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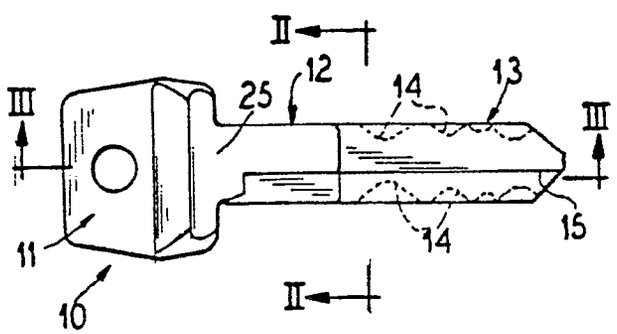
(54) Reinforced shank plastic key.

(57) A molded plastic key having a handle, a shank and a bit has the shank reinforced to withstand extraordinary torque applied through the head when resistance to turning is encountered after the key is inserted into a lock. The reinforcement may comprise integrally molded thickening throughout the length of the shank and extending at least partially on to the handle, and the thickening termination short of the adjacent end of the bit of the key. If preferred, the reinforcement may comprise a metallic reinforcing insert having an extension from the handle into the shank.

FIG. 1



EP 0 305 588 A2

REINFORCED SHANK PLASTIC KEY

The present invention relates to molded plastic keys, whether individual keys, or plastic card/key combinations on the order of the disclosure in my U.S. Patent No. 4,677,835 dated July 7, 1987, and is more particularly concerned with reinforcing such keys against breaking at their shanks due to extraordinary twisting stress applied through the handles of the keys.

Conventional metal keys for operating tumbler locks such as in automobiles, building doors, apparatus controls, and the like, have heretofore been generally constructed throughout the shank and bit portions, at least, and generally also the handles, of a thickness common with the bit thickness. Molded plastic keys have also heretofore been constructed of substantially uniform thickness throughout their length similarly as comparable metal keys.

The key bit must be fairly snuggly fitted to the key slot in the cylinder plug. Looseness of the bit in the key slot might defeat proper engagement of the lock tumblers in the key notches. On the other hand, especially in the USA, to avoid difficulty in quick reception of the key bit into the slot, general practice has been to provide enlarged entrance dimensions. This results in the key shank often having little if any torque support when subjected to considerable twisting stress, if for any reason there is resistance to turning of the key in the lock. Such resistance may be variously caused such as by faulty cutting of the key notches, binding due to corrosion or icing, and the like. Tendency of the user, where there is any such resistance to turning of the key in the lock, is to apply additional torque or twisting force to the key through its handle. Metal keys will generally withstand such extraordinary twisting stress.

In a normal automobile ignition or trunk lock, only about three to five inch pounds of torque (IPT) are necessary to open the lock. A normal uniform thickness molded plastic key will withstand up to eight to nine IPT. If greater torque is applied there is danger of breaking the plastic key shank. An average women can apply up to seven to ten IPT and an average man can apply up to ten to fourteen IPT. Therefore, there has been some key shank breakage experienced in respect to molded plastic keys having a substantially common thickness throughout their lengths.

Molded plastic keys have been disclosed in U.S. Patent of Donald F. Almblad No. 4,637,236, and in U.S. Patent No. 4,677,835 of the present application. In both of those patents the keys are shown as of a common thickness throughout their lengths.

By way of a typical disclosure of a metal key and tumbler lock, U.S. Patent No. 4,656,851 is referred to.

An important object of the present invention is to provide a new and improved molded plastic key which is strengthened against torque induced breakage of the shank portion of the key.

Another object of the present invention is to provide a new and improved molded plastic key in which the shank portion is reinforced by a thickening.

A further object of the present invention is to provide a new and improved molded plastic key provided with a shank reinforcing insert.

In accordance with the principles of the present invention, there is provided a molded plastic key having a handle, a shank and a bit, and in which the shank is reinforced against breakage due to unusual torque applied though the key handle when resistance to turning is encountered after the bit is inserted into a lock.

There is also provided by the present invention a new and improved method of making a shank reinforced molded plastic key.

Other objects, features and advantages of the present invention will be readily apparent from the following description of preferred embodiments threof, taken in conjunction with the accompanying drawings, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

Fig. 1 is a plan view of a molded plastic key blank embodying a reinforced shank according to the present invention;

Fig. 2 is an enlarged cross-sectional detail view taken substantially along the line II-II in Fig. 1;

Fig. 3 is an enlarged longitudinal sectional detail view taken substantially along the line III-III in Fig. 1;

Fig. 4 is a generally schematic illustration of the key of Fig. 1 located operatively within one form of tumbler lock;

Fig. 5 is a plan view of a modified form of molded plastic key embodying the present invention but having a somewhat shorter shank than in the form of Fig. 1;

Fig. 6 is an enlarged tansverse sectional detail view taken substantially along the line VI-VI in Fig. 5;

Fig. 7 is an enlarged longitudinal sectional detail view taken substantially along the line VII-VII in Fig. 5;

Fig. 8 is a schematic illustration showing the key of Fig. 5 in a typical tumbler lock;

Fig. 9 is a plan view of another modified form of molded plastic key embodying a reinforced shank according to the present invention;

Fig. 0 is an enlarged transverse sectional detail view taken substantially along the line X-X in Fig. 9;

Fig. 11 is an enlarged longitudinal sectional detail view taken substantially long the line XI-XI in Fig. 9;

Fig. 12 is an enlarged side elevational view of the key in Fig. 9;

Fig. 13 is a perspective view of the reinforcing insert present in the key of Fig. 9;

Fig. 14 is a plan view of a plastic card/key combination embodying a key substantially according to Fig. 9;

Fig. 15 is a sectional detail view taken substantially along the line XV-XV of Fig. 14;

Fig. 16 is a sectional detail view taken substantially along the line XVI-XVI of Fig. 14;

Fig. 17 is a plan view of the opposite side of the combination plastic card/key combination of Fig. 14;

Fig. 18 is a plan view of still another modified form of molded plastic key embodying a reinforced shank according to the present invention;

Fig. 19 is an enlarged fragmentary sectional detail view taken substantially along the line XIX-XIX in Fig. 18;

Fig. 20 is an enlarged longitudinal sectional detail view taken substantially along the line XX-XX in Fig. 18;

Fig. 21 is an enlarged fragmentary sectional detail view taken substantially along the line XXI-XXI in Fig. 18;

Fig. 22 is a plan view showing yet another modified form of molded plastic key embodying a reinforced shank according to the present invention;

Fig. 23 is an enlarged cross-sectional detail view taken substantially along the line XXIII-XXIII in Fig. 22; and

Fig. 24 is an enlarged longitudinal sectional detail view taken substantially along the line XXIV-XXIV in Fig. 22.

Referring to Figs. 1-4, a one-piece molded plastic key 10 is disclosed having a head or handle 11, typically of substantially greater width than an integral shank 12 connecting the handle to a blade or bit 13. In this instance, the bit 13 is of the type which may have tumbler notches 14 cut along either or both edges, and for this purpose the cross-sectional geometry of the shank and bit may, as best seen in Fig. 2, be provided with longitudinal rabbet grooves 15 providing thinner margins along both edges.

Illustratively, the key 10 has the shank 12 and the bit 13 elongated for reception in a tumbler lock 17 (Fig. 4) having a tumbler barrel cylinder or plug 18 extending from a housing 19 defining a chamber 20 of ample size to accommodate a spring-biased flapper closure 21 which is adapted to be pushed aside by the key from the dash position to the full line position when the key is inserted through an entrance 22. It may be noted that the entrance 22 affords ample clearance to facilitate entry of the key therethrough for reception in a key slot 23 which for practical reasons is fairly closely dimensioned relative to the key bit 13. A tolerance clearance of only about .005 inch is desirable between the bit 18 and the slot 23. An entrance 24 into the key slot 23 flairs towards its outer end in a generally lead-in cam fashion to facilitate reception of the key bit 13 into the slot 23. From this it will be apparent that should there by extraordinary torque applied through the handle 11 after the key bit 13 has been introduced into the slot 23, there is no torque support for the shank 12, although the bit 13 fits closely in the slot 23.

In order to equip the shank 12 against twisting, torque-stressed breakage, the shank is reinforced. By way of example, where there is ample lock entrance clearance, e.g. as in Fig. 4, reinforcement for the shank 12 may be advantageously provided by an integrally molded thickening 25 of the shank. Such thickening 25 is preferable effective throughout the length of the shank from adjacent to but clear of the proximal area of the bit 13 to be notched. Thus, the thickening avoids interference with close reception of the bit 13 in the key slot 23. By preference the thickening 25 is effected about .020 inch on both faces of the shank 12 and extends to at least a limited distance onto the adjacent portion of the handle 11.

For utmost integrity of reinforcement, the thickening 25 extends over substantially the entire width of both the shank 12 and the portion of the handle 11 provided with the thickening. At the bit end of the shank 12, the thickening 25 may end abruptly, as shown at 26 (Fig. 3) as close as practicable to the area of the bit to be notched, so as to gain maximum advantage the thickening for its reinforcing function. At the handle end of the thickening 25 it may taper for smoothness both at the sides and at the handle end, substantially as visualized in Figs. 2 and 3. Although the thickening 25 could cover the entire handle 11 on both faces of the handle, that is not necessary and plastic material is saved by having the thickening extend only partway onto the remainder of the handle. In any event, the thickening provides ample digital grip area for transmission of torque to the reinforced shank.

In Figs. 5-8, a modified shorter molded plastic key 27 is depicted having a handle 28, a short shank 29 and a bit 30 of a suitable length for the

intended purpose. In this instance, the bit 30 has a rabbet groove 31 along only one side providing a thin longitudinal side area for receiving tumbler pin notches 32. The key 27 is especially adaptable for operating a tumbler lock 33 of the kind having an escutcheon 34 providing an entrance with lead-in surfaces 35 and 37 of wider dimensions than a key slot 38 within the plug of the lock and into which the bit 30 fits fairly snuggly.

Reinforcement of the key 27 against torque breakage of the shank 29 is, similarly as described in connection with the key 10 in Fig. 1, provided by means of thickening 39 which stops short of the notch 32 located in the bit 30 nearest to the shank. In that portion of the thickening 39 which extends over onto the handle 28 on each face of the key, the thickening tapers toward the handle substantially as shown. The thickening 39 on each face of the key extends from side-to-side of the key as is clearly evident in Fig. 6.

In the modification depicted in Figs. 9-13, a reinforced shank molded plastic key 40 is provided which is especially suitable for use with tumbler locks that do not have the entrances into the key slot of significantly larger cross sectional dimensions than the key slot. Such tumbler locks are especially prevelant outside of the U.S.A., particularly, in automobile locks. To this end, the key 40 has a handle 41 which may be thicker than a short shank 42 and a bit 43 of suitable length. The shank 42 and the bit 43 may have one or more longitudinally extending coding grooves 44, and at least one rabbet groove 45 along one longitudinal side of the bit 43 providing a relatively thin longitudinal side area 47 for having tumbler notches 48 cut therein to enable opening an intended tumbler lock (not shown).

In order to provide reinforcement against torque breakage of the shank 42 adjacent to the handle, a highly torque resistant reinforcing insert 48 is embodied in the shank 42 and the adjacent portion of the key handle. In a preferred construction the insert 48 comprises a thin hard metal member, desirably a hard steel stamping including a shank-reinforcing extension or finger 49 projecting from a body 50 having a head portion 51 at the opposite end from the finger 49. Rounded, i.e. radiused, corners 51a on the head 51 and similarly rounded corners 50a on the body 50 enhance molded integrity of the plastic key 40 and the insert 48.

The reinforcing finger 49 is of a width and thickness to be received in the shank portion of the tumbler pin notch-receiving area 47. In width, the finger 49 is desirably slightly less than the width of the key area 47 so as to maintain integrity of the shank portion 42 of the key relative to the key handle 41 and the bit 43. The thickness of the reinforcing finger 49 and the key area 47 is preferably identical, and the opposite faces of the finger 49 may be exposed at the opposite faces of the area 47, whereby the finger 49 may be substantially in direct torque force contact with the entrance end of a tumbler lock key slot within which the shank 42 is received after the bit 43 has been fully inserted in the slot for operating the lock. The length and terminal end of the finger 49 are calculated to extend the maximum permissible distance into the shank and the shank end of the area 47, having regard to the nearest tumbler pin notch 48. To gain maximum extension, a slanted or oblique terminal edge 49a is provided on the finger 49 to afford a clearance relative to the nearest notch 48 that may be cut in the area 47. As best seen in Fig. 9, the diagonal terminal edge 49a terminates short of the place for the nearest notch 48, leaving a narrow separating portion of the area 47 between the edge 49a and the nearest notch 48. Through this arrangement intereference from the finger 49 with efficient cutting of the notches 48 is avoided.

Desirably the body portion 50 of the insert 48 is dimensioned to be imbedded within a stop portion 52 of the handle 40 and which stop portion abuts the outer end of a lock when the key shank is fully received within a lock. The head end portion 51 of the insert 48 is dimensioned to be imbedded within the key handle 41 and is desirably of a length which will occupy about half the length of the handle, and is of a sufficient width for a thorough torque transmission connection between the finger 49 and the area of the handle 41 which is digitally grasped when turning the key 40 for operting a lock.

As will be noted in Figs. 9-12, the flat insert 48 is substantially thinner than the key handle 41. The shank 42, and the main thickness of the bit 43, and the body portion 50 and the head portion 51 are respectively sufficiently narrower than the stop portion 52 and the handle 41, so that as moldably embedded in the handle 41 the insert is thoroughly integrated in the handle. Such molded integration and integrity of the key/insert unit is enhanced by having the handle 41 substantially thicker than the insert 48.

Although the key 40 may be utilized independently, it may also provide the key for a plastic card/key combination as depicted in Figs. 14-17. To this end, the key 40 is located within a complementary recess 53 within a preferably generally wallet size holder 54. Desireably the recess 53 is located as conveniently near one side of the card 54 so that the remaining area of the face, or both faces, of the card can be utilized for any desired legends or indicia as schematically shown at 55.

For retaining the key 40 integrally with the card

54, integral multidirectional hinge means 55 is provided comprising a unitary part of the molding and formed from the same material as the key and the molded card, and integrally connecting an edge of the key head or handle 41 to an edge of the card 54 in the recess 53. Desirably the hinge means 55 comprises a generally elongated element which permits the key to be not only swung out of the plane of the card 54 but also to be twisted relative to the card on and about the hinge without breaking away from the card. In the preferred form, the hinge 55 comprises a generally rod shaped element which may be of cylindrical cross section and is longer than its diameter. Although the hinge 55 may be of slightly smaller diameter than the thickness of the head 41, as best seen in Fig. 15 the hinge diameter may be slightly greater than the thickness of the card 54. A reinforcement extension 57 extends from the attached end of the hinges 55 onto the adjacent portion of the card 54 and is connected to a reinforcing rib 58 which runs along the edge of the card and stiffens the card in this area against undue flexibility.

Referring now to Figs. 18-21, a reinforced shank molded plastic key 60 is depicted which, in general respects, is similar to the key 40 in Fig. 9, but differs there from in that tumbler notching 48 is effected along both edges of the bit. To this end, the key 16 has a handle 61, a shank 62 and a bit 63. The bit 63 is symmetrical in cross section and has along each longitudinal side a generally rabbet coding groove 64, and the grooves face alternately relative to the opposite faces of the bit 63. Along each of the grooves 64 there is a longitudinal side area 65 which is about half the thickness of the body of the bit 63. Tumbler notches 67 ae adapted to be cut in the area 65.

Reinforcement against torque breakage of the shank 62 is provided by a high torque resistant reinforcing insert which is preferably in the form of a steel stamping 68. A body portion 69 and a head portion 70 of the reinforcing insert 68 are fully embedded in the handle 61. For thorough interlocking of the head portion 70 within the handle 61, a transverse interlock slot 71 in the insert head 70 provides for a molded interlock 72 of the plastic key handle.

In a preferred construction, the insert 68 is of a thickness no greater than the thickness of at least one of the notch-receiving aeas 65 into which a reinforcing extension in the form of a finger 73 of the insert 68 projects from the insert body 69. As best seen in Figs. 19 and 20, the finger 73 is so aligned with the associated bit area 65 that opposite faces of the finger 73 are exposed at the opposite faces of the area 65 for similar reasons as expressed in connection with the finger 49 in Fig. 9. For adequate torque resistant strength in the finger 73, it is preferably wider than the width of the associated key area 65 and part of the finger is therefore moldable accommodated within the adjacent portion of the body of the shank 62. Such body-embedded portion of the finger 73 is desirably the longer dimension of the finger where the finger has, as shown in Fig. 18, a slanted or oblique terminal edge 74. Whether or not the terminal edge 74 is oblique, it is desirably coined from opposite faces of the finger, as best seen in Fig. 21, to provide tapered or bevelled surfaces leading to the edge 74. This provides a thinner section for the finger 73 adjacent to the edge 74, so that there will be interlocking overlaps 77 of the molded plastic material of the bit 63 in engagement with the tapered surfacs 75. This provides good anchorage of the terminal end of the finger 73 within the molded material of the finger and maintains sound structural integrity of the moldably joined key 60 and the insert 68.

As shown in Figs. 22-24, a key 80, similarly as the keys 40 and 60 comprises a handle 81 which is desirably thicker than a shank 82 and a bit 83, with a metal reinforcing insert 84 embedded in the handle and shank. A head end portion 85 of the insert is embedded in the handle 81, with an interlock slot 87 providing for a molded plastic interlock 88. From the head 85 projects an insert body 89 and, in this instance, a pair of spaced parallel reinforcing fingers 90 and 91 project from the body 89 into the key shank 82. The finger 90 may be slightly wider than the finger 91, and in the shank area between the fingers may be a longitudinal coding groove extending troughout the length of the bit 83 as well as the shank 82. There may additional longitudinal coding grooves 93 in the shank 82 and running on along the bit 83. A flat longitudinal tumbler pin notch-receiving area 94 runs along the side of the bit 83 which is in alignment with reinforcing finger 90. At the face of the shank 82 which may make contact with an entrance into a key slot in a lock with which the key 80 may be used, the finger 90 as well as the finger 91 have their face areas exposed as contact surfaces. It may be observed that if it were not for the coding groove 92, the two fingers 90 and 91 could be constructed solidly in one piece. This emphasizes the verstatility of the fingered reinforcing insert concept for plastic keys.

Molded plastic keys of the kind described may be formed from an acetal resin, comprising a polymerized formaldehyde formulation, such as may be obtained from E.I. Dupont De Nemours & Company under the trademark "Delrin 500".

As to the reinforcing inserts for the keys, suitable material comprises sheet steel stampings such as cold rolled steel which may be hardened if desired, or a C1095 spring steel annealed and

hardened to 55-57 Rockwell prior to molding in place in the plastic keys.

From the foregoing it will be apparent that the present invention provides substantial reinforcement protection against torque damage to the critical shank areas of the molded plastic keys.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the present invention.

The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A molded plastic key having a handle, a shank and a bit, and comprising: a shank reinforcement against breakage due to unusual torque applied through said handle when resistance to turning is encountered after the bit is inserted into a lock.

2. A molded plastic key according to claim 1, which is injection molded from an acetal resin.

3. A molded plastic key according to claim 1, wherein said shank reinforcement is a thickening molded integrally with said shank, said thickening extending throughout substantially the length of said shank, and said thickening continuing at least a limited distance onto the adjacent portion of said handle.

4. A molded plastic key according to claim 3, wherein said thickening extends over substantially the entire area on both faces of said shank.

5. A molded plastic key according to claim 4, wherein said thickening ends abruptly adjacent to the proximal end of said bit and in clearance relation to a key notch area of said bit.

6. A molded plastic key according to claim 5, wherein said thickening tapers toward a head end of said handle.

7. A molded plastic key according to claim 2, wherein said thickening extends sufficiently onto said handle for digital engagement by a user applying torque to the key when the key is located in a lock.

8. A molded plastic key according to claim 1, wherein said shank reinforcement comprises a metal insert.

9. A molded plastic key according to claim 8, wherein said insert is embedded in said handle and a reinforcing extension from said handle into said shank.

10. A molded plastic key according to claim 9, wherein said extension comprises a finger having a diagonal edge at its distal end.

11. A molded plastic key according to claim 10, wherein said finger has face surfaces adjacent to said distal end edge bevelled toward said edge, and plastic interlocks of said key shank engaging said bevelled surfaces.

12. A molded plastic key according to claim 9, wherein said reinforcing extension finger has bevelled face surfaces with plastic interlocks of the key engaging said surfaces.

13. A molded plastic key according to claim 8, wherein said insert has a body is molded within the key handle.

14. A molded plastic key according to claim 13, wherein said key handle and said insert body are interlocked within said handle.

15. A molded plastic key according to claim 8, wherein said insert comprises a plurality of spaced fingers extending into said shank from an insert body in said handle.

16. A molded plastic key according to claim 1, including a card-like key holder having a single recess offset adjacent to one side and leaving a substantial card face area between said recess and a second side of the holder, said key being in said recess, and a hinge connecting said key handle to said holder in a manner permitting the key to be swung hingedly into and out of said recess.

17. A method of making a molded plastic key having a handle, a shank and a bit, comprising: providing said shank with a reinforcement against breakage due to unusual torque applied through said handle when resistance to turning is encountered after the bit is inserted in a lock.

18. A method according to claim 17, which comrises injection molding said key from acetal resin.

19. A method according to claim 17, which comprises molding integrally with said shank, a reinforcing thickening extending throughout substantially the length of said shank, and continuing said thickening to at least a limited distance onto the adjacent portion of said handle sufficiently for effective digital engagement by a user applying torque to the key when the key is located in a lock.

20. A method according to claim 19, comprising effecting said thickening over substantially the entire area on both faces of said shank.

21. A method according to claim 19, comprising abruptly ending said thickening adjacent to the proximal end of said bit and in clearance relation to a key notch area of the bit.

22. A method according to claim 21, comprising tapering said thickening toward a head end of said handle.

23. A method according to claim 17, which comprises providing said shank reinforcement as a metal insert.

24. A method according to claim 23, comprising locating a body portion of said insert in said handle and providing said insert with a reinforcing extension from said handle into said shank.

25. A method according to claim 24, which comprising providing said extension in the form of a finger with a diagonal distal end edge.

26. A method according to claim 25, which comprises bevelling face surfaces of said finger adjacent to said edge toward said edge and overlapping said surfaces with plastic interlocks of said shank.

27. A method according to claim 24, which comprises providing bevelled surfaces on said extension and directing said surfaces toward a distal edge of said finger, and interlocking said surfaces within said shank.

28. A method according to claim 24, which comprises molding said insert body within the key head.

29. A method according to claim 24, which comprises interlocking said insert body within said handle.

30. A method according to claim 23, which comprises providing said insert with a plurality of reinforcing fingers extending into said shank from an insert body carried by said handle.

31. A method according to claim 17, which comprises providing a generally card-like key holder with a key accommodating recess adjacent to one side of the holder, attaching said key in said recess to said card by a hinge connecting said key handle to said card so that the key can be swung into and out of a position with respect to said recess, and leaving substantial display area on faces of the card between said recess and a second side of the card.

FIG. 1

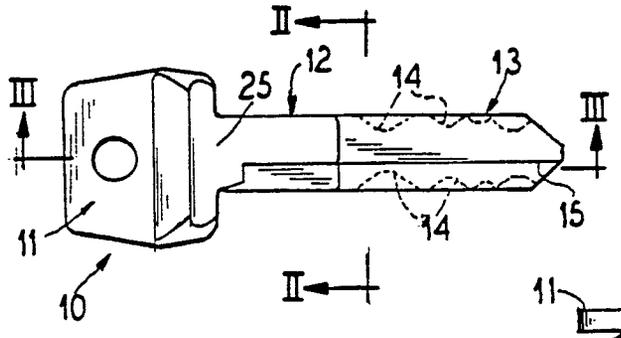


FIG. 2

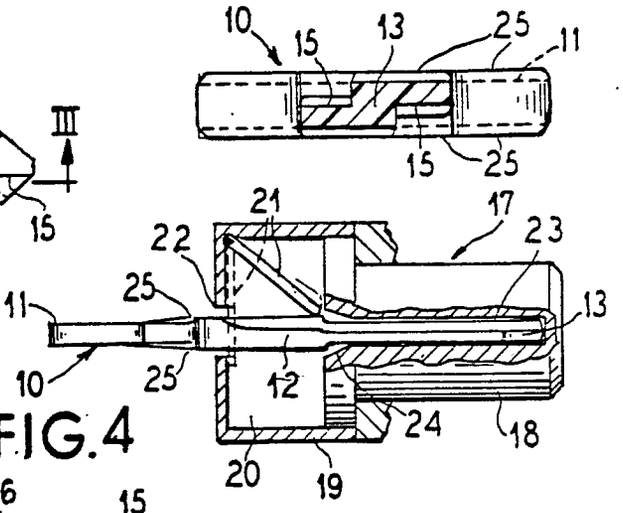


FIG. 3

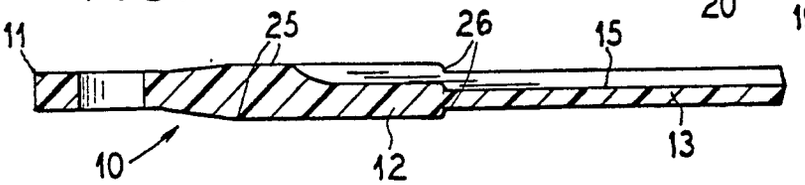


FIG. 4

FIG. 6

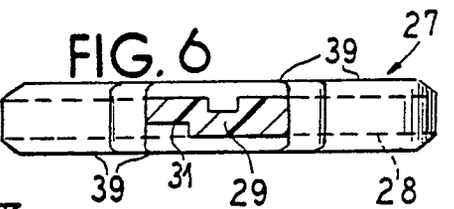


FIG. 5

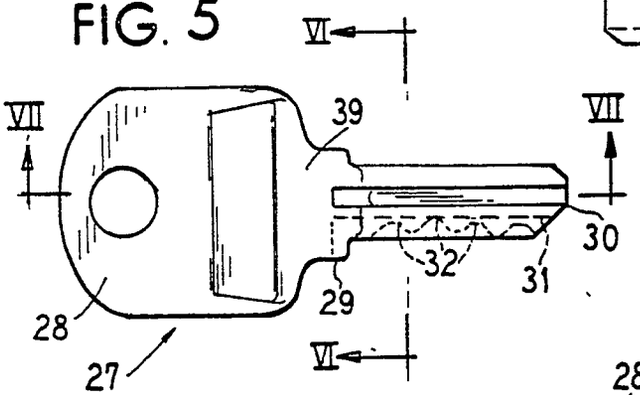


FIG. 8

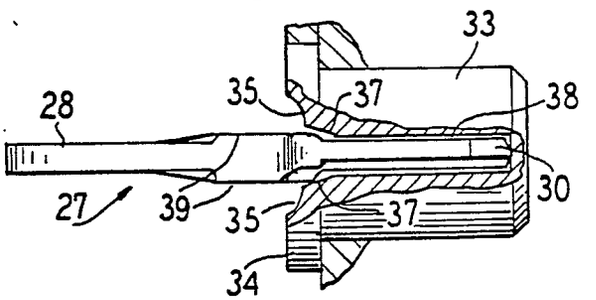


FIG. 7

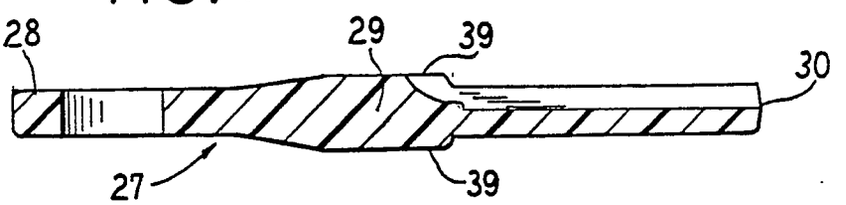


FIG. 9

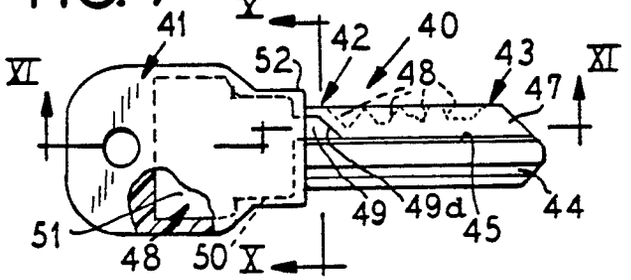


FIG. 10

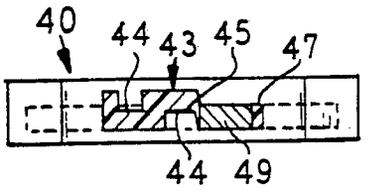


FIG. 11

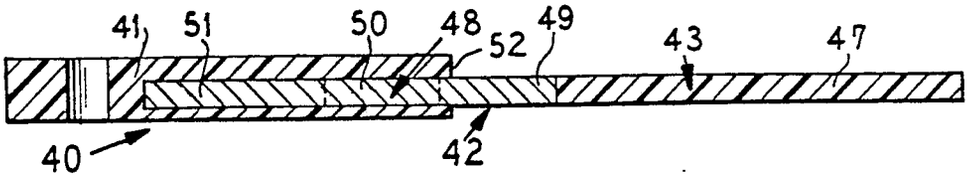


FIG. 12

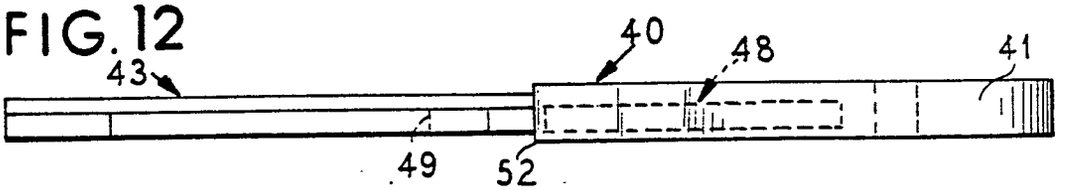


FIG. 13

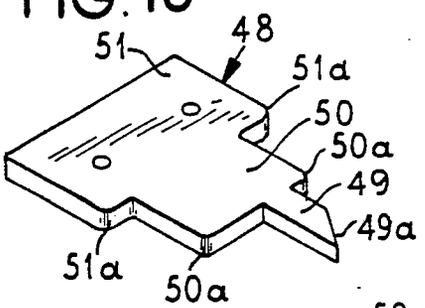


FIG. 14

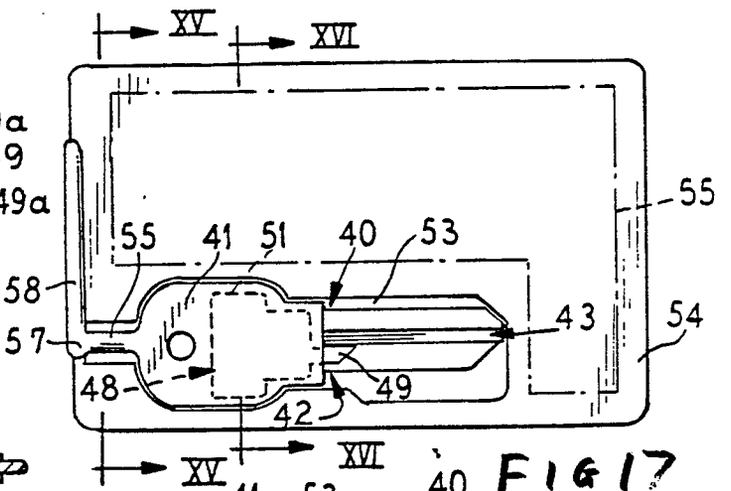


FIG. 15

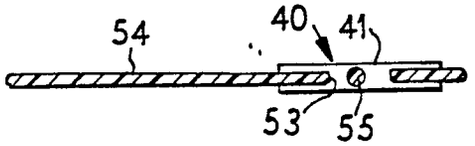


FIG. 16

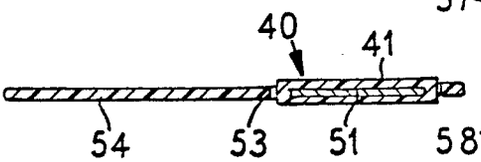


FIG 17

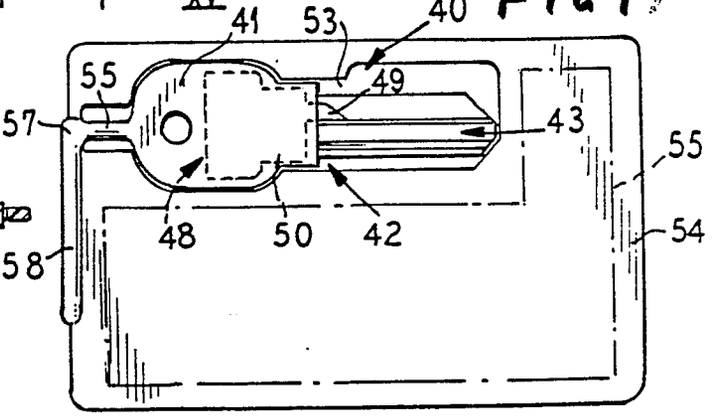


FIG. 18

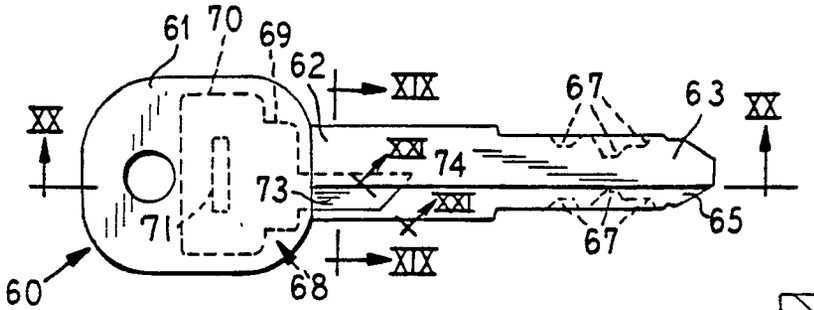


FIG. 19

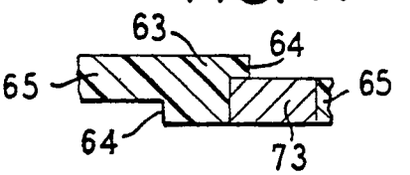
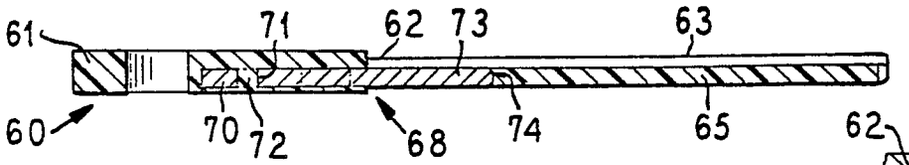


FIG. 20



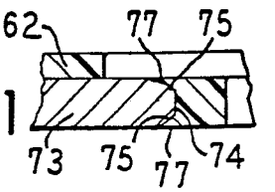


FIG. 21

FIG. 22

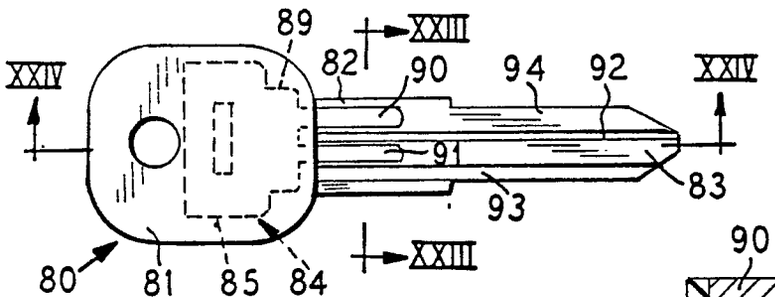


FIG. 23

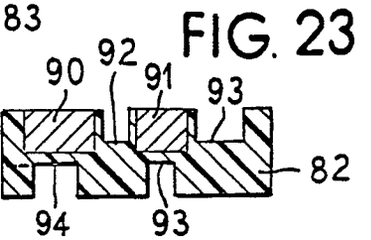


FIG. 24