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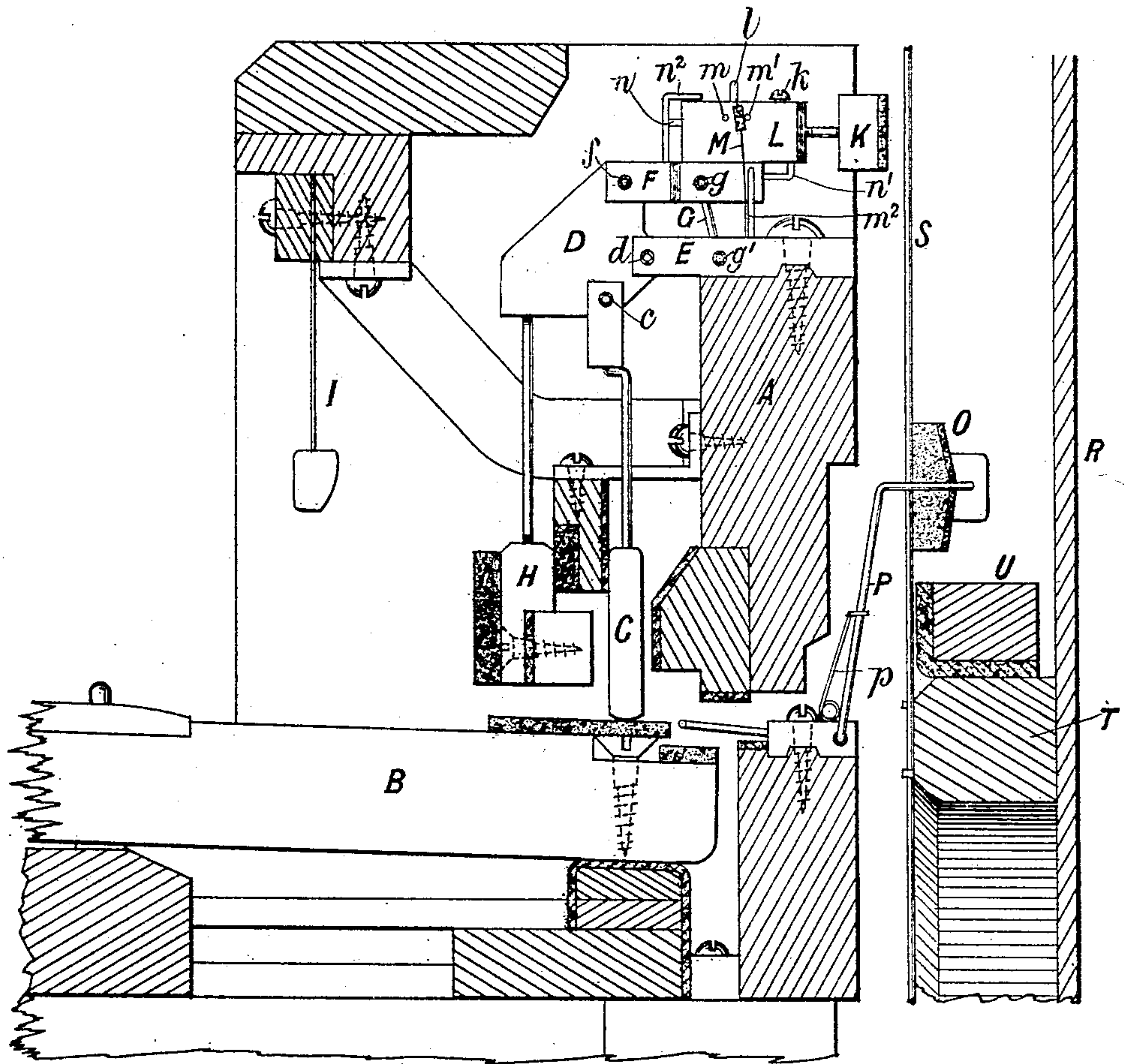
A. L. CALDERA.

KEYBOARD MUSICAL INSTRUMENT.

No. 395,543.

Patented Jan. 1, 1889.

FIG. 1.



Witnesses:

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T. F. Bourne.

Inventor:

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(No Model.)

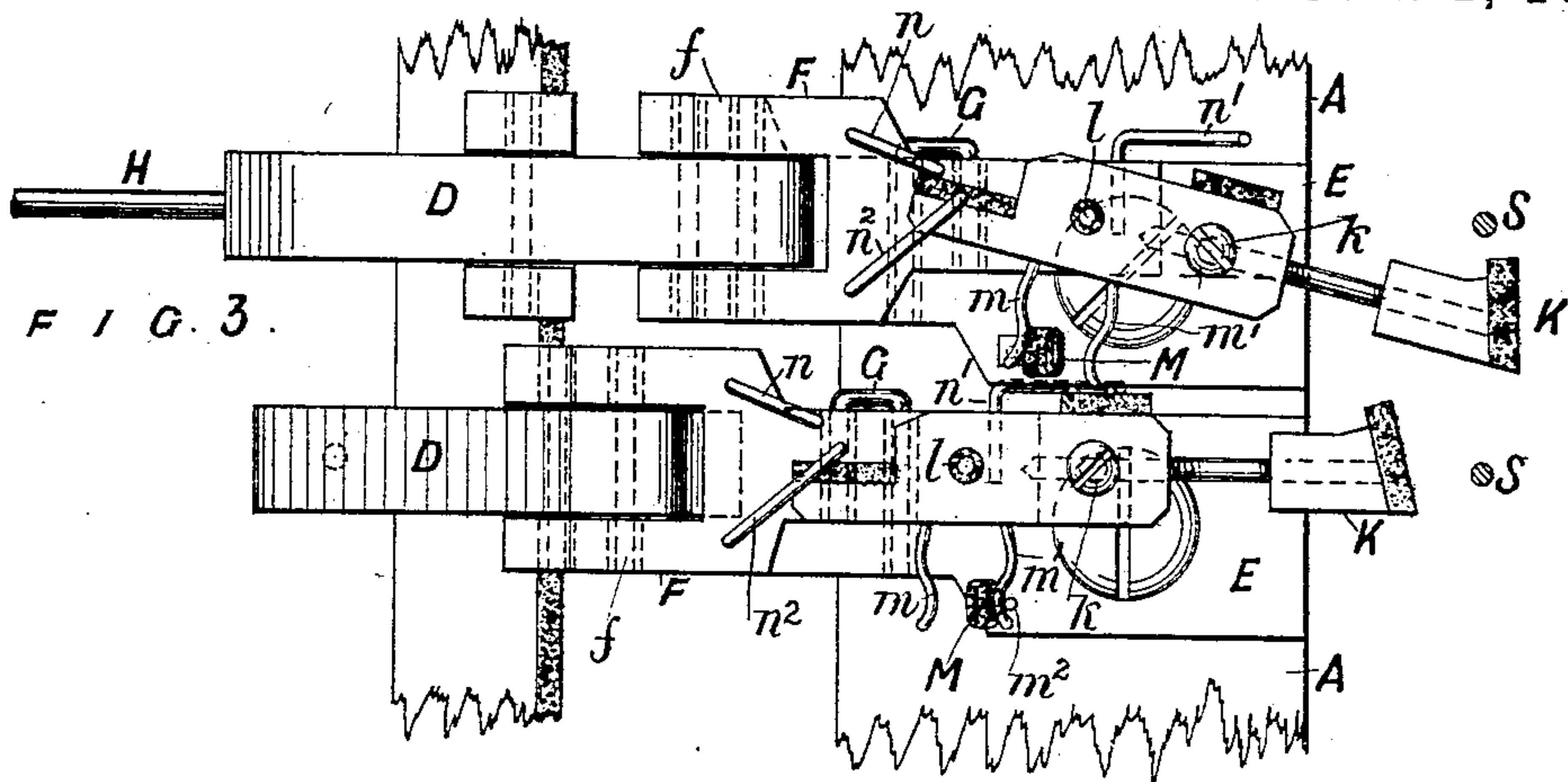
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A. L. CALDERA.

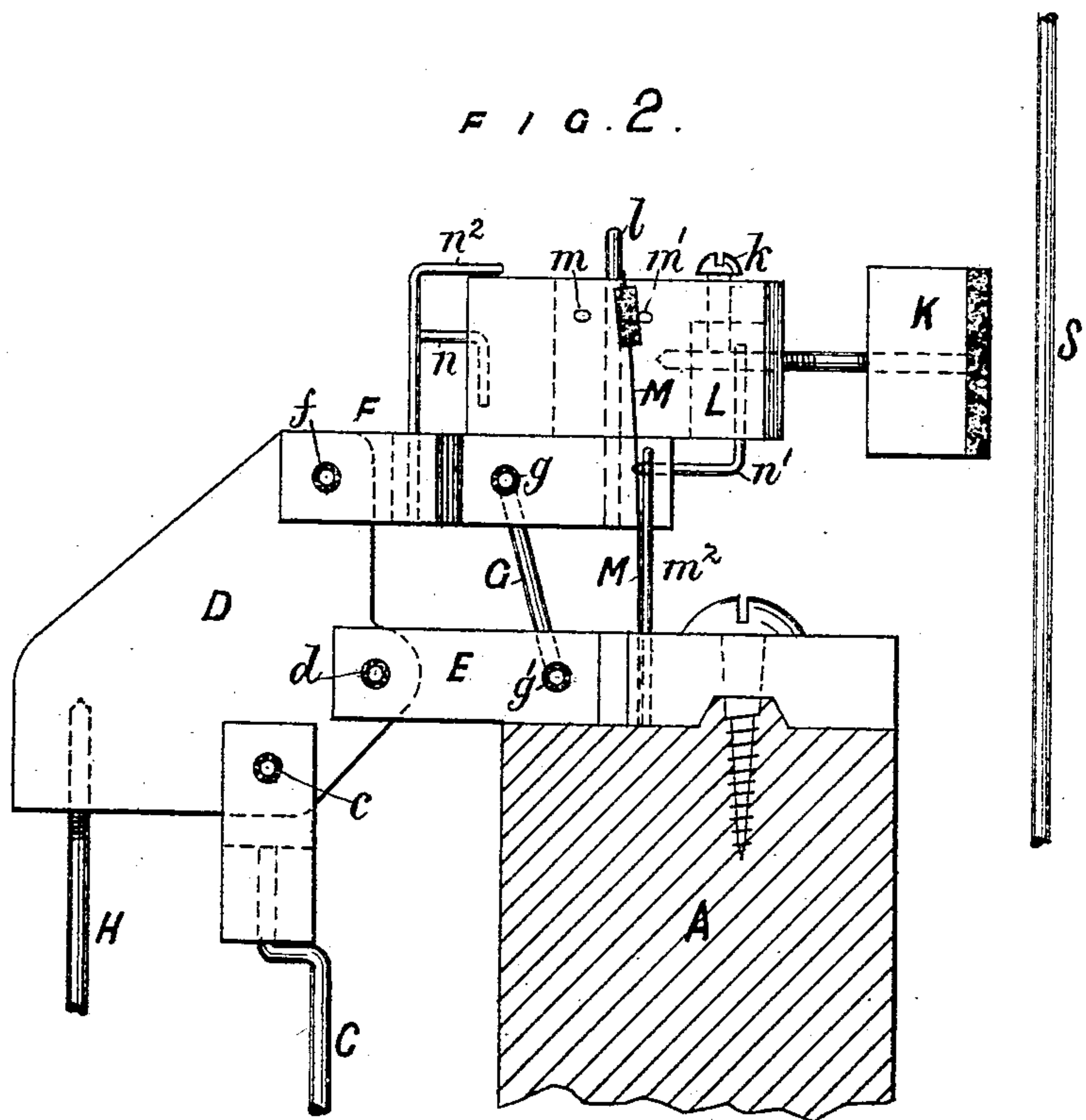
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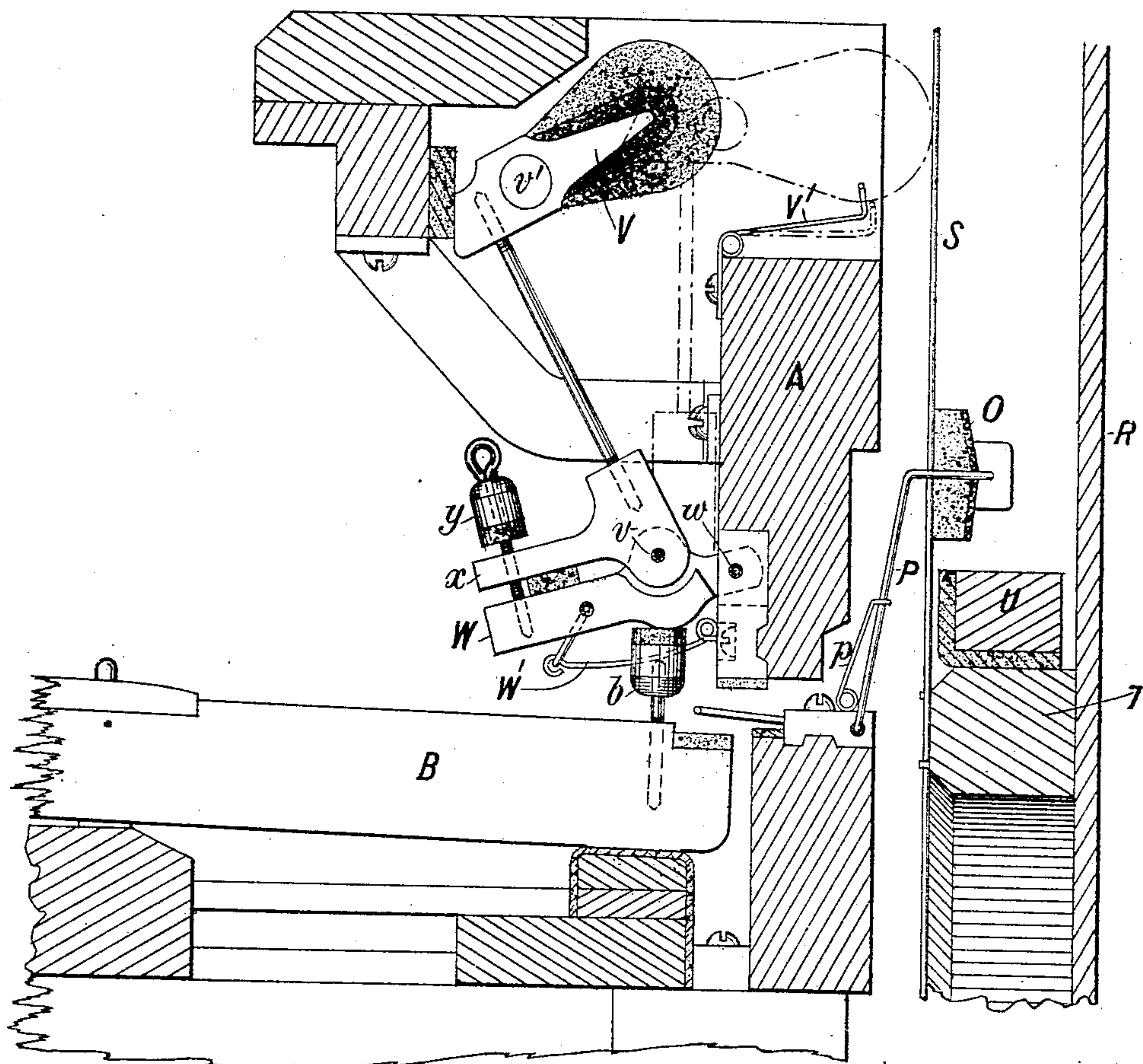
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FIG. 4.



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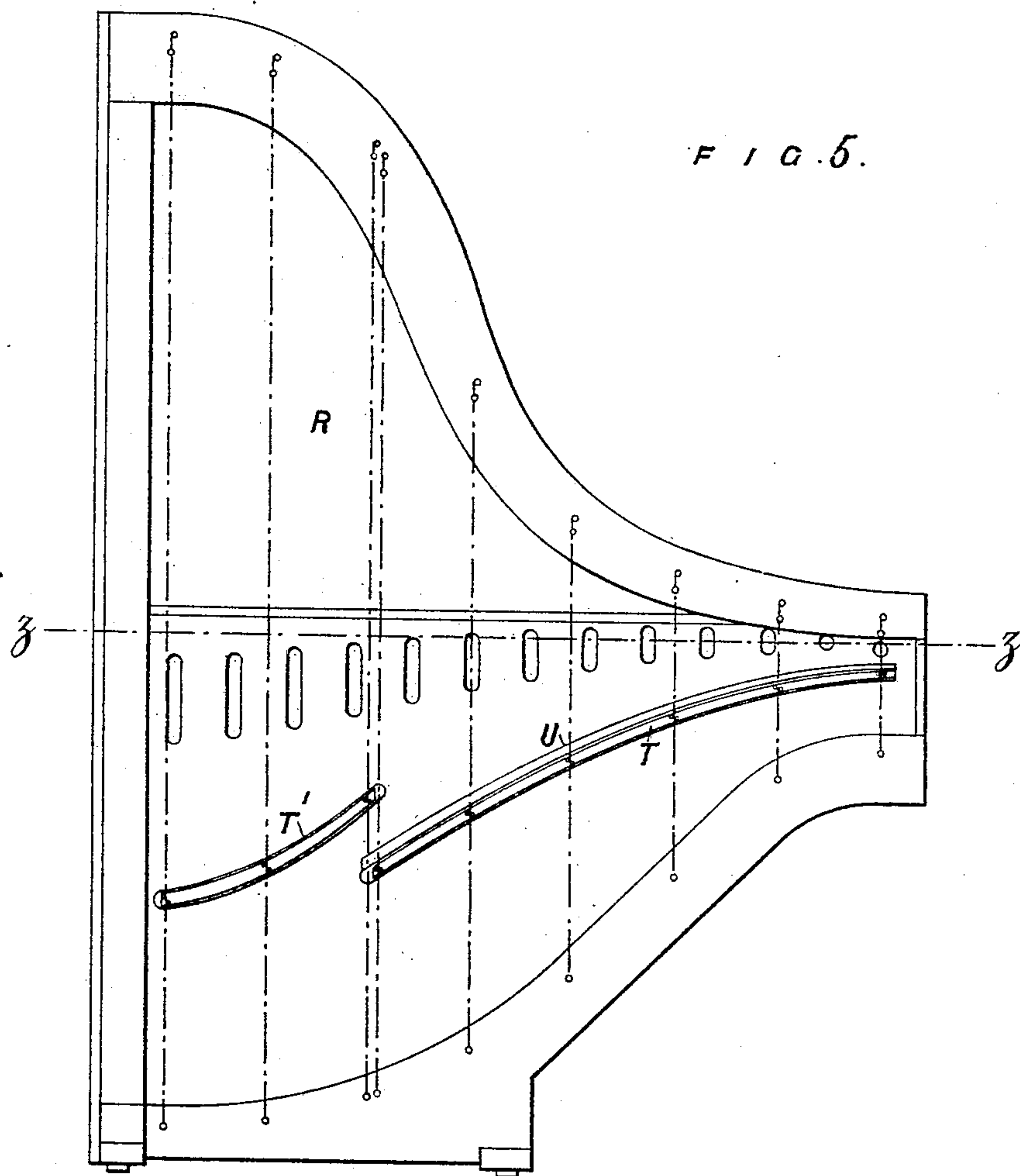
4 Sheets—Sheet 4.

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Patented Jan. 1, 1889.



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UNITED STATES PATENT OFFICE.

ANDREA LUIGI CALDERA; OF TURIN, ITALY.

KEY-BOARD MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 395,543, dated January 1, 1889.

Application filed August 25, 1888. Serial No. 283,787. (No model.)

To all whom it may concern:

Be it known that I, ANDREA LUIGI CALDERA, engineer, of Turin, Italy, and at present of 30 Lillie Road, Brompton, in the county of Middlesex, England, have invented new and useful Improvements in Key-Board Musical Instruments, of which the following is a full, clear, and exact description.

My invention relates to improvements in the key-board harp forming the subject of former Letters Patent of the United States granted to me and dated May 1, 1888, No. 382,028; and it has, first, for its object to lighten the touch and to simplify and otherwise improve the construction of the action or mechanism by which the plectra or mechanical fingers are caused to act on the strings; secondly, to improve the quality and volume of the tone produced by the instrument, particularly in the lower register, for which a special percussive action, different to that used for the remainder of the instrument, is provided; and, thirdly, to enable the quality of the tone to be modified at the will of the performer.

In order to simplify the construction and increase the durability of the action and, by rendering it more independent of climatic influences, insure greater precision and more constant uniformity of touch, I dispense with the escapement and counter-escapement ties or tapes and their coiled springs, referred to in my previous patent, and cause the plectrum or finger to be acted on directly by a steel spring; and in order to lighten the touch of the instrument I dispense with the spring-connection between the acting head of the plectrum and the pivoted shank or body by which it is connected; and to enable the plectrum or finger to quit or escape from the string with the necessary facility, after having pressed against and deflected the string, the acting face of the plectrum, instead of being perpendicular in the direction of its width to the line of motion of the plectrum, is beveled in such direction as to enable it to slip more readily off the string in the act of twanging or plucking it, the angle to which it is so beveled being such that the plectrum shall not slip off prematurely, but only after having deflected the string to a sufficient ex-

tent, and then only under the action of the escapement-spring.

In order to increase the volume of tone in the lower or bass register, I provide for this part of the instrument an action somewhat similar to that of a piano-forte, by which the strings are struck percussively, instead of being twanged or plucked, this action being, however, of special construction and acting on the strings at a different point in their length to that at which the strings of a piano-forte are struck.

In order to enable the quality of the tone to be modified at will and caused to approximate more or less nearly to that of a harp, as may be required, a manual or pedal operated "mute" or sourdine, is provided, which acts on the strings at a point immediately adjacent to the sound-board bridge.

Reference is to be had to the accompanying drawings, forming part of this specification, wherein—

Figure 1 is a cross-section of the action, full size. Fig. 2 is a similar view, and Fig. 3 a plan of the same on an enlarged scale, the latter figure showing two of the plectra in different positions. Fig. 4 is a cross-section of the action for the lower bass-register, and Fig. 5 is a face view of the sound-board and frame.

The same letters of reference indicate like parts in all the figures.

The instrument, as in the former case, is a monochord, there being one string to each note, these strings being of metal wire of about two-thirds the diameter (at the middle register) to about half the diameter (in the upper register) of the corresponding strings of an ordinary upright piano-forte—for instance, the No. 8 wire is preferably employed for the highest notes, and No. 13 at the middle register.

A is the rail on which the action is mounted.

B is the key, C the sticker, jointed at *c* to an elbow-lever, D, pivoted at *d* in a fork, E, fixed on rail A.

F is what I term the "jack," jointed at *f* to the elbow-lever D, and connected by a radius-link, G, with the fork E, the centers of motion, *d*, *f*, and *g* being equidistant, so that the jack receives a nearly-parallel motion.

H is a weighted arm fixed to the elbow-lever D for the purpose of equalizing by its *viva* the movement of the action and assisting the finger to overcome the resistance of the string S to deflection from a straight line.

I is a steel spring to cushion this weighted arm on arriving at the end of its motion. All the above-mentioned parts are substantially similar to those described in my former patent.

K L is the plectrum or mechanical finger, which acts on the string S, K being the acting head affixed rigidly by a screw wire, *k*, in the body portion L. This body portion is pivoted on a center pin, *l*, which is vertical or parallel to the string S, this center being carried by the jack F. This body portion L is virtually an elbow-lever, one arm of the lever being formed by a pair of laterally-projecting pins or abutments, *m m'*, between which plays a steel spring, M, fixed to the fork E, this spring being re-enforced in the direction in which it effects the escapement of the plectrum from the string by a stiff rod, *m²*, standing up behind it for part of its length.

The motion of the part L in the two directions is limited by wire stops *n n'*, and it is held down in its place on the center *l* by a wire catch, *n²*. The acting face of the plectrum is beveled at an incline of about one in four from the perpendicular to the direction of its motion.

The distance between the abutments *m m'* is proportional to the stiffness of the spring and to the amount of rectilinear motion of the plectrum necessary to cause it to deflect the string and effect its escapement therefrom. The abutment *m* may be termed the escapement-abutment, and the other abutment, *m'*, the counter-escapement abutment. In the normal position of the action the spring presses lightly against the counter-escapement abutment *m'* and holds the plectrum in the position shown in the lower part of Fig. 3, in readiness to act on and deflect the string by a direct thrust against it. At the proper moment, after the plectrum has partially deflected the string, the escapement-abutment *m* comes in contact with the spring, which, being stiffened or re-enforced by the rod *m²*, opposes sufficient resistance to the abutment *m* to cause the plectrum to move laterally with a rubbing action against the deflected string, and thereby to effect its escape therefrom. On the release of the key the plectrum returns toward its position of rest, and in so returning, after having passed clear of the string, the counter-escapement abutment *m'* meets the spring, which is less stiff in this direction than in the other, and is by it returned into line with the string, in readiness to act on it again with a direct thrust when the key is again depressed.

The damper O is carried by an elbow-lever, P, acted on by the key and is pressed by a spring, *p*, against the string. R is the belly or sound board, and T the belly-bridge.

U is the mute or sourdine, being a cloth or

felt covered bar conforming in shape to the outline of the bridge T, immediately above which it is placed, as shown in Fig. 5, and operated in one direction by a pedal or knee motion suitably connected thereto at numerous points in its length; as will be readily understood, and in the other direction by springs. This mute presses against the vibrating portion of the strings at a point close against the belly-bridge, and, unlike the dampers, it is not removed from the string when the latter is put in vibration, whereby the quality of tone of the metal strings is caused to approximate more nearly to that of the catgut strings of the ordinary harp. In its normal position the mute is held away from the strings, a more metallic quality of tone being then produced.

The various centers and contact-surfaces of the parts of the action are bushed or faced with cloth, as usual in such actions, and the acting face of the plectrum is clothed with felt of a very fine and compact quality, such as used for "wide-awake" felt hats.

Referring to Fig. 4, in which the same letters of reference indicate the same parts as in the previous figures, it will be seen that the plectrum is replaced by a hammer, V, similar to that of an ordinary piano-forte, whereby a far more powerful tone may be obtained than with a plectrum, the point at which the string is struck causing the tone, however, to partake of the harp quality, as hereinafter described. The hammer, it will be observed, has no escapement, as in that of the piano-forte, but the hammer-butt is centered at *v* to a jack or lever, W, centered at *w* in a fork fixed to the rail A. The hammer-butt has a tail-piece, *x*, which is loosely connected by a wire and stop, *y*, with the jack-lever W in such a way that the hammer is permitted a limited amount of play or motion independent of the jack. The key B acts directly on the hammer through the lifter *b* and jack W, which has a rounded part on which the lifter acts, and the head of the hammer is weighted at *v'* to enable it to strike the string with sufficient force by its own momentum after the key ceases to act on it.

V' is a check-spring fixed to the rail and acting on the hammer-head for the purpose of preventing the hammer rebounding and striking a second blow.

W' is a recoil-spring by which the jack, and consequently the hammer, is drawn downward when the key is released.

Referring to Fig. 5, it will be observed that the belly-bridge T is in correlation with the curved line passing through the wrest-plank bridge-studs; but instead of being continuous it is made in two portions, T T', the bass-strings passing over the part T' being struck by the hammers illustrated in Fig. 4. In Fig. 5 only the octave-strings corresponding to the notes A are shown.

It will be observed that the "strike-line" *z z* of both the hammers and the plectra or fingers is a continuous straight line across the

strings parallel to the key-board; but its proportional distance from the belly-bridge is different for the bass-strings, and hence the break in the belly-bridge.

5 In order to conserve the harp-like quality of tone in the lower register, notwithstanding the use of a percussive action, the strike-line $z z$, or line of percussion of the hammers, is situated for the lowest A in the bass at
10 four-thirteenthths of the length of string in vibration, reckoning from the belly-bridge. From this point upward in the scale the proportions are gradually varied until at the third A of the bass the strike-line is situated
15 at one-fourth of the length of the string. For the lowest string upon the part T of the bridge the strike-line is situated at one-third the length of the string, and from this point toward the treble it gradually approaches the
20 middle of the strings until, on reaching the sixth A from the bass, it is at about mid-length of the string, at which point it remains for the higher notes. The bass-strings struck by the hammers along the strike-line above indicated yield soft and mellow tones, partaking
25 of the characteristic quality of those of the ordinary harp, by reason that the harmonic and over tones which accompany the primary tones approximate more nearly to the latter and produce a less metallic sound than
30 when the string is struck, as in the piano-forte, at a comparatively short distance from the wrest-plank.

Having now particularly described and as-
35 certained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In the herein-described action for a key-board harp, the combination, with a mechanical finger or plectrum pivoted upon a vertical axis upon a jack receiving motion in a direction perpendicular to the string, as described, of a leaf-spring fixed at one end and applied to act at the other end against an
45 abutment projecting laterally from the pivoted body of the plectrum for the purpose of effecting the escapement of the plectrum from the string, as described.

2. In the herein-described action for a key-board harp, the combination, with the mechanical finger or plectrum pivoted upon a vertical axis upon a jack receiving motion in a direction perpendicular to the string, as described, of escapement and counter-escape-

ment abutments projecting laterally from 55 the pivoted body of the plectrum, and of a leaf-spring fixed rigidly at one end and acting at the other end in opposite directions against the said abutments, the said spring being re-enforced, so as to be stiffer in one 60 direction than the other, substantially as and for the purpose specified.

3. In the herein-described action for a key-board harp, the plectrum or mechanical finger having its acting head rigidly fixed to the 65 pivoted body or elbow-lever by which it is carried and operated, as described, and having its acting face beveled, as described, for the purpose of facilitating its escapement from the string. 70

4. In an action for a key-board harp, the combination, with a lever or jack, of a hammer centered thereon, and connected thereto, as described, so as to be actuated thereby, and to have limited motion independently thereof 75 by virtue of its own momentum, substantially as specified.

5. In an action for a key-board harp, the combination, with the hammer and its jack or lever, connected and operating as de- 80 scribed, of the recoil and check springs, as specified.

6. A key-board harp in which the action acts partly by percussion and partly by plucking the strings, the percussive portion of the 85 action being constructed and operating as herein specified, and being applied only at the bass-register, while the plucking part of the action is applied at the middle and upper registers, the strike-lines of the two parts 90 of the action being continuous across the strings, as described.

7. The combination, with a key-board harp and its belly-bridge, of a mute or sourdine contiguous to the belly-bridge and applied, by 95 means of a pedal or otherwise, against the strings while contiguous to the belly-bridge, as described.

The foregoing specification of my improvements in key-board musical instruments 100 signed by me this 1st day of August, 1888.

ANDREA LUIGI CALDERA.

Witnesses:

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