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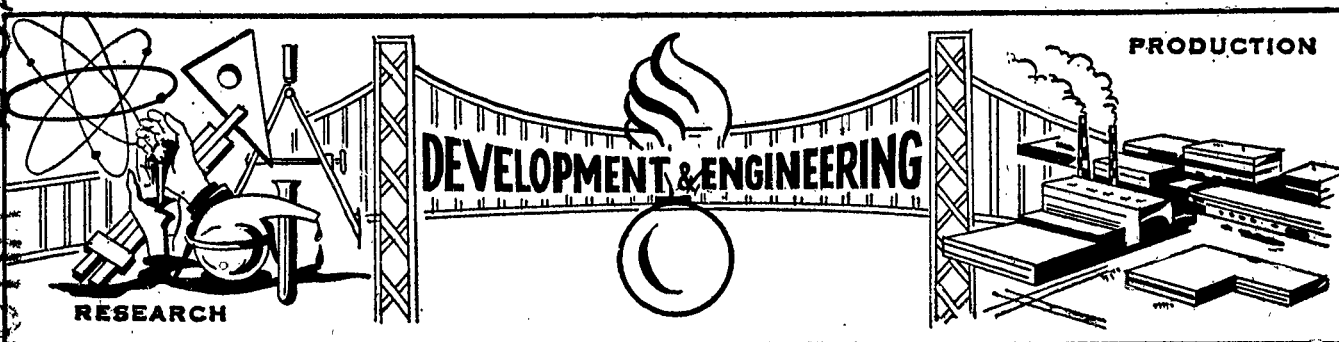
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TECHNICAL REPORT
DB-TR: 9-61

EVALUATION OF THE DEBURRING
OF
40 MM CARTRIDGE CASES
BY THE
VAPOR BLAST PROCESS

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BY
NEAL J. FRIEDMAN
HENRY C. SEAVEY

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AMMUNITION GROUP
PICATINNY ARSENAL - DOVER, NEW JERSEY

TECHNICAL REPORT
EVALUATION OF THE DEBURRING OF 40MM CARTRIDGE CASES
BY THE VAPOR BLAST PROCESS

BY
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HENRY C. SEAVEY

PROJECT NO. 9599.3800

REPORT NO. DB-TR: 9-61 701 500

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SECTION I

INTRODUCTION

The purpose of this investigation was to examine the factors involved in determining an optimum vapor blast process for the deburring of the eight .070 diameter vent-holes in the 40mm Cartridge Cases, M118.

An inherent problem in the production of 40mm Cartridge Cases is the presence of burrs in the vent-holes of the powder chamber. The erratic velocities caused by these burrs produces a variability of performance which is unacceptable. A process to remove these burrs without enlarging the holes or changing the dimensions of the chamber was required.

A solution to this burr problem is a machine built by the Vapor-Blast Manufacturing Company of Milwaukee (for the Amron Corporation of Waukesha, Wisconsin) that removes the burr satisfactorily. A purchase order was issued by Picatinny Arsenal to the Vapor-Blast Manufacturing Company to determine the variables involved in removing the burrs. These tests were conducted on a special experimental test set-up at the Vapor-Blast Manufacturing Company.

SECTION II

SUMMARY

Five hundred and sixty 40mm Cartridge Cases were subjected to a "Vapor-Blast Process" for the purpose of removing the burrs that remain in the vent-holes of these cases. Initially, a representative sample of cartridge cases from two lots -- 1-5 and 1-10 -- were inspected at Picatinny Arsenal to determine the extent of the burr. Two hundred and eighty cartridge cases from each lot were then shipped to the Vapor-Blast Manufacturing Company for processing. A quantitative examination of the burrs was conducted with the aid of a bore scope before and after the deburring process. In addition, the chamber and vent-holes were gaged when these cases were returned to Picatinny Arsenal to determine whether these dimensions were enlarged by the process. The amount of burr removed by "Vaporblasting" depends primarily on four factors:

1. The abrasive used
2. Time of blast
3. Percentage of abrasive by volume
4. The type of burr

These physical specifications remained constant for all the tests conducted during this study:

<u>Pressure P. S. I.</u>		<u>Nozzle Diameter</u>	<u>Air Jet Diameter</u>
<u>Air</u>	<u>Abrasive</u>	<u>Inch</u>	<u>Inch</u>
100	85	1/2	3/16

SECTION III

CONCLUSIONS

1. The Vapor-Blast Process satisfactorily removes light or feathery burrs in the vent-holes of 40mm Cartridge Cases.
2. In many of the cartridge cases, one or more vent-holes had enough heavy metal blockage to cause unacceptable enlargement of the remaining vent holes. Such heavy blockage seldom occurs in current cartridge case production when the powder chamber boring tool is kept sharp.
3. In nearly every case, the vent-holes were enlarged by about .001 inch. Other dimensions and features were materially unaffected.
4. Some Vapor -Blast combinations are more suitable than others. The best appears to be seven percent 100 QVB abrasive at 30 seconds. Others are (in order of decreased effectiveness): ten percent 220 AVB at 15 seconds and seven percent 140 QVB at 20 seconds. Amron Corporation successfully uses seven percent 140 QVB at 25 seconds.

SECTION IV
RECOMMENDATION

None.

SECTION V
STUDY

The conclusions of this 40mm cartridge case study are based on the tabulations of tests conducted at the Vapor-Blast Corporation that are listed on subsequent pages.

TABLE A
SUMMARY OF TESTS RUN ON LABORATORY SETUP:
FOR LOT 1-10 CARTRIDGE CASES

<u>Piece Number</u>	<u>Type of Abrasive*</u>	<u>% Abrasive by Volume</u>	<u>Time Per Piece, Sec.</u>	<u>Resultant % Clean Holes</u>
1-20	140 QVB	7	20	83
21-30	140 QVB	7	33	82
31-50	140 QVB	14	30	67
51-70	140 QVB	7	30	67
71-90	140 QVB	14	25	80
91-100	140 QVB	14	20	87
101-120	140 QVB	21	15	81
121-140	220 AVB	5	15	80
141-160	220 AVB	5	20	79
161-180	220 AVB	10	15	85
181-202	100 QVB	7	30	91
203-224	100 QVB	7	20	92
225-246	100 QVB	14	15	77
247-257	100 QVB	14	20	73
258-267	100 QVB	21	10	76

Samples run on
machine designed
for the Amron
Corporation

140 QVB	7	30	76
---------	---	----	----

12 Pieces marked
"V" on base of
Cartridge Case

*"QVB" indicates Quartz Abrasive, Vapor-Blast Process
"AVB" indicates Aluminum Oxide Abrasive, Vapor-Blast Process.

TABLE B
SUMMARY OF TESTS RUN ON LABORATORY SETUP
FOR LOT 1-5 CARTRIDGE CASES

<u>Piece Number</u>	<u>Type of Abrasive*</u>	<u>% Abrasive by Volume</u>	<u>Time Per Piece, Sec.</u>	<u>Resultant % Clean Holes</u>
1-20	140 QVB	7	20	95
21-40	140 QVB	21	33	92
41-60	140 QVB	14	30	95
61-80	140 QVB	7	30	78
81-100	140 QVB	14	25	97
101-120	140 QVB	14	20	89
121-130	140 QVB	21	15	93
131-150	220 AVB	5	15	93
151-170	220 AVB	5	20	91
171-190	220 AVB	10	15	99
191-212	100 QVB	7	30	97
213-234	100 QVB	7	20	86
235-257	100 QVB	14	15	98
V1.1-V1.8	140 QVB	7	30	64
V2.1-V2.14	140 QVB	7	25	70

*"QVB" indicates Quartz Abrasive, Vapor-Blast Process.

"AVB" indicates Aluminum Oxide Abrasive, Vapor-Blast Process.

VENT HOLE EXAMINATION - TREATED CASES

SPOT CHECK FOR LOT 1-10 CASES*

Case No.	% Abrasive	Type	Sec.	Condition After Treatment		Vent Hole Characteristics*
				Appearance		
3	7	140 QVB	20	Extruded Metal-2 holes		Clear holes average .001 over maximum
5	7	140 QVB	20	Clean		3 holes .002 over maximum
24	7	140 QVB	33	1 heavy burr, 1 extruded burr		Clear holes average .002 over maximum
27	7	140 QVB	33	Clean		1 hole OK. 7 holes avg .001 over maximum
31	14	140 QVB	30	Clean		6 holes over max approx .002 Inch
43	14	140 QVB	30	Heavy burr - 3 holes		4 holes over max approx .001 Inch
53	7	140 QVB	30	Burrs - 4 holes		5 holes over max approx .002 Inch
75	14	140 QVB	25	Heavy burr - 1 hole		7 holes over max .001 to .003 Inch
97	14	140 AVB	20	Burrs - 2 holes		5 holes .001 over maximum
105	21	140 QVB	15	Burr - 2 holes		7 holes over max less than .001
112	21	140 QVB	15	Clean		5 holes .001 over maximum
131	5	220 AVB	15	Clean		7 holes avg .002 over maximum
137	5	220 AVB	15	Heavy burr - 1 hole		2 holes .003 under min 3 holes .0005 over max

*Powder chamber dimensions remained within tolerance.

*Holes reported as "undersize" are not out of tolerance in drilled diameter but, rather, they have burrs or chips which effect an apparently smaller diameter.

VENT HOLES EXAMINATION - TREATED CASES

SPOT CHECK FOR LOT 1-10 CASES+

Case No.	% Abrasive	Type	Sec.	Condition After Treatment	
				Appearance	Vent Hole Characteristics*
152	5	220 AVB	20	Clean	7 holes average .001 over maximum
155	5	220 AVB	20	Heavy Chips - 3 holes	7 holes undersize .001 to .005 Inch
171	10	220 AVB	15	Heavy chip - 4 holes	7 holes average .002 over maximum
164	10	220 AVB	15	Clean	7 holes .0005 over maximum
183	7	100 QVB	30	Clean	All holes oversize .003 to .006 Inch
187	7	100 QVB	30	Heavy Extrusion - 2 holes	5 holes .004 to .006 over maximum
207	7	100 QVR	20	Clean	All holes oversize .001 average
210	7	100 QVB	20	Extruded Metal - 2 holes	6 holes oversize .001 average
226	14	100 QVB	15	Clean	5 holes .001 oversize
228	14	100 QVB	15	Heavy burr - 2 holes	5 holes oversize .001 average
249	14	100 QVB	20	Heavy chips - 2 holes	4 holes oversize .001 average
250	14	100 QVB	20	Extrusion - 1 hole	5 holes oversize .001 average
259	21	100 QVR	10	Clean	6 holes oversize .001 average
265	21	100 QVR	10	Burrs - 2 holes	4 holes oversize .001 average
V4	7	140 QVB	30	Clean	4 holes undersize .001 to .004
V7	7	140 QVB	30	Distortion & burr - 7 holes	5 holes .001 to .005 under minimum

+Powder chamber dimensions remained within tolerance.

*Holes reported as "undersize" are not out of tolerance in drilled diameter but, rather, they have burrs or chips which effect an apparently smaller diameter.

VENT HOLE EXAMINATION - TREATED CASES

SPOT CHECK FOR LOT 1-5 CASES*

Case No.	% Abrasive	Type	Sec.	Appearance	Condition After Treatment	
					Vent Hole	Characteristics*
4	7	140 QVB	20	Clean	OK	
7	7	140 QVB	20	Fringe burrs	OK	
21	21	140 QVR	33	Clean		All holes oversize .001 to .003
24	21	140 QVE	33	Extrusions - 5 holes		All holes oversize .001 to .003
43	14	140 QVB	30	Clean		1 hole .001 undersize
46	14	140 QVB	30	Extruded metal - 4 holes		4 holes out of tolerance
63	7	140 QVB	30	Clean		4 holes undersize
67	7	140 QVB	30	Burrs - All holes		1 hole .004 oversize. Others .005 under-size
83	14	140 QVB	25	Clean		1 hole .001 oversize
96	14	140 QVB	25	Smeared metal - some holes		2 holes undersize .001 and .003
104	14	140 QVB	20	Clean		1 hole undersize. 1 hole oversize .001
107	14	140 QVB	20	Burrs - Three holes		3 holes undersize .002 to .004
121	21	140 QVB	15	Extruded metal - 5 holes		7 holes .005 or more undersize
123	21	140 QVB	15	Clean		1 hole .001 undersize
131	5	220 AVB	15	Clean		2 holes approximately .0005 oversize
150	5	220 AVB	15	Extruded Metal - 4 holes		3 holes undersize .001 to .005
152	5	220 AVB	20	Clean	OK	
154	5	220 AVB	20	Burrs and extrusions all holes		All holes .005 undersize
171	10	220 AVB	15	Clean		1 hole .001 undersize
181	10	220 AVB	15	Burr - 1 hole		2 holes .0005 oversize

*Powder chamber dimensions remained within tolerance.

*Holes reported as "undersize" are not out of tolerance in drilled diameter but, rather, they have burrs or chips which effect an apparently smaller diameter.

VENT HOLES EXAMINATION - TREATED CASES

SPOT CHECK FOR LOT 1-5 CASES*

Case No.	% Abrasive	Type	Sec.	Condition After Treatment	
				Appearance	Vent Hole Dimensional Characteristics*
191	7	100 QVB	30	Clean	All holes oversize .001 to .004
203	7	100 QVB	30	Extruded - 3 holes	4 holes undersize .005 average
213	7	100 QVB	20	Clean	5 holes approximately .001 oversize
224	7	100 QVB	20	Heavy Burrs - 3 holes	1 hole oversize 3 undersize
235	14	100 QVB	15	Clean	1 hole .001 oversize
242	14	100 QVB	15	Heavy chip - 1 hole	2 holes out of tolerance .001
V1-3	7	140 QVB	30	Clean	1 hole .001 undersize
V1-4	7	140 QVB	30	Burrs - 4 holes	4 holes .001 undersize
V2-4	7	140 QVB	25	Clean	2 holes .001 undersize
V2-5	7	140 QVB	25	Burrs - 5 holes	3 holes .001 undersize

+Powder chamber dimensions remained within tolerance.

*Holes reported as "undersize" are not out of tolerance in drilled diameter but, rather, they have burrs or chips which effect an apparently smaller diameter.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
1-20	Lot 1-10 These pieces have light burrs around holes, some are heavier burr on 1 or 2 holes.
Time Per Piece	20 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
1	Clean
2	Clean
3	Extruded metal in 2 holes
4	Extruded metal in 1 hole
5	Clean
6	Extruded metal in 2 holes
7	Clean
8	Light burr, 1 hole
9	Clean
10	Clean
11	Clean
12	Large burr - 2 holes
13	Clean
14	Extruded edge - 1 hole
15	Clean
16	Large burrs - 2 holes
17	Extruded metal - 2 holes
18	Extruded metal - 2 holes
19	Misshapen holes - Clean
20	Extruded metal

SPECIFIC COMMENTS

Piece #4 had a lot of metal left in 1 hole. A light fringe burr remained around the circumference of the holes on many of the pieces. Piece #12 had one hole badly blocked with metal after V.B. However, after examining cartridge case it was found that the inner edge at the mouth of the case was serrated, indicating it had not been clamped well before blasting. Pieces #16, 18 and 20 had bad burrs in holes - these remained after V.B.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
21-30	Lot 1-10 These cases had very heavy burrs and badly extruded holes.
Time Per Piece	33 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
21	*Slight extrusion - 4 holes
22	*
23	*Extruded metal - 1 hole
24	2 holes - badly extruded - One of these still has burr
25	*Light burr - 1 hole
26	Extruded metal - 3 holes
27	*
28	*Broken metal - 2 holes
29	*
30	Broken metal - 1 hole

*Asterisk indicates good burr removal. These pieces (21-30) better than previous pieces (1-10).

Pieces 21 and 30 were badly extruded to begin with.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
31-50	Lot 1-10 Cases with heavy burrs.
Time Per Piece	30 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
31	*
32	3 holes - Extruded metal
33	*
34	Broken metal - 3 holes
35	Broken metal - 1 hole
36	1 hole had burr
37	Light burr - 2 holes
38	1 hole was deformed, broken metal - 1 hole
39	Light burr- 1 hole
40	1 hole - extruded metal
41	2 holes - broken metal
42	*Very light fringe burrs
43	Heavy burr - 3 holes
44	Broken metal - 2 holes
45	Extruded metal - 3 holes
46	Extruded metal - 2 holes
47	Extruded metal - 1 hole
48	Extruded metal - 3 holes
49	Extruded metal - 3 holes
50	*

*Good burr removal

These 1-10 Cases were very badly burred before V.B. Burrs remained on many of the holes as indicated for the above pieces.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
51-70	Lot 1-10 Burrs on most cases, same extrusions.
Time Per Piece	30 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
51	*Very clean
52	*Light fringe burrs - 8 holes
53	Burrs - 4 holes
54	*Very clean - 2 holes deformed
55	*Very clean
56	Light fringe burr - 6 holes
57	Light fringe burr - 5 holes
58	*Very clean
59	Light burr - 1 hole
60	*Very clean - deformed holes
61	*Very clean - deformed holes
62	Light burr - 2 holes
63	Light burr - 3 holes
64	Light burr - 4 holes
65	*Very clean
66	Extruded metal - 1 hole
67	*Very clean
68	Heavy extrusion - 1 hole, deformation - 2 holes
69	Broken metal - 1 hole
70	Broken metal - 4 holes

*Good burr removal

Amron is using the same variables on their machine except the time/piece is 25 seconds.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
71-90	Lot 1-10 Most cases had burrs and/or extrusions.
Time Per Piece	25 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
71	Light burr - 1 hole
72	Broken metal - 1 hole
73	Light burr - 5 holes
74	Burr - 2 holes
75	Large burr - 1 hole
76	Light burr - 1 hole
77	Light extrusion - 3 holes
78	Light extrusion - 3 holes
79	Free of burrs
80	Free of burrs
81	Extruded metal - 3 holes
82	Free of burrs
83	Broken metal - 3 holes
84	Deformed - 2 holes
85	Free of burrs
86	Free of burrs
87	Free of burrs
88	Free of burrs
89	Small burr - 1 hole
90	Free of burrs

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
91-100	Lot 1-10
Time Per Piece	20 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
91	Small burr - 1 hole
92	Small extrusion- 1 hole
93	Clean
94	Clean, Deformation - 1 hole
95	Clean
96	Bad extrusion-1 hole
97	Burrs - 2 holes
98	Extruded edges - 5 holes
99	Clean
100	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
101-120	Lot 1-10 Heavy burred cases.
Time Per Piece	15 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	21%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
101	Clean
102	Light burr - 2 holes
103	Light extrusion- 2 holes
104	Burr - 1 hole
105	Burr - 2 holes
106	Clean
107	Clean
108	Light extrusion - 1 hole
109	Smeared metal - 2 holes
110	Clean
111	Clean
112	Clean
113	Good
114	Good
115	Good
116	Good
117	Good
118	Good
119	Burr in 3 holes
120	1 burred hole

Cases looked extremely good for lot 1-10. Since this lot had exceptionally bad burrs. However, pieces #119 for example had burrs in 3 holes. These burrs are of the half-moon variety which is characteristic of this lot of cases showing careless machining.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
121-140	Lot 1-10 Some extrusions and burrs.
Time Per Piece	15 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	5%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
121	Clean
122	Clean
123	Extruded metal - 3 holes
124	Clean
125	Lodged heavy chip - 1 hole
126	Extruded metal - 2 holes
127	Lodged heavy chip - 1 hole
128	Lodged heavy chip, - 4 holes
129	Lodged heavy chip, - 3 holes
130	Extruded metal - 4 holes
131	Clean
132	Lodged heavy chip - 1 hole
133	Clean
134	Heavy chips and extruded metal - 5 holes
135	Heavy chips and extruded metal - 4 holes
136	Clean
137	Heavy burr - 1 hole
138	Clean
139	Heavy burr - 1 hole
140	Heavy chips - 2 holes

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
141-160	Lot 1-10 Burrs and extruded metal - most cases.
Time Per Piece	20 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	5%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
141	Heavy chips and extruded metal - 2 holes
142	Heavy chips and extruded metal - 2 holes
143	Heavy chips and extruded metal - 2 holes
144	Heavy chips and extruded metal - 2 holes
145	Clean
146	Heavy chips and extruded metal - 2 holes
147	Heavy chips and extruded metal - 3 holes
148	Heavy chips and extruded metal - 1 hole
149	Heavy chips and extruded metal - 2 holes
150	Heavy chips and extruded metal - 2 holes
151	Heavy chips and extruded metal - 2 holes
152	Clean
153	Heavy chips and extruded metal - 3 holes
154	Deformed - 2 holes
155	Heavy chips and extruded metal - 3 holes
156	Heavy chips and extruded metal - 2 holes
157	Heavy chips and extruded metal - 1 hole
158	Heavy chips and extruded metal - 3 holes
159	Clean
160	Extruded metal - 1 hole

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
161-180	Lot 1-10 Burrs and extrusions - most cases
Time Per Piece	15 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	10%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
161	Clean
162	Clean
163	Clean
164	Clean
165	Heavy chip and extruded metal - 2 holes
166	Heavy chip and extruded metal - 1 hole
167	Extruded metal - 1 hole
168	Heavy chip and extruded metal - 3 holes
169	Heavy chip and extruded metal - 1 hole
170	Heavy chip and extruded metal - 2 holes
171	Heavy chip and extruded metal - 4 holes
172	Heavy chip and extruded metal - 4 holes
173	Heavy chip and extruded metal - 2 holes
174	Heavy chip and extruded metal - 1 hole
175	Clean
176	Clean
177	Heavy extrusion - 1 hole
178	Heavy chip and extruded metal - 1 hole
179	Heavy chip and extruded metal - 1 hole
180	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
181-202	Lot 1-10 Burrs - most cases.
Time Per Piece	30 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
181	Clean
182	Clean
183	Clean
184	Heavy chip and extruded metal - 1 hole
185	Heavy extrusion - 1 hole
186	Heavy extrusion - 1 hole
187	Heavy extrusion - 2 holes
188	Clean
189	Clean
190	Heavy extrusion - 2 holes
191	Heavy extrusion - 2 holes
192	Clean
193	Heavy extrusion - 1 hole
194	Clean
195	Heavy chip - 1 hole
196	Extruded metal - 1 hole
197	Heavy chip - 1 hole
198	Heavy chip - 1 hole
199	Clean
200	Deformed - 2 holes
201	Heavy chip - 2 holes
202	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
203-224	Lot 1-10 Burrs - all cases.
Time Per Piece	20 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
203	Clean
204	Lodged heavy chip - 1 hole
205	Lodged heavy chip - 1 hole
206	Clean
207	Clean
208	Clean
209	Broken metal - 1 hole
210	Extruded metal - 2 holes
211	Clean
212	Heavy chip - 1 hole
213	Extruded metal - 1 hole
214	Heavy chip - 1 hole
215	Clean
216	Extruded metal - 2 holes
217	Heavy chips - 2 holes
218	Extruded metal - 2 holes
219	Extruded metal - 1 hole
220	Clean
221	Extruded metal - 1 hole
222	Light fringe burr - 1 hole
223	Heavy burr - 1 hole
224	Heavy chip - 1 hole

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
225-246	Lot 1-10 Large burrs - most cases
Time Per Piece	15 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
225	Heavy extruded burr - 1 hole
226	Clean
227	Heavy burr - 1 hole
228	Heavy burr - 2 holes
229	Clean
230	Heavy burr - 1 hole
231	Heavy burr - 2 holes
232	Clean
233	Heavy burr - 2 holes
234	Light burr - 2 holes
235	Heavy extruded burr - 2 holes
236	Clean
237	Heavy burr - 2 holes
238	Clean
239	Burr - 3 holes
240	Heavy burr - 2 holes
241	Heavy chip - 1 hole
242	Heavy extrusion - 5 holes
243	Heavy chips - 3 holes
244	Clean
245	Heavy burr and extrusions - 6 holes
246	Heavy burrs - 6 holes

PICATINNY ARSENAL
DOVER, NEW JERSEY

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
247 - 257	Lot 1-10 Burrs - all cases
Time Per Piece	20 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
247	Heavy burr - 1 hole
248	Heavy chips - 2 holes
249	Heavy chips and extruded metal - 2 holes
250	One hole extruded
251	Very heavy burr - 1 hole
252	Burr - 2 holes
253	Heavy burr - 1 hole
254	Burr - 3 holes
255	Heavy chips - 3 holes
256	Heavy chips - 3 holes
257	Burrs - 5 holes

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ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
258 - 268	Lot 1-10 Chips and burrs - all cases.
Time Per Piece	10 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	21%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
258	Chip lodged in 1 hole
259	Clean
260	Heavy chips - 2 holes
261	Lodged chip - 1 hole
262	Extruded metal - 2 holes
263	Heavy chips lodged - 2 holes
264	Heavy chips lodged - 2 holes
265	Burrs - 2 holes
266	Chips lodged - 3 holes
267	Chips lodged - 3 holes
268	Chips lodged - 3 holes

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
V1 - V12	Lot 1-10 Burrs - most cases.
Time Per Piece	30 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
V1	Clean
V2	Lodged chips - 3 holes
V3	Clean
V4	Clean
V5	Clean
V6	Light burr - 3 holes
V7	Distortion and heavy burr - 7 holes
V8	Heavy burr - 3 holes
V9	Heavy burr - 3 holes
V10	Distortion - 7 holes
V11	Distortion and burrs - 6 holes
V12	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
1-20	Lot 1-5. These pieces when examined under 30 power microscope showed heavy burrs around most of the holes.
Type of Abrasive	140 QVB
Abrasive Volume	7%
Time Per Piece	20 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
1	Used for setup, Clean
2	Burr removed on bad piece
3	All holes clean
4	Clean
5	Clean
6	Clean
7	Light fringe burrs - large chip - 1 hole
8	Clean
9	Clean
10	Clean
11	Clean
12	Burr - 1 hole
13	Clean
14	Clean
15	Clean
16	Still some burr left on holes
17	Clean
18	Clean
19	Clean
20	Clean

Specific Comments

Removal of burr was evident on all parts. On a few parts the holes were very poorly formed. These parts showed V-notches and badly extruded metal still remaining on some of the holes of a few samples. Most of the parts showed that some of the burr had been removed, however, a light fringe burr remained indicating that the abr./yd or the time should be increased.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
21-40	Lot 1-5 Condition of pieces similar to pieces 1-20.
Type of Abrasive	140 QVB
Abrasive Volume	21%
Time Per Piece	33 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
21	*
22	*
23	Slight fringe burr - 1 hole
24	Extruded burrs - 5 holes
25	*
26	*
27	*
28	*
29	*
30	*
31	*
32	Heavy extruded burr - 1 hole, light burr - 1 hole
33	*
34	*
35	*
36	Extruded burr - 1 hole, fringe burr - 1 hole
37	*
38	Heavy burr - 1 hole, light burr - 1 hole
39	*
40	*

*Asterisk indicates good burr removal. It was found that these cases would accept the "Not Go" plug, which is attributed to the fact that the abrasive by volume was increased to 21% and the time was increased to 33 seconds.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
41 - 60	Lot 1-5 Burrs - most holes.
Type of Abrasive	140 QVB
Abrasive Volume	14%
Time Per Piece	30 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
41	Clean
42	Clean
43	Clean
44	Clean
45	Extruded metal - 1 hole
46	Extruded metal - 4 holes
47	Extruded metal - 1 hole
48	Clean
49	Clean
50	Clean
51	1 badly extruded hole still has burr
52	*
53	1 hole - burr remained
54	*
55	*
56	*
57	*
58	*
59	*
60	*

Except where noted these cases looked very good.

*Good.

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ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
61 - 80	Lot 1-5 Burrs in most cases, one has rough turned bore.
Type of Abrasive	140 QVB
Abrasive Volume	7%
Time Per Piece	30 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
61	Slight burr on 1 hole
62	Clean
63	Clean
64	Clean
65	Clean
66	Clean
67	Heavy extruded burrs - all holes
68	Metal smeared into holes
69	Clean
70	Light fringe burr on some holes
71	Clean
72	Clean
73	Metal in some holes
74	Clean
75	Burrs in most holes
76	Clean, edges broken
77	Clean, edges broken
78	Heavy burr - 2 holes
79	Clean
80	Heavy burr - 2 holes

Piece #61 and some of the other cases of this lot show evidence of rough turned bore.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
81 - 100	Lot 1-15 Burrs in most cases.
Type of Abrasive	140 QVB
Abrasive Volume	14%
Time Per Piece	25 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
81	Clean
82	Clean
83	Clean
84	Clean
85	Clean
86	Clean
87	Clean
88	Clean
89	Clean
90	Clean
91	Clean
92	Clean
93	Clean
94	Clean
95	Clean
96	Smearred metal in some holes
97	Clean
98	Clean
99	Clean
100	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
101-120	Lot 1-5 Burrs - most holes.
Type of Abrasive	140 GVB
Abrasive Volume	14%
Time Per Piece	20 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
101	Clean
102	Clean
103	Clean
104	Clean
105	Clean
106	Clean
107	Burrs - 3 holes
108	Clean
109	Clean
110	Clean
111	Clean
112	Clean
113	Extruded metal - 3 holes
114	Extruded metal - 1 hole
115	Clean
116	Heavy burr - 1 hole, fringe burr - 4 holes
117	Clean
118	Clean
119	Heavy burr - 4 holes
120	Clean

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
121 - 130	Lot 1-5 Burrs - most cases.
Type of Abrasive	140 QVB
Abrasive Volume	21%
Time Per Piece	15 Seconds

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
121	Extremely heavy extruded metal- 5 holes
122	Clean
123	Clean
124	Clean
125	Heavy burr - 1 hole
126	Clean
127	Clean
128	Clean
129	Clean
130	Clean

Cases looked very good under microscope.

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<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
131 - 150	Lot 1-5 Burrs - most cases.
Time Per Piece	15 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	5%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
131	Clean
132	Clean
133	Slight extruded burr - 1 hole
134	Fringe burr - 1 hole
135	Clean
136	Clean
137	Clean
138	Light fringe burr - 1 hole
139	Clean
140	Clean
141	Clean
142	Clean
143	Clean
144	Clean
145	Burr - 4 holes
146	Clean
147	Clean
148	Clean
149	Clean
150	Extruded metal - 4 holes

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ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
151 - 170	Lot 1-5 Burrs most cases.
Time Per Piece	20 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	5%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
151	Clean
152	Clean
153	Clean
154	Heavy burrs and extruded metal - all holes
155	Clean
156	Clean
157	Clean
158	Clean
159	Clean
160	Clean
161	Heavy chip - 1 hole, light fringe - 3 holes
162	Clean
163	Medium burrs - 3 holes
164	Clean
165	Clean
166	Clean
167	Clean
168	Clean
169	Clean
170	Clean

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ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
171 - 190	Lot 1-5 Light burrs - most cases.
Time Per Piece	15 Seconds
Abrasive Size and Type	220 AVB
Abrasive Volume	10%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
171	Clean
172	Clean
173	Clean
174	Clean
175	Clean
176	Clean
177	Clean
178	Clean
179	Clean
180	Clean
181	Burr - 1 hole
182	Clean
183	Clean
184	Clean
185	Clean
186	Clean
187	Clean
188	Clean
189	Clean
190	Clean

PICATINNY ARSENAL
DOVER, NEW JERSEY

ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
191 - 212	Lot 1-5 Burrs - most cases
Time Per Piece	30 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
191	Clean
192	Clean
193	Clean
194	Clean
195	Clean
196	Clean
197	Clean
198	Clean
199	Clean cracked metal - 1 hole
200	Clean
201	Clean
202	Clean
203	Metal extruded - 3 holes, fringe burr - 2 holes
204	Clean
205	Clean
206	Clean
207	Clean
208	Clean
209	Clean
210	Clean
211	Clean
212	Clean

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ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
213 - 234	Lot 1-5 Burrs - all cases
Time Per Piece	20 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
213	Clean
214	Clean
215	Clean
216	Clean
217	Clean
218	Clean
219	Cracked metal - 1 hole
220	Clean
221	Smeared metal - 2 holes
222	Very light fringe burr - all holes
223	Extremely heavy burrs - 3 holes
224	Extremely heavy burrs - 3 holes
225	Clean
226	Clean
227	Extruded burrs - 3 holes, fringe burr - 2 holes
228	Clean
229	Clean
230	Clean
231	Clean
232	Clean
233	Clean
234	Burrs - 2 holes

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DOVER, NEW JERSEY

ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
235 - 257	Lot 1-5 Burrs - most cases.
Time Per Piece	15 Seconds
Abrasive Size and Type	100 QVB
Abrasive Volume	14%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
235	Clean
236	Clean
237	Clean
238	Clean
239	Clean
240	Clean
241	Clean
242	Heavy chip - 1 hole, light fringe, - 2 holes
243	Clean
244	Light fringe burrs - all holes
245	Clean
246	Clean
247	Clean
248	Light fringe burrs - all holes
249	Clean
250	Clean
251	Clean
252	Clean
253	Clean
254	Clean
255	Clean
256	Clean
257	Clean

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DOVER, NEW JERSEY

ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
V1-1 - V1-8	Lot 1-5 Burrs - all cases.
Time Per Piece	30 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
V1-1	Burrs - all holes
V1-2	Burrs - 2 holes
V1-3	Clean
V1-4	Burrs - 4 holes
V1-5	Clean
V1-6	Burrs - 1 hole
V1-7	Heavy chips and burrs - all holes
V1-8	Clean

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DOVER, NEW JERSEY

ENGINEERING TEST REPORTS

<u>Piece Number</u>	<u>Description of Parts Before Processing</u>
V2-1 - V2-14	Lot 1-5 Burrs all cases.
Time Per Piece	25 Seconds
Abrasive Size and Type	140 QVB
Abrasive Volume	7%

<u>Piece Number</u>	<u>Condition of Parts After Processing</u>
V2-1	Light fringe burrs - all holes
V2-2	Clean
V2-3	Clean
V2-4	Clean
V2-5	Burrs - 5 holes
V2-6	Light fringe burrs - 3 holes
V2-7	Light burrs - all holes
V2-8	Light fringe burrs - most holes
V2-9	Clean
V2-10	Clean
V2-11	Extruded burr - 1 hole
V2-12	Clean
V2-13	Clean
V2-14	Clean

APPENDIX

APPENDIX A
FIGURES

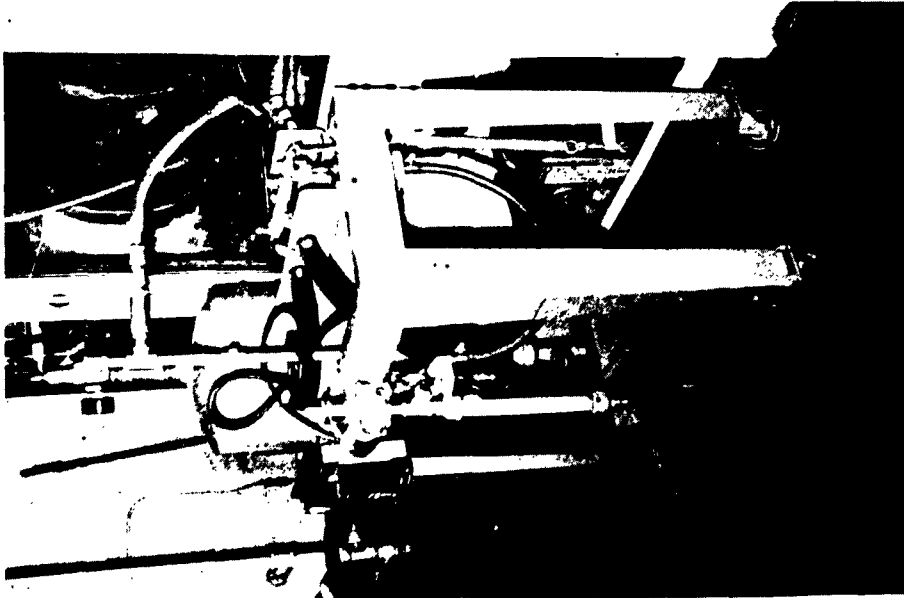


Figure 2

LEFT, UNIT FOR PRESSURIZED SLURRY DELIVERY
TO VAPOR BLAST GUN.

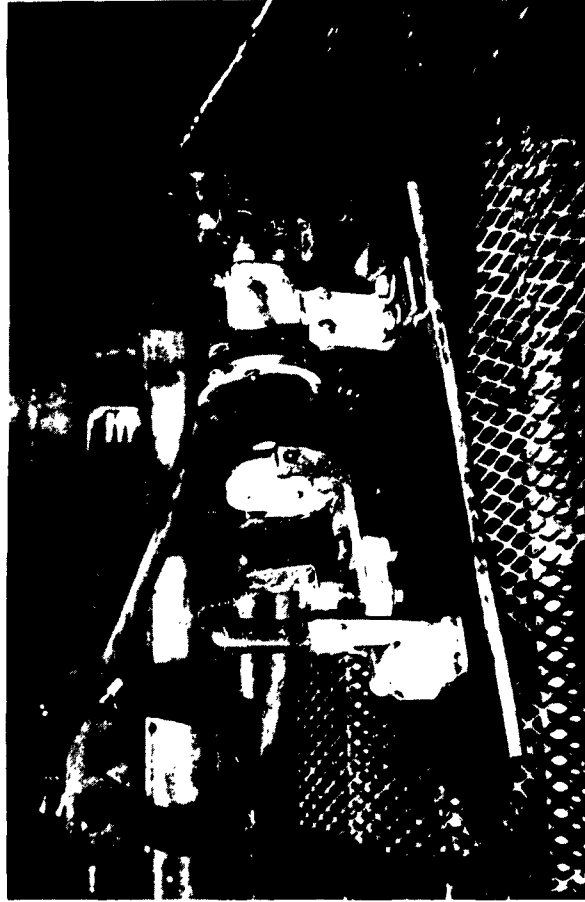
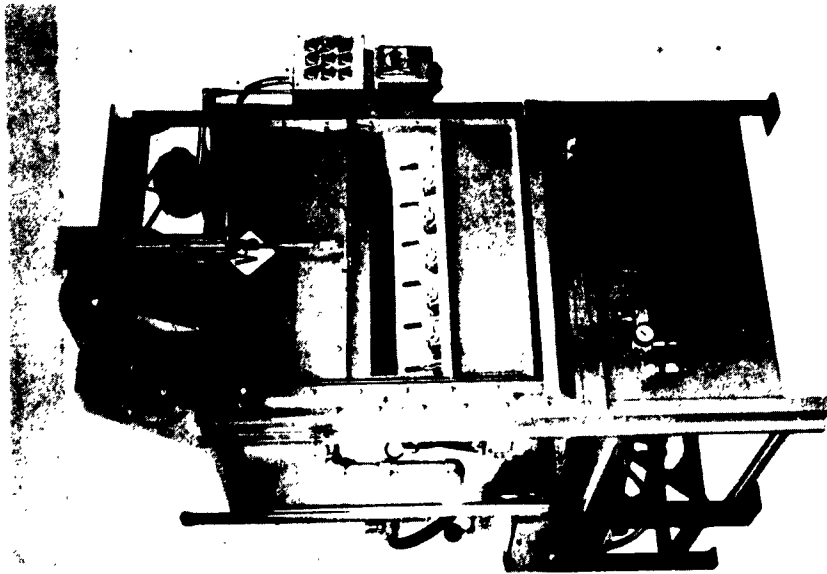


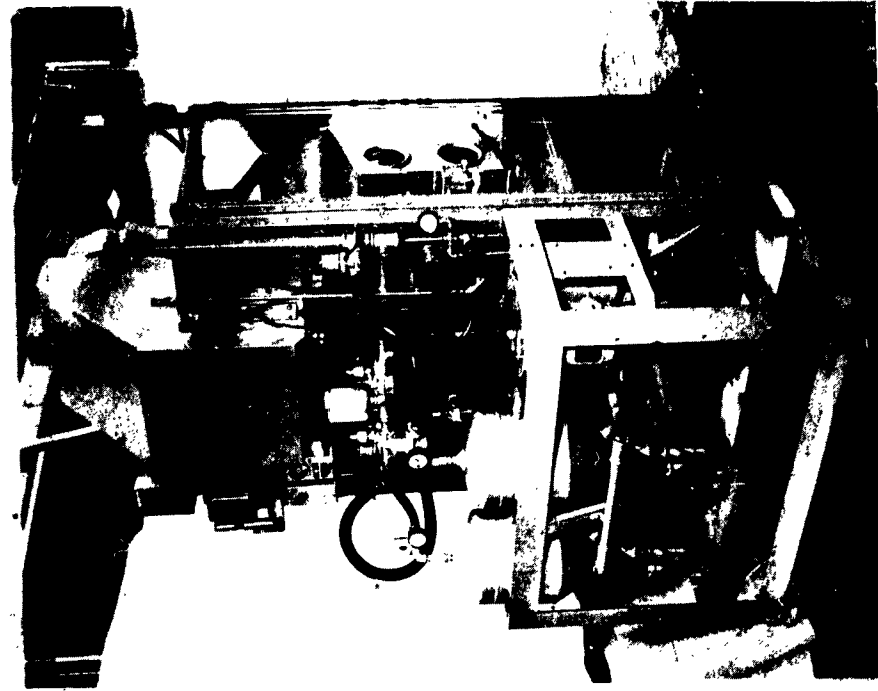
Figure 1

ABOVE, VAPOR BLAST GUN & CARTRIDGE CASE
HOLDING FIXTURE WITH MOUNTED CASE.



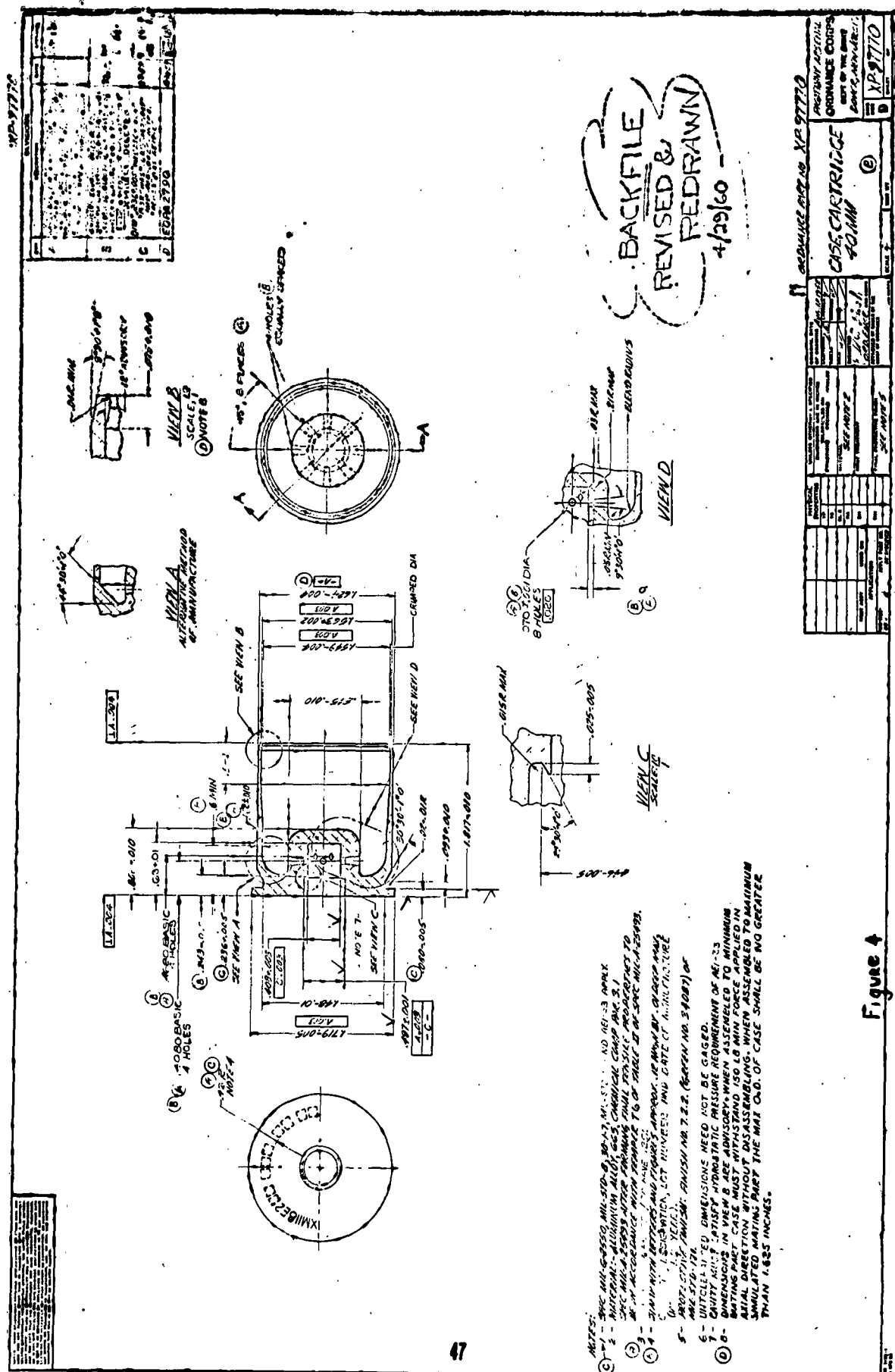
4-35827

Front View



Rear View

Figure 3 40MM ALUMINUM CARTRIDGE CASE DEBURRING MACHINE. SUPPLIED TO AMRON CORP., WAUKESHA, WISCONSIN



ABSTRACT DATA

ABSTRACT

AD _____ Accession No. _____

Picatinny Arsenal. Ammunition Group
Dover, New Jersey

EVALUATION OF THE DEBURRING OF 40MM CARTRIDGE CASES BY THE VAPOR BLAST PROCESS

Neal J. Friedman and Henry C. Seavey

Technical Report DB-TR: 9-61, July 1961,
44 pp, drawings, photographs,
Unclassified Report.

An inherent problem in the production of 40mm cartridge cases is the presence of burrs in the vent-holes of the powder chamber. A process to remove these burrs without enlarging the holes or changing the dimensions of the chamber was required. A solution to this burr problem is provided by a machine built by the Vapor-Blast Manufacturing Co. of Milwaukee.

The amount of burr removed by "Vapor-blasting" depends upon the abrasive used; the duration of blast, percent of abrasive by volume, and the type of burr. Some combinations are more suitable than others, the best appearing to be the use of seven percent 100 QVB abrasive for 30 seconds.

UNCLASSIFIED

1. Deburring.
2. Cartridge cases, 40mm
--Deburring.

- I. Friedman, Neal J.
- II. Seavey, Henry C.
- III. Title: Vapor blast process.
- VI. Project no. 9599.3800.

UNITERMS

Deburring
40mm
Cartridge case
Vapor blast
Vent holes
Abrasive
Friedman, N. J.
Seavey, H. C.
Project no. 9599.3800

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Vapor blast
Vent holes

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Picatinny Arsenal, Ammunition Group
Dover, New Jersey

EVALUATION OF THE DEBURRING OF 40 MM CARTRIDGE CASES BY THE VAPOR BLAST PROCESS

Neal J. Friedman, Henry C. Seavey

Technical Report DB-TR: 9-61, July 1961, 44 pp, drawings, photographs.

Unclassified Report

An inherent problem in the production of 40 mm cartridge cases is the presence of burrs in the vent-holes of the powder chamber. A process to remove these burrs without enlarging the holes or changing the dimensions of the chamber was required. A solution to this burr problem

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1. Deburring
2. Cartridge cases, 40 mm-Deburring

- I. Friedman, Neal J.
- II. Seavey, Henry C.
- III. Title: Vapor blast process.
- IV. Proj No. 9599.3800

UNITERMS

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40mm
Cartridge case
Vapor blast
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is provided by a machine built by the Vapor-Blast Manufacturing Co. of Milwaukee.

The amount of burr removed by "Vaporblasting" depends upon the abrasive used, the duration of blast, percent of abrasive by volume, and the type of burr. Some combinations are more suitable than others, the best appearing to be the use of seven percent 100 QVB abrasive for 30 seconds.

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Neal J. Friedman, Henry C. Seavey

Technical Report DB-TR: 9-6L, July 1961, 44 pp, drawings, photographs.

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