

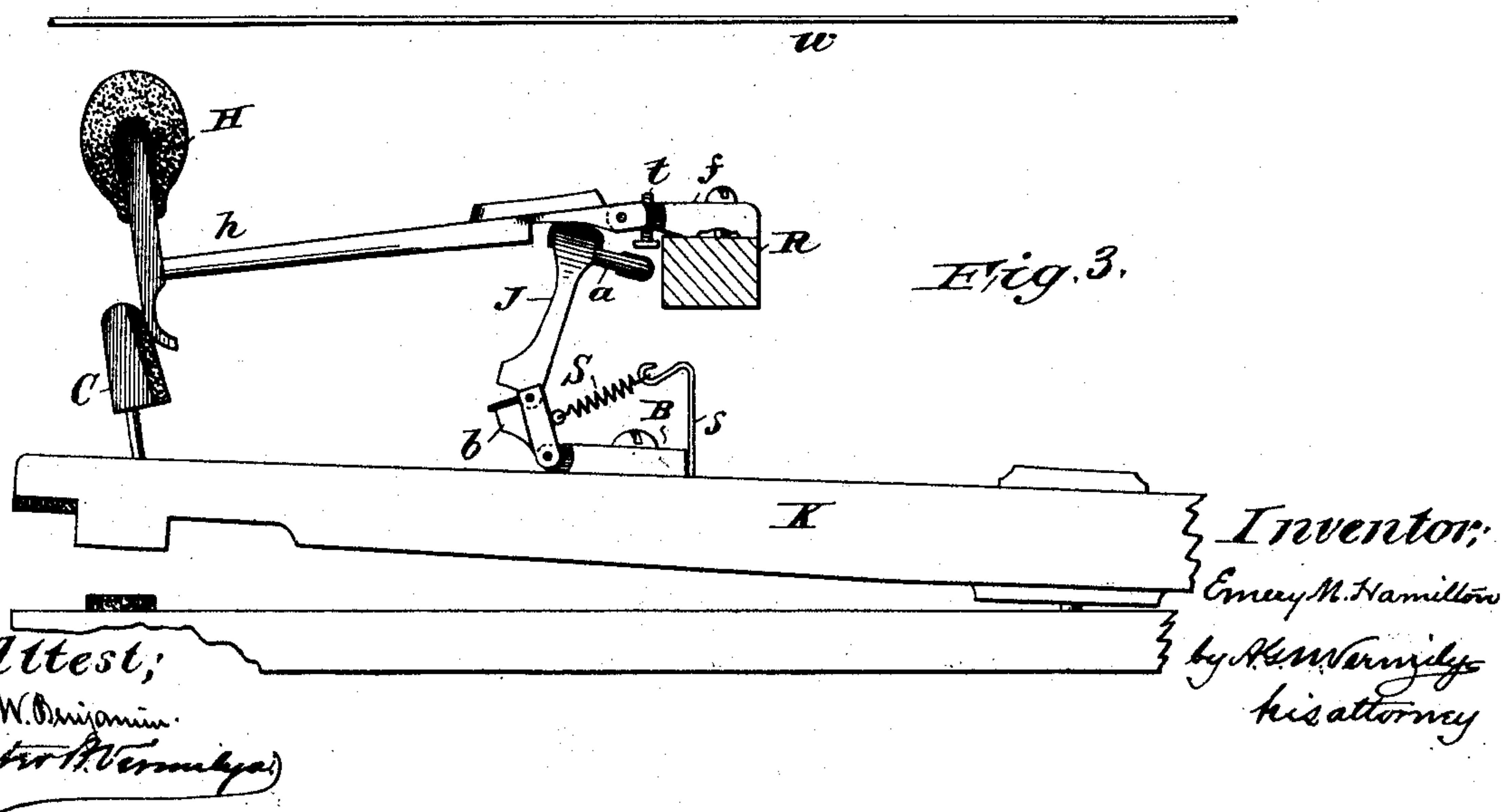
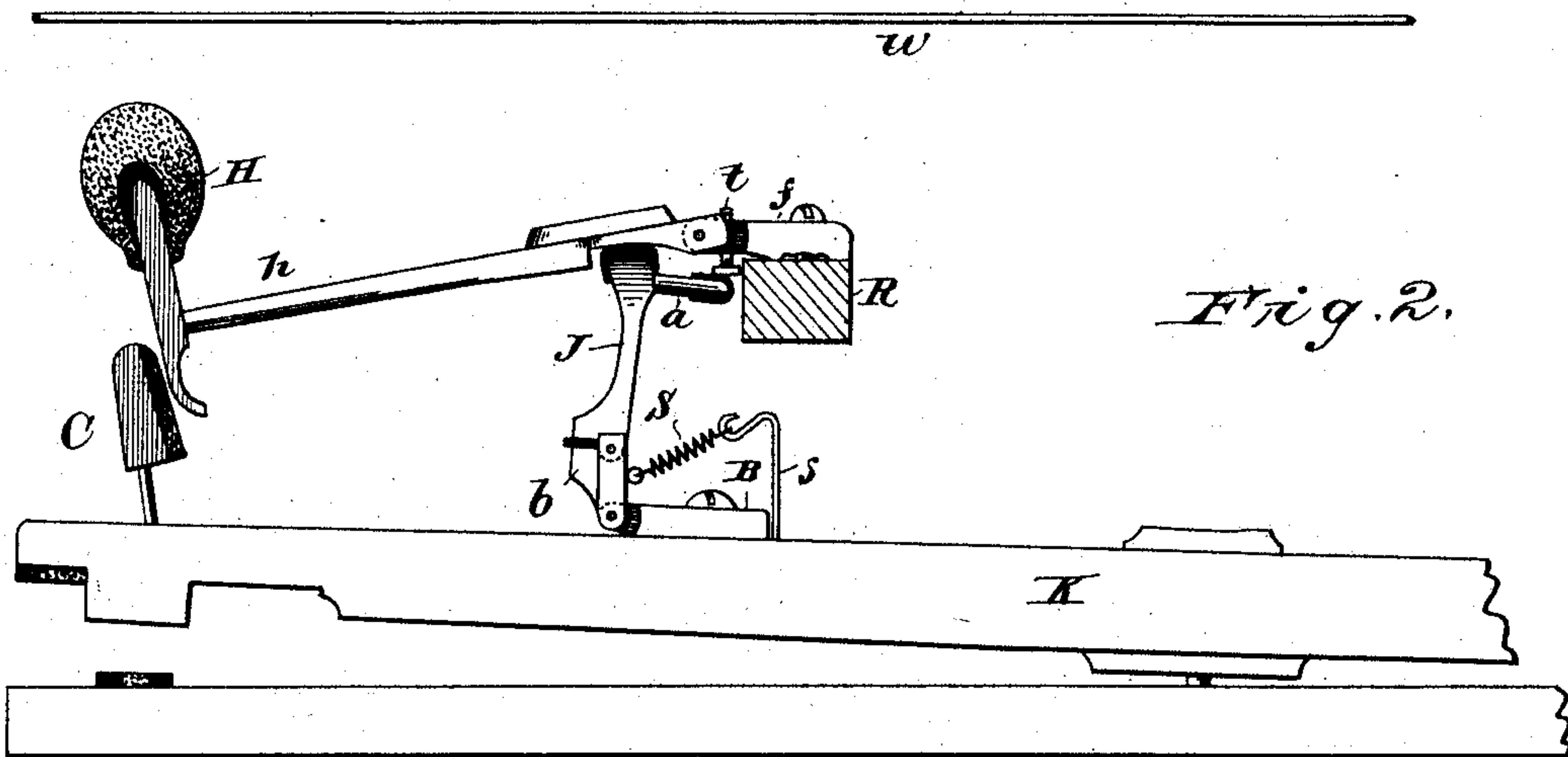
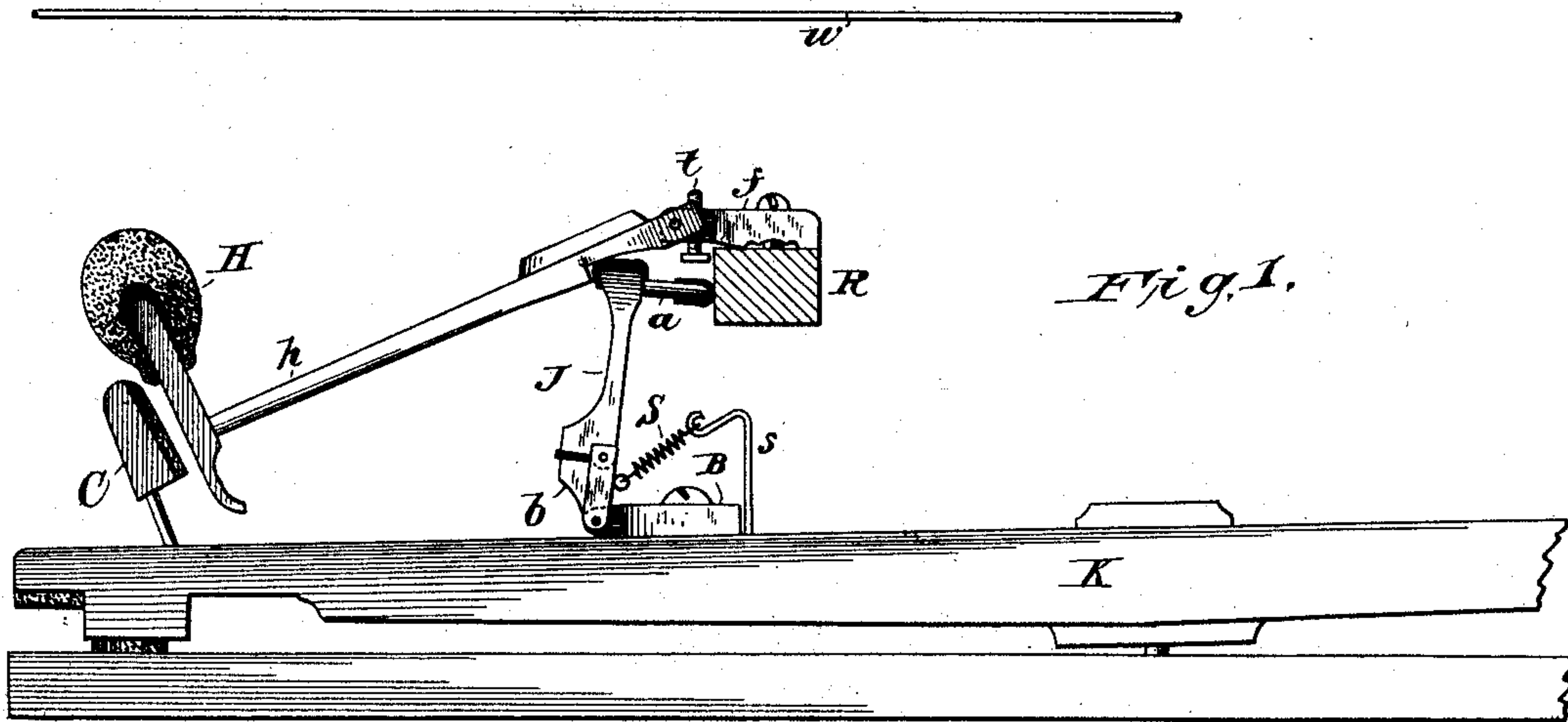
(No Model.)

2 Sheets—Sheet 1.

E. M. HAMILTON.
PIANO ACTION.

No. 506,225.

Patented Oct. 10, 1893.



(No Model.)

2 Sheets—Sheet 2.

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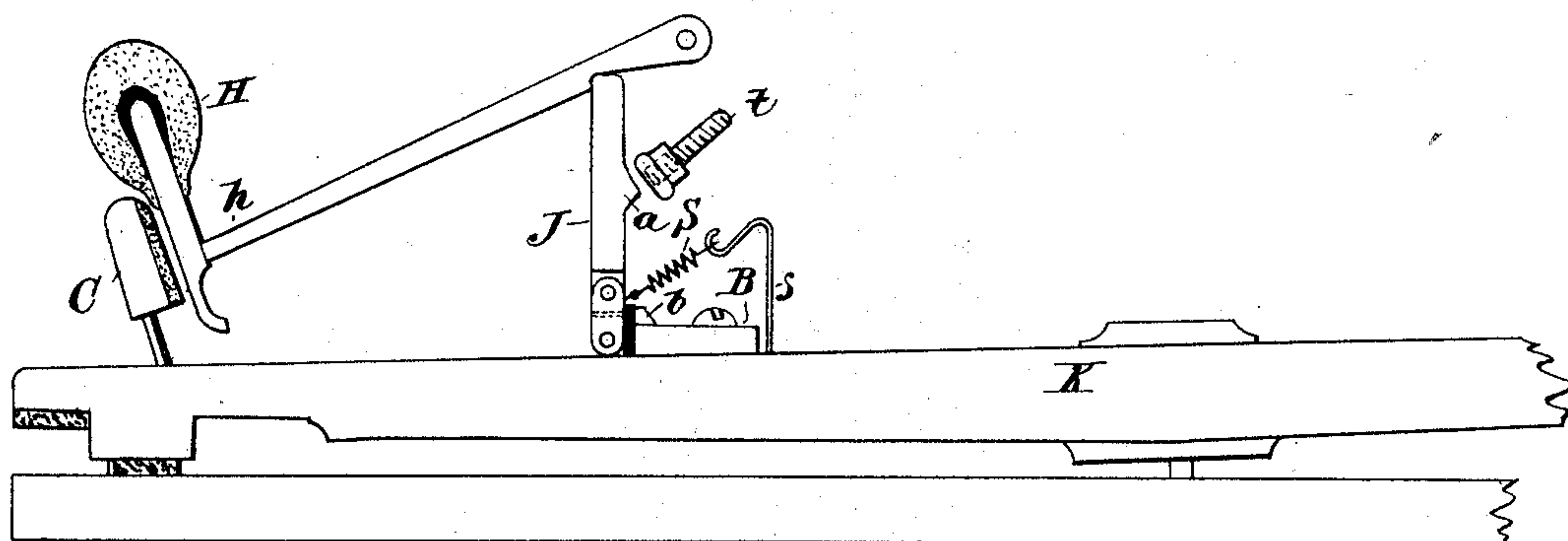


Fig. 5.

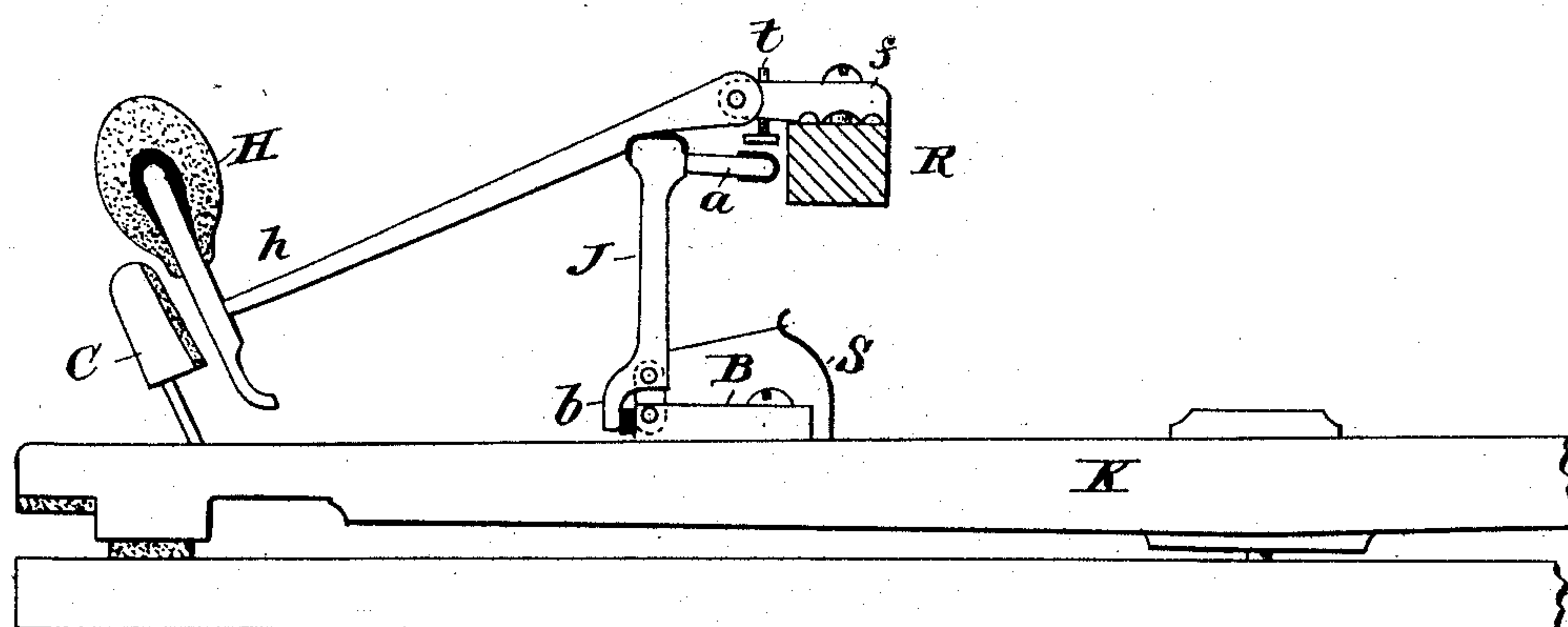


Fig. 4

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UNITED STATES PATENT OFFICE.

EMERY M. HAMILTON, OF NEW YORK, N. Y.

PIANO-ACTION.

SPECIFICATION forming part of Letters Patent No. 506,225, dated October 10, 1893.

Application filed March 7, 1892. Renewed February 28, 1893. Serial No. 464,118. (No model.)

To all whom it may concern:

Be it known that I, EMERY M. HAMILTON, a citizen of the United States of America, and a resident of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Piano-Actions, of which the following is a specification, reference being had to the accompanying drawings, forming part of the same, in which—

Figure 1, is a side elevation of those parts of a piano action embodying my invention, at rest. Fig. 2, is a similar view of those parts in the position they assume when the stroke is partially made. Fig. 3, is a similar view of those parts where the stroke has been delivered, but before the key has been released. Fig. 4, is a similar view of a modified form of jack which may be used in place of the one shown in the other figures; and Fig. 5, is a similar view of a still further modified form of jack.

The requisites of a satisfactory piano action are lightness, clearness and quickness. Its stroke should be light,—that is—as powerful a stroke with the hammer as desired with as slight a pressure as possible upon the key assuring sensitiveness and ease. This is approximated by the proper mechanical arrangement of the levers and their connecting links, thereby providing a direct and positive series; by using as few parts as possible, which also makes it easier to render the action noiseless, and by making them as light as is consistent with due strength and rigidity. It should be clear—that is—without jerkiness and with as little friction as possible and arranged to permit the hammer to reach the back check as soon as its blow has been delivered and before the key is released, thereby preventing any rebounding, and it should be quick—that is—capable of causing a rapid repetition of the stroke without the necessity of waiting till the key assumes the position in which it is when normally at rest. These conditions have been met with more or less success by escapements of more or less complication none of which have been entirely satisfactory and all of which I think have contained parts which at some points, usually the end of the jack, rubbed against the adjacent part, a thing in itself objectionable.

My invention consists in the means herein described whereby with very simple parts all the requirements are met more satisfactorily than before and the objections or some of them avoided.

K is the key lever, C the check, B the block on which is pivoted the jack J, provided with an extension or arm *a*. S, is the spring and *s*, its support. H, is the hammer, *h*, its shank, R, the main rail, *f*, the hammer flange, and *t*, the trip. Instead of block B, a rocker may be there provided, to permit of easy adjustment. Its form and arrangement are well known. Except the jack, the other parts are of ordinary construction (though the hammer shank is preferably notched as shown that the upper end of the jack may be securely held from misplacement).

The important novelty in the jack consists in the knee joint shown, preferably located below the center and arranged so that the distance between the extremities of the jack may be shortened without moving either extremity from its bearing, but by the moving of each member of the jack forming the knee joint out of the line drawn directly from the bearing at one extremity to that at the other, or in other words, the bending of not merely one but both members away from their respective normal position. This joint and the pivot by which it is joined to the block B, I usually preferably so arrange that when at rest (as in Fig. 1) the knee pivot will lie behind (here to the left of) a line drawn from the pivot in B, to the then point of contact between the head of the jack and the hammer shank, in order that when the key is at rest the knee may be straight and furnish a substantially rigid leg to force up the hammer when the key is depressed. This end might be attained by an unusually strong spring being employed but that would render the action stiff and unpleasant and might interfere with the proper reverse movement of the hammer toward the back check. At the same time the pivot of the knee should preferably not be located very far back of the line described, for a perfect action requires that when the arm *a*, has reached the trip *t*, the pivot at the knee should be just in the line described in order that the pressure upon the key to bend the knee may not need to be so great as it would were it required to force

the knee pivot past center, as it were. If the jack were jointed or hinged to the hammer shank the action would be much less easy and at one point a little jerky for the reason, that the hammer is intended to go a little farther than it would be raised by a very slow movement of the key, and is intended to be carried that farther distance by the momentum acquired during the time the jack is rising. Now if the jack be hinged or jointed to the hammer shank, the shank would necessarily have to carry the jack and its connected parts while passing through that additional space, which would not only interfere with the clearness, precision, and power of the stroke, but would require a heavier blow, one sufficient to throw all the parts the required distance, while as now arranged, it only needs force enough to throw the hammer and shank that distance. I have therefore left the shank and jack disconnected, and that feature is a material one in the construction of an efficient action. When I say disconnected, I do not mean absolutely, that is, I do not mean that it must be absolutely disconnected. A slight spring-connection which would permit the hammer shank to separate from the head of the jack and yet would guide it again to its seat and facilitate its return after the blow had been delivered, might in some instances be practical, but I do mean that there shall be nothing which will prevent the shank from separating from the head of the jack in passing through the latter portion of its movement toward the wire or string. An action could, of course, be arranged in which the jack would continue to move upward by reason of actual and continued pressure upon the key lever throughout the entire movement and would therefore carry the hammer the whole distance and not throw it at all, in which action the shank and jack might be connected, but such an action would not accomplish the results desired. It would especially lack elasticity, which is a necessity in a satisfactory action. Again my arrangement of parts, (the jack inclined away from the hammer, the trip located on the side toward which it is inclined, and mounted on the rail or the shank itself, and the relative locations of the point of contact of the jack and shank and the pivots of the jack,) insures that the jack will remain in its proper position without any additional check upon the left hand side of it, thereby dispensing with an additional rail for the support of said check, as the arm of the jack almost (and sometimes quite) rests against the main rail in normal position, but bears away from it without rubbing, the instant the key is depressed.

The operation is manifest. The depression of the key lever at the finger end of course throws up the other end carrying with it the jack with a straight knee and the hammer shank and hammer and the blow is delivered upon the wire *w*. Just before the jack

reaches the limit of upward movement its arm *a*, comes in contact with the trip *t*, (which is here made adjustable by being screw threaded into the flange *f*,) and can no longer rise rigidly straight but (as seen in Fig. 3) is bent at the knee by the shortening of the distance between its pivot in block B and the trip, and when the hammer (which has, as stated, been carried against the wire by the impetus of the blow) and its shank fall back, the knee yields to permit it to return far enough to come in contact with back check C and thus all rebounding is prevented. The stress of spring S, however tends continually to straighten the knee of the jack and the instant the finger end of the key is released but a little, the knee becomes straight and the parts are in position for a rapid repetition of the stroke, and this too before the key has moved but a short distance on its return to rest (as seen plainly in Fig. 2).

The simplicity and accuracy of the action are apparent. It will be noticed that the head of the jack is somewhat elongated in the direction of the length of the hammer shank and this accomplishes a further object which is to accelerate the speed of the hammer toward the end of its stroke. At the beginning the shank rests upon the forward part of the head as seen in Fig. 1. Its speed is of course regulated by the ratio between the upward movement of the jack and the distance of its then point of contact from the pivot of the hammer shank. As the movement continues the point of contact continually changes moving always toward the pivot of said shank continually shortening the second term of the ratio and thereby increasing the ratio of the speed of the hammer. It will also be noticed that the movement of the head of the jack upon the shank is substantially a rolling motion and that the rubbing action so universal at this or a substantially similar point is entirely avoided in this device. A still further improvement is effected by this arrangement. It is by some thought desirable that "forte" notes should be made by as light a touch as possible and the "piano" notes by a harder blow and the changing fulcrum as described, accomplishes this end.

Fig. 4 as specified is a modified form of the jack. Its action is substantially the same as that already described, the difference being, that instead of having the two parts of the knee, back of the pivot make contact with each other on a substantially horizontal line (as seen in Figs. 1 to 3) and thereby forming a stop to prevent a reverse bending of the knee, I have here arranged them to make contact on a vertical line, the lower one being cut away and a portion of the upper one extended down below the pivot for that purpose, a mere variation of form. In Fig. 5 I exhibit a further variation of the joint and also a variation of the trip. The joint is a

mere hinge, but is converted into a knee joint—one that will substantially bend in but one direction—by providing a stop *b*, limiting motion in the other direction, but the stop in this instance is made part of, or secured to the block B, as shown, its action however being very similar to that of the other stops shown. In this figure the arm *a*, is in the form of a taper lug and the trip *t*, placed near it and with its face preferably substantially parallel to the face of the lug. As the jack moves upward the face of the lug comes in contact with the face of the trip, the jack is thrown to the left and the knee joint bent with the same result heretofore described. And I desire to say that many other variations of form in the arrangement of the knee might be adopted, all of which however I believe to be entirely within the spirit of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a piano action, a lifting part or jack provided with a knee joint substantially as set forth and interposed between the hammer shank and the key lever but disconnected from the hammer shank.

2. In a piano action, the combination of a key lever; a jack pivoted thereto and provided with a knee joint, substantially as set forth, a head and an arm; a hammer and shank, the latter of which is pivoted to a rail and in contact with the jack head, but disconnected therefrom, substantially as set forth; and a trip so placed as to make contact with the arm of the jack before the key lever has reached its limit of movement, substantially as set forth.

3. In a piano action, the combination of a key lever; a jack pivoted thereto and provided with a knee joint, substantially as set forth, a head and an arm; a hammer and shank, the latter of which is pivoted to a rail and in contact with the jack head, but disconnected therefrom, substantially as set forth; a trip so placed as to make contact with the arm of the jack before the key lever has reached its limit of movement; and a spring secured to the jack so that its stress shall act to hold the knee straight, substantially as set forth.

4. In a piano action, a lifting part or jack provided with a knee joint substantially as set forth and interposed between the hammer shank and the key lever, but disconnected from the hammer shank substantially as set forth, and a stop as set forth, to limit its bending to substantially one direction as specified.

5. The combination of a pivoted piano hammer and shank a key lever; and a jack interposed between, and provided with an elongated head in contact with the shank, but shaped and arranged substantially as set forth; whereby one portion of the head makes contact with the shank at the beginning of

the stroke and another portion of said head, nearer the shank pivot, makes such contact as the stroke progresses; substantially as set forth.

6. The combination in a piano action, of a pivoted key lever; a hammer and shank pivoted to the main rail; a jack pivoted to the key lever, divided into two parts pivoted together, and provided with a stop and an arm, but disconnected from the hammer shank substantially as set forth; a spring secured to said jack and to the key lever; and a trip located in the line of movement of said arm of the jack, at a point within the limit of said movement; all substantially as described.

7. The combination of a pivoted piano hammer and shank, a key lever, a jack provided with a knee joint in two parts, one of which is pivoted to the key lever and to the second part and the other of which is arranged to make contact with the hammer shank, an arm and a stop as set forth, the point of contact and the pivots being arranged as described whereby at rest the knee pivot will be at the rear of a line drawn from the point of contact with the shank to the pivot of the jack on the key lever, but at the moment of contact between the arm and stop, said knee pivot will be in or to the front of a line from the key lever pivot to the point of contact, all substantially as set forth.

8. In a piano action, the combination of the key lever K, the jack J, inclined as set forth, and provided with an arm *a*, a hammer H, and shank *h*, a main rail R, and a trip *t*, all arranged and combined substantially as set forth.

9. In a piano action, the combination of a main rail, key lever, a hammer and hammer shank with a knee jointed jack interposed between them as set forth, and a spring arranged as described, whereby said spring not only tends to hold straight the knee joint, but also tends to hold the head of the jack against the rail when said jack is in normal position, substantially as set forth.

10. The combination of a pivoted piano hammer and shank; a key lever; and a jack interposed between, and provided with an elongated head in contact with the said shank, but shaped and arranged substantially as set forth; whereby one portion of the head makes contact with the shank at the beginning of the stroke and another portion of said head, nearer the shank pivot, makes such contact as the stroke progresses; substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 4th day of March, 1892.

E. M. HAMILTON.

Witnesses:

PETER B. VERMILYA,
A. G. N. VERMILYA.