

[54] SAW AND IMPACT RESISTANT SECURITY
BAR AND METHOD OF MAKING SAME

[75] Inventors: **Warren M. Shwayder**, Bloomfield
Hills; **Baruch Sfar**, Oak Park, both
of Mich.
[73] Assignee: **Warren M. Shwayder**, Bloomfield,
Mich. ; a part interest
[22] Filed: **July 12, 1973**
[21] Appl. No.: **369,400**

Related U.S. Application Data

[62] Division of Ser. No. 260,397, June 7, 1972, Pat. No.
3,777,517.
[52] U.S. Cl..... **29/420.5**, 29/191.2, 29/191.6,
29/527.1, 70/417
[51] Int. Cl..... **B22f 3/24**
[58] Field of Search 29/191.2, 191.6, 420, 420.5,
29/474.3, 474.4, 474.6, 527.1; 70/38 R, 38
A, 38 B, 38 C, 53, 54, 55, 56, 333 R, 416,
417; 161/174

[56]

References Cited

UNITED STATES PATENTS

2,372,607	3/1945	Schwarzkopf.....	29/191.2 X
2,686,439	8/1954	Tobert	29/191.2 X
3,552,938	1/1971	Draca	29/191.6
3,713,309	1/1973	Miller	70/38 A

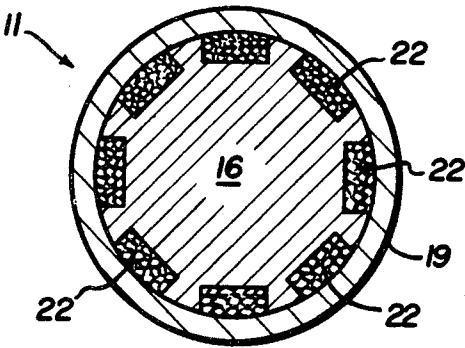
Primary Examiner—C. W. Lanham
Assistant Examiner—D. C. Reiley, III
Attorney, Agent, or Firm—Cullen, Settle, Sloman &
Cantor

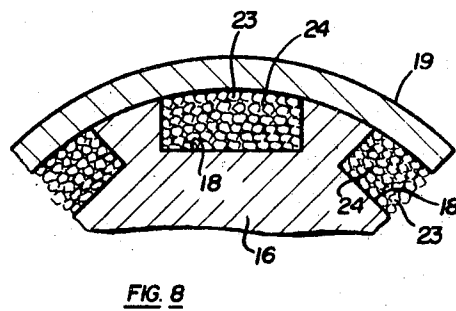
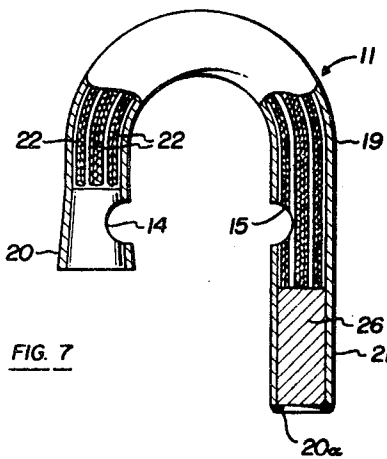
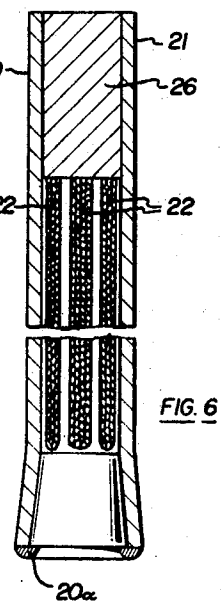
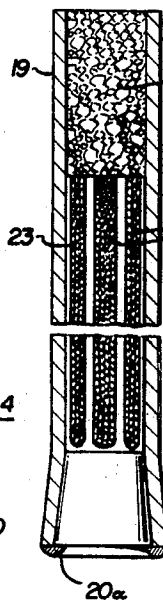
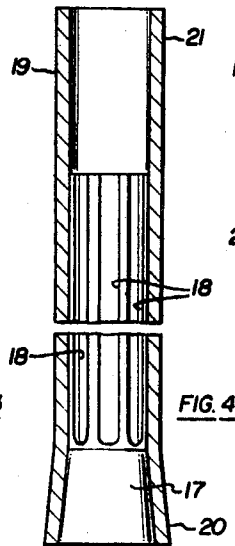
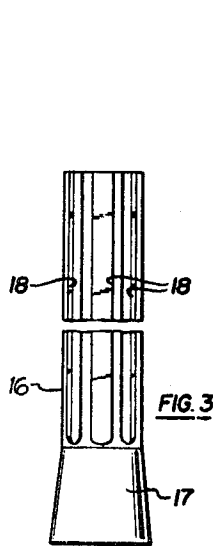
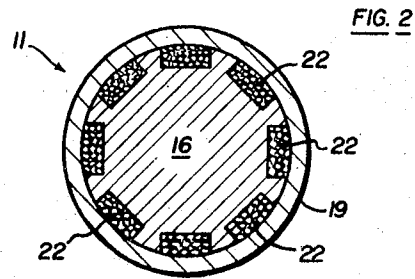
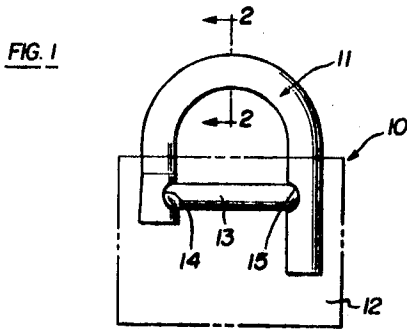
[57]

ABSTRACT

A lock shackle formed of an elongated metal core
having longitudinally extending shallow grooves
formed in its surface, and a thin wall tube closely fit-
ted around the core, with the grooves filled with a ma-
trix formed of hard carbide particles and a soft mate-
rial binder.

12 Claims, 8 Drawing Figures





SAW AND IMPACT RESISTANT SECURITY BAR AND METHOD OF MAKING SAME

This application is a division of Ser. No. 260,397, filed June 7, 1972, now U.S. Pat. No. 3,777,517.

BACKGROUND OF INVENTION

Padlock shackles are generally made of steel rods bent into the U-shape of a shackle and heat treated for hardness. These conventionally used shackles have only a limited resistance to saw cutting and virtually no resistance to cutting by carbide coated saws such as rod saws. In addition, they are relatively easily broken by the impact of a heavy hammer. Moreover, they can be relatively easily stretched or elongated by insertion of chisels or wedges between a shackle loop and padlock casing, so that they can be pulled out of the locked position. Thus, conventional padlocks, and particularly their shackles, provide no protection against a determined and sustained effort to break them. Thus, the invention herein relates to an improved shackle which is highly resistant to saw cutting, impact application and stretching.

SUMMARY OF INVENTION

The improved shackle herein comprises a conventional appearing, U-shaped, rod-like member, but formed of an elongated, inner core which is generally spline shaped in cross-section to provide longitudinally extending, shallow grooves in its surface, with a tubular sleeve closely fitted around the outside of the core, and with the grooves filled with a matrix of hard particles, such as tungsten carbide or the like, in a soft metal binder. The core and sleeve are made of a work hardenable steel. The assembly of core, matrix and sleeve is swaged to work harden the metal, elongate and form the finished diameter of the part, as well as to seal the elements together.

The finished rod-like shackle cannot be sawed through or broken by impact using any conventional means, including the extremely hard type carbide coated saws. While such a saw might penetrate through the thin sleeve, upon contacting the matrix, it is immediately destroyed so that it cannot penetrate deeply into the shackle. Moreover, the shackle will resist repeated blows or impacts of even a heavy sledge hammer without breaking, and it resists elongation or stretching.

These and other objects and advantages of this invention will become apparent, upon reading the following description, of which the attached drawings form a part.

DESCRIPTION OF DRAWINGS

FIG. 1 is a schematic view of a padlock showing the improved shackle herein.

FIG. 2 is an enlarged cross-sectional view of the shackle taken in the direction of arrows 2—2 of FIG. 1.

FIG. 3 is an elevational view of the core, per se.

FIG. 4 shows the initial assembly of the sleeve upon the core, and

FIG. 5 shows the step of applying the binder material into the grooves which have already been filled with hard particles.

FIG. 6 is a partially cross-sectioned view of the assembled rod-like member.

FIG. 7 is an elevational view, partially in cross-section, of the finished shackle.

FIG. 8 is a fragmentary, enlarged cross-sectional view of a portion of the shackle.

DETAILED DESCRIPTION

FIG. 1 illustrates a conventional padlock 10 having a shackle 11 which fits into and locks within the padlock casing or body 12. The construction and locking parts of the casing are omitted since these form no part of the invention herein. A locking bar 13, which is arranged within and forms part of the locking mechanism, is schematically illustrated. This bar engages notches 14 and 15 formed in the shackle to lock the shackle into the padlock casing. It should be understood that the shackle of this invention may be used with any form of padlock casing, regardless of the type of locking mechanism included therein.

The shackle is formed of a central core 16 which preferably is roughly spline-shaped in cross-section and of uniform diameter. The core lower end 17 may be flared or tapered. The core is thus provided with a number of longitudinally extending shallow grooves 18 defined by the tooth-like formation of the spline.

A tubular sheath 19 is closely fitted over the core (see FIG. 4), including force fitting the lower end 20 of the sheath around the flared end 17 of the core. Additionally, where desired, the lower end 20 may be welded at 20a to the core lower end. As illustrated in the drawing, the tube is preferably of greater length than the core so that its upper end 21 extends a distance above the upper end of the core.

The grooves 18 are filled with a matrix 22 formed of hard particles 23 (see FIG. 8) and a binder 24. The particles are preferably of a hard metal carbide such as tungsten carbide, either cast or cemented, or other similar carbide particles which have high degrees of hardness. The binder may be of a soft metal material, such as copper braze or other suitable brazing materials. The particles are closely packed within the grooves and the spaces between them are filled with the binder to form a solid matrix.

METHOD OF MAKING SHACKLE

A method of forming the improved shackle herein is as follows: First, the core 16 is formed with the longitudinally extending shallow grooves and the flared end 17 (see FIG. 3). Next, the thin walled tubular sheath is forced into position around the core, as illustrated in FIG. 4. Then, the hard particles are poured into the grooves, with the rod arranged upright as shown in FIG. 5, to form a packing of particles within the grooves. The space at the upper end 21 of the tube 19 may then be filled with pellets or beads or powder of the brazing compound, such as copper brazing pellets 25, and while the rod is held upright, it is heated to melt the braze which flows downwardly, filling the spaces between the particles. Preferably enough braze is placed into the tube, so that the upper end 21 of the tube is filled with braze material above the upper end of the core. When the rod is permitted to cool and the braze to solidify, a slug 26 of braze fills the upper end of the sheath (see FIG. 6).

Next, the composite rod is swaged to reduce its diameter to required size, while simultaneously elongating it and more importantly, work hardening the metal forming the sleeve and the core. Both of these metals are se-

lected from the work hardenable steels, with the tube preferably being of a stainless steel material to provide greater toughness, corrosion resistance, improved appearance, etc.

After the swaging, the rod is of uniform cross-section, the flared portion being reduced to the common diameter of the rod.

Thereafter, the rod may be bent into the U-shaped shackle form illustrated in FIG. 7 and the notches 14 and 15 formed therein. The notch 14 may be easily cut into the shackle since it is arranged in the area of the end of the core where there is no matrix material. On the other hand, the notch 15, located in an area where there is matrix material, may be formed either by a suitable deformation process or electrical or heat cutting method.

Alternatively, the area into which the notch 15 is formed may be made without the groove and matrix so as to permit easy notching.

The portion of the shackle below the notch 15, that is, where the slug 26 of braze fills the tube, is concealed within the padlock casing and does not carry any unexpected loads. Thus, the slug 26 simply functions as a filler, as a place where openings may be easily drilled through for various types of locking mechanisms, and also as a heat conductor to remove heat which may be applied to the shackle.

EXAMPLE OF CONSTRUCTION

While the materials and the sizes and shape of the shackle may vary, an example of its construction is as follows: A one-half inch diameter spline formed of work hardenable 304 stainless steel rod was provided with six grooves, equally spaced apart around its surface, the grooves being approximately 0.12 wide by 0.08 deep. The grooves were filled with cemented tungsten carbide grit of approximately 12/20 mesh size. The tube or sheath was made of approximately 9/16ths outside diameter, with a wall thickness of approximately 0.028 inches and formed of 304 stainless steel tubing. Conventional copper braze was used as the binder.

After the assembly, the rod was swaged down to a little less than one-half inch in diameter. The swaging also work hardened the material to roughly Rockwell C-10.

The bent shackle resisted penetration by and destroyed all available saws, including carbide coated ones of the rod-saw type, sustained in excess of 16,000 pounds tensile test and resisted breakage by repeated pounding with a conventional four pound hammer. All of the foregoing results were far in excess of any possible results achievable in conventional shackles.

While the rod-like construction and method are described in connection with shackles for padlocks, it may likewise be used in other applications where similar types of penetration resistance, impact resistance and stretching resistance is desired, such as for example, protective bars, jail bars, locking bars, etc. Likewise, the cross-sectional shape may be varied as may the shape of the grooves or passageways or spaces which are arranged between the core and the sheath.

Having fully described an operative embodiment of this invention, we now claim:

1. A saw and impact resistant member comprising:

an elongated metal core having a closely fitted, thin wall metal sheath surrounding and in face to face contact therewith;

longitudinally extending core spaces, of shallow depth, formed between the surface of the core and the interior surface of the sheath, with said core spaces being filled with a matrix formed of closely packed hard particles, such as of metallic carbides and the like and a softer binder material;

said sheath being closely fitted on said core to exclude both said binder and said hard particles therebetween except in said core spaces.

2. A construction as defined in claim 1, and said member being in the form of a rod, with the core being generally spline-shaped in cross-section, wherein said core spaces are defined by the gaps between the spline teeth.

3. A method of making a saw and impact resistant bar-like member comprising the steps of:

forming an elongated core with spaced apart, generally longitudinally extending shallow surface grooves;

closely fitting a generally tubular, thin walled sheath over said core;

then filling said grooves in an endwise direction with a packing formed of particles of a hard material, such as a hard metal carbide;

next, flowing a molten binder into the grooves to fill the spaces between the particles and solidifying the binder to form a solid matrix of particles and binder;

said close fitting of said sheath over said core to deliberately exclude both said packing and said binder therebetween and to restrict said particles and said binder to said grooves;

then swaging the member to elongate it, reduce its cross-sectional size and to work harden the metal.

4. A method as defined in claim 3, and including said sheath being longer than the core, and arranging the tube and core in an upright position with the tube extending a distance above the upper end of the core, and placing the binder material into the upper ends of the tube above the core, then flowing the molten binder downwardly into the grooves.

5. A method as defined in claim 3, and including placing said binder material into the tube upper end in solidified form and thereafter melting the binder so that it flows downwardly into the grooves containing the particles.

6. A method as defined in claim 3 and including bending the swaged member into the shape of a lock shackle.

7. A saw and impact resistant member comprising: an elongated metal core surrounded by closely fitted, thin wall metal sheath;

a longitudinally extending, shallow depth space formed between at least a portion of the outer surface of the core and the interior wall surface of the sheath;

said spacing being filled with a matrix formed of closely packed hard particles, such as of metallic carbides and the like and a softer binder material, such as a copper braze material and the like, binding the particles together and generally filling the voids between particles;

5

said sheath and said core being closely fitted to prevent said particles and said binder from being positioned therebetween except in said formed spaces.

8. A construction as defined in claim 1, and said member and its core being in the form of an elongated, approximately uniform cross-section rod, with the sheath being in the form of a thin wall approximately uniform diameter tube.

9. A saw and impact resistant member comprising: an elongated metal core having a first end and an outwardly tapered second end;

said metal core having a plurality of longitudinal grooves of shallow depth extending radially inwardly from the outer surface thereof and extending radially inwardly from the outer surface thereof and extending from the first end of said core to approximately the beginning of the taper at said second end;

a thin walled metal tube surrounding said core, said tube having a first end extending longitudinally beyond the first end of said core and having an outwardly tapered second end force fit onto the tapered second end of said core; and

the grooves of said core being filled with a matrix formed of closely packed hard particles such as of metallic carbides and the like in a soft binder material.

10. The construction as defined in claim 9 and further including a plug of said softer binder material above the first end of said metal core, said plug substantially filling the interior of said tube from said first

6

end of said tube to said first end of said core.

11. A method of making a saw and impact resistant bar-like member comprising the steps of:

forming an elongated core having a first end and a second end with said core being tapered outwardly at said second end, said core having a plurality of spaced apart longitudinal surface grooves extending radially inwardly from the outer surface of said core, said grooves extending generally from said first end of said core and terminating in the region of said core where said taper commences;

closely fitting a thin walled tube over said core, said tube having first end extending longitudinally beyond the first end of said core and having an outwardly tapered second end force fit onto the second tapered end of said core;

filling said grooves in an endwise direction with a packing formed of particles of hard material such as hard metal carbide; and

flowing a molten binder into said grooves to fill the spaces between the particles and solidifying the binder to form a solid matrix of particles and binder.

12. The method as defined in claim 11, wherein said step of flowing includes flowing a molten binder into the tube above the first end of said core and solidifying said binder above said core during the solidifying of said binder in said grooves to form a solid matrix of particles and binder in said grooves and to form a solid plug of said binder material interiorly of said tube at the first end thereof and above the first end of said core.

* * * * *

35

40

45

50

55

60

65