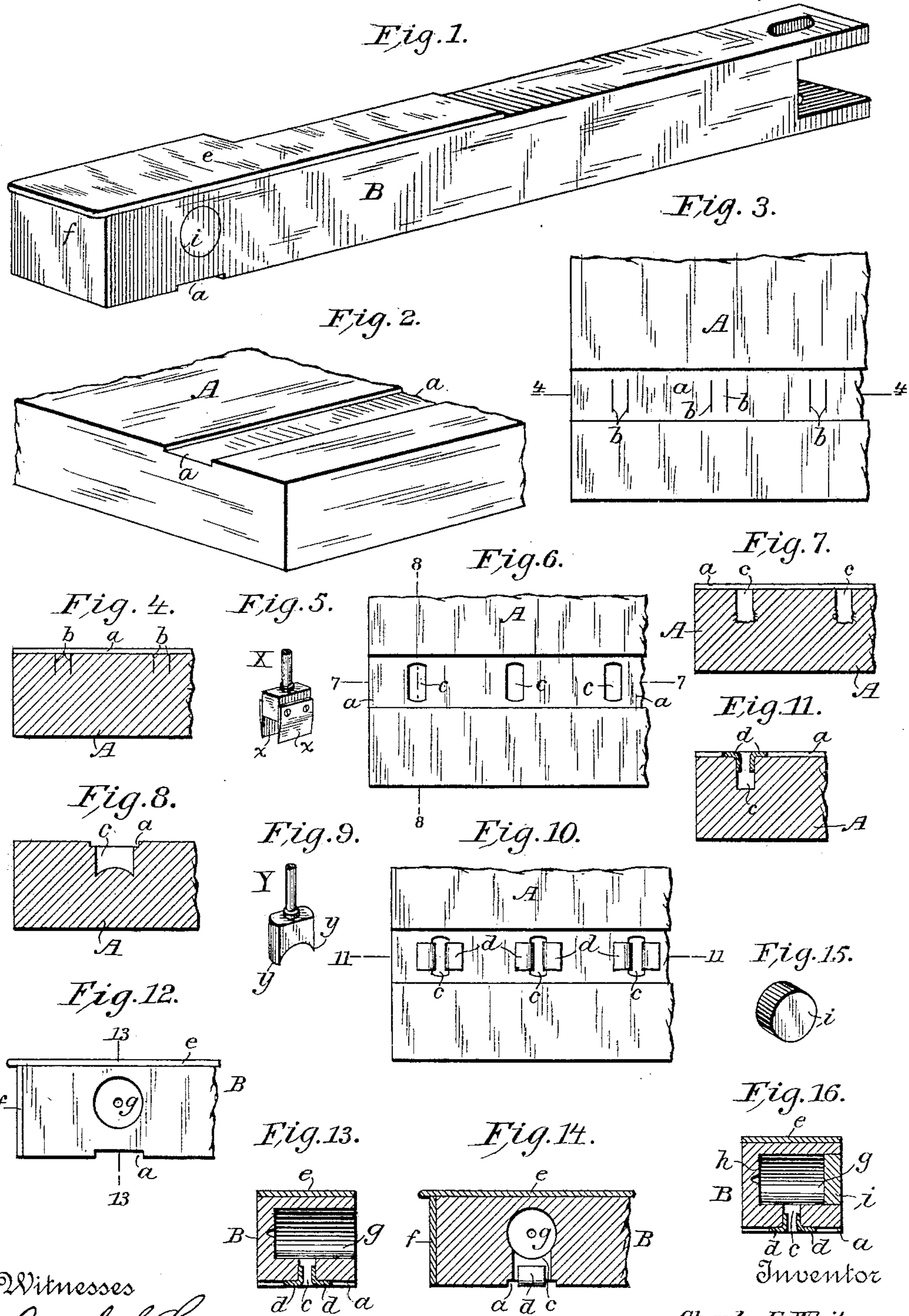


C. E. WHITNEY.
KEY FOR MUSICAL INSTRUMENTS.

No. 477,830.

Patented June 28, 1892.



Witnesses
Joseph S. Lottimer
Carleton C. Snell.

Charles E. Whitney
by *Arthur D. Brown*
his Attorney

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Fig. 17.

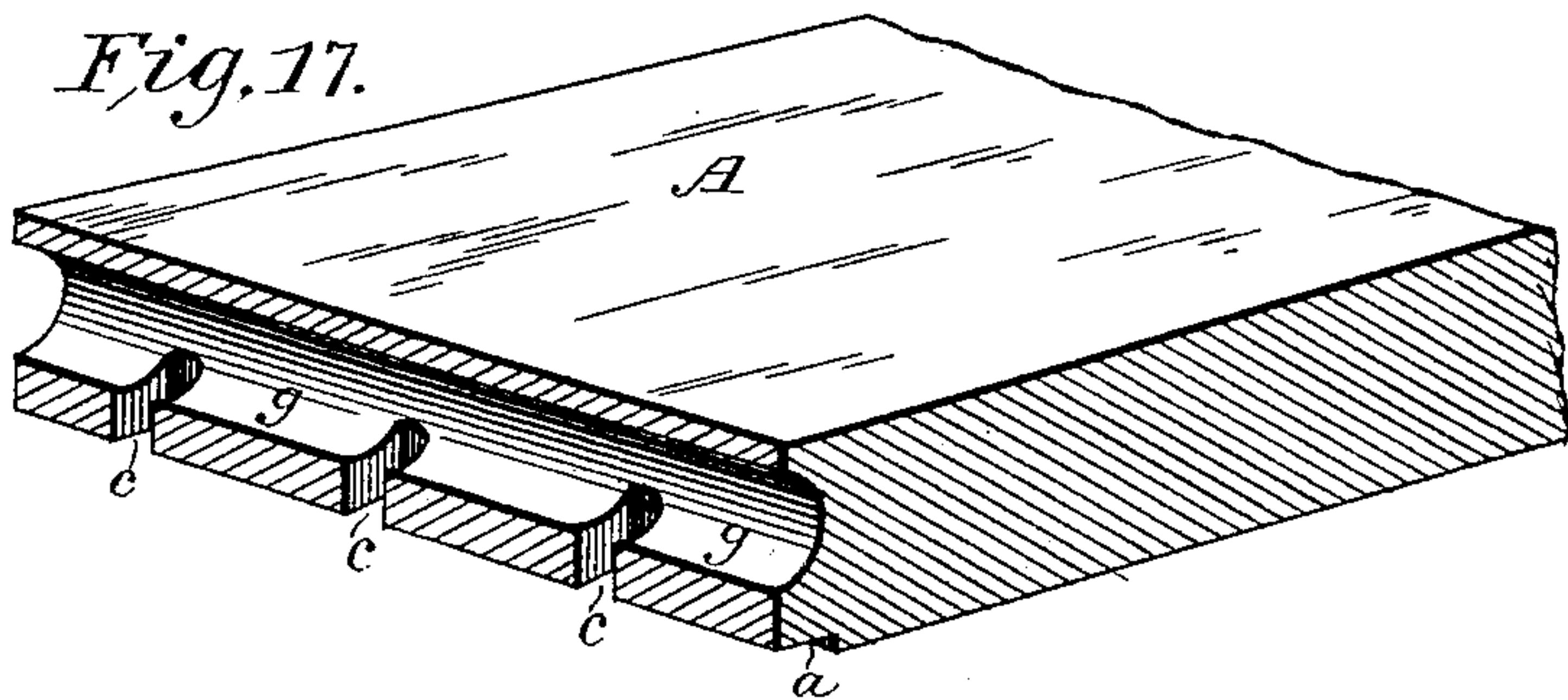


Fig. 18.

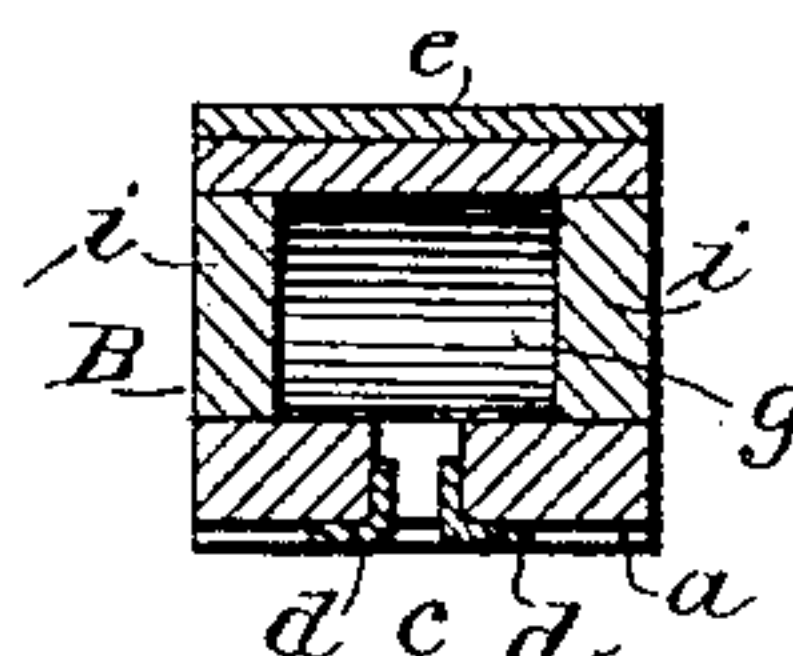


Fig. 19.

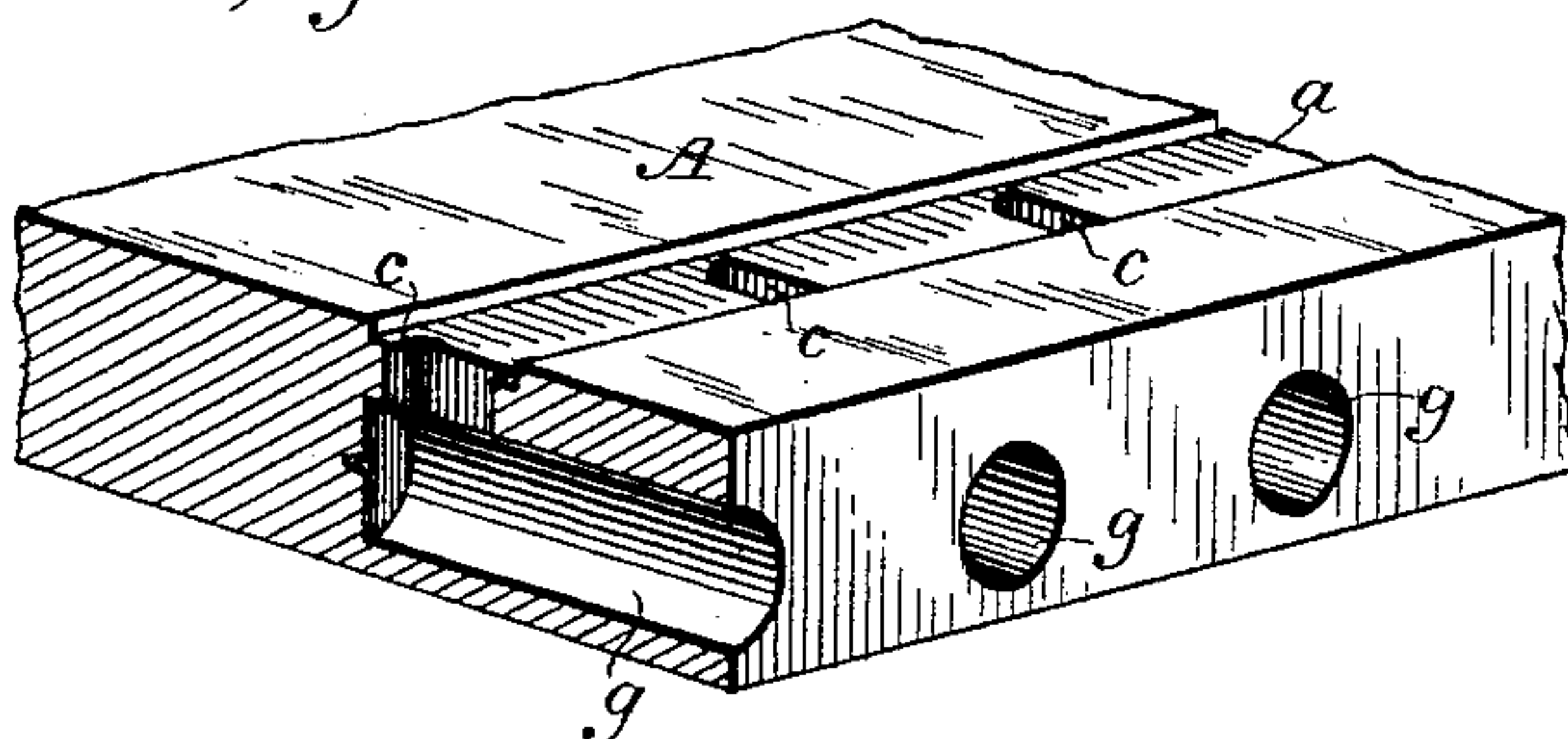


Fig. 20.

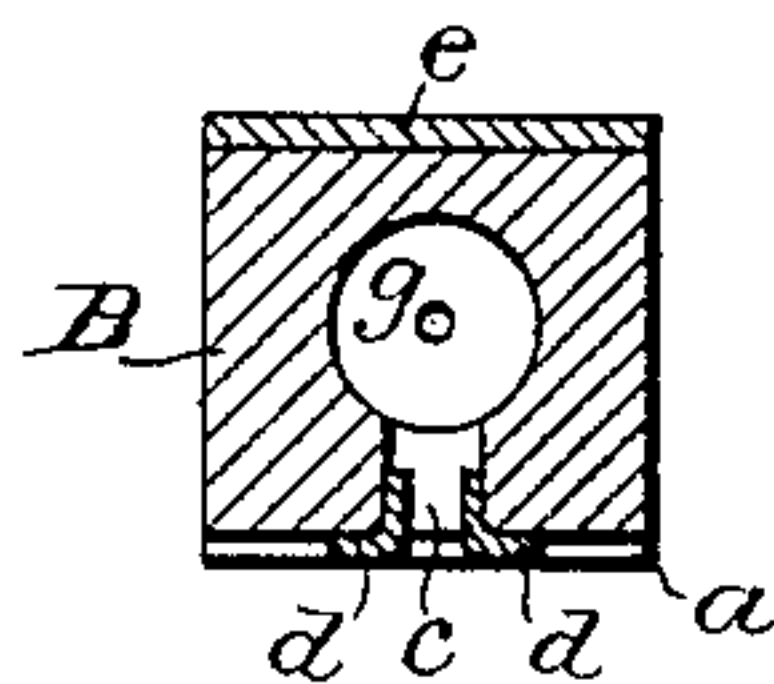


Fig. 21.

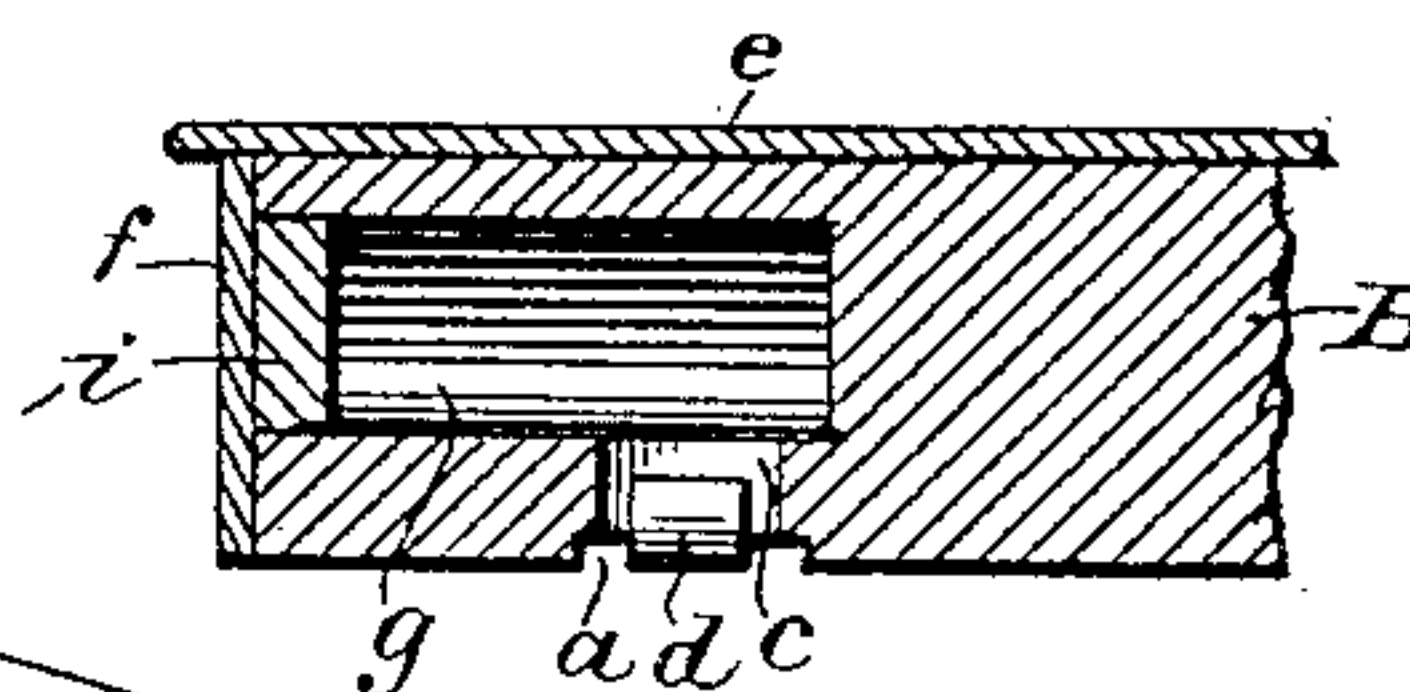


Fig. 22.

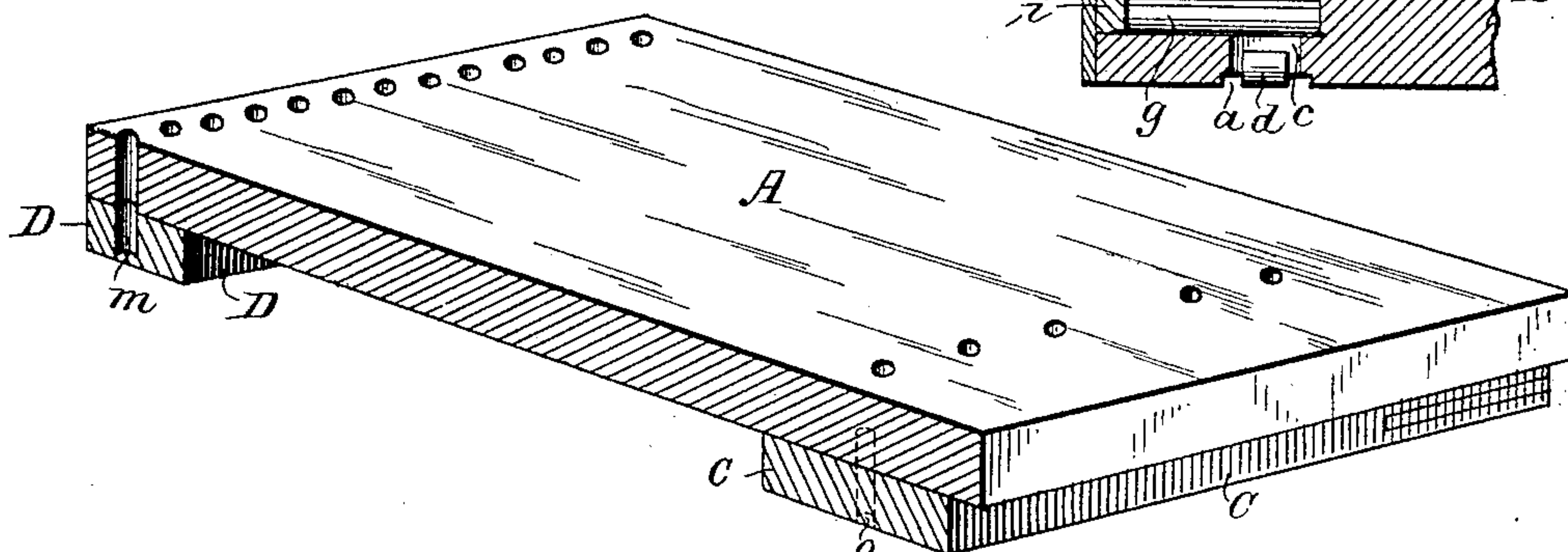
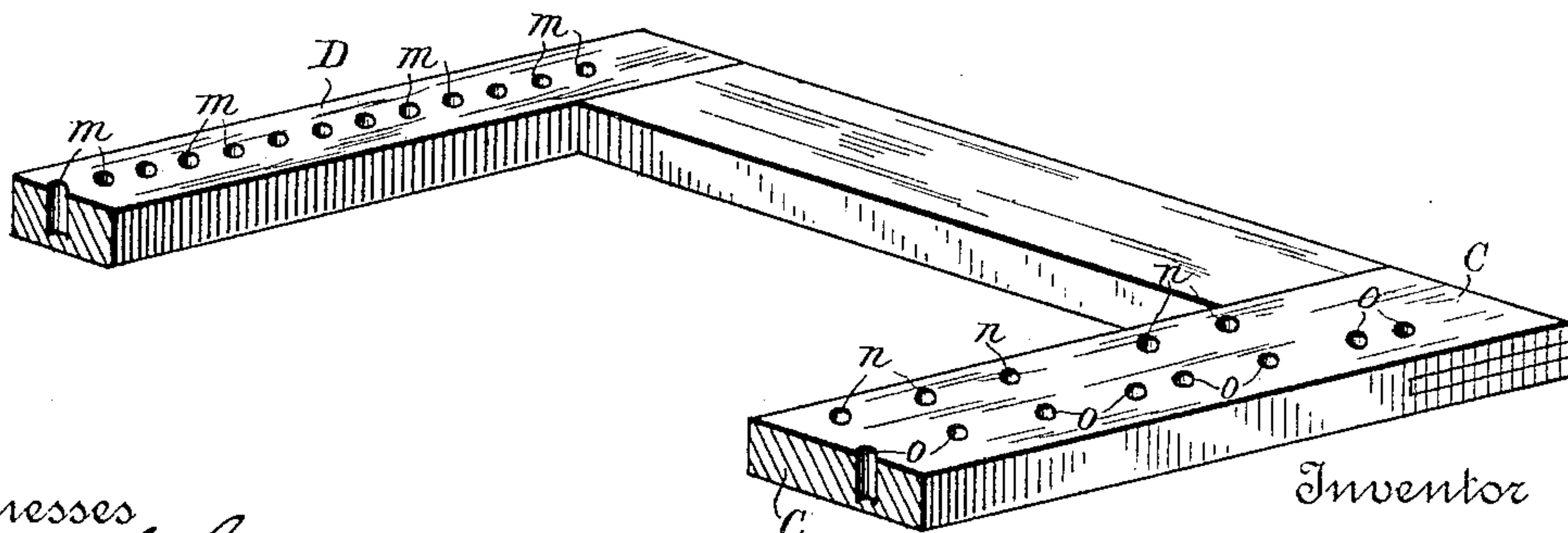


Fig. 23.



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UNITED STATES PATENT OFFICE.

CHARLES E. WHITNEY, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE
ESTEY ORGAN COMPANY, OF BRATTLEBOROUGH, VERMONT.

KEY FOR MUSICAL INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 477,830, dated June 28, 1892.

Application filed January 19, 1892. Serial No. 418,582. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. WHITNEY, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Keys for Musical Instruments and the Method of Making the Same, of which the following is a specification.

The present invention relates to the manufacture and construction of the front ends of the white keys of organs, pianos, and similar musical instruments.

The primary object of the present invention is to produce an organ or piano key the wooden body of which shall have an unbroken and unperforated top surface, so that when the celluloid or ivory covering is applied to the top surface of the key-body it shall always preserve a uniform and even appearance.

In the old and usual method of making piano and organ keys, such as was practiced almost uniformly until quite recently, it was customary to make the guide slots or holes for the front guide-pins of the keys by boring down from its top through the wooden key-body. A cross-channel was then cut across the guide-pin hole thus formed, and in this cross-channel a strip of wood was laid flush with the top of the key-body. This cross-strip covered the pin-hole and afforded, with the general upper surface of the key-body, the surface on which the celluloid was laid. Owing to various causes—such as the unequal shrinkage of the wood, warping due to the presence of the glue for retaining the cross-strip, and the high pressure to which the celluloid is subjected when applied to the keys—this usual method of manufacture has proven unsatisfactory, since the joints between the cross-strip and the main body of the key affect the appearance of the surface of the celluloid and render it uneven and ridged. This uneven surface of the celluloid is further objectionable, since it is felt by the player of the instrument and proves an annoyance.

The objections to keys made in accordance with the old method are well set forth in Letters Patent of the United States No. 423,076, granted to Augustus Newell March 11, 1890.

To obviate and remove these objections, several methods have recently been proposed to manufacture keys in such a manner that they shall have an unbroken and imperforate top surface for the celluloid covering. In accordance with one of these methods the old method of boring the front pin-hole through the top of the key has been preserved, and a veneer has been glued to the entire portion of the top of the key which receives the celluloid. This prevents any sagging of the celluloid into the joints of a cross-strip inserted in a channel extending across the upper face of the key-body; but it introduces an additional glued veneer of wood across the entire top of the key, which is objectionable, since there may be a warping of the entire veneer, and if it starts at any point from the key-body it is liable to come entirely off. In accordance with a second method which has been proposed the round pin-hole has been bored from the bottom of the key, but not extending to the top thereof. This necessitates special means for providing the felted rectangular guide-slot or "mortise" for the reception and guiding of the front guide-pin. The provision adopted for this purpose has been to glue onto the bottom of the key (or into a recess cut therein) a felted strip or strips, (block or blocks,) which furnish the guide-slot. This method of manufacture may entirely overcome the difficulty in reference to the celluloid and be as cheap (if not cheaper) to carry out as the old method. It presents, however, two difficulties. It necessitates, in the first place, the use of glue to hold the felted blocks or strips to the key-body and the less glued parts to the key the better, since if such parts are essential to the proper action of the key (as these felted blocks are) and they should fall off the instrument would have to be repaired, and, in the second place, it is essential that the sides of the front guide-slot should be exactly parallel with the longitudinal axis of the key, and this exact parallelism can only be obtained (where felted pieces separate from the key-body are employed) by the exercise of such considerable care as to add appreciably to the cost of the keys.

Now the present invention seeks likewise to secure the unbroken top surface of the key-body, so that the appearance of the celluloid is not affected and so that the celluloid may be applied directly to the key-body. In this way the merits of both of the recent new methods referred to are secured. At the same time the present invention secures the cutting of the front guide slot or mortise directly in the key-body, thereby obviating the necessity of the application of any separate glued part to the body of the key. The new method involved in the present invention produces a new key having all the merits of the best keys thus far produced with none of their defects or disadvantages, and the new method is, moreover, cheaper than any of the existing methods.

The improved method and the improved keys produced thereby are illustrated in the accompanying drawings, wherein—

Figure 1 is a perspective view of the completed key. Fig. 2 is a perspective view of a portion of a key-blank from which the keys for an entire keyboard are made, illustrating the first step of the method of forming the front ends of the keys. Fig. 3 is a view of the bottom of a portion of the key-blank, illustrating the second step of the method of forming the front ends of the keys. Fig. 4 is a vertical section of a portion of the key-blank in a plane indicated by the line 4 4 in Fig. 3. (Fig. 4 is a cross-section considered in reference to the individual keys. Hereinafter for convenience all sections will be considered in reference to the individual keys.) Fig. 5 is a perspective view of the tool by which the second step of the method as illustrated in Figs. 3 and 4 is performed. Fig. 6 is a bottom view similar to Fig. 3, illustrating the third step of the method of forming the front ends of the keys. Fig. 7 is a vertical cross-section in a plane indicated by the line 7 7 in Fig. 6. Fig. 8 is a vertical longitudinal section in a plane indicated by the line 8 8 in Fig. 6. Fig. 9 is a perspective view of the tool used in performing the third step illustrated in Figs. 6, 7, and 8. Fig. 10 is a bottom view similar to Figs. 3 and 6, illustrating the fourth step of the method of forming the front ends of the keys. Fig. 11 is a cross-section in a plane indicated by the line 11 11 in Fig. 10. Fig. 12 is a side view of an individual key, illustrating the next or fifth step, which is distinctive of the present method. Fig. 13 is a cross-section in a plane indicated by the line 13 13 in Fig. 12. Fig. 14 is a longitudinal section of the key shown in Fig. 13. Fig. 15 is a perspective view of a filling-plug employed. Fig. 16 is a section similar to Fig. 13, showing the plug in place. Fig. 17 is a perspective view of a portion of a key-blank, partly in section, illustrating a modification in the method. Fig. 18 is a cross-section of a completed key made in accordance with this modification. Fig. 19

is a perspective view of a portion of a key-blank, partly in section, illustrating another modification of the method. Fig. 20 is a cross-section, and Fig. 21 a longitudinal section, of a completed key made in accordance with this second modification. Fig. 22 is a perspective view, partly in section, of a portion of a key-frame and a key-blank, illustrating the old method of forming the pin-holes in the key-frame for the rear pins and the front pins for the black keys and also one way for forming the holes for the front pins for the white keys. Fig. 23 is a perspective view, partly in section, of a portion of the key-frame, illustrating the preferred method of forming the pin-holes for the front pins of the white keys.

In the manufacture of keys in accordance with the present invention a portion of the operations are preferably performed upon a key-blank of sufficient size for all of the keys of a keyboard, as has been usual in the manufacture of keys. Accordingly there is shown in Fig. 2 one corner of a key-blank A, which, it will be understood, is as wide as the keys to be made from it are long and as long as the combined width of all of the keys in a completed keyboard.

The first operation performed upon the key-blank A which is material to the present invention is to cut a shallow channel *a* lengthwise along the bottom of the key-blank, and consequently across the bottoms of the completed individual keys. This channel *a* is cut a short distance back of the front edge of the key-blank, so as to be in the line of the front guide-pins for the white keys. This channel *a* consequently is cut in the bottoms of the white keys only.

Since the present invention relates to the manufacture of the white keys only, it is unnecessary to consider the method of making the black keys, which are made in accordance with the old established method. It may be stated, however, in this connection that the primary object of the present invention—to wit, the provision of an unbroken top surface for the celluloid covering—has no pertinence in reference to the black keys, since the black keys are formed by adding a wooden top of ebony wood to the wooden base (usually of basswood) which is cut out from the key-blank A. After the channel *a* has been cut the second step consists in cutting a series of parallel slits *b b* in the key-blank A. These slits *b b* are cut by a machine having a reciprocating tool X, (see Fig. 5,) provided with two sharp thin parallel knives *x x*. These knives are plunged into the bottom of the key-blank A in the channel *a*. A pair of these slits *b b* are formed in the key-blank at proper intervals, one pair for each white key. The purpose of these slits *b b* will presently appear.

The third step consists in the formation of the rectangular slots or mortises *c*, as shown in Figs. 6, 7, and 8. These slots *c* are formed

by a machine (which may conveniently be the same machine carrying the tool X) having a reciprocating tool Y, (see Fig. 9,) which consists of a plunger having two sharp cutting-edges $y y$. This plunger is forced into the key-blank between the slits $b b$ of each pair of slits, thus forcing the wood beneath the plunger toward the top side of the key-blank, and consequently compressing the wood between the top surface of the key-blank and the slot c , formed by the plunger. The slot or mortise c thus formed has smooth straight parallel sides formed by the knives $x x$ and smooth clean-cut ends formed by the cutting-edges $y y$ of the plunger Y. After all of the mortises or slots $c c$ are thus cut in the key-blank the bushing-felts $d d$ are applied in the usual and well-known way. A portion of each felt d is glued to the bottom of the key-blank in the channel a and a portion within the slot and against the longitudinal straight side formed by one of the knives x . In this manner there is formed in the bottom of each key a felted guide-opening having perfectly straight sides exactly parallel with each other and with the longitudinal axis of the key for the reception and guiding of the front guide-pin. The key-blank, with the felts applied, is illustrated in Figs. 10 and 11.

The purpose of the channel a , it will now be observed, is to accommodate the parts of the felts d lying outside of the slots or mortises c , so that they will be inside of the plane of the bottom of the key-blank. The key-blank is then put through other necessary operations, which are old and constitute no part of the present improvements. These operations include applying the upper celluloid surface e and the front celluloid surface f and the division of the key-blank into the individual keys. At this stage of the process it will be noted that the front end of the key is incomplete, the slot or mortise c is shallow and insufficient for the reception and accommodation of the front guide-pin, and the key-body contains above the mortise a mass of compressed and distorted wood, which would warp the key out of shape when used a short time.

The next and most distinctive step of the present new method consists, therefore, in removing this compressed and distorted wood within the key-body and at the same time and by the same operation forming room for the reception and accommodation of the front guide-pin. This step (illustrated in Figs. 12, 13, and 14) consists in boring into the key-body B from one wall thereof (preferably one of the side walls) and in a line perpendicular to the mortise or slot c a round hole g . This hole g extends across and beyond the mortise or slot c , so that its formation removes all of the wood compressed and distorted by the plunger Y. The hole g communicates with the inner portion or bottom of the mortise or slot c , so that it affords room for the

front guide-pin. This hole, being of a diameter less than the height of the key and of a depth less than the width of the key, does not pierce the top surface of the key, and consequently does not affect the celluloid, and it leaves a side wall h at its bottom composed of an integral portion of the key-body. The formation of this hole g leaves, however, a circular opening in one side of the key, which is objectionable, since it is exposed when the adjacent key of the instrument is played. Accordingly to avoid the objection to the appearance of the key when its side is exposed the next step of the method consists in closing the open end of the hole in the side of the key, as illustrated in Figs. 15 and 16. A circular disk or plug i of wood (see Fig. 15) is formed of a size to just fit the open end of the hole and is inserted in the opening, as shown in Fig. 16, so that its outer face is flush with the side wall of the key. These plugs i are made of the same kind of wood as the key-bodies.

The completed key is illustrated in Fig. 1. The plug i is only visible when an adjacent key is depressed and can, as a matter of fact, be noticed only by close inspection, since, being of the same kind of wood as the body of the key and being neatly fitted in place, its presence is not noticeable. Aside from the plug the remainder of the key-body B is a single piece of wood; and as the separate plug i is a mere matter of finish and plays no part in the operation of the key its presence in nowise affects the life or utility of the key. For these reasons, also, no glue is required to maintain the plug in place, since it is sufficiently well retained by fitting accurately in the hole g .

It will be noted by reference to Figs. 8 and 9 that the pressing-face of the plunger Y is arched, and consequently when it forms the slot or mortise c the bottom thereof is similarly arched. By thus forming the plunger the minimum compression of the wood is necessitated, and, owing to the fact that the hole g is a round one, the compressed wood is all removed just as well as though the bottom of the mortise c were straight. The curve of the bottom or pressing face of the plunger Y corresponds, substantially, with the curve of the tool which bores the hole g . The completed key thus manufactured has an unbroken and imperforate top surface for the celluloid or ivory covering. It has a rectangular felted guide-slot in the bottom of the key exactly parallel with the longitudinal axis of the key for the reception and guiding of the front pin, the felts being applied directly to the key-body, and at the same time space is provided for the entire length of the front guide-pin and for the movement of the key without any distortion of the wood in the completed key and without the exposure of said space when the key is played.

The preferred method of manufacturing

the improved keys and the preferred construction of the key itself are illustrated in Figs. 1 to 16, inclusive, and have just been described.

5 Modifications in the method and in the construction of the completed key can be adopted without departing from the invention. One such modification is illustrated in Figs. 17 and 18. In the preferred method it will
10 be noted that the boring of the holes *g* perpendicular to the vertical axis of the slot or mortise *c* can only be performed on the individual keys after they have been severed from the key-blank. This is not necessary, how-
15 ever, since the holes *g* for an entire set of keys might be formed at one operation by boring a hole throughout the length of the key-blank *A*, intersecting the several slots or mortises *c*, as indicated in Fig. 17. This method of manufac-
20 ture, however, involves forming the individual keys with a hole extending laterally entirely through the key-body, and consequently to finish the key it is necessary to insert two plugs *i* on opposite sides of the key, as illus-
25 trated in Fig. 18. Fig. 17 also shows that it is not necessary to add the felts at the stage of the method as first described. Fig. 17 shows the holes *g* formed before the felts are glued to the key-blank. In fact, the order in which
30 a number of the steps are taken is quite immaterial. It is desirable, however, that the mortises or slots *c* should be formed before the perpendicular holes *g* are cut, since to reverse the operation would endanger splitting
35 and splintering the wood.

Figs. 19, 20, and 21 illustrate a second modification. In accordance with this modifica-
40 tion the holes *g* are cut in the key-blank and are formed by boring into the front edge of the key-blank (and consequently into the front wall or end of each individual key) in a line perpendicular to the vertical axis of the mortise or slot *c*. This method permits
45 the formation of the holes *g* in the key-blank instead of in the individual separated keys, but involves the disadvantage that the plug *i* must be placed in the front end of each key-
50 where it must be covered by the front celluloid *f*, as shown in Fig. 21. This might result in the uneven appearance of the front celluloid, which, however, would not be a fatal
objection, since the front celluloid is not very conspicuous. This modification is an inferior
55 one both in the method and in the completed key, but is nevertheless a possible one which unless brought within the present invention might be employed as an evasion thereof.

By whichever method the keys are made
60 they all possess the essential characteristics of a key having an unbroken imperforate top surface for the reception of the celluloid covering, (or ivory, if ivory be used,) having the front-pin-guide slot formed in the key-body, with the felts applied to the key-body, and
65 having a front-pin space formed by a hole extending across and communicating with the inner portion of the said guide-slot.

The present improved method of manufacturing keys has also involved a new method of forming the holes in the key-frame for
70 holding the guide-pins. The improvements in this respect are illustrated in Figs. 22 and 23. In these figures *C* is the front rail of the key-frame, and *D* is the rear rail.

In commencing the manufacture of keys the
75 key-blank *A* is first securely attached to the key-frame, usually by nailing the two together. The rear-pin-receiving holes *m* for all of the keys and the front-pin-receiving holes *n* for the "sharps" or black keys in the front rail
80 *C* are formed in the usual manner by boring down through the upper surface of the key-blank *A* and into the rails *C* and *D* far enough to afford deep enough holes *m* and *n* for the
85 retention of the guide-pins. The front-pin-receiving holes *o* in the front rail *C* for the white keys cannot, however, be formed any
longer in this manner, since this would involve holes in the top surface of the white
90 keys beneath the celluloid. The pin-receiving holes *o* might be formed by turning the key-frame and key-blank shown in Fig. 22
over and boring through the under side of the key-frame, as indicated in dotted lines at *o* in
95 Fig. 22; but this is undesirable, since it leaves holes in the bottom of the key-frame. Accordingly the improved method of forming the
holes *o* consists in removing the key-blank *A* from the key-frame after the holes *m* and *n*
100 have been formed and then boring the holes *o* downwardly into the front rail *C* of the key-frame, as indicated in Fig. 23.

I claim as my invention—

1. A key for a musical instrument, having
105 in the bottom of the key-body a guide-slot for the front guide-pin and a hole extending across and communicating with the inner portion of said guide-slot within the key-body, substantially as set forth.

2. A key for a musical instrument, having
110 an unbroken and imperforate top surface to its body for the reception of the celluloid or ivory covering, having a felted guide-slot in its bottom for the front guide-pin, the felts for said guide-slot being applied to the key-
115 body, and having a space for the guide-pin within the key-body, extending across and communicating with the inner portion of said guide-slot, substantially as set forth.

3. A key for a musical instrument, having
120 in the bottom of the key-body a guide-slot for the front guide-pin and a hole open at one end at least and extending from one of the walls of the key-body across and communicating with the said guide-slot within said
125 key-body, substantially as set forth.

4. A key for a musical instrument, having
at its bottom a guide-slot for the front guide-pin and a hole open at one end at least and
130 extending from one of the walls of the key-body across and communicating with the said guide-slot within said key-body and a plug covering the open end of said hole, substantially as set forth.

5. A key for a musical instrument, having at its bottom a guide-slot for the front guide-pin and a hole extending transversely from one side (at least) of the key-body across and communicating with said guide-slot within the key-body and a plug covering the open end of said hole, substantially as set forth.

6. A key for a musical instrument, having an unbroken and imperforate top surface to the key-body for the reception of the celluloid or ivory covering, having a felted guide-slot for the front guide-pin in the bottom of the key-body, with the felts for said guide-slot applied to the key-body, having a hole open at one end extending transversely partly through the key-body from one side thereof and extending across and communicating with the inner end of said guide-slot, and having a plug filling and closing the open end of said hole, substantially as set forth.

7. In the method of forming the front end of a key for a musical instrument, forming a guide-slot in the bottom of the key-body by forcing and pressing inwardly the wood where the slot is to be formed and then boring a hole into the key-body perpendicularly to the axis of the guide-slot, substantially as set forth.

8. In the method of forming the front end of a key for a musical instrument, forming a guide-slot in the bottom of the key-body by forcing and pressing inwardly the wood where the slot is to be formed and then boring a hole laterally from one side of the key perpendicu-

larly to the axis of the guide-slot and across the bottom of the guide-slot, substantially as set forth.

9. In the method of forming the front ends of keys for musical instruments, forming a series of guide-slots in the bottom of a key-blank by forcing and pressing inwardly the wood at the points where the guide-slots are to be formed, subsequently dividing the key-blank into individual keys, then boring a hole into the side of each key transversely across the inner end of the guide-slot, and then filling the open end of said hole with a plug, substantially as set forth.

10. The method of forming the guide-pin-retaining holes in the key-frame of a musical instrument, which consists in securing the key-blank to the upper side of the key-frame, boring holes down through the key-blank and into the key-frame to form the rear-guide-pin-retaining holes for all the keys and the front-guide-pin-retaining holes for the black keys, then separating the key-frame and key-blank, and then boring directly into the key-frame to form the front-guide-pin-retaining holes for the white keys, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES E. WHITNEY.

Witnesses:

JUSTIN WHITNEY,
ARTHUR L. BROWNE.