Shot Peening Techniques 1994048

Double Peening - U.S. Patent 3,073,022

The following peening treatments were disclosed in U.S. Patent 3,073,022, issued on January 15, 1963 and assigned to the General Motors Corporation.

This patent relates to first shot peening in a conventional manner and then applying a second treatment which differs from the first operation.

When the second treatment is of lower intensity or is accomplished with a smaller size shot than used in the initial treatment, material benefits can be obtained.

Further, when both a lower intensity and a smaller shot size are used in the secondary treatment than was used in the first, unexpected substantial increases in fatigue life of the part are obtained.

These benefits, as disclosed, were primarily related to work done on SAE 5160 flat spring steel which was hardened and tempered to Rockwell "C" 48 hardness.

The optimum intensity (Almen strip reading) and shot size for each treatment is dependent upon the nature of the part being peened.

The degree of curvature or intensity measured on an "Almen" strip depends upon the properties of the blast, e.g. velocity, size, shape, density, kind of part material, part hardness, and hardness of the shot.

Additionally, the curvature (of the Almen strip) depends upon the properties of exposure to the blast, e.g. length of time, angle of impact and shot flow rate.

They found that the shot size and intensity of the secondary treatment is preferably 1/3 to 1/5 of these two elements used for the initial treatment.

It was also found that an increase in fatigue can be obtained by grit blasting the surface of a previously shot peened metal part. However, this increase in fatigue life was not as pronounced as that obtained by using steel shot in the secondary treatment.

Their grit blast work was done at about 70 to 80 P.S.I., direct pressure, using grit sizes from G-200 to G-40.

One leaf spring specimen was first peened with SAE 660 to .009 to .011 "C" strip. At 70 P.S.I. they then used G-80 grit for an exposure time of about 15 seconds which increased the fatigue life about 100%.

The leaf spring specimens used were SAE 5160 steel, 48 Rockwell "C", measuring .192" thick, 1.5" wide, and 12" long.

After each peening treatment, the specimens were fatigue tested by subjecting the shot peened side to a uniform bending tensile stress over the central 6" of length with a range of zero to 200,000 P.S.I. at the surface in each cycle.

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In general, satisfactory results were obtained when spring steel is initially shot peened with a shot size range of .023" to .066" diameter and thereafter subjected to a second treatment with a shot size range of .007" to .011" mean diameter. The intensity of the above general practice should be .016 "A" to .034 "A" down to .003 "A" to .011 "A" on the second treatment. (.001 "C" strip = .0035 "A" strip intensity).

For a complete copy of U.S. Patent 3,073,022 circle Bingo No. 26. ○

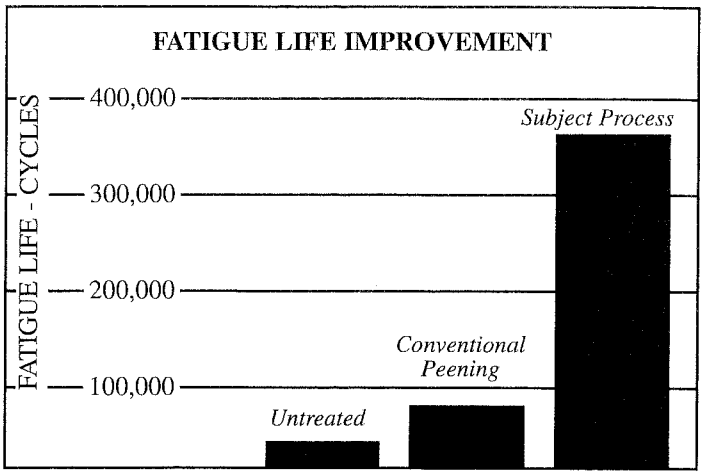

TABLE I
REDUCING INTENSITY AND SHOT SIZE

TEST GROUP	MEDIAN LIFE
Non-peened	22,720
Single peened: SAE 660 at 0.0090C	80,730
Double peened: SAE 660 at 0.0090C; SAE 70 at 0.0014C	372,000

TABLE II
REDUCING INTENSITY - SAME SHOT SIZE

TEST GROUP	MEDIAN LIFE
Single peened: SAE 660 at 0.0090C	80,730
Double peened: SAE 660 at 0.0090C; SAE 660 at 0.0016C	121,000

TABLE III
REDUCING SHOT SIZE - SAME INTENSITY

TEST GROUP	MEDIAN LIFE
Single peened: SAE 660 at 0.0073A	135,400
Double peened: SAE 660 at 0.0072A; SAE 70 at 0.0070A	149,300

Fatigue Test Results

GROUP	PRIMARY TREATMENT SAE SHOT SIZE[1]	PRIMARY TREATMENT SAE INTENSITY[2]	SECONDARY TREATMENT SAE SHOT SIZE	SECONDARY TREATMENT SAE INTENSITY	MEAN LIFE[3]
A	230	0.0046C	70	0.0014C	479,000
B	660	0.0090C	70	0.0014C	384,000
C	110	0.0029C	70	0.0014C	272,000
D	70	0.0020C	----	-----	207,000
E	110	0.0029C	----	-----	141,000
F	230	0.0046C	----	-----	115,000
G	660	0.0090C	----	-----	82,000
H	110	0.0017C	660	0.0095C	57,000
J	(4)	(4)	(4)	(4)	22,400

[1] Chilled iron shot used.
[2] Commonly designated by deflection in thousandths of an inch of a standard strip.
[3] Number of bending cycles before complete rupture.
[4] No peening.