve as a fulcrum for said jack independent of its pivot and a hammer-butt operated by said jack, substantially as described.

11. In a piano-action the combination with a key, of an operating-rod moved thereby and provided with a friction-cap, a jack operated by said rod, a hammer operated by said jack, a hammer-check connected to said hammer and adapted to strike against said friction-cap, and be checked thereby, and means for decreasing the resistance of the hammer-butt to the movement of the key to compensate for the resistance of the damper-lever to such movement, substantially as described.

12. In a piano-action the combination with a piano-key of an operating-rod moved thereby and provided with a friction-cap; a jack operated by said rod, a hammer operated by said jack, a hammer-check provided with a covering on one face of soft yielding material and adapted to strike said friction-cap, means for adjustably connecting the hammer-check to the hammer, and means for interposing a decreasing graded resistance between said key and said hammer during the motion of the hammer-butt toward the string, substantially as and for the purpose described.

13. In a piano-action, the combination with a piano-key, of an operating-rod moved thereby and provided with a friction-cap; a jack operated by said rod, a hammer operated by said jack, a hammer-check provided with a covering on one face of soft yielding material and adapted to strike said friction-cap, and a wire screw threaded at one end and adjustably connecting the hammer-check to the hammer, and means for interposing a decreasing graded resistance between said key and said hammer during the motion of the hammer-butt toward the string, substantially as described.

14. In a piano-action, the combination with a fixed stop, of a piano-key, an operating-rod moved thereby and provided with a friction-cap, and an enlarged screw-threaded portion, a sleeve adjustably mounted on said rod over said enlarged screw-threaded portion and adapted to strike against said stop and so limit the motion of said rod, a jack operated by said rod, a hammer operated by said jack, a hammer-check connected to said hammer and adapted to strike against said friction-cap, and to be checked thereby, and means for interposing a decreasing graded resistance between said key and said hammer during the motion of the hammer-butt toward the string, substantially as described.

15. In a piano-action, the combination of a key, a hammer-butt operated thereby, a recovery-spring, and mechanism operated by the recovery-spring acting upon said hammer-butt at a leverage greater than that upon which the key operates, substantially as described.

16. In a piano-action, the combination of a key, a rod operated thereby, mechanism operated by said rod, a hammer-butt operated by said mechanism, a recovery-spring carried by said rod, and causing said mechanism during recovery to act upon said hammer-butt at a greater effective leverage than that with which the force imparted by the key operates, substantially as described.

17. In a piano-action, the combination with a key, a hammer-butt, and damper-lever moved thereby, of means for decreasing the

resistance of the hammer-butt to the movement of the key to approximately compensate for the resistance of the damper-lever to such movement, and a soft-pedal rail for shortening the stroke of the hammer, substantially as described.

18. In a piano-action, the combination with a key, a hammer-butt and damper-lever moved thereby, of means for increasing the leverage of the key upon the hammer to approximately compensate for the resistance of the damper-lever to such motion, and a soft-pedal rail for shortening the stroke of the hammer, substantially as described.

19. In a piano-action, the combination of a key, and a jack operated thereby, a hammer-butt operated by said jack, a recovery-spring and means for causing the force imparted to the hammer-butt by the jack when acted on by the recovery-spring to act upon the said hammer-butt at a leverage greater than that through which force is imparted by the jack when acted on by the key, and a soft-pedal rail for shortening the stroke of the hammer, substantially as described.

20. In a piano-action, the combination with a key, of a pivoted jack operated by said key, a hammer engaging and operated by said jack and a fulcrum operating with said jack before release begins independent of the pivot and of the hammer, substantially as described.

21. In a piano-action, the combination with a key, of a hammer operated thereby, means for terminating the operative relation between said key and hammer, a spring for restoring said relation, said spring being detached from but operating on said hammer at a greater leverage than that at which said key operates, substantially as described.

22. In a piano-action, the combination with a key, of a hammer operated thereby, means for terminating the operative relation between said key and hammer, and a spring for restoring said relation, the force of said spring operating on said hammer at a greater leverage than that at which the force of said key operates through the jack, substantially as described.

23. In a piano-action, the combination with a key, of an operating-rod, a jack abutting on said rod, a hammer engaged by said jack, a lever pivoted to said rod and operating said jack, and a sliding engagement between the rod and a part of the action-frame, substantially as described.

24. In a piano-action, the combination with a key, of a hammer operated thereby, means for terminating the operative relation between said key and hammer, a spring for restoring said relation, and mechanism operated by said spring and engaging said hammer at a greater effective leverage than the key operates, substantially as described.

25. In a piano-action, the combination with a key and operating-bar, of a lever pivoted to said bar, a jack operated by said lever and abutting against said bar, and a hammer operated by said jack, the parts being so arranged that the top of the jack and the abutting portion of the hammer shall have substantially the same locus, while the hammer is being driven toward the string, substantially as described.

26. In a piano-action, the combination of a key, a rod operated thereby, a jack operated by said rod, a hammer-butt operated by said jack, a recovery-spring carried by said rod and bearing on said jack, and a bridle connecting said hammer-butt and said jack, substantially as described.

27. In a piano-action, the combination of a key, an abstract operated by said key, a jack operated by said abstract, a hammer-butt operated by said jack, and a recovery-spring carried by said abstract, the force of said spring acting on the hammer-butt through said jack at a longer effective leverage than that through which the force is imparted to the jack by the key, substantially as described.

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

JOHN W. DARLEY, JR.

Witnesses:
FREDK. J. THON,
ALBERT HAUBEN.