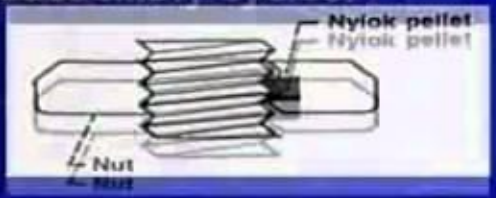
Locking Methods

NylokPellet (cont'd)

If a nut is used, the pellet will be in the nut.

If a bolt is installed in a tapped hole, the pellet will be in the bolt.



1
00:00:00,000 --> 00:00:18,749
I

2
00:00:25,150 --> 00:00:22,419
okay continuing with platings and

3
00:00:28,540 --> 00:00:25,160
coatings in the passivation and pre

4
00:00:35,939 --> 00:00:28,550
oxidation and right now perspiration so

5
00:00:38,590 --> 00:00:35,949
we'll get rid of the coat and proceed

6
00:00:41,860 --> 00:00:38,600
now stainless steel fasteners are

7
00:00:44,020 --> 00:00:41,870
normally passivated or pre oxidized

8
00:00:47,170 --> 00:00:44,030
during a manufacturing process to make

9
00:00:49,749 --> 00:00:47,180
them more inert and of course I

10
00:00:52,299 --> 00:00:49,759
mentioned earlier is done with the acid

11
00:00:54,280 --> 00:00:52,309
treatment and then of course the pre

12
00:00:56,410 --> 00:00:54,290
oxidation is just done simply by putting

13
00:00:59,530 --> 00:00:56,420

them in a furnace and run them up to

14
00:01:02,350 --> 00:00:59,540
about 1300 degrees and cooling them to

15
00:01:04,600 --> 00:01:02,360
form an oxide coating on the surface the

16
00:01:06,969 --> 00:01:04,610
advantages are that it deters galling

17
00:01:09,969 --> 00:01:06,979
and it's a relatively inexpensive

18
00:01:12,069 --> 00:01:09,979
process the disadvantage is that making

19
00:01:18,340 --> 00:01:12,079
parts still need to be lubricated for

20
00:01:21,640 --> 00:01:18,350
torque coefficient consistency and

21
00:01:25,600 --> 00:01:21,650
here's the old familiar black oxide

22
00:01:27,760 --> 00:01:25,610
coating with oil and it's nice and

23
00:01:31,719 --> 00:01:27,770
pretty in black and you put oil on it

24
00:01:35,070 --> 00:01:31,729
and it glistens and looks good but once

25
00:01:40,960 --> 00:01:35,080
the oil is gone black oxide is worthless

26
00:01:43,330 --> 00:01:40,970
it's real cheap no baking required after

27
00:01:46,539 --> 00:01:43,340
plating it this the material strength is

28
00:01:47,980 --> 00:01:46,549
less than 200 k SI and its disadvantages

29
00:01:50,680 --> 00:01:47,990
it's worthless for corrosion prevention

30
00:01:57,700 --> 00:01:50,690
once the oil is gone and the coating

31
00:02:00,190 --> 00:01:57,710
doesn't adhere well to steal now here's

32
00:02:03,820 --> 00:02:00,200
a bunch of miscellaneous platings and

33
00:02:07,600 --> 00:02:03,830
coatings and electric lyst nickel is one

34
00:02:10,600 --> 00:02:07,610
of them and it is used a lot on just

35
00:02:16,240 --> 00:02:10,610
coating of steel where you don't have

36
00:02:19,390 --> 00:02:16,250
threads but on threads it creates some

37
00:02:21,369 --> 00:02:19,400
problems in that you can get uneven

38
00:02:24,070 --> 00:02:21,379

plating on the threads so that they're

39
00:02:30,369 --> 00:02:24,080
kind of out of tolerance this sir Mattel

40
00:02:31,030 --> 00:02:30,379
sir Malloy is a aluminum inorganic

41
00:02:34,449 --> 00:02:31,040
material

42
00:02:36,640 --> 00:02:34,459
all that is used for corrosion

43
00:02:40,199 --> 00:02:36,650
protection of both unthreaded and

44
00:02:43,509 --> 00:02:40,209
threaded parts but once again if you

45
00:02:46,300 --> 00:02:43,519
assemble reassemble very many times it

46
00:02:48,339 --> 00:02:46,310
will come off synergistic because

47
00:02:52,780 --> 00:02:48,349
another one is a combination of surface

48
00:02:56,080 --> 00:02:52,790
oxidation and a fluoropolymer used for

49
00:02:59,229 --> 00:02:56,090
corrosion protection and lubricity but

50
00:03:02,920 --> 00:02:59,239
these are assembly reassembly none of

51
00:03:05,640 --> 00:03:02,930
these work that well on proposed

52
00:03:10,240 --> 00:03:05,650
replacements for cadmium of course the

53
00:03:12,659 --> 00:03:10,250
there's been a big push to do away with

54
00:03:16,569 --> 00:03:12,669
cadmium because it is such a bad thing

55
00:03:18,610 --> 00:03:16,579
environmentally so there's not fit over

56
00:03:22,149 --> 00:03:18,620
in chardon came up with this dr. Matt

57
00:03:24,399 --> 00:03:22,159
320 with the plus a ol sealer as a

58
00:03:29,949 --> 00:03:24,409
proprietary thing for the automotive

59
00:03:32,619 --> 00:03:29,959
companies and it has metal oxide zinc

60
00:03:35,379 --> 00:03:32,629
and aluminum and a clear sealer it's

61
00:03:37,869 --> 00:03:35,389
good up to 600 degrees but the coating

62
00:03:40,899 --> 00:03:37,879
is damaged by assembly disassembly

63
00:03:45,339 --> 00:03:40,909

cycles and it will support fungus growth

64
00:03:48,460 --> 00:03:45,349
and it costs about the same as cadmium

65
00:03:50,979 --> 00:03:48,470
so the cost savings isn't there the only

66
00:03:55,000 --> 00:03:50,989
thing that it's kinder to the

67
00:03:57,250 --> 00:03:55,010
environment zinc nickel coating is one

68
00:04:00,099 --> 00:03:57,260
that is used some there's about ninety

69
00:04:02,589 --> 00:04:00,109
percent ten percent nickel but it

70
00:04:04,649 --> 00:04:02,599
doesn't work very well on fasteners it

71
00:04:07,569 --> 00:04:04,659
works on rods and things of this nature

72
00:04:15,180 --> 00:04:07,579
now here is a summary of pleadings and

73
00:04:21,370 --> 00:04:18,849
important here is the useful design

74
00:04:25,990 --> 00:04:21,380
temperature limit you will notice that

75
00:04:28,930 --> 00:04:26,000
most of these don't go that high and the

76
00:04:30,909 --> 00:04:28,940
a here is for the black oxide with oil

77
00:04:33,370 --> 00:04:30,919
as soon as the oil boils off your

78
00:04:38,200 --> 00:04:33,380
corrosion resistance it's gone so you

79
00:04:40,330 --> 00:04:38,210
see when you get down to it about 1,200

80
00:04:43,540 --> 00:04:40,340
degrees is the best that any of these

81
00:04:44,770 --> 00:04:43,550
will do so that's why that in a lot of

82
00:04:48,129 --> 00:04:44,780
cases where you

83
00:04:50,770 --> 00:04:48,139
super high temperatures you have to use

84
00:04:53,890 --> 00:04:50,780
a material that doesn't require coding

85
00:04:56,650 --> 00:04:53,900
like wasp a lawyer Hanes or inconel or

86
00:04:59,820 --> 00:04:56,660
something of that nature because you

87
00:05:04,240 --> 00:04:59,830
can't rely on the coatings now here's a

88
00:05:08,680 --> 00:05:04,250

table that just gives various

89
00:05:10,210 --> 00:05:08,690
characteristics of the coatings and

90
00:05:15,090 --> 00:05:10,220
plated there's a couple here that i

91
00:05:18,940 --> 00:05:15,100
wanted to mention era date is a common

92
00:05:22,650 --> 00:05:18,950
coating in fact we used it on the CM one

93
00:05:26,800 --> 00:05:22,660
chamber for it is electrically

94
00:05:30,640 --> 00:05:26,810
conductive whereas anodized isn't and it

95
00:05:32,680 --> 00:05:30,650
is a type of chromate conversion coating

96
00:05:36,520 --> 00:05:32,690
in which you actually treat the surface

97
00:05:40,350 --> 00:05:36,530
with an acid to form a real thin layer

98
00:05:44,350 --> 00:05:40,360
that is somewhat corrosion resistant so

99
00:05:48,010 --> 00:05:44,360
what we had to do in in on CM one you

100
00:05:50,020 --> 00:05:48,020
mask it in the irritated areas where you

101
00:05:52,330 --> 00:05:50,030
have electrical conductivity required

102
00:05:54,070 --> 00:05:52,340
and then the anodized which is actually

103
00:05:57,310 --> 00:05:54,080
used although it's used on other

104
00:06:02,830 --> 00:05:57,320
materials as we know it as being used on

105
00:06:06,130 --> 00:06:02,840
aluminum it is a acid etch using

106
00:06:10,600 --> 00:06:06,140
sulfuric acid I believe that forms a

107
00:06:14,800 --> 00:06:10,610
fairly heavy oxide coating and fact you

108
00:06:17,200 --> 00:06:14,810
can't anodized a fastener because the

109
00:06:19,090 --> 00:06:17,210
anodized is thick and well you can

110
00:06:20,740 --> 00:06:19,100
anodized it physically but it doesn't

111
00:06:22,719 --> 00:06:20,750
work out very well on the threaded areas

112
00:06:24,400 --> 00:06:22,729
because you will have a to heavier

113
00:06:29,230 --> 00:06:24,410

coating and the threads where it doesn't

114
00:06:32,170 --> 00:06:29,240
work too well now moving on to thread

115
00:06:34,450 --> 00:06:32,180
lubricants there's all kinds of

116
00:06:40,830 --> 00:06:34,460
lubricants available and of course all

117
00:06:45,190 --> 00:06:40,840
of us have used the old 10w30 oil and

118
00:06:49,990 --> 00:06:45,200
for our cars to lubricate stuff the oil

119
00:06:53,230 --> 00:06:50,000
grease wax graphite silver molybdenum

120
00:06:55,290 --> 00:06:53,240
disulphide and prep proprietary types

121
00:06:57,600 --> 00:06:55,300
such as never sees silver goop

122
00:06:59,820 --> 00:06:57,610
synergistic can ever lube and so

123
00:07:01,740 --> 00:06:59,830
on some of these are applied at

124
00:07:09,929 --> 00:07:01,750
installation and some are cured on the

125
00:07:13,770 --> 00:07:09,939
fastener by the manufacturer I'm having

126
00:07:17,760 --> 00:07:13,780
trouble turning my page okay for oil and

127
00:07:19,409 --> 00:07:17,770
grease you have good lubrication up to

128
00:07:22,499 --> 00:07:19,419
the boiling point of the oil or grease

129
00:07:23,850 --> 00:07:22,509
which is usually around 250 degrees and

130
00:07:27,920 --> 00:07:23,860
of course you can't use any of this

131
00:07:32,309 --> 00:07:27,930
stuff in vacuum now graphite graphite

132
00:07:36,230 --> 00:07:32,319
drag graphite is not dry it's a fine

133
00:07:40,140 --> 00:07:38,429
usually oil or water to become a

134
00:07:42,480 --> 00:07:40,150
lubricant and then when the moisture

135
00:07:45,390 --> 00:07:42,490
evaporates it becomes an abrasive powder

136
00:07:54,300 --> 00:07:45,400
and of course it can't be using a vacuum

137
00:07:59,330 --> 00:07:54,310
either silver plating as I mentioned

138
00:08:02,640 --> 00:07:59,340

earlier it is normally used on stainless

139
00:08:05,010 --> 00:08:02,650
nuts stainless bolts as both a lubricant

140
00:08:07,350 --> 00:08:05,020
and I Colleen coating and it's good up

141
00:08:10,430 --> 00:08:07,360
to about 1600 degrees it can be used in

142
00:08:13,050 --> 00:08:10,440
a vacuum but it is very expensive

143
00:08:15,059 --> 00:08:13,060
molybdenum disulfide is kind of a

144
00:08:18,360 --> 00:08:15,069
universal tape that's used in the

145
00:08:20,939 --> 00:08:18,370
aerospace industry because it's a can be

146
00:08:23,790 --> 00:08:20,949
put on us a dry film lubricant it's good

147
00:08:26,879 --> 00:08:23,800
up to 750 degrees it can be used in a

148
00:08:32,730 --> 00:08:26,889
vacuum and it can be applied to both

149
00:08:36,959 --> 00:08:32,740
alloy steel and stainless steel now

150
00:08:41,310 --> 00:08:36,969
never sees is a proprietary petroleum

151
00:08:45,960 --> 00:08:41,320
based lubricant and it contains metal

152
00:08:49,250 --> 00:08:45,970
oxide usually copper or nickel depending

153
00:08:51,900 --> 00:08:49,260
on what temperature you want because the

154
00:08:54,689 --> 00:08:51,910
copper of course has a lower melting

155
00:08:58,290 --> 00:08:54,699
point than the nickel and it's good up

156
00:09:00,449 --> 00:08:58,300
to 2,200 degrees because what you wind

157
00:09:04,860 --> 00:09:00,459
up with is the metal flakes between the

158
00:09:07,260 --> 00:09:04,870
threads as the oil it boils off and so

159
00:09:09,780 --> 00:09:07,270
this means that you have to reapply each

160
00:09:11,310 --> 00:09:09,790
time you reassemble it and it can't be

161
00:09:13,350 --> 00:09:11,320
using a vacuum either but

162
00:09:14,960 --> 00:09:13,360
you have the the flakes in between the

163
00:09:21,600 --> 00:09:14,970

threads making them easier to

164
00:09:25,190 --> 00:09:21,610
disassemble silver goop which is made by

165
00:09:30,750 --> 00:09:25,200
some company here in Cleveland I believe

166
00:09:33,540 --> 00:09:30,760
is a proprietary paste that contains

167
00:09:36,420 --> 00:09:33,550
twenty to thirty percent silver and it's

168
00:09:40,550 --> 00:09:36,430
good up to about 1500 degrees but of

169
00:09:44,130 --> 00:09:40,560
course silver does not is corrosive to

170
00:09:48,480 --> 00:09:44,140
aluminum magnesium so you don't don't

171
00:09:50,550 --> 00:09:48,490
use it on them it's curse the silver

172
00:09:55,770 --> 00:09:50,560
goop is very expensive and it can't be

173
00:09:59,730 --> 00:09:55,780
using a vacuum either the fluorocarbon

174
00:10:02,760 --> 00:09:59,740
coatings there's a lot of them available

175
00:10:05,460 --> 00:10:02,770
the I'm just listing a few of them here

176
00:10:08,670 --> 00:10:05,470
the synergistic span coke style garden

177
00:10:12,420 --> 00:10:08,680
ever lube and they're only good for a

178
00:10:16,610 --> 00:10:12,430
few assemblies because they flake off if

179
00:10:19,890 --> 00:10:16,620
you assemble and disassemble a fastener

180
00:10:22,980 --> 00:10:19,900
nut bolt very much and there are only

181
00:10:25,980 --> 00:10:22,990
good up to about 400 degrees they can be

182
00:10:29,520 --> 00:10:25,990
used in a vacuum and here was one that I

183
00:10:32,160 --> 00:10:29,530
learned when I was looking for different

184
00:10:35,630 --> 00:10:32,170
types of lubricants for high temperature

185
00:10:39,750 --> 00:10:35,640
applications plain ol milk of magnesia

186
00:10:42,840 --> 00:10:39,760
is used by the turbine engine companies

187
00:10:45,180 --> 00:10:42,850
for engine assembly because anything

188
00:10:46,910 --> 00:10:45,190

that you use in a jet engine for

189
00:10:49,170 --> 00:10:46,920
lubricants going to burn off anyway

190
00:10:52,400 --> 00:10:49,180
after the things operating but in

191
00:10:54,390 --> 00:10:52,410
putting it together this is a suitable

192
00:10:59,030 --> 00:10:54,400
lubricant and it doesn't harm anything

193
00:11:05,550 --> 00:10:59,040
when it burns up now here's a summary of

194
00:11:08,610 --> 00:11:05,560
the thread lubricants and most of stuff

195
00:11:11,670 --> 00:11:08,620
we have covered here there this is

196
00:11:15,300 --> 00:11:11,680
doesn't necessarily include all of them

197
00:11:19,560 --> 00:11:15,310
but these are the the common ones and

198
00:11:22,260 --> 00:11:19,570
once again there's very few that are

199
00:11:23,520 --> 00:11:22,270
good for high temperatures here are the

200
00:11:24,840 --> 00:11:23,530
three that are good for the high

201
00:11:25,920 --> 00:11:24,850
temperatures so

202
00:11:27,949 --> 00:11:25,930
this is something you have to keep in

203
00:11:31,170 --> 00:11:27,959
mind that going back to that original

204
00:11:33,090 --> 00:11:31,180
principle that the first thing you want

205
00:11:36,050 --> 00:11:33,100
to do is establish the environment that

206
00:11:39,569 --> 00:11:36,060
you're going to have your fasteners in

207
00:11:42,900 --> 00:11:39,579
now going into the subject of corrosion

208
00:11:45,809 --> 00:11:42,910
of course this is a major field so we

209
00:11:48,720 --> 00:11:45,819
just try to hit it a little here in the

210
00:11:50,610 --> 00:11:48,730
way of fastener corrosion galvanic and

211
00:11:55,110 --> 00:11:50,620
stress corrosion we've already covered

212
00:11:57,600 --> 00:11:55,120
and the corrosion resistance of a

213
00:12:01,350 --> 00:11:57,610

particular metal to occur rodent can be

214
00:12:03,269 --> 00:12:01,360
found in a book of tables which I will

215
00:12:06,870 --> 00:12:03,279
be leaving behind when I retire there is

216
00:12:10,350 --> 00:12:06,880
a two-volume set that actually gives for

217
00:12:12,569 --> 00:12:10,360
the different percentages of different

218
00:12:17,939 --> 00:12:12,579
types of corrodens it gives the effect

219
00:12:19,559 --> 00:12:17,949
on the various materials and hydrogen

220
00:12:21,840 --> 00:12:19,569
embrittlement and graphite corrosion

221
00:12:28,949 --> 00:12:21,850
will be covered in the corrosion section

222
00:12:33,329 --> 00:12:28,959
here hydrogen embrittlement it's talked

223
00:12:35,490 --> 00:12:33,339
about a lot in recent years and yet you

224
00:12:40,370 --> 00:12:35,500
can test for it but it's kind of UFO

225
00:12:47,879 --> 00:12:45,509
it's caused by having free hydrogen ions

226
00:12:50,100 --> 00:12:47,889
in the presence of the metal which in

227
00:12:53,189 --> 00:12:50,110
most of the time it's steel it causes

228
00:12:55,740 --> 00:12:53,199
problems in during the manufacturing or

229
00:12:57,569 --> 00:12:55,750
plating process the higher the strength

230
00:13:00,329 --> 00:12:57,579
of the material the more sensitive it is

231
00:13:03,569 --> 00:13:00,339
the hydrogen embrittlement you can get a

232
00:13:06,179 --> 00:13:03,579
hydrogen chemical reaction in which it

233
00:13:12,900 --> 00:13:06,189
combines with the carbon in the steel to

234
00:13:15,300 --> 00:13:12,910
form methane gas or are hydrogen niobium

235
00:13:17,670 --> 00:13:15,310
columbium same thing the English call it

236
00:13:22,110 --> 00:13:17,680
niobium the Americans call it Colombian

237
00:13:26,069 --> 00:13:22,120
or tantalum to form hydrides the methane

238
00:13:29,220 --> 00:13:26,079

gas can cause cracks and the hydrides

239
00:13:32,100 --> 00:13:29,230
are weaker than the parent material so

240
00:13:34,740 --> 00:13:32,110
they can weaken the material then you

241
00:13:37,019 --> 00:13:34,750
can get hydrogen blistering where the

242
00:13:38,500 --> 00:13:37,029
atomic hydrogen fuses into the material

243
00:13:40,750 --> 00:13:38,510
and combines in the moloch

244
00:13:43,210 --> 00:13:40,760
tools and then the molecule is bigger so

245
00:13:45,610 --> 00:13:43,220
it can't get back out so it will build

246
00:13:48,700 --> 00:13:45,620
up pressure to create blisters that will

247
00:13:52,330 --> 00:13:48,710
eventually cause cracks and here's the

248
00:13:54,160 --> 00:13:52,340
problem there's no external indication

249
00:13:56,470 --> 00:13:54,170
that hydrogen is present you can't look

250
00:13:59,770 --> 00:13:56,480
at it you can't run it through x-ray

251
00:14:04,210 --> 00:13:59,780
machine anything like that and find out

252
00:14:08,050 --> 00:14:04,220
that it's there so the only thing that

253
00:14:10,480 --> 00:14:08,060
you can do is test for it enjoy they

254
00:14:13,590 --> 00:14:10,490
test fasteners for hydrogen

255
00:14:17,230 --> 00:14:13,600
embrittlement they put them on a fixture

256
00:14:19,060 --> 00:14:17,240
there's an ASTM spec which I'm not don't

257
00:14:24,870 --> 00:14:19,070
remember the number of it you actually

258
00:14:28,240 --> 00:14:24,880
put them on with a wedge type washer and

259
00:14:30,460 --> 00:14:28,250
take them down and leave them for I

260
00:14:34,270 --> 00:14:30,470
think it's 48 hours or something like

261
00:14:38,590 --> 00:14:34,280
that if the head didn't pop off it

262
00:14:41,470 --> 00:14:38,600
passed the test and that's that's so

263
00:14:42,730 --> 00:14:41,480

what they do on testing for hydrogen

264
00:14:45,480 --> 00:14:42,740
embrittlement is just take a bunch of

265
00:14:48,490 --> 00:14:45,490
samples and test them that way to see if

266
00:14:50,790 --> 00:14:48,500
if they can find where any of them have

267
00:14:54,370 --> 00:14:50,800
embrittlement now on hydrogen

268
00:14:55,900 --> 00:14:54,380
environment embrittlement usually you

269
00:14:59,800 --> 00:14:55,910
wouldn't run into that because it takes

270
00:15:02,170 --> 00:14:59,810
high-pressure hydrogen to cause that so

271
00:15:03,790 --> 00:15:02,180
if you had a tank of some kind of high

272
00:15:06,430 --> 00:15:03,800
pressure tank that you had fasteners

273
00:15:11,230 --> 00:15:06,440
holding something together inside then

274
00:15:13,270 --> 00:15:11,240
you could actually get hydrogen into the

275
00:15:14,920 --> 00:15:13,280
fasteners just from the high pressure in

276
00:15:16,720 --> 00:15:14,930
other words we're assuming there there

277
00:15:18,790 --> 00:15:16,730
was no hydrogen embrittlement in the

278
00:15:21,640 --> 00:15:18,800
fastener before it was installed then

279
00:15:23,800 --> 00:15:21,650
you need about 2,000 psi hydrogen in

280
00:15:28,090 --> 00:15:23,810
order for it to go in the material after

281
00:15:29,920 --> 00:15:28,100
it's installed so that's not likely to

282
00:15:34,270 --> 00:15:29,930
happen but hydrogen embrittlement is

283
00:15:37,620 --> 00:15:34,280
always a problem because it depends on

284
00:15:41,790 --> 00:15:37,630
how good the manufacturer was at making

285
00:15:46,690 --> 00:15:41,800
the part so here are some percussions

286
00:15:48,910 --> 00:15:46,700
use the killed steals coat and plate the

287
00:15:51,640 --> 00:15:48,920
fasteners bake the hydrogen out within

288
00:15:52,060 --> 00:15:51,650

two hours after plating otherwise you

289
00:15:56,380 --> 00:15:52,070
can't

290
00:16:00,010 --> 00:15:56,390
take it out Taylor the plating bath to

291
00:16:02,740 --> 00:16:00,020
minimize free hydrogen ions and avoid

292
00:16:05,860 --> 00:16:02,750
the use of alloy steel fasteners above

293
00:16:07,630 --> 00:16:05,870
190 KSA because the only way you can

294
00:16:09,580 --> 00:16:07,640
plate without getting hydrogen

295
00:16:13,930 --> 00:16:09,590
embrittlement is to do it in a vacuum

296
00:16:16,030 --> 00:16:13,940
atmosphere then use stainless steels

297
00:16:20,110 --> 00:16:16,040
that are not sensitive to hydrogen

298
00:16:21,730 --> 00:16:20,120
embrittlement and run the tests to see

299
00:16:28,170 --> 00:16:21,740
if you can find any evidence of any

300
00:16:34,090 --> 00:16:28,180
embrittlement here's one that is

301
00:16:38,470 --> 00:16:34,100
slightly different in your book that had

302
00:16:41,430 --> 00:16:38,480
had a revised it at the last minute the

303
00:16:45,100 --> 00:16:41,440
definition of the graphite here just to

304
00:16:48,340 --> 00:16:45,110
indicate what it is it it's a actually

305
00:16:50,230 --> 00:16:48,350
to drive dry film carbon lubricant which

306
00:16:56,320 --> 00:16:50,240
can cause corrosion when exposed to

307
00:17:00,160 --> 00:16:56,330
moisture because the on some materials

308
00:17:04,150 --> 00:17:00,170
and it can cause you problems and I

309
00:17:08,949 --> 00:17:04,160
realize that they put out a la keys or

310
00:17:12,730 --> 00:17:08,959
used to put it up which is a graphite in

311
00:17:17,110 --> 00:17:12,740
oil to use for locks but yet it will

312
00:17:19,090 --> 00:17:17,120
corrode some types of locks so a guy but

313
00:17:21,130 --> 00:17:19,100

the name of Gilbert gave a course on

314
00:17:23,140 --> 00:17:21,140
corrosion here several years back and he

315
00:17:26,050 --> 00:17:23,150
pointed that out that graphite was a

316
00:17:27,520 --> 00:17:26,060
no-no for lubrication of locks for that

317
00:17:30,400 --> 00:17:27,530
reason because it'll actually corrode a

318
00:17:31,930 --> 00:17:30,410
lot and one of the things then this

319
00:17:36,370 --> 00:17:31,940
happened to us on one of the turbine

320
00:17:41,740 --> 00:17:36,380
engine programs around here is dry

321
00:17:46,360 --> 00:17:41,750
graphite is an abrasive so if you cook

322
00:17:50,380 --> 00:17:46,370
it and dry it out now you have a carbon

323
00:17:52,570 --> 00:17:50,390
powder abrasive which is does a lot more

324
00:17:54,400 --> 00:17:52,580
harm than good and here's something I

325
00:17:57,160 --> 00:17:54,410
threw in just just for your information

326
00:18:00,100 --> 00:17:57,170
I had run into this in a failure course

327
00:18:04,480 --> 00:18:00,110
that I took d zinc tification it's kind

328
00:18:06,720 --> 00:18:04,490
of an odd word but you can actually get

329
00:18:11,230 --> 00:18:06,730
in a material that has

330
00:18:13,090 --> 00:18:11,240
it's even used for just removal of a

331
00:18:17,500 --> 00:18:13,100
particular element from a material by

332
00:18:20,160 --> 00:18:17,510
corrosion but usually it's the removal

333
00:18:24,220 --> 00:18:20,170
of zinc from brass by chemical action

334
00:18:26,860 --> 00:18:24,230
leaves a brittle shell of copper and I

335
00:18:30,690 --> 00:18:26,870
saw on the samples the guy had and you

336
00:18:33,610 --> 00:18:30,700
could compare it to what happens to a

337
00:18:35,920 --> 00:18:33,620
wet piece of wood once the carpenter

338
00:18:40,810 --> 00:18:35,930

ants get done with it it's just a shell

339
00:18:42,610 --> 00:18:40,820
that you can crush and rather rather

340
00:18:45,730 --> 00:18:42,620
striking to look at a failed piece like

341
00:18:48,120 --> 00:18:45,740
that so here's the the galvanic series

342
00:18:51,300 --> 00:18:48,130
which I had been talking about earlier

343
00:18:53,830 --> 00:18:51,310
in fact I believe we showed it earlier

344
00:18:56,050 --> 00:18:53,840
that shows the different materials now

345
00:19:04,060 --> 00:18:56,060
of course magnesium is right at the top

346
00:19:08,980 --> 00:19:04,070
and magnesium is a disaster in a

347
00:19:13,950 --> 00:19:08,990
corrosive environment in fact this guy

348
00:19:16,690 --> 00:19:13,960
who taught a course on failure analysis

349
00:19:20,830 --> 00:19:16,700
pointed out that when an airplane goes

350
00:19:23,500 --> 00:19:20,840
down in the ocean one of the ways if it

351
00:19:26,500 --> 00:19:23,510
that they look for it is if it had zinc

352
00:19:28,570 --> 00:19:26,510
components in it the zinc will decompose

353
00:19:30,700 --> 00:19:28,580
so fast in the saltwater that you will

354
00:19:34,560 --> 00:19:30,710
have bubbles coming up out of the ocean

355
00:19:37,510 --> 00:19:34,570
and they can look for it so magnesium

356
00:19:40,390 --> 00:19:37,520
I'm a member of the mill handbook five

357
00:19:41,680 --> 00:19:40,400
committee I don't know whether some of

358
00:19:43,240 --> 00:19:41,690
you are familiar with it or not but

359
00:19:47,890 --> 00:19:43,250
anyway it is kind of the Bible the

360
00:19:53,410 --> 00:19:47,900
aerospace materials world and magnesium

361
00:19:55,900 --> 00:19:53,420
is kinda out of usage by the aircraft

362
00:19:57,430 --> 00:19:55,910
manufacturers for this reason because it

363
00:20:02,230 --> 00:19:57,440

is so hard to protect it from corrosion

364
00:20:04,540 --> 00:20:02,240
and it's it's not used in any primary

365
00:20:08,230 --> 00:20:04,550
structure that I know of on any of the

366
00:20:16,060 --> 00:20:08,240
airplanes okay going on to locking

367
00:20:18,610 --> 00:20:16,070
methods in most any application some

368
00:20:19,890 --> 00:20:18,620
type of locking must be used prevent the

369
00:20:24,990 --> 00:20:19,900
fastener from loosening

370
00:20:27,000 --> 00:20:25,000
underload and without a locking device

371
00:20:29,610 --> 00:20:27,010
of course the only resistance you have

372
00:20:34,710 --> 00:20:29,620
is just head friction and the nut

373
00:20:37,740 --> 00:20:34,720
friction which if you are vibrating it

374
00:20:39,480 --> 00:20:37,750
very much at all is not enough now find

375
00:20:41,640 --> 00:20:39,490
threads give you slightly better

376
00:20:44,720 --> 00:20:41,650
resistance to loosening from vibration

377
00:20:47,160 --> 00:20:44,730
than course threads but it's not a lot

378
00:20:50,820 --> 00:20:47,170
due to the flatter angle of the threads

379
00:20:52,860 --> 00:20:50,830
and one of the things that you try to do

380
00:20:55,260 --> 00:20:52,870
and this'll this'll help you once in a

381
00:20:59,460 --> 00:20:55,270
while is to mount bolts with the heads

382
00:21:01,080 --> 00:20:59,470
up to lessen the loss of loose bolts

383
00:21:03,000 --> 00:21:01,090
because sometimes maybe you'll find

384
00:21:04,350 --> 00:21:03,010
something on your car that the nuts gone

385
00:21:06,150 --> 00:21:04,360
but the bolts still hanging there

386
00:21:12,540 --> 00:21:06,160
flopping back and forth and you can go

387
00:21:17,390 --> 00:21:12,550
ahead and put lock that on it now here's

388
00:21:25,710 --> 00:21:21,380

locking methods is deformed thread and

389
00:21:30,270 --> 00:21:25,720
what you do with the nut it's usually on

390
00:21:32,730 --> 00:21:30,280
the net after you have formed it the

391
00:21:38,580 --> 00:21:32,740
last operation you actually hit it from

392
00:21:41,580 --> 00:21:38,590
two sides and make it slightly oval then

393
00:21:43,560 --> 00:21:41,590
when you put it on and this this hits

394
00:21:48,230 --> 00:21:43,570
got to be controlled to because

395
00:21:53,130 --> 00:21:48,240
otherwise you can be in heap of trouble

396
00:21:55,860 --> 00:21:53,140
it will kind of go back to circular

397
00:21:58,350 --> 00:21:55,870
again so let's see initially here it is

398
00:22:01,230 --> 00:21:58,360
oval then when you put the thing on it

399
00:22:03,540 --> 00:22:01,240
goes the circular it will actually be

400
00:22:06,650 --> 00:22:03,550
for them enough and of course when it

401
00:22:10,590 --> 00:22:06,660
does that the threads will lock up on

402
00:22:14,250 --> 00:22:10,600
the bolt then when you take it off it

403
00:22:18,210 --> 00:22:14,260
will go back to oval again so you can

404
00:22:20,430 --> 00:22:18,220
use this one all around ten times before

405
00:22:22,290 --> 00:22:20,440
it loses its locking capability because

406
00:22:26,690 --> 00:22:22,300
eventually putting it on and off you're

407
00:22:30,210 --> 00:22:26,700
going to yield it back to the circular

408
00:22:32,250 --> 00:22:30,220
condition and it will no longer lock but

409
00:22:33,180 --> 00:22:32,260
that's one of the good ones and you can

410
00:22:36,540 --> 00:22:33,190
buy

411
00:22:43,350 --> 00:22:36,550
the forum thread lock nut set your

412
00:22:46,590 --> 00:22:43,360
hardware store now here is the locking

413
00:22:49,470 --> 00:22:46,600

collar tight and although I didn't call

414
00:22:51,870 --> 00:22:49,480
it out your elastic stop net is one of

415
00:22:54,990 --> 00:22:51,880
the biggest manufacturers of these what

416
00:22:59,730 --> 00:22:55,000
you have is you have a fiber or nylon

417
00:23:04,080 --> 00:22:59,740
collar here in the top of it the caller

418
00:23:07,020 --> 00:23:04,090
has a smaller diameter then the the bolt

419
00:23:10,890 --> 00:23:07,030
thread so when you run the bolt in it

420
00:23:12,990 --> 00:23:10,900
will interfere on that collar and it'll

421
00:23:15,720 --> 00:23:13,000
also provide a little bit of sealing if

422
00:23:17,280 --> 00:23:15,730
you kind of seal from getting water in

423
00:23:18,990 --> 00:23:17,290
there to give you that much ceiling

424
00:23:21,060 --> 00:23:19,000
although it's not for pressure or

425
00:23:23,280 --> 00:23:21,070
anything like that but the only problem

426
00:23:26,070 --> 00:23:23,290
is this collar area is usually only good

427
00:23:27,930 --> 00:23:26,080
for about 250 degrees to where it will

428
00:23:32,640 --> 00:23:27,940
start softening up to where to become

429
00:23:37,080 --> 00:23:32,650
ineffective now here's the split beam

430
00:23:40,260 --> 00:23:37,090
lock nut this is one that works quite

431
00:23:43,590 --> 00:23:40,270
well and what you have you have a

432
00:23:48,600 --> 00:23:43,600
smaller diameter at the top of it and

433
00:23:51,030 --> 00:23:48,610
its salt cut so that when you put it on

434
00:23:55,500 --> 00:23:51,040
it'll spin freely till it gets up to

435
00:23:58,880 --> 00:23:55,510
that area then as you tighten it up the

436
00:24:02,310 --> 00:23:58,890
beams if you will these six beams on it

437
00:24:05,100 --> 00:24:02,320
have to deflect outward in order for the

438
00:24:07,410 --> 00:24:05,110

bolt to go through so once again this

439
00:24:10,170 --> 00:24:07,420
gives you a pretty heavy friction load

440
00:24:13,830 --> 00:24:10,180
on the threads and will lock it in place

441
00:24:15,990 --> 00:24:13,840
I had a personal experience with the one

442
00:24:17,490 --> 00:24:16,000
of these on a car that I had that the

443
00:24:20,340 --> 00:24:17,500
shock absorbers didn't want to stay on

444
00:24:24,420 --> 00:24:20,350
it and I put these split beam lock nuts

445
00:24:27,600 --> 00:24:24,430
on it and that held versus the the jam

446
00:24:30,780 --> 00:24:27,610
nut to which I'll cover later now here's

447
00:24:32,850 --> 00:24:30,790
a nighlok pellet nighlok is the biggest

448
00:24:37,110 --> 00:24:32,860
manufacturer of this type of thing

449
00:24:39,450 --> 00:24:37,120
although it's even covered by a milspec

450
00:24:41,370 --> 00:24:39,460
so there's a lot of people in on the act

451
00:24:43,530 --> 00:24:41,380
on making it this way but what do you do

452
00:24:47,010 --> 00:24:43,540
is you you cut a little hole in the

453
00:24:50,760 --> 00:24:47,020
thread and stick a nighlok plug in it

454
00:24:53,940 --> 00:24:50,770
and this plug sticks up past the thread

455
00:24:58,350 --> 00:24:53,950
so when you when you put it on the nylon

456
00:25:02,160 --> 00:24:58,360
will bind up in the threads and cause it

457
00:25:05,780 --> 00:25:02,170
to lock this one is a fairly good cheap

458
00:25:07,920 --> 00:25:05,790
way of locking stuff using on a bicycle

459
00:25:12,360 --> 00:25:07,930
lawnmower or something like that it'll

460
00:25:14,250 --> 00:25:12,370
hold up but once again the temperature

461
00:25:18,090 --> 00:25:14,260
range on it is kind of low because nylon

462
00:25:20,820 --> 00:25:18,100
as starts getting soft about 250 degrees

463
00:25:24,120 --> 00:25:20,830

and of course the threads will chew it

464
00:25:25,920 --> 00:25:24,130
up so you can't put the thing on take it

465
00:25:32,430 --> 00:25:25,930
off very many times without run into

466
00:25:33,780 --> 00:25:32,440
trouble now here's luck tight which we

467
00:25:35,900 --> 00:25:33,790
use around here all the time that's

468
00:25:41,030 --> 00:25:35,910
actually a trade name but different

469
00:25:44,040 --> 00:25:41,040
people make this it's actually a a one

470
00:25:46,640 --> 00:25:44,050
one component type adhesive that you

471
00:25:50,100 --> 00:25:46,650
just smear on the fastener before you

472
00:25:53,400 --> 00:25:50,110
assemble it and it's made in different

473
00:25:55,830 --> 00:25:53,410
grades so that if you want to remove the

474
00:25:58,640 --> 00:25:55,840
fastener you use the volesse sticky tape

475
00:26:01,890 --> 00:25:58,650
like an in Lafayette I think 242 is

476
00:26:05,040 --> 00:26:01,900
removable and 271 as the tamper-proof

477
00:26:06,930 --> 00:26:05,050
fasteners and there's another one in but

478
00:26:08,940 --> 00:26:06,940
to another one or two in between there

479
00:26:12,480 --> 00:26:08,950
four bolts that you just want to make

480
00:26:14,760 --> 00:26:12,490
difficult to get off but some of the

481
00:26:17,220 --> 00:26:14,770
manufacturers other manufacturers of

482
00:26:20,570 --> 00:26:17,230
this are Bostick in the industry's

483
00:26:23,130 --> 00:26:20,580
nighlok 3m velcro and perma bond and

484
00:26:31,740 --> 00:26:23,140
lock tight is good up to about 400

485
00:26:34,980 --> 00:26:31,750
degrees now a poxy ribbon this is used a

486
00:26:38,280 --> 00:26:34,990
lot on bolts you get them and they have

487
00:26:40,860 --> 00:26:38,290
to to ribbons of epoxy so that you have

488
00:26:43,830 --> 00:26:40,870

the main one and then you have the

489
00:26:46,520 --> 00:26:43,840
hardener that goes with it and this way

490
00:26:51,480 --> 00:26:46,530
you can store them it has a shelf life

491
00:26:54,600 --> 00:26:51,490
at least that you can keep them for I

492
00:26:59,010 --> 00:26:54,610
think up the years like that and the

493
00:27:00,690 --> 00:26:59,020
epoxy is mixed when you install it so it

494
00:27:03,180 --> 00:27:00,700
will combine in

495
00:27:04,710 --> 00:27:03,190
a hardon to hold the fastener in place

496
00:27:08,340 --> 00:27:04,720
now of course this type once you would

497
00:27:10,110 --> 00:27:08,350
remove it it would have to be replaced

498
00:27:12,450 --> 00:27:10,120
because it you destroyed the seal

499
00:27:14,970 --> 00:27:12,460
because it's a one-time type thing and

500
00:27:21,870 --> 00:27:14,980
the maximum operating temperature on

501
00:27:24,480 --> 00:27:21,880
these is also about 400 degrees here is

502
00:27:26,970 --> 00:27:24,490
another type of thread as a special

503
00:27:29,820 --> 00:27:26,980
thread spiral lock I think Detroit

504
00:27:32,610 --> 00:27:29,830
tappan dies the holder the patent on

505
00:27:37,980 --> 00:27:32,620
this one and this is a cross section

506
00:27:41,910 --> 00:27:37,990
here of a kept thread and a fastener now

507
00:27:45,420 --> 00:27:41,920
the problem with this when you install

508
00:27:47,700 --> 00:27:45,430
it is you have to have spiral locks tap

509
00:27:51,290 --> 00:27:47,710
because this is an oddball see the

510
00:27:54,150 --> 00:27:51,300
thread the tap cold is not fit the

511
00:27:58,860 --> 00:27:54,160
thread and you get your locking action

512
00:28:04,530 --> 00:27:58,870
by actually wedging the ramp of the

513
00:28:08,160 --> 00:28:04,540

thread up against the oddball tape tap

514
00:28:11,700 --> 00:28:08,170
and but you can distribute over several

515
00:28:14,850 --> 00:28:11,710
threads so it offers better locking

516
00:28:18,450 --> 00:28:14,860
capability than ordinary thread would

517
00:28:20,430 --> 00:28:18,460
and some people have used it and run

518
00:28:23,520 --> 00:28:20,440
vibration tests and it holds up fairly

519
00:28:28,410 --> 00:28:23,530
well but of course the the disadvantage

520
00:28:31,850 --> 00:28:28,420
is that you can't you have to get their

521
00:28:34,620 --> 00:28:31,860
tap to tap the whole initially and and

522
00:28:38,070 --> 00:28:34,630
so that creates a problem sometimes for

523
00:28:42,210 --> 00:28:38,080
people on universal type of sembly on

524
00:28:45,960 --> 00:28:42,220
the direct interfering thread in this

525
00:28:51,690 --> 00:28:45,970
case you just have a fastener that is

526
00:28:56,520 --> 00:28:51,700
made deliberately with an oversized root

527
00:29:00,210 --> 00:28:56,530
diameter to give a slight interference

528
00:29:02,610 --> 00:29:00,220
fit to lock now some studs that you have

529
00:29:04,470 --> 00:29:02,620
where you have a stud that is installed

530
00:29:08,070 --> 00:29:04,480
in something and you want to leave it in

531
00:29:11,280 --> 00:29:08,080
place you use this type of thread so

532
00:29:13,860 --> 00:29:11,290
that it will not come out when you take

533
00:29:14,580 --> 00:29:13,870
the nut off the other end the tapered

534
00:29:16,409 --> 00:29:14,590
thread

535
00:29:18,180 --> 00:29:16,419
is kind of a variation of this and what

536
00:29:22,250 --> 00:29:18,190
you actually tapert this is a smaller

537
00:29:26,460 --> 00:29:22,260
diameter up in here and then when you

538
00:29:30,840 --> 00:29:26,470

put it together it has to push the

539
00:29:39,930 --> 00:29:30,850
threads out here and that gives you a

540
00:29:42,659 --> 00:29:39,940
locking force on it now here's one that

541
00:29:45,659 --> 00:29:42,669
we covered in the drafting room manual

542
00:29:47,610 --> 00:29:45,669
stuff run Roman check that we we fought

543
00:29:50,810 --> 00:29:47,620
semantics on that one a lot whether it's

544
00:29:53,519 --> 00:29:50,820
a castle nut or a castellated nut so

545
00:29:57,630 --> 00:29:53,529
since I wrote this I put my preferences

546
00:30:03,600 --> 00:29:57,640
castellated nut with a cotter pin this

547
00:30:05,399 --> 00:30:03,610
is used a lot for installing bearings

548
00:30:07,710 --> 00:30:05,409
and things like that where you don't

549
00:30:10,100 --> 00:30:07,720
want to tighten it very tight but you

550
00:30:16,950 --> 00:30:10,110
want it to stay put once you tighten it

551
00:30:20,130 --> 00:30:16,960
so you can take the nut up then to the

552
00:30:22,320 --> 00:30:20,140
to the Turk you want then back it off or

553
00:30:24,539 --> 00:30:22,330
taking it to the next next spot on it to

554
00:30:26,490 --> 00:30:24,549
get you a slot because you only have a

555
00:30:28,500 --> 00:30:26,500
single hole drilled in the end of the

556
00:30:31,409 --> 00:30:28,510
fastener so you line up one of these

557
00:30:35,090 --> 00:30:31,419
with that hole then put a cotter

558
00:30:40,700 --> 00:30:35,100
pin in it and it will hold it in place

559
00:30:45,240 --> 00:30:40,710
at the exact spot that you said it and

560
00:30:47,100 --> 00:30:45,250
this way when your for instance a lot of

561
00:30:48,720 --> 00:30:47,110
the cars are made this way there's

562
00:30:52,980 --> 00:30:48,730
another way that would be my next slide

563
00:30:54,810 --> 00:30:52,990

I think but on wheel bearing when you

564
00:30:57,539 --> 00:30:54,820
tighten it up usually you tighten it up

565
00:31:00,630 --> 00:30:57,549
tight seek the bearings then back it off

566
00:31:04,590 --> 00:31:00,640
enough to let it spin so the nut is a

567
00:31:06,299 --> 00:31:04,600
little more than finger tight now here's

568
00:31:09,269 --> 00:31:06,309
a nut here's another one that is used

569
00:31:12,360 --> 00:31:09,279
for the same reason evidently this is

570
00:31:16,440 --> 00:31:12,370
cheaper because you're doing the same

571
00:31:18,690 --> 00:31:16,450
thing with a regular nut then you're

572
00:31:21,870 --> 00:31:18,700
taking this nut cap which is a sheet

573
00:31:24,450 --> 00:31:21,880
metal stamp sheet metal piece but it has

574
00:31:26,450 --> 00:31:24,460
the serrations here with the slot senate

575
00:31:31,070 --> 00:31:26,460
that you can put the cotter pin in

576
00:31:35,600 --> 00:31:31,080
so you Turk the nut to the spot you want

577
00:31:39,340 --> 00:31:35,610
it then slip this thing over it then put

578
00:31:43,340 --> 00:31:39,350
the cotter pin through the hole in the

579
00:31:44,930 --> 00:31:43,350
axle or shaft whatever it is and fasten

580
00:31:46,580 --> 00:31:44,940
it the same way as we did on the other

581
00:31:49,940 --> 00:31:46,590
one and of course the reason that grease

582
00:31:52,730 --> 00:31:49,950
cap is on there is i got this diagram

583
00:31:54,380 --> 00:31:52,740
from a truck manual and i didn't

584
00:31:55,220 --> 00:31:54,390
separate the grease cap from it that

585
00:31:59,780 --> 00:31:55,230
goes on after you've installed

586
00:32:03,560 --> 00:31:59,790
everything else now here is luck wearing

587
00:32:06,620 --> 00:32:03,570
which is normally used just by the

588
00:32:12,440 --> 00:32:06,630

aerospace industry because of the cost

589
00:32:16,460 --> 00:32:12,450
and labor involved because you are

590
00:32:20,690 --> 00:32:16,470
winding these wires on here through

591
00:32:24,260 --> 00:32:20,700
either holes straight through the top of

592
00:32:25,910 --> 00:32:24,270
the heads or in the case of the nut

593
00:32:28,610 --> 00:32:25,920
holes through the corners of the nuts

594
00:32:30,890 --> 00:32:28,620
you put these on in such a pattern that

595
00:32:33,290 --> 00:32:30,900
if you try to loosen one fastener it

596
00:32:34,820 --> 00:32:33,300
tightens the other one this way they

597
00:32:40,550 --> 00:32:34,830
can't loosen because they're all tied

598
00:32:45,320 --> 00:32:40,560
together and this is a method that is

599
00:32:49,100 --> 00:32:45,330
covered by an MS spec 30 35 40 you can

600
00:32:51,350 --> 00:32:49,110
use it quite well where you have a

601
00:32:53,960 --> 00:32:51,360
circular pattern of fasteners on a

602
00:32:57,860 --> 00:32:53,970
flange or something like that but the

603
00:33:02,000 --> 00:32:57,870
only people that use it in normal cases

604
00:33:07,160 --> 00:33:02,010
as the aerospace industry here is an

605
00:33:10,130 --> 00:33:07,170
alternative method to the lock wearing

606
00:33:12,650 --> 00:33:10,140
this is a similar thing in which you

607
00:33:15,910 --> 00:33:12,660
start out with a piece of cable by the

608
00:33:18,680 --> 00:33:15,920
Bergen cable company here that has a

609
00:33:21,920 --> 00:33:18,690
barrel already switched in place on it

610
00:33:23,810 --> 00:33:21,930
so you just feed it through you run the

611
00:33:25,490 --> 00:33:23,820
wire through the heads to wind them the

612
00:33:27,050 --> 00:33:25,500
same way so that one can't loosen

613
00:33:28,460 --> 00:33:27,060

without tightening the other one then

614
00:33:32,780 --> 00:33:28,470
when you get to the end you have a

615
00:33:36,440 --> 00:33:32,790
machine similar to a rivet gun or

616
00:33:39,240 --> 00:33:36,450
something that actually puts a barrel on

617
00:33:41,300 --> 00:33:39,250
here pulls the right tension on the wire

618
00:33:44,370 --> 00:33:41,310
and closes it off so that this is

619
00:33:46,260 --> 00:33:44,380
actually a faster and cheaper way of

620
00:33:50,120 --> 00:33:46,270
luck wearing than the standard luck

621
00:33:58,110 --> 00:33:54,290
this is the disc lock washer it is a

622
00:34:01,200 --> 00:33:58,120
little bit cumbersome in that you have a

623
00:34:06,930 --> 00:34:01,210
pair of washers together and these lines

624
00:34:08,610 --> 00:34:06,940
here represent the angles on them where

625
00:34:10,830 --> 00:34:08,620
you put the two together and turn them

626
00:34:13,530 --> 00:34:10,840
together now as long as you keep them

627
00:34:18,629 --> 00:34:13,540
together they can't rotate with with

628
00:34:21,000 --> 00:34:18,639
respect to each other so the angle of

629
00:34:24,060 --> 00:34:21,010
this ramp is steeper than the angle of

630
00:34:27,659 --> 00:34:24,070
the thread so it will keep it from

631
00:34:29,389 --> 00:34:27,669
turning however the bottom and top of

632
00:34:31,619 --> 00:34:29,399
those two washers have to have

633
00:34:36,810 --> 00:34:31,629
serrations on them that bite in the

634
00:34:39,389 --> 00:34:36,820
joint material and also the bottom of

635
00:34:41,760 --> 00:34:39,399
the nut in order to keep it from

636
00:34:45,480 --> 00:34:41,770
slipping with respect to the nut or the

637
00:34:49,350 --> 00:34:45,490
joint otherwise the washer will spend as

638
00:34:52,379 --> 00:34:49,360

a unit and doesn't help you any so so

639
00:34:54,119 --> 00:34:52,389
that one will work if you are not

640
00:35:01,860 --> 00:34:54,129
concerned with carrying the coating

641
00:35:04,710 --> 00:35:01,870
loose on the surfaces here is a kind of

642
00:35:08,130 --> 00:35:04,720
a take-off on the disc lock washers in

643
00:35:12,300 --> 00:35:08,140
that you have a nut assembly now this

644
00:35:14,220 --> 00:35:12,310
one has the ramp cheer and the lower

645
00:35:16,350 --> 00:35:14,230
part of it from here down is not

646
00:35:17,730 --> 00:35:16,360
threaded just the upper parts threaded

647
00:35:20,810 --> 00:35:17,740
well to see you put the two of them

648
00:35:24,030 --> 00:35:20,820
together you put them on with a socket

649
00:35:27,450 --> 00:35:24,040
extends down over both of them now this

650
00:35:30,330 --> 00:35:27,460
will hold the thing while you twurk it

651
00:35:32,580 --> 00:35:30,340
up and then of course the bottom surface

652
00:35:36,650 --> 00:35:32,590
of it has in serrations on it that bite

653
00:35:39,690 --> 00:35:36,660
into the attaching plane of the joint so

654
00:35:43,530 --> 00:35:39,700
once again you're scratching the surface

655
00:35:46,400 --> 00:35:43,540
you're attaching to however a company on

656
00:35:48,540 --> 00:35:46,410
the west coast makes these and the

657
00:35:51,360 --> 00:35:48,550
president of it told me that they had

658
00:35:53,070 --> 00:35:51,370
they were selling millions of these for

659
00:35:55,080 --> 00:35:53,080
the heavy truck industry

660
00:35:56,880 --> 00:35:55,090
because the heavy truck industries had a

661
00:36:00,140 --> 00:35:56,890
lot of trouble through the years with

662
00:36:03,870 --> 00:36:00,150
nuts coming off and wheels coming off so

663
00:36:05,490 --> 00:36:03,880

so they're paying for this type of nut

664
00:36:10,830 --> 00:36:05,500
in order to hold them on because they do

665
00:36:14,580 --> 00:36:10,840
work on holding truck wheels on here is

666
00:36:18,780 --> 00:36:14,590
a another method this is a durar lock

667
00:36:20,730 --> 00:36:18,790
nut which is a trademark of SPS which

668
00:36:24,780 --> 00:36:20,740
one of the one of the big manufacturers

669
00:36:28,410 --> 00:36:24,790
of fasteners it has serrations on it

670
00:36:32,220 --> 00:36:28,420
here that bite into the surface so that

671
00:36:34,680 --> 00:36:32,230
it will not slip and start loosening up

672
00:36:36,570 --> 00:36:34,690
once you get it tight now you have to

673
00:36:38,730 --> 00:36:36,580
depend on this embedment of the

674
00:36:40,950 --> 00:36:38,740
serrations in the contact surfaces and

675
00:36:44,880 --> 00:36:40,960
so it will scratch up the surface if you

676
00:36:50,580 --> 00:36:44,890
can live with that this one will do a

677
00:36:54,260 --> 00:36:50,590
pretty good job of locking here are two

678
00:36:57,410 --> 00:36:54,270
flock washers which are common in the

679
00:37:00,990 --> 00:36:57,420
electrical and automotive industry

680
00:37:03,060 --> 00:37:01,000
because they do afford locking oh and

681
00:37:07,800 --> 00:37:03,070
but once again they do it by gouging

682
00:37:09,540 --> 00:37:07,810
into things they these teeth are twisted

683
00:37:12,180 --> 00:37:09,550
although this doesn't show it they're

684
00:37:16,500 --> 00:37:12,190
actually twisted so that you have one

685
00:37:18,240 --> 00:37:16,510
surface bites into the fastener the

686
00:37:24,450 --> 00:37:18,250
other one bites into the surface that

687
00:37:26,340 --> 00:37:24,460
it's up against so that it will get

688
00:37:31,130 --> 00:37:26,350

enough bite on both of them to hold them

689
00:37:34,320 --> 00:37:31,140
in place and prevent rotation however

690
00:37:36,720 --> 00:37:34,330
you damage the surface quite a bit now

691
00:37:39,900 --> 00:37:36,730
this one is also available with teeth on

692
00:37:41,610 --> 00:37:39,910
the inside so that the outside is smooth

693
00:37:44,820 --> 00:37:41,620
in areas where you don't have room

694
00:37:46,200 --> 00:37:44,830
enough to have it stick out that much

695
00:37:51,140 --> 00:37:46,210
you can you can get them with the teeth

696
00:37:59,250 --> 00:37:56,600
here is the old famous jam nut which is

697
00:38:03,480 --> 00:37:59,260
one that if I polled the people in the

698
00:38:05,370 --> 00:38:03,490
audience neither one would be able to

699
00:38:07,140 --> 00:38:05,380
give me a positive answer on which side

700
00:38:08,670 --> 00:38:07,150
you put this and whether you put it here

701
00:38:10,380 --> 00:38:08,680
where it's showing or you've already put

702
00:38:12,810 --> 00:38:10,390
the big one on the inside and the little

703
00:38:16,230 --> 00:38:12,820
one on the outside because the experts

704
00:38:18,000 --> 00:38:16,240
can agree on that it's difficult to load

705
00:38:21,330 --> 00:38:18,010
each one of these so that it'll carry

706
00:38:23,610 --> 00:38:21,340
any load compared to the other ones

707
00:38:28,890 --> 00:38:23,620
because if you if you tighten this one

708
00:38:32,760 --> 00:38:28,900
tight it will unload this one and if you

709
00:38:34,920 --> 00:38:32,770
don't tighten it enough then the two of

710
00:38:36,900 --> 00:38:34,930
them will not work together so it's very

711
00:38:40,620 --> 00:38:36,910
difficult to get both of these loaded to

712
00:38:42,450 --> 00:38:40,630
where they would carry a load so jam

713
00:38:45,810 --> 00:38:42,460

nuts in my opinion are not to be used

714
00:38:49,160 --> 00:38:45,820
for critical designs unless it's

715
00:38:52,170 --> 00:38:49,170
something like locking a turnbuckle or

716
00:38:53,700 --> 00:38:52,180
some sort of a rod where something else

717
00:38:55,830 --> 00:38:53,710
carries all the load and you're just

718
00:39:00,840 --> 00:38:55,840
pushing this up against it to keep it

719
00:39:05,700 --> 00:39:00,850
from working loose and here is the good

720
00:39:08,630 --> 00:39:05,710
old split helical up were sure which is

721
00:39:12,990 --> 00:39:08,640
a misnomer because once you compress it

722
00:39:15,300 --> 00:39:13,000
under normal bolt torque it will flatten

723
00:39:16,920 --> 00:39:15,310
out and then this is the flat washer

724
00:39:20,940 --> 00:39:16,930
anyway which doesn't do anything for you

725
00:39:23,610 --> 00:39:20,950
and vibration testing of the split lock

726
00:39:25,440 --> 00:39:23,620
washers assemblies indicate that they're

727
00:39:29,580 --> 00:39:25,450
about us the same as a flat 4shared

728
00:39:32,460 --> 00:39:29,590
resist vibration and I don't recommend

729
00:39:36,450 --> 00:39:32,470
them for any kind of a locking situation

730
00:39:38,990 --> 00:39:36,460
although I was sharply criticized for

731
00:39:41,580 --> 00:39:39,000
writing this in a fastener magazine

732
00:39:45,030 --> 00:39:41,590
because the person who wrote in the

733
00:39:46,650 --> 00:39:45,040
criticism was a manufacturer of split

734
00:39:49,110 --> 00:39:46,660
lock washers so he didn't like it

735
00:39:52,410 --> 00:39:49,120
because I said his his product was

736
00:39:57,660 --> 00:39:52,420
worthless for locking now here is a

737
00:40:00,930 --> 00:39:57,670
method that is used some but it's kind

738
00:40:04,440 --> 00:40:00,940

of a going a long ways to do your

739
00:40:06,390 --> 00:40:04,450
locking as I see it it

740
00:40:09,540 --> 00:40:06,400
this is a trademark of some company on

741
00:40:16,740 --> 00:40:09,550
the west coast age 8 and you see what

742
00:40:18,750 --> 00:40:16,750
you have is a special boat that has a

743
00:40:21,390 --> 00:40:18,760
kind of the double-headed one with a

744
00:40:24,599 --> 00:40:21,400
groove machined in it which creates the

745
00:40:28,319 --> 00:40:24,609
little problem on initial manufacturing

746
00:40:32,339 --> 00:40:28,329
then you have a retainer plate that

747
00:40:38,280 --> 00:40:32,349
slides down over this outer head on to

748
00:40:41,460 --> 00:40:38,290
the bottom one then you use this snap

749
00:40:45,750 --> 00:40:41,470
ring to put in that groove to lock the

750
00:40:48,990 --> 00:40:45,760
thing in place now you do this after

751
00:40:51,930 --> 00:40:49,000
you've already took the bolt to the spot

752
00:40:56,099 --> 00:40:51,940
that you want it now the only thing is

753
00:41:01,680 --> 00:40:56,109
you have to have something for this to

754
00:41:04,800 --> 00:41:01,690
brace against to keep the bolt from

755
00:41:07,440 --> 00:41:04,810
backing off so it has to be a special

756
00:41:11,460 --> 00:41:07,450
design in that respect and then the

757
00:41:15,930 --> 00:41:11,470
other problem that I had on the control

758
00:41:19,740 --> 00:41:15,940
arms on a Ford wagon this retainer plate

759
00:41:22,650 --> 00:41:19,750
is made out of sheet metal over a period

760
00:41:24,750 --> 00:41:22,660
of time it will rust up on you and then

761
00:41:27,150 --> 00:41:24,760
you go to loosen this thing for a front

762
00:41:30,470 --> 00:41:27,160
end alignment and the retainer plate

763
00:41:33,930 --> 00:41:30,480

comes off and you can't get in there to

764
00:41:37,200 --> 00:41:33,940
get anything else on it loosen it so

765
00:41:39,569 --> 00:41:37,210
that one is one that I would not

766
00:41:46,400 --> 00:41:39,579
recommend in any environment where you

767
00:41:48,690 --> 00:41:46,410
would have corrosion now getting into

768
00:41:53,520 --> 00:41:48,700
washers and out some of them we've

769
00:41:57,150 --> 00:41:53,530
already covered so we won't do a lot on

770
00:41:58,829 --> 00:41:57,160
summon the most of them are flat they're

771
00:42:00,809 --> 00:41:58,839
used to provide a hardened smooth

772
00:42:02,970 --> 00:42:00,819
surface for the contact of a fastener

773
00:42:04,740 --> 00:42:02,980
header nut and that's that's really one

774
00:42:06,839 --> 00:42:04,750
of the the main reasons for using

775
00:42:09,770 --> 00:42:06,849
worships both under the head and the nut

776
00:42:13,260 --> 00:42:09,780
is if if you are rotating either one

777
00:42:15,450 --> 00:42:13,270
usually the joint surface is not as

778
00:42:17,450 --> 00:42:15,460
strong as the fastener so therefore you

779
00:42:22,820 --> 00:42:17,460
you have to have that too

780
00:42:25,820 --> 00:42:22,830
avoid embedment and then here's another

781
00:42:29,570 --> 00:42:25,830
one for shade tree mechanics if you have

782
00:42:33,050 --> 00:42:29,580
a washer under a bolt and it's rusted in

783
00:42:34,880 --> 00:42:33,060
place usually you can take a cold chisel

784
00:42:37,280 --> 00:42:34,890
and a hammer and not the washer

785
00:42:40,400 --> 00:42:37,290
laterally and get it get it loosened

786
00:42:46,190 --> 00:42:40,410
some so that you can loosen the bolt and

787
00:42:50,270 --> 00:42:46,200
washer now here's the plain flat and

788
00:42:52,490 --> 00:42:50,280

countersunk type for sures the here this

789
00:42:55,460 --> 00:42:52,500
is the ordinary hardware store variety

790
00:42:59,180 --> 00:42:55,470
and they're covered by all kinds of

791
00:43:01,609 --> 00:42:59,190
standards there's msan antsy so on which

792
00:43:03,560 --> 00:43:01,619
defines the outside diameter inside

793
00:43:06,620 --> 00:43:03,570
diameter and thickness for a given size

794
00:43:08,810 --> 00:43:06,630
so so normally you can just call out a

795
00:43:13,370 --> 00:43:08,820
dash number from one of these specs and

796
00:43:15,290 --> 00:43:13,380
your your cupboard the counter sunk

797
00:43:18,020 --> 00:43:15,300
coursers are made with the countersink

798
00:43:21,829 --> 00:43:18,030
in them we're on a high-strength boat

799
00:43:25,820 --> 00:43:21,839
you have a larger radius under the head

800
00:43:27,710 --> 00:43:25,830
so you don't want point contact if it is

801
00:43:30,800 --> 00:43:27,720
this diameter is tight you could get

802
00:43:33,560 --> 00:43:30,810
point contact on the head radius so you

803
00:43:35,359 --> 00:43:33,570
want to counter sunk so that it will now

804
00:43:38,540 --> 00:43:35,369
distribute the load better under the

805
00:43:44,210 --> 00:43:38,550
head and you won't have that high stress

806
00:43:47,180 --> 00:43:44,220
concentration at the radius now on the

807
00:43:49,280 --> 00:43:47,190
course we covered the split lock washer

808
00:43:50,960 --> 00:43:49,290
the tooth lock washer and the disc lock

809
00:43:52,550 --> 00:43:50,970
washer I just wanted to point out that

810
00:43:54,730 --> 00:43:52,560
we'd already covered those in case

811
00:43:59,870 --> 00:43:54,740
somebody would wonder if why we hadn't

812
00:44:01,609 --> 00:43:59,880
then we go on to a another unique type

813
00:44:04,370 --> 00:44:01,619

and this is used a lot in the

814
00:44:09,220 --> 00:44:04,380
construction business the DTI of worship

815
00:44:12,560 --> 00:44:09,230
the direct tension indicating it is a

816
00:44:18,160 --> 00:44:12,570
flat ground washer that has these bumps

817
00:44:22,760 --> 00:44:18,170
stamped on it and but you have to use

818
00:44:24,790 --> 00:44:22,770
regular washers in addition to these in

819
00:44:27,260 --> 00:44:24,800
order to distribute the load properly

820
00:44:31,069 --> 00:44:27,270
because you don't want these grinding

821
00:44:34,940 --> 00:44:31,079
against the head or not of your boat

822
00:44:37,880 --> 00:44:34,950
and actually these are manufactured and

823
00:44:40,190 --> 00:44:37,890
they do tests to determine the loads on

824
00:44:45,109 --> 00:44:40,200
them if we're the amount of compression

825
00:44:47,959 --> 00:44:45,119
that you get on the bumps determines the

826
00:44:51,920 --> 00:44:47,969
axial load in the bolt so you took the

827
00:44:54,489 --> 00:44:51,930
thing with a torque wrench without

828
00:44:56,839 --> 00:44:54,499
reading the torque unless you want to

829
00:45:01,160 --> 00:44:56,849
down to the point that you have a

830
00:45:04,069 --> 00:45:01,170
certain gap left and underneath the

831
00:45:05,989 --> 00:45:04,079
washer and the bumps and you measure it

832
00:45:09,859 --> 00:45:05,999
with a feeler gauge so this way

833
00:45:11,959 --> 00:45:09,869
regardless of the coefficients of

834
00:45:13,880 --> 00:45:11,969
friction on the threads or the head or

835
00:45:17,479 --> 00:45:13,890
anything you can actually torque it down

836
00:45:24,910 --> 00:45:17,489
to where the gap you get will tell you

837
00:45:33,410 --> 00:45:28,160
now here's our old familiar belleville

838
00:45:36,439 --> 00:45:33,420

washers that named after the inventor

839
00:45:40,459 --> 00:45:36,449
who invented them way back in 1867 so

840
00:45:43,130 --> 00:45:40,469
they've been around a while it's also

841
00:45:51,880 --> 00:45:43,140
known as a comb washer or spring washer

842
00:45:55,219 --> 00:45:51,890
and these are designed with a load

843
00:45:57,650 --> 00:45:55,229
preload determination for a given washer

844
00:46:00,529 --> 00:45:57,660
or how much it takes the platen it and

845
00:46:02,719 --> 00:46:00,539
it will flatten elastically so a lot of

846
00:46:06,979 --> 00:46:02,729
times you can use them in a critical

847
00:46:09,319 --> 00:46:06,989
application where you want to limit the

848
00:46:12,049 --> 00:46:09,329
amount of axial load you have if you put

849
00:46:14,479 --> 00:46:12,059
a Belleville washer on and tell the

850
00:46:16,370 --> 00:46:14,489
mechanic okay just perk this thing until

851
00:46:17,809 --> 00:46:16,380
the washer starts to go flat and then

852
00:46:23,439 --> 00:46:17,819
quit regardless of what your torque

853
00:46:26,449 --> 00:46:23,449
wrench says it also can be used for

854
00:46:30,079 --> 00:46:26,459
absorbing differential thermal expansion

855
00:46:32,239 --> 00:46:30,089
between fastener and joint material for

856
00:46:35,180 --> 00:46:32,249
instance if you're bolding big joints

857
00:46:36,529 --> 00:46:35,190
with of aluminum with steel bolts so you

858
00:46:40,209 --> 00:46:36,539
have a different coefficient of

859
00:46:43,269 --> 00:46:40,219
expansion and contraction you can put

860
00:46:47,529 --> 00:46:43,279
belleville washers on to absorb

861
00:46:49,839 --> 00:46:47,539
some of this a thermal expansion to keep

862
00:46:53,729 --> 00:46:49,849
from overloading or under loading the

863
00:46:57,849 --> 00:46:53,739

joint you can use them in stacks in

864
00:47:08,559 --> 00:46:57,859
series or parallel in order to an in

865
00:47:10,329 --> 00:47:08,569
effect use them to become a spring now

866
00:47:12,669 --> 00:47:10,339
here's another one is that is kind of an

867
00:47:14,669 --> 00:47:12,679
oddball you don't see them around very

868
00:47:17,819 --> 00:47:14,679
much because they're expensive a

869
00:47:22,359 --> 00:47:17,829
self-aligning moisture you can use these

870
00:47:24,689 --> 00:47:22,369
on a structural shaped flange which is

871
00:47:27,759 --> 00:47:24,699
used usually has some taper to it and

872
00:47:29,380 --> 00:47:27,769
the reason they're so expensive is the

873
00:47:31,179 --> 00:47:29,390
washer and nut ermichine that's an

874
00:47:33,669 --> 00:47:31,189
assembly so you actually have a cone

875
00:47:36,999 --> 00:47:33,679
here two cousins that are rotating

876
00:47:39,939 --> 00:47:37,009
together to give you the proper

877
00:47:43,929 --> 00:47:39,949
alignment so that you still get axial

878
00:47:46,539 --> 00:47:43,939
loading on your boat instead of putting

879
00:47:49,899 --> 00:47:46,549
bending on it and this will take up to

880
00:47:52,449 --> 00:47:49,909
eight degrees maximum misalignment I

881
00:47:55,269 --> 00:47:52,459
don't remember now what the angle is on

882
00:47:56,679 --> 00:47:55,279
the i-beams and stuff like that I think

883
00:48:00,029 --> 00:47:56,689
it's less than that i believe it's like

884
00:48:04,569 --> 00:48:00,039
a 325 degree or something like that

885
00:48:08,729 --> 00:48:04,579
paper on the flange at seven now this is

886
00:48:16,029 --> 00:48:08,739
this is another one that gives you a

887
00:48:22,719 --> 00:48:16,039
axial reading without using a torque

888
00:48:25,569 --> 00:48:22,729

wrench and this is a PL PL I preload

889
00:48:28,779 --> 00:48:25,579
indicating that SPS has the patent on

890
00:48:34,719 --> 00:48:28,789
and on this one you have a regular

891
00:48:36,759 --> 00:48:34,729
washer a soft inner ring and then a ring

892
00:48:39,039 --> 00:48:36,769
that goes around that it has capstan

893
00:48:42,519 --> 00:48:39,049
holes in it and then a regular washer

894
00:48:47,289 --> 00:48:42,529
and you put all this assembly on you

895
00:48:52,120 --> 00:48:47,299
tighten it down and the this inner ring

896
00:48:56,300 --> 00:48:52,130
is actually a load cell if you will in

897
00:48:59,840 --> 00:48:56,310
that for a given amount of compression

898
00:49:01,370 --> 00:48:59,850
it has been pre calculated the amount of

899
00:49:04,880 --> 00:49:01,380
load that it takes to give you that

900
00:49:10,010 --> 00:49:04,890
compression so you can press it down to

901
00:49:13,630 --> 00:49:10,020
where this outer washer the cap span

902
00:49:15,830 --> 00:49:13,640
ring and the regular were sure are

903
00:49:17,510 --> 00:49:15,840
grinding against each other and we'll

904
00:49:19,820 --> 00:49:17,520
turn that means that this thing is

905
00:49:22,760 --> 00:49:19,830
compressed down to where you bottom

906
00:49:24,830 --> 00:49:22,770
doubt on this so you check the thing you

907
00:49:26,720 --> 00:49:24,840
can't turn that ring any longer you know

908
00:49:29,660 --> 00:49:26,730
you've got it to a certain axial load

909
00:49:31,850 --> 00:49:29,670
and they haven't color coded and

910
00:49:35,750 --> 00:49:31,860
available in all kinds of materials so

911
00:49:37,460 --> 00:49:35,760
that you can get them to use where you

912
00:49:39,260 --> 00:49:37,470
want to determine the load and there's

913
00:49:44,210 --> 00:49:39,270

really no good way of doing it as far as

914
00:49:46,400 --> 00:49:44,220
measuring it now going to inserts which

915
00:49:51,530 --> 00:49:46,410
is a very common thing around here in

916
00:49:54,440 --> 00:49:51,540
the airspace world an insert is actually

917
00:49:57,020 --> 00:49:54,450
it's a special bushing that's threaded

918
00:49:59,510 --> 00:49:57,030
on the inside diameter and locked with

919
00:50:03,680 --> 00:49:59,520
threads or protrusions or a combination

920
00:50:07,700 --> 00:50:03,690
on the outside diameter and installed in

921
00:50:10,820 --> 00:50:07,710
a drilled molded or tapped hole it's

922
00:50:13,070 --> 00:50:10,830
used to provide a strong wear resistant

923
00:50:16,790 --> 00:50:13,080
tapped hole in a softer material

924
00:50:18,760 --> 00:50:16,800
normally than the fastener and you can

925
00:50:22,070 --> 00:50:18,770
also use them to repair stripped threads

926
00:50:24,380 --> 00:50:22,080
where you've stripped the threads in a

927
00:50:27,380 --> 00:50:24,390
whole rather than going to the next

928
00:50:31,070 --> 00:50:27,390
bigger size in taps you can put an

929
00:50:33,770 --> 00:50:31,080
insert in without opening the hole up as

930
00:50:38,150 --> 00:50:33,780
much in fact one of the places you use

931
00:50:40,910 --> 00:50:38,160
them is when people strip the spark plug

932
00:50:44,570 --> 00:50:40,920
holes in aluminum engines a lot of the

933
00:50:46,430 --> 00:50:44,580
times they use in hela coil or Keynes

934
00:50:49,040 --> 00:50:46,440
herders and I pletely use hela coils

935
00:50:52,730 --> 00:50:49,050
most the time for that and in general

936
00:50:54,740 --> 00:50:52,740
they're the two types the one that is

937
00:50:56,690 --> 00:50:54,750
threaded externally and those that are

938
00:51:00,050 --> 00:50:56,700

locked by some method other than threads

939
00:51:03,310 --> 00:51:00,060
and we'll go into them and you get self

940
00:51:06,110 --> 00:51:03,320
tapping and all that sort of thing too

941
00:51:08,060 --> 00:51:06,120
now the earth space industry uses

942
00:51:09,820 --> 00:51:08,070
inserts and tapped holes and soft

943
00:51:13,430 --> 00:51:09,830
materials in order to

944
00:51:16,370 --> 00:51:13,440
increase the load carrying capability is

945
00:51:18,920 --> 00:51:16,380
pull out and this way you can use a

946
00:51:22,070 --> 00:51:18,930
smaller fastener and put in an insert

947
00:51:23,900 --> 00:51:22,080
and since the insert is normally about

948
00:51:26,990 --> 00:51:23,910
an eighth of an inch bigger in diameter

949
00:51:30,410 --> 00:51:27,000
than the internal thread in it you can

950
00:51:37,750 --> 00:51:30,420
take a 1032 bolt and install it in like

951
00:51:44,060 --> 00:51:41,240
here is one of the most common one and

952
00:51:47,000 --> 00:51:44,070
the generic name is key insert although

953
00:51:52,250 --> 00:51:47,010
some call them a solid threaded bushing

954
00:51:56,360 --> 00:51:52,260
or whatever and the insert we usually

955
00:51:58,910 --> 00:51:56,370
have external locking tangs that's these

956
00:52:02,450 --> 00:51:58,920
things you see here and when you install

957
00:52:04,370 --> 00:52:02,460
them after they're threaded in you pound

958
00:52:07,100 --> 00:52:04,380
those that there's a tool for pounding

959
00:52:11,090 --> 00:52:07,110
those down and they extend actually

960
00:52:13,190 --> 00:52:11,100
passed the threads you're the root

961
00:52:17,120 --> 00:52:13,200
diameter the threads to give you locking

962
00:52:20,270 --> 00:52:17,130
capability the the bigger diameters will

963
00:52:22,190 --> 00:52:20,280

have four of those on them whereas the

964
00:52:23,840 --> 00:52:22,200
smaller ones will have to and of course

965
00:52:26,000 --> 00:52:23,850
you can get them that are not locking at

966
00:52:28,630 --> 00:52:26,010
all that you use some other method of

967
00:52:32,090 --> 00:52:28,640
triangle up the external thread on them

968
00:52:34,640 --> 00:52:32,100
now they are very labor-intensive to

969
00:52:38,690 --> 00:52:34,650
install so you don't install them unless

970
00:52:42,710 --> 00:52:38,700
you have to here is the other type the

971
00:52:47,690 --> 00:52:42,720
Gila coil which is I believe now owned

972
00:52:50,060 --> 00:52:47,700
by Black & Decker i think is the owner

973
00:52:55,220 --> 00:52:50,070
of the patent but they're also called a

974
00:52:57,230 --> 00:52:55,230
wire thread and it's usually made of

975
00:53:01,570 --> 00:52:57,240
stainless steel and has a diamond-shaped

976
00:53:03,890 --> 00:53:01,580
cross section that will actually form

977
00:53:06,110 --> 00:53:03,900
internal and external threads when

978
00:53:07,910 --> 00:53:06,120
install and it's like like taking a

979
00:53:10,280 --> 00:53:07,920
spring if you will and winding it down

980
00:53:12,110 --> 00:53:10,290
into a hole and the Diamonds section

981
00:53:14,410 --> 00:53:12,120
part on the back goes into the existing

982
00:53:17,930 --> 00:53:14,420
threads and then the diamond section on

983
00:53:20,330 --> 00:53:17,940
the inside is your thread diameter that

984
00:53:23,059 --> 00:53:20,340
you put your fastener in now they're

985
00:53:26,269 --> 00:53:23,069
usually coated to deter her

986
00:53:28,640 --> 00:53:26,279
ocean and seizing and you can get them

987
00:53:30,380 --> 00:53:28,650
both in locking and unlocking you see if

988
00:53:32,660 --> 00:53:30,390

you look at this this is the non locking

989
00:53:34,969 --> 00:53:32,670
here and this is a locking you actually

990
00:53:38,569 --> 00:53:34,979
have some deform coils down in here in

991
00:53:40,459 --> 00:53:38,579
this installment Tang which you may not

992
00:53:42,769 --> 00:53:40,469
may or may not be able to see on here

993
00:53:46,969 --> 00:53:42,779
it's broken off after installation now

994
00:53:50,749 --> 00:53:46,979
well the the difference between the Gila

995
00:53:57,130 --> 00:53:50,759
coil and the key insert the Keen cert is

996
00:54:00,380 --> 00:53:57,140
only available in one length for a size

997
00:54:02,779 --> 00:54:00,390
the Gila coils you can get them in

998
00:54:06,589 --> 00:54:02,789
different lengths you can get them up to

999
00:54:10,309 --> 00:54:06,599
from 1 D 2 3 D length where D is the

1000
00:54:12,799 --> 00:54:10,319
diameter of the fastener and another

1001
00:54:16,849 --> 00:54:12,809
thing of course you need a to open the

1002
00:54:19,219 --> 00:54:16,859
hole up less where you put a Gila coil

1003
00:54:21,949 --> 00:54:19,229
in so if you're repairing stripped

1004
00:54:27,099 --> 00:54:21,959
threads in an area where you don't have

1005
00:54:30,620 --> 00:54:27,109
a lot of room you can recap the whole

1006
00:54:32,269 --> 00:54:30,630
just slightly and get it opened up

1007
00:54:40,870 --> 00:54:32,279
enough that you can put a Gila coil in

1008
00:54:53,269 --> 00:54:45,799
here's a kind of a more rare tape this

1009
00:54:57,980 --> 00:54:53,279
is a locking tape insert in which you

1010
00:55:00,529 --> 00:54:57,990
have the split beam nut machined on the

1011
00:55:05,599 --> 00:55:00,539
bottom of it remember I showed you the

1012
00:55:08,749 --> 00:55:05,609
slip split beam lock nut earlier and so

1013
00:55:12,470 --> 00:55:08,759

that you have the locking capability but

1014
00:55:14,269 --> 00:55:12,480
of course you are have a longer insert

1015
00:55:16,039 --> 00:55:14,279
because of this thing having to be

1016
00:55:19,460 --> 00:55:16,049
installed because this is not threaded

1017
00:55:22,220 --> 00:55:19,470
into the hole and these are made

1018
00:55:24,319 --> 00:55:22,230
primarily for aerospace usage out of

1019
00:55:29,029 --> 00:55:24,329
either eight to eighty six or inconel

1020
00:55:31,609 --> 00:55:29,039
718 and since you have less external

1021
00:55:33,859 --> 00:55:31,619
thread you have to be careful in soft

1022
00:55:36,380 --> 00:55:33,869
materials to make sure that you don't

1023
00:55:39,799 --> 00:55:36,390
exceed the pullout allowable when you

1024
00:55:42,200 --> 00:55:39,809
install a bolt in them because the

1025
00:55:46,880 --> 00:55:42,210
because of the split beam increasing the

1026
00:55:51,499 --> 00:55:46,890
overall length and here is one that

1027
00:55:55,640 --> 00:55:51,509
solves some problems but it also creates

1028
00:55:58,099 --> 00:55:55,650
some others the floating insert of

1029
00:56:00,529 --> 00:55:58,109
course if you're using and i'll be

1030
00:56:02,589 --> 00:56:00,539
covering us later on with if you're

1031
00:56:07,269 --> 00:56:02,599
using counter sunk or flathead fasteners

1032
00:56:11,089 --> 00:56:07,279
the countersink tries to sulfa line

1033
00:56:13,279 --> 00:56:11,099
fastener if you're going into a rigid

1034
00:56:15,230 --> 00:56:13,289
pepto now you have the two of them

1035
00:56:17,509 --> 00:56:15,240
working against each other which is not

1036
00:56:21,470 --> 00:56:17,519
too good well this solves that problem

1037
00:56:23,990 --> 00:56:21,480
in that the insert is in you have

1038
00:56:25,999 --> 00:56:24,000

actually an insert in the bottom of this

1039
00:56:28,819 --> 00:56:26,009
one so that it's externally threaded

1040
00:56:30,710 --> 00:56:28,829
just like the regular teen cert then you

1041
00:56:35,089 --> 00:56:30,720
have this little jobby that floats down

1042
00:56:38,630 --> 00:56:35,099
in here and so this will give you some

1043
00:56:43,190 --> 00:56:38,640
self-alignment when when using

1044
00:56:46,130 --> 00:56:43,200
countersunk fasteners but by putting all

1045
00:56:50,839 --> 00:56:46,140
of this in it it since this has to float

1046
00:56:53,629 --> 00:56:50,849
inside the main king cert you have a

1047
00:56:57,649 --> 00:56:53,639
smaller diameter

1048
00:57:00,239 --> 00:56:57,659
internally for a given diameter

1049
00:57:04,199 --> 00:57:00,249
externally so therefore you're losing

1050
00:57:07,049 --> 00:57:04,209
some to put that floating capability in

1051
00:57:10,939 --> 00:57:07,059
you're losing some so you might wind up

1052
00:57:13,919 --> 00:57:10,949
having to go to a larger diameter insert

1053
00:57:18,709 --> 00:57:13,929
externally then you nor normally would

1054
00:57:22,169 --> 00:57:18,719
use now here's the self-tapping inserts

1055
00:57:24,749 --> 00:57:22,179
this is usually a self or so solid

1056
00:57:27,089 --> 00:57:24,759
bushing with either tapered external

1057
00:57:31,379 --> 00:57:27,099
threads like a self-tapping screw like

1058
00:57:35,519 --> 00:57:31,389
this or you can have and you can have

1059
00:57:39,539 --> 00:57:35,529
them also solid with a nighlok pelletier

1060
00:57:42,479 --> 00:57:39,549
for locking them or you can have one

1061
00:57:45,929 --> 00:57:42,489
that they use in plastic quite a bit

1062
00:57:50,299 --> 00:57:45,939
what they call a speed cert and this is

1063
00:57:53,119 --> 00:57:50,309

used I think for like in electrical

1064
00:57:58,459 --> 00:57:53,129
circuit boards and stuff like that it

1065
00:58:03,509 --> 00:57:58,469
you drill a hole and you actually can

1066
00:58:07,699 --> 00:58:03,519
push self tap the thing by deforming the

1067
00:58:14,759 --> 00:58:07,709
plastic without generating any shavings

1068
00:58:18,029 --> 00:58:14,769
so we will continue next with the Sun