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00:00:00,000 --> 00:00:07,000

On this epic episode of Mythbusters, Adam and Jamie go Newton cradle crazy.

2

00:00:07,000 --> 00:00:10,000

Even these two and a half inch balls are making you get going.

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00:00:10,000 --> 00:00:19,000

As they find out if this viral video is wrecking Bob the Loney from big beginnings to a colossal conclusion.

4

00:00:19,000 --> 00:00:21,000

Looks beautiful.

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00:00:21,000 --> 00:00:25,000

But will their mother of all Newton's cradles really work?

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00:00:25,000 --> 00:00:27,000

That's like just Newton cradle.

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00:00:27,000 --> 00:00:28,000

In three, two, one.

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00:00:28,000 --> 00:00:32,000

Also toying with big machines are Carrie, Grant and Tori.

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00:00:32,000 --> 00:00:35,000

As they test a cliffhanger of a myth.

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00:00:35,000 --> 00:00:37,000

I've had nightmares like this.

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00:00:37,000 --> 00:00:40,000

If your car is teetering over a gorge.

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00:00:40,000 --> 00:00:42,000

With even a breeze that car is going to go over.

13

00:00:42,000 --> 00:00:47,000

And a burden landing on the hood really cause you to totter over the edge.

14

00:00:47,000 --> 00:00:49,000

Don't make any sudden moves.

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00:00:52,000 --> 00:00:54,000

Who are the Mythbusters?

16

00:00:54,000 --> 00:00:55,000

Adam Savage.

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00:00:55,000 --> 00:00:56,000

It's a delicious memory.

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00:00:56,000 --> 00:00:58,000

And Jamie Heinemann.

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00:00:58,000 --> 00:00:59,000

One and down.

20

00:00:59,000 --> 00:01:00,000

C4.

21

00:01:00,000 --> 00:01:04,000

Between them more than 30 years of special effects experience.

22

00:01:04,000 --> 00:01:07,000

Together with Tori Pelleici.

23

00:01:07,000 --> 00:01:08,000

Well the name of science.

24

00:01:08,000 --> 00:01:10,000

Grant Imahara.

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00:01:10,000 --> 00:01:11,000

The mix of techman.

26

00:01:11,000 --> 00:01:13,000

And Carrie Byron.

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00:01:13,000 --> 00:01:14,000

This should be fun.

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00:01:14,000 --> 00:01:16,000

They don't just tell the myths.

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00:01:16,000 --> 00:01:19,000

They put them to the test.

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00:01:24,000 --> 00:01:31,000

What are you doing?

31

00:01:31,000 --> 00:01:32,000

An equation.

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00:01:32,000 --> 00:01:33,000

Go on.

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00:01:33,000 --> 00:01:41,000

Does one of these plus one of these equal this?

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00:01:41,000 --> 00:01:44,000

It's a simple equation taken from this viral video.

35

00:01:44,000 --> 00:01:47,000

Take five cranes and five wrecking balls.

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00:01:47,000 --> 00:01:54,000

And you've got a desktop toy taken to the max.

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00:01:54,000 --> 00:02:00,000

But is it really possible to supersize a Newton's cradle?

38

00:02:00,000 --> 00:02:02,000

A wrecking ball size Newton cradle.

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00:02:02,000 --> 00:02:04,000

That is fantastic.

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00:02:04,000 --> 00:02:05,000

Ain't it sweet?

41

00:02:05,000 --> 00:02:06,000

It's my favorite.

42

00:02:06,000 --> 00:02:08,000

How do you want to proceed?

43

00:02:08,000 --> 00:02:10,000

Well we all know where this is going to end up.

44

00:02:10,000 --> 00:02:13,000

It's going to be with full sized wrecking balls.

45

00:02:13,000 --> 00:02:15,000

And that is going to be a huge build.

46

00:02:15,000 --> 00:02:18,000

Well since this is all about scaling the Newton's cradle effect.

47

00:02:18,000 --> 00:02:22,000

There's no need to go stampeding towards the full on wrecking balls.

48

00:02:22,000 --> 00:02:24,000

Why don't we do it gradually?

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00:02:24,000 --> 00:02:26,000

You mean it's going to be a huge build?

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00:02:26,000 --> 00:02:29,000

Well since this is all about scaling the Newton's cradle effect.

51

00:02:29,000 --> 00:02:33,000

There's no need to go stampeding towards the full on wrecking balls.

52

00:02:33,000 --> 00:02:36,000

You mean incrementally bumping up the size of our Newton's cradles?

53

00:02:36,000 --> 00:02:37,000

Exactly.

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00:02:37,000 --> 00:02:41,000

And see if we can tease out any kind of problems dealing with the increase in scale.

55

00:02:41,000 --> 00:02:42,000

That sounds perfect. Let's do it.

56

00:02:42,000 --> 00:02:43,000

Okay.

57

00:02:43,000 --> 00:02:47,000

So after the first of many cheap gags.

58

00:02:47,000 --> 00:02:50,000

You need to stop playing with your balls and get back to work.

59

00:02:50,000 --> 00:02:53,000

Adam sets sail on small scale.

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00:02:53,000 --> 00:02:58,000

Now the Newton's cradle is effectively an instant lesson in energy transfer.

61

00:02:58,000 --> 00:03:00,000

And energy transfer is the soul of this story.

62

00:03:00,000 --> 00:03:03,000

For when we bring this up to full scale wrecking balls.

63

00:03:03,000 --> 00:03:07,000

The biggest problem we could encounter is that the energy transfer doesn't work.

64

00:03:07,000 --> 00:03:09,000

That when we lift ball one of the wrecking balls.

65

00:03:09,000 --> 00:03:14,000

It does not send ball five like you'd expect a Newton's cradle to work.

66

00:03:14,000 --> 00:03:17,000

So how are we going to know how we're doing as we scale this up incrementally?

67

00:03:17,000 --> 00:03:18,000

This is how.

68

00:03:18,000 --> 00:03:21,000

I will pull ball one up to this block.

69

00:03:21,000 --> 00:03:25,000

Which is the exact same distance from ball one as this block is from ball five.

70

00:03:25,000 --> 00:03:27,000

I release ball one.

71

00:03:27,000 --> 00:03:33,000

It sends ball five a certain distance that I can measure and compare against my subsequent Newton cradles.

72

00:03:33,000 --> 00:03:36,000

It's a simple but short lived setup.

73

00:03:36,000 --> 00:03:37,000

All right.

74

00:03:37,000 --> 00:03:40,000

So let's see it again in slow motion.

75

00:03:40,000 --> 00:03:42,000

Adam releases ball one.

76

00:03:42,000 --> 00:03:46,000

And in a clear demonstration of this cradle's efficiency.

77

00:03:46,000 --> 00:03:49,000

Ball five almost kisses the blue block.

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00:03:49,000 --> 00:03:50,000

What'd you get?

79

00:03:50,000 --> 00:03:53,000

The energy transfer was surprisingly clean.

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00:03:53,000 --> 00:03:57,000

Ball five traveled 98% the distance that ball one did.

81

00:03:57,000 --> 00:03:58,000

Wow.

82

00:03:58,000 --> 00:04:00,000

Only 2% loss after one hit.

83

00:04:00,000 --> 00:04:02,000

Why don't we take it up a notch next size up?

84

00:04:02,000 --> 00:04:03,000

Absolutely.

85

00:04:03,000 --> 00:04:04,000

Let's do it.

86

00:04:04,000 --> 00:04:08,000

Now I've got to make one of these with five of these.

87

00:04:08,000 --> 00:04:11,000

Now clearly all I have to do is attach some string to this but that's no mean feat.

88

00:04:11,000 --> 00:04:15,000

I don't know if you've ever tried to drill into a chrome steel bearing but I have.

89

00:04:15,000 --> 00:04:17,000

It sucks.

90

00:04:17,000 --> 00:04:33,000

And with that complete a quick montage later and Newton 2.5 is ready to roll.

91

00:04:33,000 --> 00:04:36,000

And roll it does.

92

00:04:36,000 --> 00:04:39,000

It's not easy being me some times.

93

00:04:39,000 --> 00:04:41,000

But after a quick restring.

94

00:04:41,000 --> 00:04:43,000

Shall we try it out?

95

00:04:44,000 --> 00:04:49,000

It's got Adam dancing with excitement.

96

00:04:49,000 --> 00:04:52,000

Oh that's cool.

97

00:04:54,000 --> 00:05:01,000

And while both he and Janie get particularly pleased at something a little low key.

98

00:05:01,000 --> 00:05:02,000

Isn't that nice?

99

00:05:02,000 --> 00:05:05,000

It's definitely a build to be proud of.

100

00:05:05,000 --> 00:05:09,000

It's funny even these two and a half inch balls are making me giggle.

101

00:05:09,000 --> 00:05:11,000

I love it.

102

00:05:11,000 --> 00:05:16,000

But in my mind's eye I'm already seeing the larger and larger ones that we're going to be building.

103

00:05:16,000 --> 00:05:19,000

And it's going to be hilarious.

104

00:05:19,000 --> 00:05:23,000

But before that hilarity it's time for scale test two.

105

00:05:23,000 --> 00:05:29,000

Two and a half inch ball Newton cradle in three two one.

106

00:05:31,000 --> 00:05:33,000

Let's check it out on high speed.

107

00:05:33,000 --> 00:05:40,000

Like last time Adam releases ball one before measuring where ball five maxes out.

108

00:05:40,000 --> 00:05:43,000

And the results are very encouraging.

109

00:05:43,000 --> 00:05:45,000

It looks like it's going to touch.

110

00:05:45,000 --> 00:05:50,000

It's three eighths away which is three percent which means it's pretty frigging efficient.

111

00:05:50,000 --> 00:05:54,000

The desktop model the ball went ninety eight percent of the original distance.

112

00:05:54,000 --> 00:05:57,000

This is ninety seven percent of the original distance.

113

00:05:57,000 --> 00:05:59,000

It's scaling beautifully.

114

00:05:59,000 --> 00:06:05,000

And what that means is that going ludicrously large like the myth may just yet work.

115

00:06:06,000 --> 00:06:12,000

Next up a cliffhanger of a myth.

116

00:06:12,000 --> 00:06:15,000

All right so I have a classic physics meets Hollywood myth.

117

00:06:15,000 --> 00:06:16,000

All right let's hear it.

118

00:06:16,000 --> 00:06:23,000

So cargo's skidding off the road and is about to go over a cliff when it's saved by stopping precariously at the edge.

119

00:06:23,000 --> 00:06:28,000

It's perfectly balanced but a little bird comes and lands on the hood and the whole car goes crashing off the cliff.

120

00:06:28,000 --> 00:06:31,000

A little bird causing the car to go over the cliff.

121

00:06:31,000 --> 00:06:34,000

Like I'm skeptical but you know what sounds like a good test.

122

00:06:35,000 --> 00:06:38,000

It's a favorite in many a script writers handbook.

123

00:06:38,000 --> 00:06:45,000

But if a car comes to a standstill on the very edge of a cliff can an inquisitive bird be enough to

tip the balance.

124

00:06:48,000 --> 00:06:52,000

All right so obviously we're going to have to balance a car on the edge of a cliff.

125

00:06:52,000 --> 00:06:53,000

Why don't we build our own cliff.

126

00:06:53,000 --> 00:06:57,000

That way we know it can hold the weight of car and if we go over we won't get killed.

127

00:06:57,000 --> 00:06:58,000

Good idea.

128

00:06:58,000 --> 00:07:02,000

And then for the fun part getting a bird to land on the hood.

129

00:07:02,000 --> 00:07:04,000

I don't think that's going to be as easy as we think.

130

00:07:04,000 --> 00:07:06,000

No I think balancing the car is going to be the easy part.

131

00:07:08,000 --> 00:07:13,000

So with tipping over a real cliff ruled out for obvious reasons.

132

00:07:17,000 --> 00:07:21,000

At the bomb range the mythbusters are going to build their own.

133

00:07:23,000 --> 00:07:25,000

I think we mean business.

134

00:07:25,000 --> 00:07:26,000

We got a lot of work.

135

00:07:26,000 --> 00:07:28,000

Luckily we have the big tools today.

136

00:07:28,000 --> 00:07:29,000

All right let's do it.

137

00:07:29,000 --> 00:07:31,000

All right let's move some earth.

138

00:07:32,000 --> 00:07:34,000

What we got here is a front load.

139

00:07:34,000 --> 00:07:36,000

Big toys for big boys.

140

00:07:36,000 --> 00:07:40,000

This thing is very powerful it's got to move a lot of weight.

141

00:07:40,000 --> 00:07:41,000

Let's see what I can break with this.

142

00:07:41,000 --> 00:07:42,000

We are going to be doing.

143

00:07:42,000 --> 00:07:46,000

We're going to be moving a lot of earth to get our slope up to our cliff.

144

00:07:46,000 --> 00:07:49,000

Not better than playing with big machinery.

145

00:07:49,000 --> 00:07:52,000

Although it may look a little bit precarious.

146

00:07:52,000 --> 00:07:55,000

No!

147

00:07:58,000 --> 00:08:03,000

The goal here is to build a solid cliff edge courtesy of a shipping container.

148

00:08:03,000 --> 00:08:05,000

Enter one portable clip.

149

00:08:05,000 --> 00:08:08,000

Which a car can then be balanced on.

150

00:08:08,000 --> 00:08:09,000

It's taking a while.

151

00:08:09,000 --> 00:08:12,000

Well it took mother nature like hundreds of thousands of years.

152

00:08:12,000 --> 00:08:14,000

So really we're right on schedule.

153

00:08:16,000 --> 00:08:19,000

Beyond the cliff edge they're making a sloping escape ramp.

154

00:08:19,000 --> 00:08:23,000

Which should make a survivable descent when the car tips over.

155

00:08:23,000 --> 00:08:25,000

A little more likely.

156

00:08:25,000 --> 00:08:28,000

It may look like we've been out here all day playing.

157

00:08:28,000 --> 00:08:32,000

I mean I've been up and down this ramp probably about a hundred times.

158

00:08:32,000 --> 00:08:34,000

But there's a very good reason.

159

00:08:34,000 --> 00:08:38,000

And that reason is we're going to be in the car that goes off this container.

160

00:08:38,000 --> 00:08:39,000

And down that ramp.

161

00:08:39,000 --> 00:08:41,000

So we want this thing to be perfect.

162

00:08:41,000 --> 00:08:44,000

And grand better hope 100 times was enough.

163

00:08:44,000 --> 00:08:47,000

Because with the cliff car delivered and pimped.

164

00:08:47,000 --> 00:08:52,000

Just in case there was any confusion who was pushing a car off a cliff out in the middle of the bomb range.

165

00:08:52,000 --> 00:08:55,000

It's all systems go for the pre-bird testing.

166

00:08:57,000 --> 00:09:00,000

Finding out the precise balance point of the car.

167

00:09:00,000 --> 00:09:02,000

Okay you guys ready?

168

00:09:02,000 --> 00:09:03,000

No!

169

00:09:06,000 --> 00:09:09,000

Binding the tipping point in three two one.

170

00:09:10,000 --> 00:09:12,000

Okay so you're just going to ease forward right?

171

00:09:13,000 --> 00:09:14,000

Um man.

172

00:09:14,000 --> 00:09:18,000

Tori's first task is to carefully drop the front wheels over the edge.

173

00:09:18,000 --> 00:09:20,000

Okay slow your back.

174

00:09:20,000 --> 00:09:21,000

Get the tire off.

175

00:09:21,000 --> 00:09:23,000

You can make it.

176

00:09:23,000 --> 00:09:25,000

There's a nightmare like this.

177

00:09:25,000 --> 00:09:28,000

And once there the balance point test can begin.

178

00:09:28,000 --> 00:09:30,000

But it's a delicate operation.

179

00:09:31,000 --> 00:09:33,000

Okay slowly slowly.

180

00:09:33,000 --> 00:09:35,000

Little less on the accelerator.

181

00:09:35,000 --> 00:09:38,000

Too little throttle and they won't budge.

182

00:09:38,000 --> 00:09:40,000

Okay we're not tipping yet.

183

00:09:40,000 --> 00:09:44,000

Too much and they'll flip over the cliff without finding the tipping point.

184

00:09:44,000 --> 00:09:47,000

We got no more traction on the back wheel.

185

00:09:50,000 --> 00:09:53,000

And that was too much.

186

00:09:56,000 --> 00:09:58,000

Holy crap that was scary.

187

00:09:58,000 --> 00:10:01,000

It was like one second we were on the edge and then boom we were off.

188

00:10:03,000 --> 00:10:04,000

I think we need to do that again.

189

00:10:04,000 --> 00:10:05,000

I think so.

190

00:10:06,000 --> 00:10:08,000

Good news and bad news.

191

00:10:08,000 --> 00:10:09,000

Our safety ramp worked.

192

00:10:09,000 --> 00:10:13,000

We were able to get the car to go off the cliff and land safely and we didn't die.

193

00:10:13,000 --> 00:10:19,000

Bad news is though I hit the gas too hard and instead of finding that teetering point we just went off the cliff.

194

00:10:19,000 --> 00:10:22,000

So we don't know exactly where that tipping point is yet.

195

00:10:22,000 --> 00:10:24,000

We're going to do the test again to find that.

196

00:10:24,000 --> 00:10:26,000

This is going to be fun.

197

00:10:27,000 --> 00:10:28,000

Still to come.

198

00:10:28,000 --> 00:10:30,000

Bird balance gets bizarre.

199

00:10:30,000 --> 00:10:31,000

There's a conor.

200

00:10:31,000 --> 00:10:34,000

But next wrecking ball baloney.

201

00:10:34,000 --> 00:10:35,000

It's a hurdle.

202

00:10:35,000 --> 00:10:36,000

Uh oh.

203

00:10:36,000 --> 00:10:38,000

It's potentially very bad.

204

00:10:45,000 --> 00:10:49,000

Is this crazy construction site's viral video really real?

205

00:10:49,000 --> 00:10:52,000

Or is this myth headed to the wrecking yard?

206

00:10:54,000 --> 00:10:56,000

Well so far it's so good.

207

00:10:56,000 --> 00:10:57,000

I love it.

208

00:10:57,000 --> 00:11:03,000

Because scaling up the Newton cradle with bigger ball bearings appears to be working.

209

00:11:04,000 --> 00:11:05,000

It's scaling beautifully.

210

00:11:06,000 --> 00:11:09,000

But now it's time to go bigger again.

211

00:11:09,000 --> 00:11:12,000

Next up we're going to go to a 6 inch diameter ball bearing.

212

00:11:12,000 --> 00:11:15,000

This is 33 pounds.

213

00:11:15,000 --> 00:11:21,000

And that means that it's 323 times as massive as these little ones.

214

00:11:22,000 --> 00:11:26,000

Like the 2 1 half inch version it's Adam who's in charge of the bill.

215

00:11:26,000 --> 00:11:29,000

Another day, another Newton cradle stand.

216

00:11:29,000 --> 00:11:33,000

From the stand that this time is more heavily reinforced.

217

00:11:33,000 --> 00:11:35,000

Nice rack.

218

00:11:35,000 --> 00:11:37,000

To the ball securing system.

219

00:11:38,000 --> 00:11:39,000

Oh yes.

220

00:11:39,000 --> 00:11:41,000

Wow that's heavy.

221

00:11:41,000 --> 00:11:45,000

I've been obsessing about this story ever since I first came across it.

222

00:11:45,000 --> 00:11:48,000

I'm finding it difficult to describe how much fun it is.

223

00:11:48,000 --> 00:11:52,000

So the only thing I could come up with was to just show you.

224

00:11:52,000 --> 00:11:54,000

The little balls.

225

00:11:55,000 --> 00:11:56,000

Bigger balls.

226

00:11:58,000 --> 00:12:00,000

And really big balls.

227

00:12:00,000 --> 00:12:02,000

Need I say anything more?

228

00:12:02,000 --> 00:12:04,000

Actually yes Jamie.

229

00:12:04,000 --> 00:12:07,000

How about you give us a countdown to the efficiency test.

230

00:12:07,000 --> 00:12:10,000

Three, two, one.

231

00:12:12,000 --> 00:12:14,000

Nice. That was a good clean one.

232

00:12:14,000 --> 00:12:15,000

Shall we check out the high speed?

233

00:12:15,000 --> 00:12:16,000

Yep.

234

00:12:17,000 --> 00:12:22,000

Alright Jamie, ball five went to 94.1% of the distance of ball one.

235

00:12:22,000 --> 00:12:24,000

Yeah that's an additional 3% loss.

236

00:12:24,000 --> 00:12:26,000

I'm still feeling pretty good about this thing.

237

00:12:26,000 --> 00:12:28,000

Yeah, still working.

238

00:12:29,000 --> 00:12:32,000

So it's increasing the mass causing us a problem.

239

00:12:32,000 --> 00:12:37,000

Well we are seeing an increase in losses the more we scale these balls up.

240

00:12:37,000 --> 00:12:40,000

But here's the thing, it's not proportionate.

241

00:12:40,000 --> 00:12:45,000

These balls are over 200 times the mass of the original small balls on the toy.

242

00:12:45,000 --> 00:12:49,000

And yet we're only seeing a total of about a 6% loss.

243

00:12:49,000 --> 00:12:51,000

It's not very much.

244

00:12:51,000 --> 00:12:54,000

Although there is drop off with increasing size,

245

00:12:54,000 --> 00:12:57,000

it's so slight that the bigger cradles still work as hoped.

246

00:12:57,000 --> 00:13:01,000

And that means that full scale may not be so far fetched.

247

00:13:01,000 --> 00:13:07,000

Provided of course that real wrecking balls perform the same as ball bearings.

248

00:13:13,000 --> 00:13:16,000

To find out if a bird can tip a car over a cliff,

249

00:13:16,000 --> 00:13:20,000

the mythbusters first need to find their car's balance point.

250

00:13:23,000 --> 00:13:25,000

Which is proving harder than expected.

251

00:13:26,000 --> 00:13:28,000

Hey you guys are safe!

252

00:13:28,000 --> 00:13:29,000

For a ride!

253

00:13:29,000 --> 00:13:32,000

Bad news is that was a little too dumb on Louise.

254

00:13:32,000 --> 00:13:34,000

So we have to put you back up there.

255

00:13:34,000 --> 00:13:35,000

Alright, yeah!

256

00:13:35,000 --> 00:13:37,000

I didn't think you'd disagree.

257

00:13:38,000 --> 00:13:41,000

After a somewhat epic but really fun failure,

258

00:13:41,000 --> 00:13:43,000

we decided to change our methods.

259

00:13:43,000 --> 00:13:45,000

We actually put the car back into place

260

00:13:45,000 --> 00:13:48,000

and now we're going to inch that car forward.

261

00:13:48,000 --> 00:13:50,000

So with the car engine off...

262

00:13:50,000 --> 00:13:51,000

Okay we're ready.

263

00:13:51,000 --> 00:13:54,000

Alright, begin the tipping point test.

264

00:13:54,000 --> 00:13:57,000

The forklift will instead gently ease it forwards.

265

00:13:57,000 --> 00:14:00,000

Oh, oh, okay stop, stop, stop.

266

00:14:00,000 --> 00:14:03,000

But will it have the required control?

267

00:14:03,000 --> 00:14:05,000

Right about five and a half feet.

268

00:14:05,000 --> 00:14:06,000

How's it feel?

269

00:14:06,000 --> 00:14:08,000

There's no tipping.

270

00:14:08,000 --> 00:14:11,000

Okay give them just another tiny little nudge.

271

00:14:15,000 --> 00:14:17,000

Well so much for plan B.

272

00:14:17,000 --> 00:14:20,000

Because like plan A, the cars tip too soon.

273

00:14:20,000 --> 00:14:23,000

And without finding that tipping point,

274

00:14:23,000 --> 00:14:25,000

they can't bring on the birds.

275

00:14:25,000 --> 00:14:27,000

Alright, plan C.

276

00:14:27,000 --> 00:14:29,000

We're actually going to need to strap this time

277

00:14:29,000 --> 00:14:31,000

so that if we go too far off the edge,

278

00:14:31,000 --> 00:14:34,000

we can pull the car back to the tipping point.

279

00:14:34,000 --> 00:14:36,000

Hope this one works.

280

00:14:36,000 --> 00:14:38,000

With resets taking too long...

281

00:14:38,000 --> 00:14:41,000

I can't tell you how many times I get myself into these situations.

282

00:14:41,000 --> 00:14:44,000

The guys are hoping that the strap system

283

00:14:44,000 --> 00:14:47,000

will let them find the balance point a little more quickly.

284

00:14:47,000 --> 00:14:50,000

Get a little bump, give me your angry inch.

285

00:14:50,000 --> 00:14:52,000

But as it turns out,

286

00:14:52,000 --> 00:14:56,000

it still takes an entire afternoon of pushing and shoving.

287

00:14:56,000 --> 00:14:58,000

Alright, now pull it back to five and a half,

288

00:14:58,000 --> 00:15:00,000

I'll tell you when to stop.

289

00:15:00,000 --> 00:15:02,000

Before they think they've cracked it.

290

00:15:02,000 --> 00:15:05,000

Grant, we are at the point of no return.

291

00:15:05,000 --> 00:15:08,000

After a lot of tinkering and a lot of trial and error,

292

00:15:08,000 --> 00:15:10,000

we have found the exact tipping point.

293

00:15:10,000 --> 00:15:12,000

I feel like we're going to go at any second.

294

00:15:12,000 --> 00:15:14,000

I think at this point with even a breeze,

295

00:15:14,000 --> 00:15:16,000

that car is going to go all the way up.

296

00:15:16,000 --> 00:15:18,000

Don't make any sudden moves.

297

00:15:18,000 --> 00:15:22,000

So now when the guys start to sway and move their weight,

298

00:15:22,000 --> 00:15:24,000

I think they're going to go over the edge.

299

00:15:24,000 --> 00:15:26,000

Ready? Let's do it together. One, two, three.

300

00:15:26,000 --> 00:15:28,000

Oh!

301

00:15:28,000 --> 00:15:30,000

Ah!

302

00:15:30,000 --> 00:15:32,000

Yes!

303

00:15:32,000 --> 00:15:35,000

Finally, they've hit paydirt.

304

00:15:35,000 --> 00:15:37,000

Okay, I think we found our teetering point.

305

00:15:37,000 --> 00:15:39,000

Wobbling at the six and a half foot mark,

306

00:15:39,000 --> 00:15:41,000

the car was so finely balanced

307

00:15:41,000 --> 00:15:43,000

that a slight lean from Grant and Tori

308

00:15:43,000 --> 00:15:45,000

was enough to send it over to the other side.

309

00:15:45,000 --> 00:15:47,000

That was enough to send it over the edge.

310

00:15:47,000 --> 00:15:50,000

But could a landing bird also tip that balance?

311

00:15:50,000 --> 00:15:52,000

Now, it takes a long time to get our car

312

00:15:52,000 --> 00:15:54,000

to that perfect balance point.

313

00:15:54,000 --> 00:15:57,000

But after seeing how easy the car went over the edge,

314

00:15:57,000 --> 00:16:00,000

I think if a bird were to land on the front end of the car,

315

00:16:00,000 --> 00:16:02,000

we're definitely going over.

316

00:16:02,000 --> 00:16:06,000

Well, in that case, let's unleash the beast.

317

00:16:06,000 --> 00:16:08,000

Later on, Myth Musters.

318

00:16:08,000 --> 00:16:10,000

World's largest Newton cradle.

319

00:16:10,000 --> 00:16:12,000

And three, two, one.

320

00:16:12,000 --> 00:16:14,000

But next.

321

00:16:14,000 --> 00:16:16,000

Who knows?

322

00:16:44,000 --> 00:16:46,000

Full-sized wrecking balls.

323

00:16:46,000 --> 00:16:49,000

Which, somewhat unexpectedly, turns out to be impossible.

324

00:16:49,000 --> 00:16:52,000

But all is not lost.

325

00:16:52,000 --> 00:16:56,000

There is nobody who has five identical wrecking balls.

326

00:16:56,000 --> 00:16:58,000

Well, you know what that means.

327

00:16:58,000 --> 00:17:00,000

I think I do.

328

00:17:00,000 --> 00:17:02,000

We're going to have to build our own.

329

00:17:02,000 --> 00:17:04,000

How do you want to do it?

330

00:17:04,000 --> 00:17:06,000

Big steel balls filled with concrete.

331

00:17:06,000 --> 00:17:08,000

That could work.

332

00:17:08,000 --> 00:17:10,000

Shall we try the scale first?

333

00:17:10,000 --> 00:17:12,000

Sure.

334

00:17:12,000 --> 00:17:15,000

First, that's because that's what you see in the video.

335

00:17:15,000 --> 00:17:17,000

But second and more importantly,

336

00:17:17,000 --> 00:17:19,000

their mass needs to be identical

337

00:17:19,000 --> 00:17:21,000

because that gives us the best energy transport possible.

338

00:17:21,000 --> 00:17:23,000

Not only their mass, but also their surfaces

339

00:17:23,000 --> 00:17:25,000

have to be as round as we can get them.

340

00:17:25,000 --> 00:17:27,000

So we've got to make our own.

341

00:17:27,000 --> 00:17:29,000

And we're going to use the building blocks of real wrecking balls,

342

00:17:29,000 --> 00:17:31,000

steel and concrete.

343

00:17:31,000 --> 00:17:33,000

Before we go to full scale, we're going to try a scale experiment

344

00:17:33,000 --> 00:17:35,000

with the simplest arrangement of this possible.

345

00:17:35,000 --> 00:17:38,000

A steel sphere filled with concrete.

346

00:17:38,000 --> 00:17:41,000

So I have sourced some six inch hollow steel balls

347

00:17:41,000 --> 00:17:43,000

I'm going to drill a hole in them

348

00:17:43,000 --> 00:17:46,000

and fill them with ceramically hard plaster

349

00:17:46,000 --> 00:17:49,000

that matches the compressive strength of concrete.

350

00:17:49,000 --> 00:17:51,000

I'm going to build a Newton cradle out of that

351

00:17:51,000 --> 00:17:53,000

and that really ought to give us a good guidance

352

00:17:53,000 --> 00:17:56,000

to the viability of our concept for the large scale one.

353

00:17:56,000 --> 00:17:58,000

And once the fillings hardened,

354

00:17:58,000 --> 00:18:00,000

everything's set to see if they work.

355

00:18:00,000 --> 00:18:02,000

Here we go.

356

00:18:02,000 --> 00:18:04,000

Uh-oh.

357

00:18:04,000 --> 00:18:06,000

Hey, Jamie, you better come take a look.

358

00:18:06,000 --> 00:18:08,000

I'm going to try to get a little bit of the concrete

359

00:18:09,000 --> 00:18:12,000

Hey, Jamie, you better come take a look at this.

360

00:18:12,000 --> 00:18:14,000

What's up?

361

00:18:14,000 --> 00:18:16,000

Check this out.

362

00:18:19,000 --> 00:18:21,000

It doesn't last very long.

363

00:18:21,000 --> 00:18:23,000

Clearly, we're going to have to come up with something

364

00:18:23,000 --> 00:18:25,000

other than just filling our wrecking balls with concrete.

365

00:18:25,000 --> 00:18:28,000

Yeah, that's kind of dead.

366

00:18:28,000 --> 00:18:30,000

This is just what I was afraid of.

367

00:18:30,000 --> 00:18:34,000

These mild steel balls are filled with an ultra-hard gypsum-based product,

368

00:18:34,000 --> 00:18:37,000

but they're still not passing enough energy through to do the job we want.

369

00:18:37,000 --> 00:18:39,000

They're absorbing it somehow.

370

00:18:39,000 --> 00:18:42,000

Personally, I'm bummed.

371

00:18:42,000 --> 00:18:44,000

Now I know that when you look at the high-speed shot here,

372

00:18:44,000 --> 00:18:46,000

it looks like the energy transfer you expect from a Newton cradle

373

00:18:46,000 --> 00:18:48,000

is actually happening.

374

00:18:48,000 --> 00:18:50,000

Ball one goes down, ball five comes up,

375

00:18:50,000 --> 00:18:52,000

but here's the thing that makes a Newton cradle awesome.

376

00:18:52,000 --> 00:18:54,000

The energy transfer continues.

377

00:18:54,000 --> 00:18:56,000

Tick, tick, tick.

378

00:18:56,000 --> 00:18:58,000

What I'm getting from this isn't tick, tick, tick.

379

00:18:58,000 --> 00:19:00,000

It's tick, tick.

380

00:19:00,000 --> 00:19:02,000

And everyone seems to want to go home.

381

00:19:02,000 --> 00:19:04,000

I don't know what we're going to do.

382

00:19:04,000 --> 00:19:06,000

With real wrecking balls unavailable

383

00:19:06,000 --> 00:19:09,000

and the most simple do-it-yourself design falling flat,

384

00:19:09,000 --> 00:19:12,000

what this myth needs is a brainstorm.

385

00:19:15,000 --> 00:19:19,000

So, giant Newton cradle, how do you want to do it?

386

00:19:19,000 --> 00:19:21,000

Well, we've got this problem, right?

387

00:19:21,000 --> 00:19:24,000

This is going to be probably 20 feet high.

388

00:19:24,000 --> 00:19:26,000

I mean, we can't forge these solid steel.

389

00:19:26,000 --> 00:19:27,000

Yeah.

390

00:19:27,000 --> 00:19:29,000

There's just no way we can go...

391

00:19:29,000 --> 00:19:33,000

And yet we can't have just a big sphere that we fill with something like concrete.

392

00:19:34,000 --> 00:19:37,000

It's a slow start, so let's speed things up.

393

00:19:38,000 --> 00:19:41,000

Their goal is to design a wrecking ball stand-in

394

00:19:41,000 --> 00:19:44,000

that transfers energy better than their earlier effort.

395

00:19:45,000 --> 00:19:47,000

Jamie gets a bolt from the blue.

396

00:19:48,000 --> 00:19:50,000

Oh, oh, I know.

397

00:19:50,000 --> 00:19:53,000

All you need is a plate to go right through the metal.

398

00:19:53,000 --> 00:19:57,000

And then we get some metal spheres and weld them top and bottom,

399

00:19:57,000 --> 00:19:59,000

then fill the rest with three-bar and concrete.

400

00:19:59,000 --> 00:20:03,000

Don't they make buoys that are made of steel?

401

00:20:03,000 --> 00:20:05,000

Yeah, that's the ticket.

402

00:20:05,000 --> 00:20:07,000

Then we get one of those, we put the plate in the middle,

403

00:20:07,000 --> 00:20:11,000

we end up with something where it's a solid steel transfer from ball to ball,

404

00:20:11,000 --> 00:20:14,000

but no one could look at them and say, that's not a wrecking ball.

405

00:20:14,000 --> 00:20:15,000

Like that.

406

00:20:15,000 --> 00:20:16,000

That is perfect.

407

00:20:16,000 --> 00:20:18,000

I think we've got a plan.

408

00:20:18,000 --> 00:20:19,000

Let's do it.

409

00:20:19,000 --> 00:20:21,000

Eureka, they've cracked it.

410

00:20:21,000 --> 00:20:24,000

But for the rest of us, here's a graphic.

411

00:20:24,000 --> 00:20:28,000

They're going to take a 28-inch navel buoy and cut it in half.

412

00:20:28,000 --> 00:20:32,000

Across the center, they'll weld a three-inch thick hardened steel plate

413

00:20:32,000 --> 00:20:35,000

that should be able to transfer the energy of the swing.

414

00:20:36,000 --> 00:20:39,000

Inside the buoy, they'll add rebar and concrete,

415

00:20:39,000 --> 00:20:41,000

just like some old-fashioned wrecking balls.

416

00:20:41,000 --> 00:20:43,000

That leaves two questions.

417

00:20:43,000 --> 00:20:46,000

With five in a row, will it work?

418

00:20:46,000 --> 00:20:48,000

And can they build them?

419

00:20:49,000 --> 00:20:53,000

Well, with the delivery of buoys, the guys get that ball rolling.

420

00:20:54,000 --> 00:20:56,000

These things are going to get cut in half,

421

00:20:56,000 --> 00:20:58,000

and then we're going to weld the plates right down the middle.

422

00:21:00,000 --> 00:21:03,000

This thing's going to be the center of our wrecking balls.

423

00:21:03,000 --> 00:21:07,000

It's a three-inch thick piece of specially hardened steel that we've chosen

424

00:21:07,000 --> 00:21:11,000

because it's going to be the contact point from ball to ball.

425

00:21:11,000 --> 00:21:14,000

And because it's really hard, hopefully it's going to transfer the energy

426

00:21:14,000 --> 00:21:16,000

just like the Newton's cradle does.

427

00:21:17,000 --> 00:21:20,000

We're also going to weld structural stuff that we need onto it,

428

00:21:20,000 --> 00:21:22,000

like a bunch of reinforcing bars,

429

00:21:22,000 --> 00:21:24,000

and the rest of this space will be filled with concrete.

430

00:21:24,000 --> 00:21:28,000

It's definitely an all-hands-on-deck type build,

431

00:21:28,000 --> 00:21:31,000

even if a couple of those hands get distracted.

432

00:21:39,000 --> 00:21:41,000

But once Adam and Jamie chime back in,

433

00:21:41,000 --> 00:21:43,000

their fearsome spheres,

434

00:21:43,000 --> 00:21:47,000

the kind of hybrid of real wrecking balls and giant ball bearings,

435

00:21:47,000 --> 00:21:49,000

take shape fast.

436

00:21:51,000 --> 00:21:53,000

And off we go.

437

00:21:54,000 --> 00:21:57,000

And while the concrete fills start chaotically,

438

00:21:57,000 --> 00:22:02,000

It's not long before the team

439

00:22:02,000 --> 00:22:08,000

has this part of the build in the can.

440

00:22:08,000 --> 00:22:10,000

Oh, messier than I thought.

441

00:22:11,000 --> 00:22:13,000

Isn't that the title of your autobiography?

442

00:22:13,000 --> 00:22:15,000

Lovely. Look at that.

443

00:22:16,000 --> 00:22:20,000

And after two weeks to cure, plus a quick paint job, they're all set.

444

00:22:20,000 --> 00:22:22,000

But will they actually work?

445

00:22:23,000 --> 00:22:27,000

After a couple of weeks' work, this is either 10,000 pounds of awesome

446

00:22:27,000 --> 00:22:29,000

or 10,000 pounds of failure.

447

00:22:30,000 --> 00:22:32,000

Coming up next on Mythbusters.

448

00:22:32,000 --> 00:22:34,000

A wrecking ball-sized Newton cradle.

449

00:22:34,000 --> 00:22:37,000

But the question is, will it work?

450

00:22:43,000 --> 00:22:47,000

A precariously balanced car is no laughing matter.

451

00:22:47,000 --> 00:22:51,000

But can a landing bird really send you over the edge?

452

00:22:51,000 --> 00:22:53,000

So we're back at the bomb range.

453

00:22:53,000 --> 00:22:57,000

Now it took a really long time to get our car perfectly balanced on our cliff.

454

00:22:59,000 --> 00:23:02,000

But now that we've done it, it's time to bring in some birds.

455

00:23:03,000 --> 00:23:07,000

We have our expert Jim coming in to use progressively bigger and bigger birds.

456

00:23:07,000 --> 00:23:09,000

It should be really interesting today.

457

00:23:10,000 --> 00:23:12,000

So essentially this myth is all about leverage.

458

00:23:12,000 --> 00:23:15,000

Now imagine that this block is the cliff,

459

00:23:15,000 --> 00:23:17,000

and this break is the car,

460

00:23:17,000 --> 00:23:20,000

and this rock is the bird because of leverage

461

00:23:20,000 --> 00:23:24,000

out here at the edge, a small bird can land there

462

00:23:24,000 --> 00:23:28,000

and cause the giant car to go over just like this.

463

00:23:29,000 --> 00:23:35,000

That's the theory, but will bird 1, a classic yet humble pigeon, provide enough leverage?

464

00:23:36,000 --> 00:23:38,000

Alright, so now we're going to start testing with the birds,

465

00:23:38,000 --> 00:23:40,000

but we're going to test it a little bit differently this time.

466

00:23:40,000 --> 00:23:42,000

We're still going to put the car on the edge of the cliff,

467

00:23:42,000 --> 00:23:45,000

right where it's bouncing just ready to fall over.

468

00:23:45,000 --> 00:23:47,000

Should have paid more attention to the sides.

469

00:23:47,000 --> 00:23:48,000

Cliff ahead.

470

00:23:48,000 --> 00:23:50,000

But this time we're going to tether the car,

471

00:23:50,000 --> 00:23:53,000

so that way if it does go off the cliff by the weight of the bird,

472

00:23:53,000 --> 00:23:55,000

it doesn't go down the hill, because let's face it,

473

00:23:55,000 --> 00:23:56,000

we don't want to hurt these birds.

474

00:23:56,000 --> 00:23:59,000

We don't care about ourselves, we still want to hurt the bird.

475

00:24:00,000 --> 00:24:04,000

With Grant and Tori sitting anxiously in the hot seats of their balancing car,

476

00:24:08,000 --> 00:24:10,000

Come on, wrangle them birds.

477

00:24:10,000 --> 00:24:13,000

Jim flips the birds, and...

478

00:24:13,000 --> 00:24:16,000

Okay, the birds are in place.

479

00:24:16,000 --> 00:24:18,000

Yep, and we haven't gone over the edge.

480

00:24:18,000 --> 00:24:20,000

There's not a hint of tibble,

481

00:24:20,000 --> 00:24:24,000

but to be sure, the guys shoe the birds down the hood.

482

00:24:24,000 --> 00:24:27,000

Go away, go ahead, shoot, shoot, go.

483

00:24:27,000 --> 00:24:29,000

Yeah, but you have a park to poop on.

484

00:24:29,000 --> 00:24:31,000

Because the further they are from the fulcrum,

485

00:24:31,000 --> 00:24:34,000

the greater the chance of a tip.

486

00:24:34,000 --> 00:24:37,000

Two pigeons, not happening.

487

00:24:37,000 --> 00:24:39,000

Nope, we are not going over the edge.

488

00:24:39,000 --> 00:24:40,000

Ain't that the truth.

489

00:24:40,000 --> 00:24:45,000

The two pounds of pigeon is just not enough to cross their balanced car

490

00:24:45,000 --> 00:24:48,000

to tilt up and over, which means...

491

00:24:48,000 --> 00:24:50,000

I think it's time for a bigger bird.

492

00:24:51,000 --> 00:24:54,000

Okay, so we didn't get any tipping from the pigeons,

493

00:24:54,000 --> 00:24:56,000

so we're going to move on to hawks.

494

00:24:56,000 --> 00:24:58,000

Now, not only are we going to get the extra weight,

495

00:24:58,000 --> 00:25:00,000

but also the momentum of the hawk's landing.

496

00:25:00,000 --> 00:25:04,000

I still don't think it's going to be quite enough to tip the car.

497

00:25:04,000 --> 00:25:05,000

You guys ready for the birds?

498

00:25:05,000 --> 00:25:07,000

It's time to let the hawks go.

499

00:25:07,000 --> 00:25:10,000

Alright, hawk number one, ready to deploy.

500

00:25:10,000 --> 00:25:12,000

Murray lands in a hurry,

501

00:25:12,000 --> 00:25:15,000

but there's no wobble to their wheels.

502

00:25:15,000 --> 00:25:17,000

That didn't send us over the edge.

503

00:25:17,000 --> 00:25:19,000

Alright, bring out another hawk.

504

00:25:19,000 --> 00:25:24,000

Doubling the mass to almost five pounds does seem to make a difference.

505

00:25:24,000 --> 00:25:27,000

I can see that the hood kind of wobbled in there.

506

00:25:27,000 --> 00:25:29,000

But it is still not enough.

507

00:25:29,000 --> 00:25:32,000

Alright, that's two hawks at the end of the car,

508

00:25:32,000 --> 00:25:34,000

and we have not gone over the edge.

509

00:25:34,000 --> 00:25:35,000

We're not going over.

510

00:25:35,000 --> 00:25:37,000

We did not follow.

511

00:25:37,000 --> 00:25:39,000

And when two hawks fail...

512

00:25:39,000 --> 00:25:41,000

You got some work to do, are you ready?

513

00:25:41,000 --> 00:25:45,000

It's time to bring in the big guns, the giant eagle owl.

514

00:25:45,000 --> 00:25:49,000

You know, many cultures, the owl is the harbinger of death.

515

00:25:49,000 --> 00:25:51,000

Harbinger of death?

516

00:25:51,000 --> 00:25:53,000

Thanks for the encouragement, Jim.

517

00:25:53,000 --> 00:25:57,000

And with those wise words, it's go time.

518

00:25:57,000 --> 00:26:00,000

Alright, let's see if this owl will send us over the cliff.

519

00:26:00,000 --> 00:26:02,000

He's big. He's really big.

520

00:26:06,000 --> 00:26:07,000

We survived.

521

00:26:07,000 --> 00:26:10,000

He's at the edge of the car, and we did not go over the cliff.

522

00:26:10,000 --> 00:26:13,000

Yep, once again, the car's balance is unaffected,

523

00:26:13,000 --> 00:26:17,000

even with this seven pounder right at the front of the hood.

524

00:26:17,000 --> 00:26:19,000

The owl's not going to do it?

525

00:26:19,000 --> 00:26:21,000

I don't know what he is.

526

00:26:21,000 --> 00:26:24,000

Grant for one is not that surprised.

527

00:26:24,000 --> 00:26:26,000

Okay, so why don't I think this works?

528

00:26:26,000 --> 00:26:30,000

Well, imagine that you're at a playground, and you have a perfect seesaw.

529

00:26:30,000 --> 00:26:33,000

Theoretically, if you have a mass, which is the bird,

530

00:26:33,000 --> 00:26:35,000

landing far enough away from the pivot,

531

00:26:35,000 --> 00:26:38,000

it should be able to move the seesaw no problem.

532

00:26:38,000 --> 00:26:42,000

The only problem here is that this seesaw weighs 3,000 pounds,

533

00:26:42,000 --> 00:26:44,000

and it's on a metal pivot.

534

00:26:44,000 --> 00:26:47,000

And the bird isn't heavy enough,

535

00:26:47,000 --> 00:26:50,000

and it's not landing with enough force to cause it to move.

536

00:26:50,000 --> 00:26:54,000

In other words, it's going to take an even bigger bird to tip this car.

537

00:26:54,000 --> 00:26:57,000

And for that, it's back to the shot.

538

00:26:57,000 --> 00:26:58,000

Did you hear that?

539

00:26:58,000 --> 00:27:00,000

That's a call of the wild.

540

00:27:00,000 --> 00:27:02,000

Kakar! Kakar!

541

00:27:08,000 --> 00:27:12,000

Adam and Jamie's wrecking balls are ready.

542

00:27:12,000 --> 00:27:14,000

Let's move them out.

543

00:27:14,000 --> 00:27:15,000

Alright.

544

00:27:15,000 --> 00:27:20,000

Now they just need to be strung up into the world's largest Newton's cradle.

545

00:27:20,000 --> 00:27:22,000

This is our location.

546

00:27:22,000 --> 00:27:24,000

It's a dry dock in Vallejo, California,

547

00:27:24,000 --> 00:27:27,000

and we've used it a number of times before for experiments.

548

00:27:27,000 --> 00:27:29,000

Check this out.

549

00:27:33,000 --> 00:27:35,000

I don't mind saying I'm hyperventilating.

550

00:27:35,000 --> 00:27:37,000

So why this location?

551

00:27:37,000 --> 00:27:40,000

Well, for the wrecking ball scale version of the Newton's cradle,

552

00:27:40,000 --> 00:27:43,000

we need to be able to suspend the balls at quite a height.

553

00:27:43,000 --> 00:27:46,000

Now we could do it on top of a large building,

554

00:27:46,000 --> 00:27:51,000

or we could do it by suspending them over a big hole, like this one.

555

00:27:51,000 --> 00:27:56,000

As well as the big hole, the dry dock also comes complete with its own cranes.

556

00:27:56,000 --> 00:28:01,000

But unlike the video, the guys won't be swinging their balls from them.

557

00:28:01,000 --> 00:28:04,000

Now in the clip, our wrecking ball Newton cradle is actually suspended

558

00:28:04,000 --> 00:28:08,000

from five adjacent tower cranes next to each other.

559

00:28:08,000 --> 00:28:10,000

There's two problems with this picture.

560

00:28:10,000 --> 00:28:14,000

One is they don't use tower cranes to swing wrecking balls.

561

00:28:14,000 --> 00:28:18,000

And two, we were never ever going to find five tower cranes that we could park

562

00:28:18,000 --> 00:28:20,000

right next to each other.

563

00:28:20,000 --> 00:28:23,000

So this I-beam and four others quite similar to it

564

00:28:23,000 --> 00:28:26,000

are going to be a figure eight structure which we are going to hang our wrecking ball

565

00:28:26,000 --> 00:28:28,000

in the cradle from.

566

00:28:28,000 --> 00:28:30,000

This is about to weld it in place.

567

00:28:32,000 --> 00:28:33,000

That's it.

568

00:28:33,000 --> 00:28:34,000

That was fast.

569

00:28:34,000 --> 00:28:35,000

Let's get it in the air.

570

00:28:35,000 --> 00:28:36,000

Yeah.

571

00:28:36,000 --> 00:28:39,000

With the frame secured so that it juts out over the dry dock,

572

00:28:39,000 --> 00:28:43,000

the guys then need to attach their wrecking balls to it.

573

00:28:43,000 --> 00:28:45,000

I'm going to go over here.

574

00:28:45,000 --> 00:28:49,000

Which given their combined weight of over five tons,

575

00:28:49,000 --> 00:28:50,000

Aren't they pretty?

576

00:28:50,000 --> 00:28:54,000

is something which is easier said than done.

577

00:28:54,000 --> 00:28:56,000

Given that each of these balls weighs about a ton,

578

00:28:56,000 --> 00:28:59,000

it's going to be quite a process to hoist them and maneuver them into place.

579

00:28:59,000 --> 00:29:02,000

So I'm going to be on the ground with the forklift

580

00:29:02,000 --> 00:29:06,000

and I'm carefully going to cradle them and pick them up and put them in place.

581

00:29:06,000 --> 00:29:07,000

Okay.

582

00:29:08,000 --> 00:29:09,000

How's the look up there?

583

00:29:09,000 --> 00:29:11,000

Looks beautiful.

584

00:29:11,000 --> 00:29:13,000

While Adam is overhead on a boom lift,

585

00:29:13,000 --> 00:29:15,000

arranging the slings and the cables,

586

00:29:15,000 --> 00:29:19,000

and we'll carefully scooch them all in so they precisely fit

587

00:29:19,000 --> 00:29:23,000

because if this thing's going to work, that's the way it's going to have to be.

588

00:29:23,000 --> 00:29:24,000

I think it's good.

589

00:29:24,000 --> 00:29:26,000

It looks perfect.

590

00:29:26,000 --> 00:29:30,000

And once that's sorted, the guys get on with the finishing touches.

591

00:29:30,000 --> 00:29:32,000

Does that add something to them?

592

00:29:32,000 --> 00:29:33,000

Totally.

593

00:29:33,000 --> 00:29:35,000

Yeah, it makes them pop a little bit, huh?

594

00:29:35,000 --> 00:29:39,000

But some viewers may be wondering why there's not two strings attached.

595

00:29:39,000 --> 00:29:41,000

Why oh why you might be asking,

596

00:29:41,000 --> 00:29:44,000

are we hanging these wrecking balls from single cables

597

00:29:44,000 --> 00:29:47,000

when every Newton cradle we've thus far built in this episode

598

00:29:47,000 --> 00:29:50,000

hangs from two cables in a V-formation?

599

00:29:50,000 --> 00:29:54,000

That's because this is the arrangement that we see in the clip.

600

00:29:54,000 --> 00:29:57,000

We're testing the circumstances of the clip first,

601

00:29:57,000 --> 00:30:01,000

and only if that doesn't work do we go to two cables.

602

00:30:01,000 --> 00:30:05,000

With the string theory sorted, everything's finally ready for a test.

603

00:30:07,000 --> 00:30:09,000

All right, you ready?

604

00:30:09,000 --> 00:30:11,000

I've been waiting for this, you know.

605

00:30:11,000 --> 00:30:12,000

I know me too.

606

00:30:12,000 --> 00:30:14,000

The world's largest Newton cradle.

607

00:30:14,000 --> 00:30:16,000

Test number one and three.

608

00:30:16,000 --> 00:30:17,000

Two.

609

00:30:17,000 --> 00:30:18,000

One.

610

00:30:20,000 --> 00:30:21,000

Oh.

611

00:30:21,000 --> 00:30:22,000

Oh.

612

00:30:22,000 --> 00:30:23,000

Oh.

613

00:30:23,000 --> 00:30:24,000

Oh.

614

00:30:24,000 --> 00:30:25,000

Uh-oh.

615

00:30:25,000 --> 00:30:26,000

Uh-oh.

616

00:30:26,000 --> 00:30:28,000

We had a little rig settling there.

617

00:30:28,000 --> 00:30:30,000

Yeah, it wasn't very exciting, though.

618

00:30:30,000 --> 00:30:32,000

No, it wasn't.

619

00:30:32,000 --> 00:30:33,000

It was one hit.

620

00:30:33,000 --> 00:30:35,000

A one hit wonder.

621

00:30:35,000 --> 00:30:38,000

A one hit wonder indeed.

622

00:30:38,000 --> 00:30:40,000

And not a good one at that.

623

00:30:40,000 --> 00:30:42,000

But all is not lost.

624

00:30:42,000 --> 00:30:45,000

I don't need this high speed camera to tell me that that one was,

625

00:30:45,000 --> 00:30:47,000

shall we say lackluster?

626

00:30:47,000 --> 00:30:48,000

Where did the energy go?

627

00:30:48,000 --> 00:30:51,000

The middle of every one of these balls was a big hardened steel plate.

628

00:30:51,000 --> 00:30:54,000

Well, some of the energy was absorbed by the balls,

629

00:30:54,000 --> 00:30:58,000

but some of it was absorbed by our framework actually moving.

630

00:30:58,000 --> 00:31:00,000

The amount of force from ball one hitting ball two

631

00:31:00,000 --> 00:31:03,000

moved our entire multi-thousand pound framework.

632

00:31:03,000 --> 00:31:06,000

So we've secured it, and we're going to go again.

633

00:31:06,000 --> 00:31:09,000

With the framework secured to within an inch of its life,

634

00:31:09,000 --> 00:31:13,000

it's onwards and upwards, because this time,

635

00:31:13,000 --> 00:31:14,000

I think that's good.

636

00:31:14,000 --> 00:31:17,000

they're pulling ball one back as high as it will go

637

00:31:17,000 --> 00:31:20,000

to try to maximize the energy of the swing.

638

00:31:21,000 --> 00:31:28,000

Single string, maximum pullback in three, two, one.

639

00:31:36,000 --> 00:31:37,000

That was a hell of a hit.

640

00:31:37,000 --> 00:31:42,000

That was a hell of a hit and a very sad, sad story.

641

00:31:42,000 --> 00:31:46,000

They're all just sort of swinging together.

642

00:31:46,000 --> 00:31:48,000

That's kind of a let down.

643

00:31:48,000 --> 00:31:49,000

That is a real let down.

644

00:31:49,000 --> 00:31:52,000

Yep, despite ball one hitting ball two

645

00:31:52,000 --> 00:31:56,000

with an impact in excess of 150,000 psi,

646

00:31:56,000 --> 00:32:00,000

there's still no catching to the swing.

647

00:32:02,000 --> 00:32:03,000

Hear that?

648

00:32:05,000 --> 00:32:07,000

Hot is the sound of failure.

649

00:32:10,000 --> 00:32:11,000

This thing is so awesome.

650

00:32:11,000 --> 00:32:13,000

I wish you could see it.

651

00:32:13,000 --> 00:32:18,000

Unfortunately, all we've got to show for it is some swinging shiny balls.

652

00:32:18,000 --> 00:32:22,000

They're not ticking like the Newton cradle of our dreams.

653

00:32:22,000 --> 00:32:23,000

Sorry.

654

00:32:23,000 --> 00:32:25,000

No need to be sorry, Adam,

655

00:32:25,000 --> 00:32:29,000

because this myth's grand finale is still to come.

656

00:32:36,000 --> 00:32:41,000

A pigeon cannot cause a precariously balanced car to tip over the edge,

657

00:32:41,000 --> 00:32:44,000

but could a much, much bigger bird.

658

00:32:45,000 --> 00:32:48,000

All right, despite what they say about working with animals,

659

00:32:48,000 --> 00:32:50,000

those birds are really cooperative.

660

00:32:50,000 --> 00:32:53,000

But since we don't have access to any bigger flying birds,

661

00:32:53,000 --> 00:32:55,000

I think we need to come up with another plan.

662

00:32:55,000 --> 00:32:58,000

Yeah, and it's starting to get a little dangerous for these birds.

663

00:32:58,000 --> 00:33:00,000

What if we went with a model helicopter?

664

00:33:00,000 --> 00:33:03,000

We get one that's the same weight as the biggest flying bird

665

00:33:03,000 --> 00:33:05,000

and have it land on the front of the car.

666

00:33:05,000 --> 00:33:06,000

That's a great idea.

667

00:33:06,000 --> 00:33:08,000

Not only can we match the mass of the bird,

668

00:33:08,000 --> 00:33:10,000

but we also get the down force from the rotors,

669

00:33:10,000 --> 00:33:12,000

just like the bird flapping its wings.

670

00:33:12,000 --> 00:33:13,000

Awesome.

671

00:33:14,000 --> 00:33:16,000

Weighing over 20 pounds,

672

00:33:16,000 --> 00:33:19,000

the California Condor is majestic.

673

00:33:19,000 --> 00:33:23,000

A far cry from the Mythbusters helicopter standing.

674

00:33:23,000 --> 00:33:27,000

But while it won't win any prizes for elegance,

675

00:33:27,000 --> 00:33:32,000

what's key is that the Condor Copter weighs the same as the real deal.

676

00:33:32,000 --> 00:33:35,000

So I've slightly altered an RC helicopter

677

00:33:35,000 --> 00:33:39,000

to emulate the heaviest flying bird in North America.

678

00:33:39,000 --> 00:33:41,000

It should not only be the same weight,

679

00:33:41,000 --> 00:33:43,000

but also it should represent its flight path.

680

00:33:43,000 --> 00:33:45,000

When it lands on top of the car.

681

00:33:45,000 --> 00:33:49,000

And that flight path is something that's been studied by Grant.

682

00:33:49,000 --> 00:33:52,000

Now I found something very interesting about the way large birds land.

683

00:33:52,000 --> 00:33:55,000

Check out this video of our giant owl.

684

00:33:55,000 --> 00:33:58,000

See how he swoops down right before he lands?

685

00:33:58,000 --> 00:34:01,000

He rears up and then lands very softly.

686

00:34:01,000 --> 00:34:03,000

He's minimizing his landing speed,

687

00:34:03,000 --> 00:34:06,000

minimizing that momentum that he imparts on the target zone.

688

00:34:06,000 --> 00:34:10,000

And that's exactly what we're going to want our helicopter to do on the hood of the car.

689

00:34:11,000 --> 00:34:13,000

Well, with the boys all buckled up.

690

00:34:13,000 --> 00:34:15,000

Alright, time to go to work.

691

00:34:15,000 --> 00:34:18,000

An expert pilot wolf went chomping at the bit.

692

00:34:20,000 --> 00:34:23,000

It's time for this myth to lift off.

693

00:34:25,000 --> 00:34:27,000

That bird is just trying to psych us out.

694

00:34:27,000 --> 00:34:29,000

I know! I know! Here it comes!

695

00:34:30,000 --> 00:34:33,000

The very precise landing route that the hell he must adhere to

696

00:34:33,000 --> 00:34:36,000

is making life very difficult for pilot wolf.

697

00:34:37,000 --> 00:34:40,000

Get away! There's a condor.

698

00:34:40,000 --> 00:34:44,000

And when the wind kicks out, things get harder still.

699

00:34:48,000 --> 00:34:50,000

Oh, he's playing games with us.

700

00:34:50,000 --> 00:34:52,000

But eventually...

701

00:34:54,000 --> 00:34:56,000

Eagle has landed.

702

00:34:56,000 --> 00:34:59,000

He did it! He did it! We didn't go over!

703

00:34:59,000 --> 00:35:02,000

Woo! We survived!

704

00:35:02,000 --> 00:35:04,000

Still there!

705

00:35:04,000 --> 00:35:06,000

20 pounds just like the condor.

706

00:35:06,000 --> 00:35:10,000

The biggest flying bird in North America still didn't tip the car.

707

00:35:13,000 --> 00:35:15,000

So to get that elusive drop off,

708

00:35:15,000 --> 00:35:19,000

the team's finishing up with some poultry in motion.

709

00:35:19,000 --> 00:35:23,000

You want to see bird-wise what it takes to get that car to tip off the cliff.

710

00:35:23,000 --> 00:35:27,000

So, I spent all morning training 80 of my best hens

711

00:35:27,000 --> 00:35:29,000

to land gently on the hood of that car.

712

00:35:29,000 --> 00:35:31,000

They're going to single file line up at the front

713

00:35:31,000 --> 00:35:34,000

and work their way back until it finally goes off.

714

00:35:35,000 --> 00:35:37,000

Okay, you guys ready?

715

00:35:37,000 --> 00:35:38,000

We're ready.

716

00:35:38,000 --> 00:35:39,000

No laughing.

717

00:35:39,000 --> 00:35:42,000

Each hand weighs a pound and a half.

718

00:35:42,000 --> 00:35:46,000

They just sit and play dead. It's incredible.

719

00:35:46,000 --> 00:35:49,000

So by keeping tally of the number on the hood...

720

00:35:49,000 --> 00:35:51,000

How many you got on there?

721

00:35:51,000 --> 00:35:52,000

Five.

722

00:35:52,000 --> 00:35:54,000

Oh! Bird down!

723

00:35:54,000 --> 00:35:57,000

The guys will know how much weight it would take.

724

00:35:57,000 --> 00:35:58,000

Twenty-two.

725

00:35:58,000 --> 00:36:00,000

I'm starting to get a little nervous.

726

00:36:00,000 --> 00:36:02,000

To unbalance the car.

727

00:36:02,000 --> 00:36:04,000

Sixty.

728

00:36:04,000 --> 00:36:07,000

You believe this? Sixty game hens.

729

00:36:07,000 --> 00:36:09,000

That's 90 pounds, man.

730

00:36:09,000 --> 00:36:13,000

90 pounds and still we are hanging on to the cliff.

731

00:36:13,000 --> 00:36:16,000

Yet incredibly, even with all 80 hens on there...

732

00:36:16,000 --> 00:36:20,000

That's like a small person standing on the hood.

733

00:36:20,000 --> 00:36:22,000

The car still doesn't go.

734

00:36:22,000 --> 00:36:24,000

I know this is getting stupid.

735

00:36:24,000 --> 00:36:25,000

That's totally stupid.

736

00:36:25,000 --> 00:36:28,000

But Tori came prepared for this eventuality.

737

00:36:29,000 --> 00:36:31,000

I don't like it! I don't like it!

738

00:36:31,000 --> 00:36:33,000

Oh my God! That's crazy!

739

00:36:33,000 --> 00:36:37,000

And brought a 20 pound robotic turkey,

740

00:36:37,000 --> 00:36:40,000

which dances and jigs until...

741

00:36:40,000 --> 00:36:41,000

Oh!

742

00:36:41,000 --> 00:36:42,000

Oh!

743

00:36:42,000 --> 00:36:43,000

Oh!

744

00:36:43,000 --> 00:36:44,000

Oh!

745

00:36:44,000 --> 00:36:45,000

Oh!

746

00:36:45,000 --> 00:36:46,000

Oh!

747

00:36:46,000 --> 00:36:47,000

Oh!

748

00:36:47,000 --> 00:36:48,000

Oh!

749

00:36:48,000 --> 00:36:49,000

Oh!

750

00:36:49,000 --> 00:36:50,000

Oh!

751

00:36:50,000 --> 00:36:51,000

Oh!

752

00:36:51,000 --> 00:36:52,000

Oh!

753

00:36:52,000 --> 00:36:53,000

Oh!

754

00:36:53,000 --> 00:36:54,000

Oh!

755

00:36:54,000 --> 00:36:55,000

Oh my God!

756

00:36:55,000 --> 00:36:56,000

That was crazy!

757

00:36:56,000 --> 00:37:00,000

I wish you could see the trail of bird destruction behind you.

758

00:37:00,000 --> 00:37:02,000

You have to make that stop.

759

00:37:02,000 --> 00:37:03,000

It's so creepy!

760

00:37:04,000 --> 00:37:06,000

Alright, it is not looking good for this myth.

761

00:37:06,000 --> 00:37:09,000

I know that movie version where a tiny little bird just kind of

762

00:37:09,000 --> 00:37:11,000

lands at the end and the whole thing goes.

763

00:37:11,000 --> 00:37:13,000

Looking a little busted to me.

764

00:37:13,000 --> 00:37:17,000

The good news is we got birds to get the car to go off the cliff.

765

00:37:17,000 --> 00:37:22,000

The bad news is it took over 80 birds, 140 pounds to be exact.

766

00:37:23,000 --> 00:37:26,000

I'm the only way that would happen is if a pterodactyl were to land

767

00:37:26,000 --> 00:37:28,000

on the front of your car.

768

00:37:28,000 --> 00:37:30,000

And we all know that that's not going to happen.

769

00:37:30,000 --> 00:37:33,000

And what that means is this myth is busted.

770

00:37:36,000 --> 00:37:38,000

At least now we know why the chicken crossed the road

771

00:37:38,000 --> 00:37:41,000

to get out of the way of the falling car.

772

00:37:44,000 --> 00:37:48,000

The Mythbusters giant Newton's cradle started with a song.

773

00:37:48,000 --> 00:37:51,000

Five Ho-Man wrecking balls, one huge steel frame,

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00:37:51,000 --> 00:37:56,000

huge empty dry dock, and a wrecking ball Newton cradle.

775

00:37:57,000 --> 00:37:59,000

But ended with a dog.

776

00:38:01,000 --> 00:38:03,000

That was a hell of a hit.

777

00:38:03,000 --> 00:38:05,000

And a very sad, sad story.

778

00:38:05,000 --> 00:38:08,000

But there may be light at the end of the tunnel.

779

00:38:10,000 --> 00:38:11,000

So check this out.

780

00:38:11,000 --> 00:38:15,000

Even though this is hard and steel, the areas where the balls are impacting

781

00:38:15,000 --> 00:38:17,000

have become flattened from the impacts.

782

00:38:17,000 --> 00:38:20,000

And it's not just here, it's throughout all of the balls.

783

00:38:20,000 --> 00:38:24,000

Which means that they're all kind of squashing like hamburger patties.

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00:38:24,000 --> 00:38:29,000

The amount of force here is something on the order of 500,000 times

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00:38:29,000 --> 00:38:33,000

as much as what's happening with those little balls on the desktop toy.

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00:38:33,000 --> 00:38:36,000

So clearly lack of energy is not our problem.

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00:38:36,000 --> 00:38:39,000

Which means the problem may be the single cable system

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00:38:39,000 --> 00:38:42,000

causing the balls to lose focus.

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00:38:43,000 --> 00:38:45,000

That's kind of a let down.

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00:38:45,000 --> 00:38:50,000

So having restrung the balls with an extra cable, things are looking up.

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00:38:51,000 --> 00:38:56,000

So with some preliminary playing with the five wrecking balls on the two lines

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00:38:56,000 --> 00:39:00,000

Jimmy and I are actually seeing somewhat of a radical improvement in their behavior.

793

00:39:02,000 --> 00:39:03,000

That's a little more positive.

794

00:39:03,000 --> 00:39:06,000

We're actually not just seeing a tick and then a boom.

795

00:39:06,000 --> 00:39:08,000

We're actually seeing a tick and tick.

796

00:39:08,000 --> 00:39:12,000

Which is, it makes me cautiously optimistic about this next test.

797

00:39:13,000 --> 00:39:16,000

So why would two strings per ball work better than a single string?

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00:39:16,000 --> 00:39:20,000

Well the Newton's cradle is all about efficient energy transfer.

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00:39:20,000 --> 00:39:25,000

So if any one of these balls is a little out of line, that's going to mess up the efficiency.

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00:39:25,000 --> 00:39:29,000

The two strings will help keep these all lined up perfectly

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00:39:29,000 --> 00:39:33,000

and hopefully that'll improve what we're seeing from this device.

802

00:39:33,000 --> 00:39:36,000

Well there's only one way to find out.

803

00:39:36,000 --> 00:39:41,000

Wrecking ball size Newton cradle, the formation, cabling and three.

804

00:39:42,000 --> 00:39:45,000

Two, one, go baby!

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00:39:46,000 --> 00:39:50,000

Yes, one, two.

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00:39:52,000 --> 00:39:55,000

Three, four.

807

00:39:56,000 --> 00:40:01,000

It's another disappointing result, but at least there was some improvement.

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00:40:01,000 --> 00:40:03,000

That was a little bit better.

809

00:40:03,000 --> 00:40:07,000

While our single string gave us a 30% throw out on ball five,

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00:40:07,000 --> 00:40:11,000

our double string version gave us a 45% throw out on the same ball.

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00:40:11,000 --> 00:40:16,000

Now that's nowhere near the desktop version which gave us 98%

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00:40:16,000 --> 00:40:18,000

and it's nothing like the clip.

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00:40:18,000 --> 00:40:23,000

But before this ball's up gets concluded, there's one last thing to try.

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00:40:23,000 --> 00:40:26,000

Ball one pulled back to the max.

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00:40:26,000 --> 00:40:29,000

Two strings, max pullback.

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00:40:29,000 --> 00:40:33,000

And three, two, one.

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00:40:33,000 --> 00:40:37,000

It really is now or never and...

818

00:40:41,000 --> 00:40:42,000

It's never.

819

00:40:42,000 --> 00:40:44,000

That went quite a ways.

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00:40:44,000 --> 00:40:47,000

And now it's all done.

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00:40:47,000 --> 00:40:50,000

So cue one of the Mythbusters models.

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00:40:50,000 --> 00:40:53,000

Failure is always an option.

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00:40:53,000 --> 00:40:55,000

There goes one of our cameras.

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00:40:55,000 --> 00:41:00,000

As far as we're aware, this is the largest Newton's cradle that's ever been built.

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00:41:00,000 --> 00:41:06,000

And it is a Newton's cradle because it's demonstrating exactly the same physical properties

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00:41:06,000 --> 00:41:08,000

that the small one does.

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00:41:08,000 --> 00:41:12,000

But as we get larger and larger, it becomes harder and harder to reign in

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00:41:12,000 --> 00:41:18,000

the physical losses of energy in the system from the balls to the cables to the overhead structure.

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00:41:18,000 --> 00:41:24,000

While it is a Newton's cradle, it's just never going to be as perfect as the little ones are.

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00:41:24,000 --> 00:41:26,000

So where do we stand?

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00:41:26,000 --> 00:41:29,000

We set out to replicate what we saw in that clip

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00:41:29,000 --> 00:41:33,000

and nobody can say that we didn't give a wrecking ball-sized Newton cradle

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00:41:33,000 --> 00:41:36,000

the best possible chance of succeeding.

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00:41:36,000 --> 00:41:38,000

But it didn't look anything like the clip.

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00:41:38,000 --> 00:41:41,000

Now, this one is totally busted.

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00:41:41,000 --> 00:41:43,000

Yeah, it's busted.

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00:41:43,000 --> 00:41:48,000

And it's busted not just because their best case scenario balls failed to fire,

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00:41:48,000 --> 00:41:53,000

but also because the viral video was nothing but CGI.

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00:41:53,000 --> 00:41:55,000

Hey, you know, we ought to start our own demolition company.

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00:41:55,000 --> 00:41:57,000

We got wrecking balls, we got explosives.

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00:41:57,000 --> 00:41:58,000

Absolutely.

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00:41:58,000 --> 00:41:59,000

Whatever you want.