No. 732,738. PATENTED JULY 7, 1903.

C. HAMMEN.

KEYS AND KEY SEATS FOR SHAFTING.

APPLICATION FILED DEC. 2, 1901.

NO MODEL.

Fig. 1.

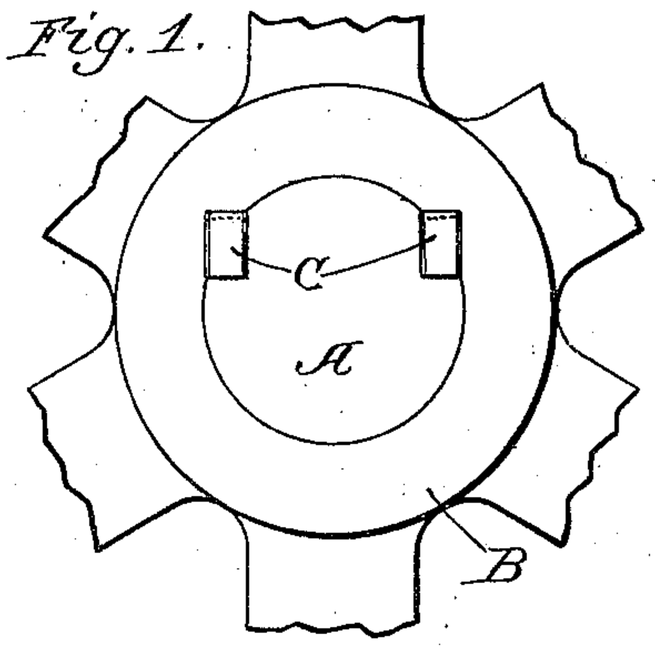


Fig. 3.

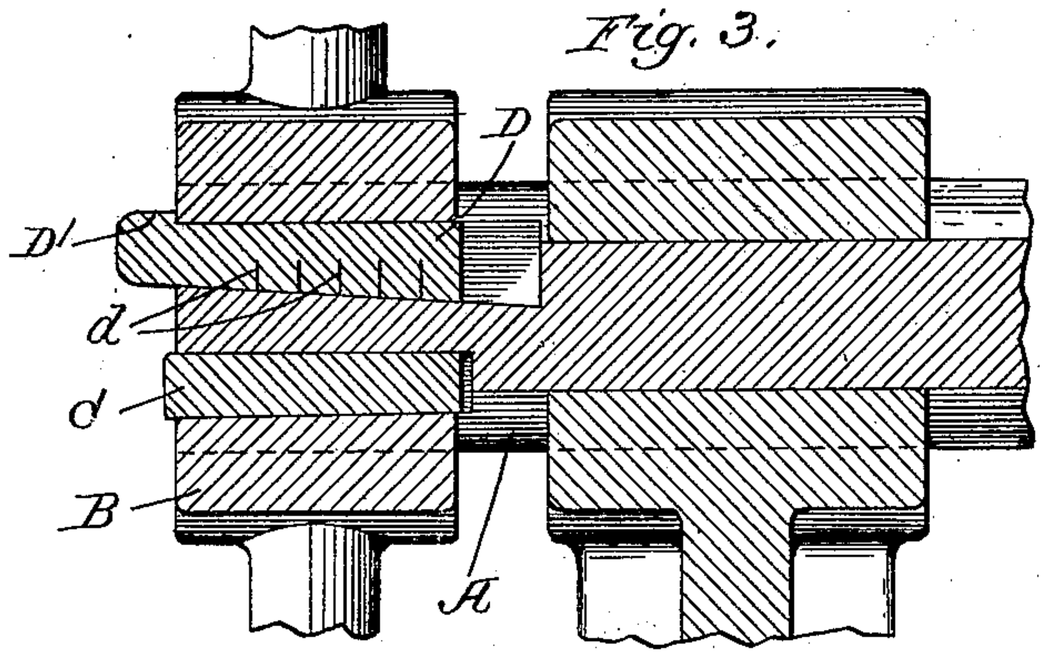


Fig. 2.

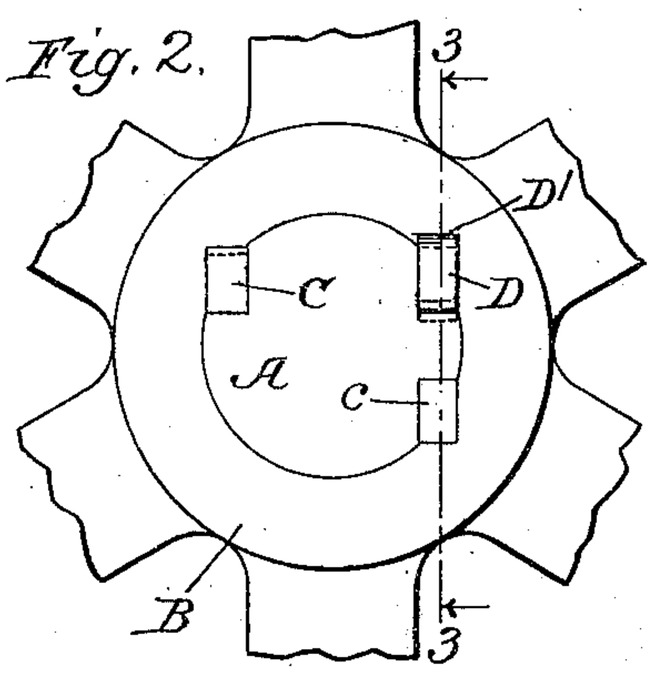


Fig. 5.

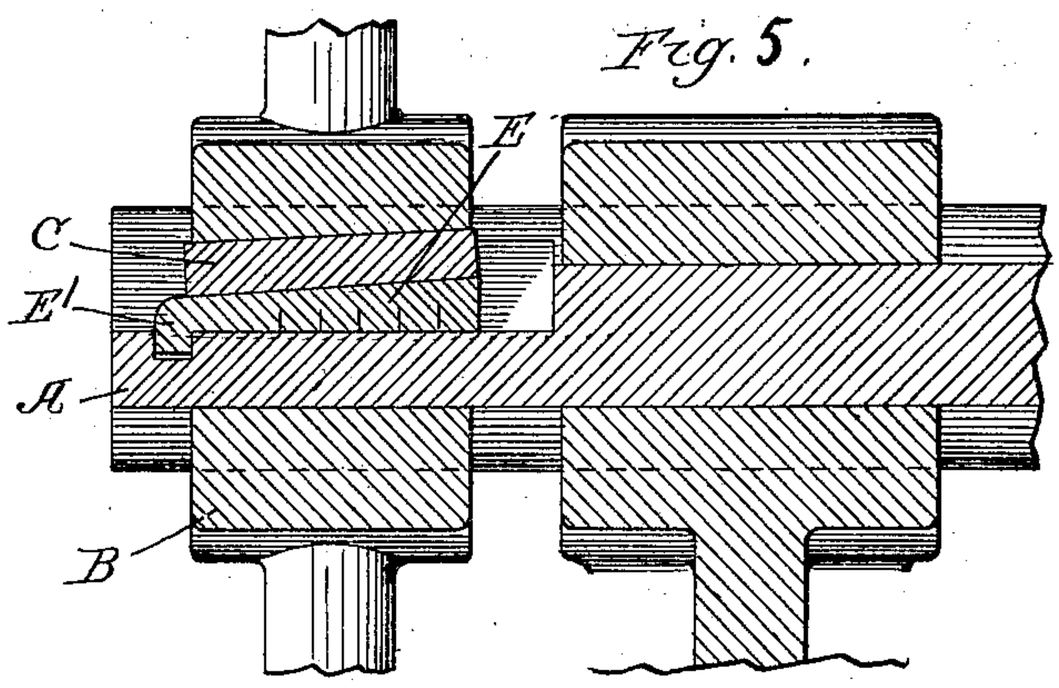


Fig. 4.

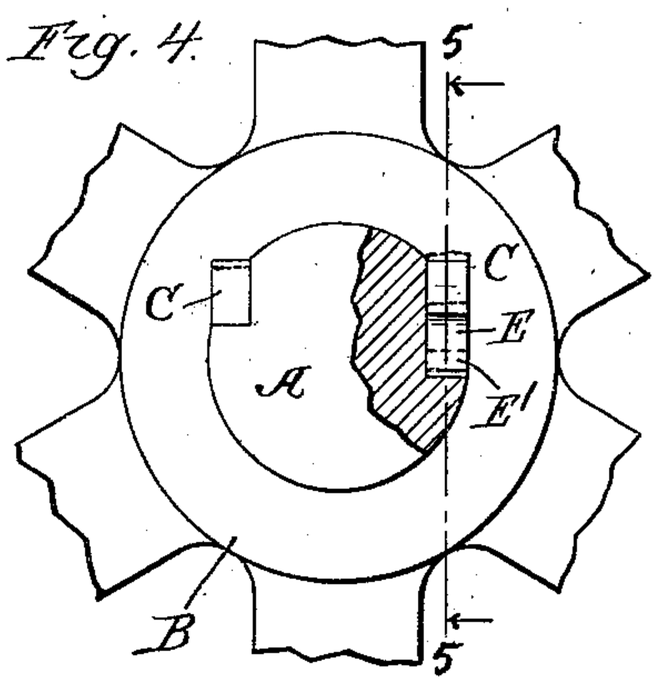
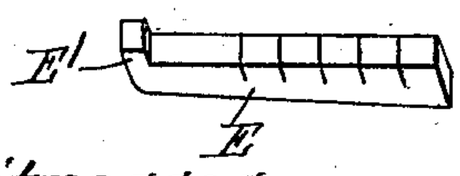


Fig. 6.



Witnesses.

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No. 732,738. Patented July 7, 1903.

UNITED STATES PATENT OFFICE.

CHARLES HAMMEN, OF CHICAGO, ILLINOIS.

KEYS AND KEY-SEATS FOR SHAFTING.

SPECIFICATION forming part of Letters Patent No. 732,738, dated July 7, 1903.

Application filed December 2, 1901. Serial No. 84,294. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HAMMEN, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Keys and Key-Seats for Shafting, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide a mode of construction for securing pulleys and the like to shafting.

It consists in the form and location of keys and key-seats, as particularly described in the claims.

In the drawings, Figure 1 is a transverse section of a shaft, showing a hub of a wheel keyed thereto according to my invention. Fig. 2 is a similar view of a slightly-modified construction. Fig. 3 is a section at the line 3 3 on Fig. 2. Fig. 4 is a view similar to Fig. 1, showing a modification. Fig. 5 is a section at the line 5 5 on Fig. 4. Fig. 6 is a perspective view of the preferred form of relief-key.

The customary construction of keys and key-seats, consisting of facing channels in the shaft and hub adapted to receive a key which is rectangular in cross-section and has a slight taper in its dimension radial to the shaft, the channels having corresponding taper, the key and channels, however, having their other sides parallel to the said radial dimension or with slight taper, is open to certain well-understood objections. For effectiveness in such construction it is necessary that all four sides of the key should bind upon the corresponding surfaces of the seats. If the surfaces tending to exert a wedging force radial with respect to the shaft come into binding contact and before like contact is obtained at the lateral surfaces, there is liable to be an initial possibility of play under the stress of reversed rotation, and the blow, however slight, which the key and seat receive in such movement tends to crush the metal and rapidly increases the play, which soon results in a destructive hammering action on the key and seat at each instance of reversion of the direction of rotation. On the other hand, if the lateral surfaces bind first the wedging effect of the other surfaces, the purpose of which is to force the shaft into such contact with the opposite sides of the bearing that the friction of such engagement shall constitute in large part the means of holding the parts against slipping, is defeated.

The leading feature of my improvement consists in such form and location of the key-seats and keys that each key shall be required to produce binding action only in one plane—that is, only one pair of its faces having this duty, the other two faces having no such duty, and the key not requiring to be closely fitted in its seat in respect to the said other two faces, and being so fitted, if at all, only for the purpose of checking its expansion in that direction under the stress of the wedging pressure in the other direction.

In the drawings, A represents the shaft; B, the hub of a wheel secured thereto. In the primary form of my invention (shown in Fig. 1) I employ two keys C C, the seats of each key in the shaft and hub, respectively, being angular and together forming a quadrilateral cavity extending longitudinally in respect to the shaft, the diagonal of such quadrilateral being the chord of the arc of the seating-surface of the shaft and hub, which is intercepted by the angular recess. Of the cavities thus formed the pair of opposed faces which are to be considered are formed one of them entirely in the shaft and the opposite one entirely in the hub, so that the key having a taper in one dimension and without taper in the other dimension being forced into this cavity tends to crowd apart the faces opposed in the direction of its tapering dimension, tending thus to rotate or roll the shaft slightly in its bearing. Such action is not contemplated and is prevented by the location of the other key at the opposite side, and preferably symmetrically disposed at the opposite side of a diametrical plane parallel to the tapering dimension of the key, so that by driving the two keys simultaneously the shaft is forced firmly into its seat in the hub, producing the most perfect frictional contact possible throughout the entire half of its circumference opposite the chord containing the two key-seats. As compared with the usual structure of key lodged in a channel it will be seen that with substantially equal reduction of the cross-area

of the shaft by reason of the cutting out of the key-seats there is obtained double facility for tightening, and at the same time the primary advantage of my invention is obtained—namely, that each key does duty in the direction of one dimension only and may therefore be driven home to the maximum degree of tightness in that dimension not impeded by friction upon the other two seats, which need not even touch the walls of the recesses and, at most, will be made only an easy fit, since no service except inclosing the key is required of these opposite walls of the chamber.

In many situations in which great security of connection is required between shaft and wheel thereon—as, for example, in securing a propeller-wheel to its shaft—it is practically impossible to remove a wheel when once keyed securely under the old construction, and the only resort in case removal is necessary is to rupture the hub. With my improved key and seat it is practicable to provide a comparatively easy means of withdrawing the keys, so as to permit the removal of the wheel. In Figs. 2 and 3 I have shown a form in which this can be done. In this form instead of one of the keys C, I provide a relief-key D, whose taper is in the opposite direction from that of the key C, such key D being lodged in the angular key-seats of the shaft and hub in the same manner as the key C, the taper, however, being preferably very much greater than would be desirable for a key to be tightened in the ordinary manner—that is, instead of having the taper about one-eighth of an inch to the foot, as is customary, the key D may have a taper of three or four times that amount, the key-seats being correspondingly tapered. This key has a head D′ at the outer end, which is stopped so that it cannot move longitudinally in the direction tending to slack it. Such key D being lodged in position and the wheel passed onto the shaft before the key C is inserted or at least before it is tightened, so as to impede the application of the wheel to the shaft, the subsequent tightening of said key C causes the relief-key D to be bound tightly between its seats, all the duty of tightening, however, devolving upon the key C, but with approximately the same ultimate effect as if both keys were driven, although in this case since the duty upon the one key which is driven is more severe it may be made of greater area than when both keys are to be driven, as in the original form. When it is desired to withdraw the keys and remove the wheel from the shaft, the head D′ of the key D can be cut off, and that key can then be driven inward, which is feasible in view of the taper of this key being much greater than if it had been designed to be originally tightened by driving. The relief afforded by driving in this key will of course relieve the key C, which can then be withdrawn. In case of large shafts it may be found desirable to employ a third key, the added key being in all respects like the keys C, but for distinction denoted *c* on Fig. 2. This additional key will be preferably located about opposite the key C and will be seated so as to crowd tangentially in the same circumferential direction as the key C and not in the opposite direction, as in the case of the two keys in Fig. 1. This key will preferably be tightened up first, and the key C being last tightened will seat the hub firmly against the shaft at the side opposite the chord in which the seats of the keys C and D are located without risk of failing to bind the key D, as might be the case if the key C were not employed by reason of the friction between the shaft and hub preventing the transmission of the pressure perfectly from the key C around to key D. When the wheel to be thus keyed onto the shaft is located near the bearing, so that the key D′ can be driven only a short distance, it will be necessary to cut it away in pieces as it is driven through, and to facilitate this such key may be made, as shown in Fig. 3, cut partly in two by slits *d d* at intervals not greater than the distance which the key can be driven in before striking the bearing. The key being first driven in this distance will be cut off at the first slit and the piece cut off, and so on until the necessary relief is obtained.

It is practicable to combine a relief-key, such as the key D, with two opposed keys, both of which are to be driven as in the first construction described. Such combination is illustrated in Figs. 4 and 5 and consists in the employment in connection with one of the keys C of a false-key seat or relief-key E, which has the form of the relief-key D—that is, tapering in the opposite direction from the keys C and lodged in the seat or as a lining of the seat of one of the keys C, the taper of the cavity remaining for the key when such lining is in place being in the opposite direction from the taper of the lining—that is, in the same direction as for the keys C C and at the same pitch. The relief-key or false-key seat E will be operated in the same manner as the relief-key D, that is, its head E′ being cut off, and it may be driven; and it may be driven through to relieve the keys C C. In practice, probably, the key C, which is lodged in the relief-key or false-key seat E, will be driven in with said false-key seat or relief-key, the net taper of the two parts combined being sufficiently great to permit such action.

In this specification and claims I use the phrase "the plane of taper" to indicate the plane in which the dimension of the key being measured shows such dimension diminishing steadily from one end to the other and the corresponding phrase "tapering in a transverse dimension" to indicate the diminution of the transverse dimension as measured in the plane division by the description immediately following the said phrase.

In describing the key-seats in the shaft facing toward one side or the other of the shaft in the specification and claims I intend

to be understood as indicating the seat in the shaft on which the key operates with binding or wedging effect and to distinguish that seat from the near lateral wall of the key-chamber which may be formed by the other side of the angular cut which is made in the shaft to produce the key-seat, since the key does not bind against said lateral wall or operate upon it in any manner with tightening effect.

I claim—

1. A shaft and hub having each two recesses for key-seats, which, when registered respectively, form rectangular key-chambers, tapering in a transverse dimension which is approximately tangential to the circumference of the shaft; correspondingly-tapered keys in said chambers, the shaft having its two key-seats on which the tapering keys act wedgewise, located facing toward the same side of the shaft.

2. A shaft and hub having corresponding recesses for key-seats, which, when registered facing each other form rectangular key-chambers tapering in a transverse dimension which is approximately tangential to the circumference of the shaft, such taper of the two key-chambers being in opposite directions, and correspondingly-tapered keys in said chambers respectively.

3. A shaft and hub having each a pair of recesses for key-seats, forming, when registered facing each other, rectangular key-chambers tapering in a transverse dimension which is approximately tangential to the circumference of the shaft, and having their respective key-seats in the shaft facing toward opposite sides of the latter, said shaft and hub having a third pair of recesses similarly registering to form a key-chamber, such third key-chamber being tapering in one dimension approximately tangential to the circumference of the shaft, its said taper being in the opposite direction from that of the other two key-chambers.

4. A shaft and hub having each two recesses for key-seats, which, when registered respectively, form rectangular key-chambers which taper in opposite directions, each in a dimension approximately tangential to the circumference of the shaft, their respective key-seats in the shaft facing toward the same side of the shaft; correspondingly-tapering keys fitting in said chambers respectively, one of the keys having transverse slits at intervals in its length, extending in from the face which is seated on the shaft.

5. A shaft and hub having each two recesses for key-seats, which, when registered respectively, form rectangular key-chambers tapering in a dimension which is approximately tangential to the circumference of the shaft; tapering keys fitting said seats respectively, one of said keys having a head at its smaller end to stop it against longitudinal withdrawal, such head being exposed so that it can be cut off to permit the key to be forced out.

6. A shaft and hub, each having two recesses for key-seats, which, when registered respectively, form rectangular key-chambers tapering in a transverse direction, which is approximately tangential to the circumference of the shaft; tapering keys in said seats respectively, one of said keys having at its smaller end a transversely-projecting head, the shaft having a recess beyond the face of the hub to receive said key-head.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 21st day of November, A. D. 1901.

CHAS. HAMMEN.

In presence of—
CHAS. S. BURTON,
HAROLD WARNER.