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2,973,979

KEY

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Fig. 1.

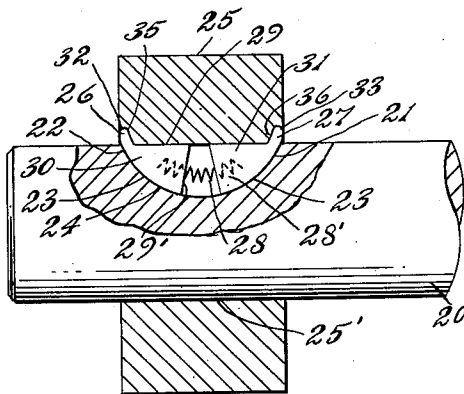
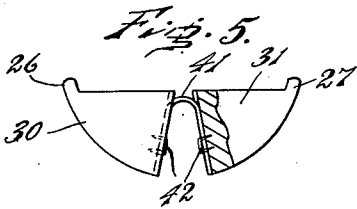


Fig. 2.

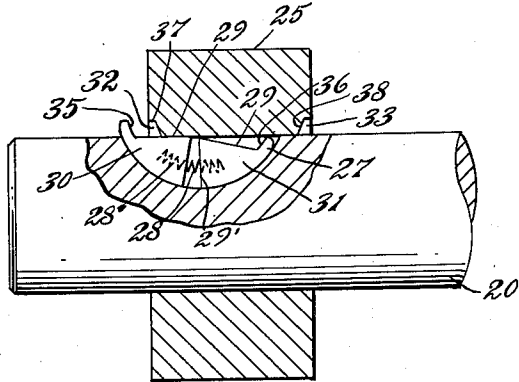


Fig. 4.

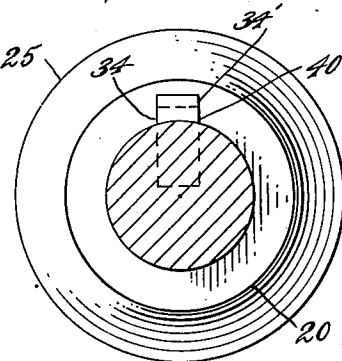
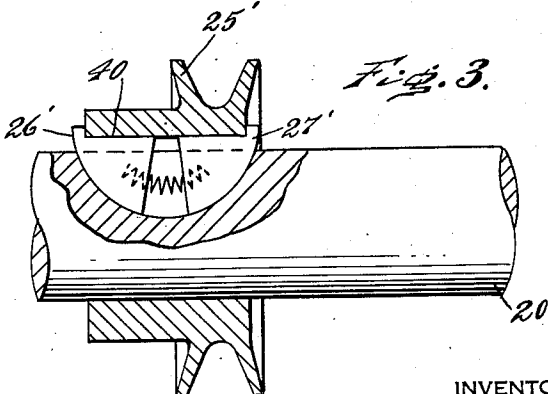


Fig. 3.



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9 Claims. (Cl. 287—52.05)

The present invention relates to locking keys which are used to secure a collar element or the like on a rotating shaft.

When reference is made herein to a collar element, it is intended to include any of a wide variety of machine elements which may be secured on a shaft by a locking key, examples being pulleys, sprockets, gears, cams, torque rods, housings, cranks, pitmans, and the like as well known in the art.

An object of the present invention is to provide a more convenient means for locking a collar element on a shaft from relative rotational or linear movement, permitting ready removal and replacement of the collar element without the difficulty incident to driving out or otherwise removing the usual type of key.

A further purpose is to provide an improved axial locking means which does not merely depend upon friction.

A further purpose is to secure an improved key which will fit in a standard Woodruff type key seat.

A further purpose is to greatly reduce the time required to remove a collar element from a shaft.

A further purpose is to make maximum shear area of a key available to transmit torque.

A further purpose is to provide a key which is very simple to manufacture and very easy in operation.

A further purpose is to accomplish locking in a keyway by a pair of opposed arcuate segments, which move rotationally together for separation of the parts and which are spring urged rotationally apart to accomplish locking of the parts.

A further purpose is to provide lugs on the segments which engage the two sides of the collar element, suitably in interlock recesses if desired.

A further purpose is to provide on the collar element a cooperating keyway aligned with the keyway on the shaft and receiving the segments, the lugs on the segments desirably engaging the two sides of the collar element at the side walls thereof.

In the drawings I have chosen to illustrate a few only of the numerous embodiments in which the invention may appear, selecting the forms shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a fragmentary axial section showing the locking key of the invention in locking position.

Figure 2 is a view similar to Figure 1 showing the locking key retracted and the collar element partially removed from its locked position on the shaft.

Figure 3 is a fragmentary axial section showing an alternate form of locking key in accordance with the invention.

Figure 4 is a sectional left end elevation of Figure 3.

Figure 5 is a side elevational partly in axial section showing a modified form of locking key in accordance with the invention.

In the prior art, it has been common practice to secure collar elements of the character previously mentioned to

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shafts by means of keys, wedges, pins, set screws, or the like. Ordinarily, in most cases it is desirable to lock the collar element to the shaft rotationally, and also to secure it against endwise movement. While in many cases it is possible to secure a collar element adequately by existing

pins, keys, set screws or wedges, the use of such attaching means is expensive and time consuming on the occasion of installation and in many instances creates serious difficulties when the collar element is to be removed or replaced.

In the case of installation by pins, it is normal to drill out, assemble and then stake rivet the pin. In the case of set screws, a socket or flat is ordinarily prepared at assembly. Keys and wedges frequently require special fitting at assembly. In any case, all of these attachments except set screws are difficult to release, and set screws are relatively limited in their load carrying capabilities.

Wedges at best are unsatisfactory because of the small amount of force which can be provided to resist movement. There is also the possibility that wedges and many standard keys may work loose and be thrown off the shaft.

In the present invention the high load carrying capabilities of standard keys are obtained, resisting rotational movement of the collar element on the shaft by a force which depends upon the shear strength of the key. Unlike prior art keys and wedges, however, the key of the present invention is quickly and easily inserted and removed and when in locking position, provides much improved anchorage of the collar element against axial movement.

Considering now the form of Figures 1 and 2, a shaft 20, of any suitable character, has a key seat or keyway 21 of arcuate contour desirably conforming to the standard Woodruff type key seat, as commonly used. Thus, the key seat has suitably arcuate walls extending longitudinally and straight lateral side slot walls as well known.

A locking key 22 is placed in the keyway or key seat of the shaft with its outer arcuate or circular edge 23 of the key in contact with the arcuate or circular edge 24 of the key seat. As well known, the key laterally suitably conforms to and fits within the side walls of the seat with sufficient closeness of conformity to avoid play. A collar element 25 having a suitable interior longitudinal opening 25' conforming to the outer contour and dimension of the shaft is moved longitudinally along the shaft 20. In order to bring the collar element to the position of the keyway, the key is retracted as shown in Figure 2, by forcing one of the lugs 27 which is provided at one end of the key down into the key seat so that it will not interfere with the longitudinal motion of the collar element.

It will be observed that the key comprises two segments 30 and 31, each of which is less than 90 degrees, to allow for retraction and still permit the segments when in locking position to occupy substantially 180 degrees. The segments follow the curvature of the outer arcuate surface 23 of the key and have outer radial locking surfaces 29 which are to engage the interior of the collar element in locking position, and also adjoining radial surfaces 29' which receive a spring 28, in this case a helical compression spring, engaging in spring recesses 28' of the radial surfaces 29' of the segments.

When the collar element 25 reaches a position directly over the key the spring 28 acts to cause rotation or separation of the segments 30 and 31, causing the radial surfaces 29 of the segments to engage the inside of the collar element. In this position, lugs 26 and 27 engage in interlock recesses 32 and 33 at the sides of the collar element. Faces 34 and 34' of the segments engage, of course, with the sides of the seat or keyway 21 and also with the sides of the interlock recesses 32 and 33.

It will thus be evident that relative rotation between the

shaft and the collar element cannot take place because of the engagement of the sides of the key respectively with the sides of the seat or keyway 21 and the sides of the interlock recesses or notches 32 and 33 in the collar element. Also the sides 35 and 36 of the lugs which are disposed toward the collar element engage with sides 37 and 38 of the interlock recesses or notches 32 and 33 and prevent relative rotational or linear movement between the collar element and the shaft.

The spring 28 keeps the radial segment positions with respect to the shaft and the collar element by overcoming any forces which tend to retract the segments to the position of Figure 2.

In the position of Figure 1, the lugs on the locking key effectively transmit any axial force between the collar element and the shaft and prevent any axial movement.

In the form of Figures 3 and 4, the collar element, in this case a pulley 25', has a standard interlock recess or keyway 40 which receives the segments of the key which extend along the shaft. The lugs 26' and 27' are in this case located beyond the sides of the collar element and engage the flange or hub of the collar element at the outside, rather than occupying recesses as in the form of Figures 1 and 2.

In the form of Figures 3 and 4, the lugs do not contribute to the shear which prevents the collar element from rotating but the collar element is prevented from rotating by the shear of the key against the side walls of the shaft socket or keyway and also against the side walls of the keyway 40 in the collar element.

In some cases it is preferable to use a leaf or V-shaped spring rather than a helical spring and in Figure 5 I illustrate a flat leaf spring 41 which is acting between the segments. The arms of the spring are suitably secured to the segments as by riveting an extension from the segment at 42 or by soldering at suitably low temperature.

In operation it will be evident that the key can be purchased as a separate component and used either with special or standard recesses, depending upon the particular design. The key can be used to replace preexisting keys in making repairs, and can also be installed readily on new work.

As already explained, it is merely necessary to place the key in the keyway of the shaft and then retract it. The collar element can then be slipped over and the key will slip into locking position. In order to remove the collar element in the form of Figures 1 and 2, it is merely necessary to insert a pointed tool between the end of the lug and the lug recess, and retract the segment to the position of Figure 2 and then the collar element can be moved off axially. In the form of Figures 3 and 4, the lug is more readily accessible and any convenient tool can be applied to the end of the lug to force the segment into retracted position by rotation of the segment.

In view of my invention and disclosure, variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A machine element comprising a shaft having a longitudinally extending keyway whose wall nearest the longitudinal axis of the shaft conforms in shape to an arc, said keyway being shallowest at the ends and deepest intermediate the ends, and a collar element having a shaft-receiving opening extending longitudinally thereof, the collar element surrounding and engaging the shaft about the keyway and having on the collar element adjoining the keyway interlock recess means cooperating in alignment with the keyway, in combination with a locking key having two opposed segments which occupy the keyway and extend into the interlock recess means of the collar

element, one of said segments being partially located at one longitudinal end of the keyway and the other of the segments being partially located at the other longitudinal end of the keyway, said segments having arcuate outer surfaces which engage and are slidable on the arc surface of the keyway and said key including spring means interposed between the segments and urging the segments apart and into locking relation with respect to the collar element and the shaft, each segment having a portion at the end remote from the other segment which extends out radially beyond all other parts of the segment and engages one of the opposed ends of the collar element, and said segment also engaging the collar element at the interlock recess means against rotation, said segments also having a retracted position in which one of said segments leaves said collar element free from engagement at one end.

2. A machine element of claim 1, in which the interlock recess means comprises opposed interlock recesses at the two ends of the collar element adjoining the keyway, the portion of each segment which extends out radially beyond all other parts of the segment comprising a lug which extends into said interlock recess means and engages the collar element at one of the opposed ends.

3. A machine element of claim 1, in which the interlock recess means comprises a cooperating keyway on the collar element which extends longitudinally of the collar element in alignment with the keyway in the shaft, the segments extending into the keyway in the collar element as well as into the keyway on the shaft, and the portion of each segment which extends out radially beyond all other parts of the segment comprising a lug radially beyond the keyway in the collar element which engages one end of the collar element.

4. A machine element, comprising a shaft having a Woodruff type keyway which extends longitudinally of the shaft providing in its shape an arcuate bottom surface, said keyway being deep in the middle and shallow at the ends, and a collar element surrounding the shaft and fitting on the shaft, the collar element having interlock recess means which cooperate in alignment with the keyway, in combination with a locking key in the keyway of the shaft and extending into the interlock recess means of the collar element comprising opposed arcuate segments whose arcuate surfaces engage an arcuate surface of the Woodruff keyway, each of the segments being placed partially at a different longitudinal end of the keyway, the segments having radial surfaces which engage the interior of the collar element and the segments having lugs at their ends extending radially of the shaft and engaging the opposite ends of the collar element, the key including spring means engaging and urging the segments apart, the key in retracted position placing one segment relatively close to the other segment at radial adjoining surfaces, with the lugs of one segment withdrawn radially inward beyond the collar element so that the collar element can slip off endwise of the key along the shaft and the collar element when the key is expanded being restrained rotationally by the key and being restrained longitudinally by the engagement of the lugs of the key against the ends of the collar element.

5. A machine element of claim 4, in which the interlock recess means on the collar element comprises opposed interlock recesses at the opposite ends of the collar element.

6. A machine element of claim 4, in which the interlock recess means on the collar element comprises a keyway in the collar element which cooperates with the keyway in the shaft and extends longitudinally in alignment with the keyway in the shaft, receiving the key in locking position.

7. A locking key comprises two flat arcuate segments, the segments having different flat surfaces of opposed segments which lie in the same plane and are adapted to engage the sides of a Woodruff keyway, the segments

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each having an arcuate surface and each having two radial surfaces, the arcuate surfaces of the two segments being arranged to conform in extension to the same surface of revolution, two of the radial surfaces of the segments being adjoining, there being spring abutments located on the adjoining radial surfaces of the segments, the segments each having a lug on the other radial surface remote from the spring abutments and adjoining the arcuate surfaces, the lugs protruding in the direction of the arc beyond the respective radial surfaces adjacent the lugs, and spring means extending from one spring abutment to the other and connecting the segments together.

8. A locking key of chain 7, in which the spring means is a helical spring.

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9. A locking key of claim 7, in which the spring means is a leaf spring.

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