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THE COLLEGE OF AERONAUTICS

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ADMINISTRATION

Test Report No. PLBO/15

Intermittent cutting tests with tools of RD107, RD110 and S1P, having radiused cutting edges

S U M M A R Y

Tools of grade S1P, RD107 and RD110 with radiused cutting edges were tested to failure cutting slotted bars of EN9 at 600 f.p.m., 0.010 in/rev. feed and 0.10 in depth of cut. The results showed that there was a reduction in the frequency of early tool failure as compared with unradiused tips. A statistical analysis showed that there was no significant difference between the mean tool lives of the three grades.

Test conditions

The following conditions were used during the tests:-

Work material:	EN9 slotted bar
Depth of cut:	0.10 in.
Feed:	0.010 in/rev.
Cutting speed:	600 f.p.m.

and the tools used were:-

S1P NT250	RD107 NT289	RD110 NT294
S1P NT277	RD107 NT290	RD110 NT296
S1P NT278	RD107 NT291	RD110 NT297
	RD107 NT292	RD110 NT298

Test results

The tests were carried out as described in Test Report No. PLBO/14, the flank wear of the tools being measured at each interval of three minutes cutting time and the criterion of tool failure being that (1) the surface finish changed markedly, (2) there was a step in the newly machined surface or (3) the noise and cutting vibrations became excessive.

Tables 1-3 show the flankwear and time to failure of the three grades tested. Figures 1-3 show the tool life of each grade in graphical form and figures 3-5 show histograms of the tool life taking intervals of one minute. The shaded portions of figures 3-5 are the results from the previous tests using tools having no edge radius.

From the histograms it can be seen that radiusing the cutting edge of the tips tended to reduce the early failures, as was suggested in report PLBO/14. The same report also suggested that radiusing would have a greater effect on RD107 and RD110 than on S1P, but this was not borne out by the results.

From the tabulated results the mean time to failure was:-

S1P	7.6 min
RD107	5.9 min
RD107	4.3 min

A statistical analysis, using a student 't' test with a Bessel correction for the bias of small samples, shows that there is no significant difference between these mean tool lives.

Conclusions

The results showed that radiusing the cutting edge gave an expected reduction in the number of early tool failures and a statistical analysis of the results showed that there was no significant difference between the mean tool lives of the three grades tested.

Table 1

Grade: S1P
Speed: 600 fpm
Feed: 0.010 in/rev
Depth of cut: .10 in.
Material: EN9 slotted bar

Tip No.	Time min.	Flankwear Fa	Flankwear Fb	Flankwear Fc	Remarks
NT250/A1	3	.046	.064	.025	
	6	.078	.0885	.0315	
	6.3	.0815	.090	.036	
NT250/A2	3	.060	.048	.034	
	5.75	.0865	.0825	.038	
NT250/A3	3	.018	.019	.013	
	6	.0225	.027	.020	
	9	.035	.035	.026	Nose chipped
NT250/A4	3	.0195	.0345	.023	
	6	.024	.044	.028	
	8.1	.043	.068	.037	
NT250/B1	3	.0505	.0505	.042	
	6	.065	.067	.053	Cutting edge chipped
NT250/B2	3	.018	.020	.013	
	6	.025	.025	.019	
	9	.030	.030	.023	
	12	.057	.048	.0395	
	14.1	.107	.107	.058	
NT250/B3	3	.021	.021	.014	
	6	.025	.025	.021	
	9	.040	.068	.024	Chipped
NT250/B4	3	.012	.015	.012	
	6	.016	.021	.019	
	9	.021	.027	.025	
	12	.094	.087	.035	
NT277/1	3	.0185	.0115	.008	
	6	.025	.016	.0135	
	9	.0295	.060	.033	
	12	.099	.102	.0465	
NT277/2	3	.022	.030	.015	
	6	.068	.0625	.019	
	7.3	.101	.107	.0235	
NT277/3	3	.059	.055	.015	
	6	.070	.089	.018	Nose failure
NT277/4	3	.016	.0195	.0135	
	6	.027	.027	.020	
	7.3	.070	.076	.040	
NT278/1	3	.059	.110	.025	Chipped
NT278/2	3	.055	.081	.056	Chipped
NT278/3	3	.011	.146	.039	
NT278/4	3	.020	.019	.016	
	6	.0265	.025	.0195	
	9	.0355	.076	.026	Chipped

Table 2

Grade: RD107
Speed: 600 fpm
Feed: 0.010 in/rev.

Depth of cut: 0.10 in.
Material: EN9

Tip No.	Time min.	Flankwear Fa	Fb	Fc	Remarks
NT289/1	3	.019	.0135	.008	
	6	.028	.0225	.016	
	9	.033	.0285	.021	
	12	.135	.1135	.028	Flank chipped
NT289/2	20 sec.	.071	.075	.073	Burr on edge
NT289/3	3	.044	.033	.016	
	4.6	.0635	.070	.025	Nose failure
NT289/4	3	.0225	.075	.034	
	6	.0475	.115	.075	
NT290/1	3	.019	.017	.010	
	5.9	.057	.0895	.0165	Surface finish change
NT290/2	3	.049	.055	.018	
	3.2	.050	.125	.020	
NT290/3	3	.054	.058	.017	
	4.2	.178	.178	.022	Chipped
NT290/4	3	.0205	.0205	.015	
	6	.103	.084	.022	
	6.7	.138	.128	.023	Nose failure
NT291/1	3	.0255	.0255	.016	
	6	.034	.034	.025	
	8.9	.067	.087	.032	Chip stuck to flank
NT291/2	3	.029	.072	.035	
	3.6	.075	.090	.035	Chip stuck to flank
NT291/3	3	.020	.033	.0145	
	6	.0265	.083	.023	
	9	.035	.142	.025	
NT291/4	3	.017	.017	.017	
	6	.023	.023	.023	
	9	.115	.060	.031	Nose failure
NT292/1	3	.046	.059	.030	
	3.9	.122	.138	.030	
NT292/2	1.2	.110	.121	.059	
NT292/3	3	.0215	.090	.0275	
	4.1	.058	.141	.029	
NT292/4	3	.040	.019	.014	
	6	.047	.032	.023	
	9	.051	.037	.031	
	12	.076	.0725	.0335	

Table 3

Grade: RD110
Speed: 600 fpm
Feed: 0.010 in/rev.

Depth of cut: 0.10 in.
Material: EN9

Tip No.	Time min.	Flankwear Fa	Fb	Fc	Remarks
NT294/1	3	.170	.168	.028	Nose chipped
NT294/2	3	.073	.073	.029	
	3.7	.106	.104	.034	Chipped
NT294/3	13 sec.	.078	.0825	.0125	Nose failure
NT294/4	3	.026	.037	.020	
	4.4	.033	.137	.0275	Change in surface finish
NT296/1	3	.020	.0155	.0155	
	6	.027	.024	.022	
	8	.070	.110	.033	Change in surface finish
NT296/2	3	.022	.022	.016	
	6	.072	.050	.025	
	6.7	.091	.113	.027	Nose chipped
NT296/3	3	.021	.016	.016	
	6	.093	.087	.023	
	6.4	.098	.091	.025	
NT296/4	3	.055	.055	.015	
	6	.070	.068	.0245	
	7.7	.072	.1105	.0365	
NT297/1	38 sec.	.133	.109	.010	Nose failure
NT297/2	3	.061	.045	.021	
	4.7	.168	.170	.0235	Chipped
NT297/3	20 sec.	.130	.125	.026	Chipped
NT297/4	3	.024	.017	.019	
	4.6	.107	.104	.023	Nose failure
NT298/1	3	.025	.054	.025	
	4.4	.0545	.075	.030	
NT298/2	3	.021	.021	.013	
	6	.039	.031	.023	
	9	.045	.037	.032	
	10.1	.012	.095	.035	Change in surface finish
NT298/3	2.2	.078	.129	.015	
NT298/4	1.1	.102	.117	.016	

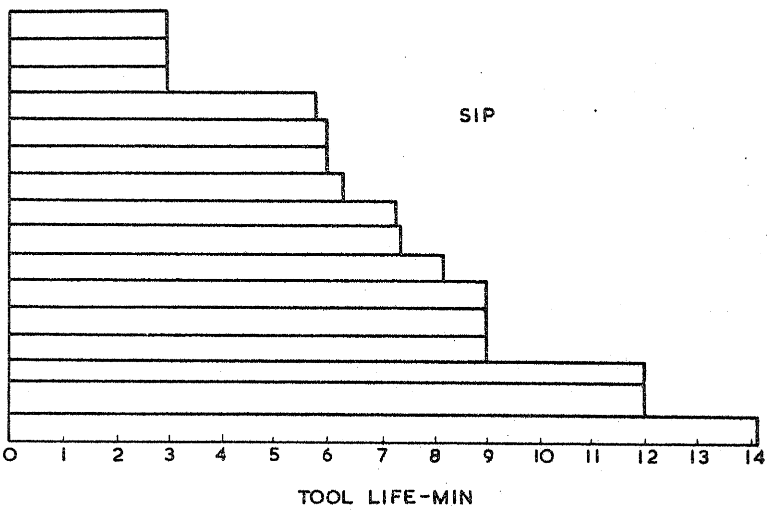

FIG. 1.

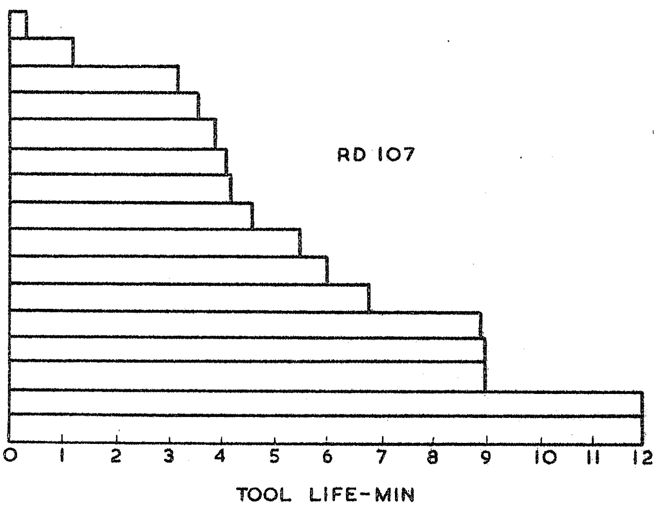

FIG. 2.

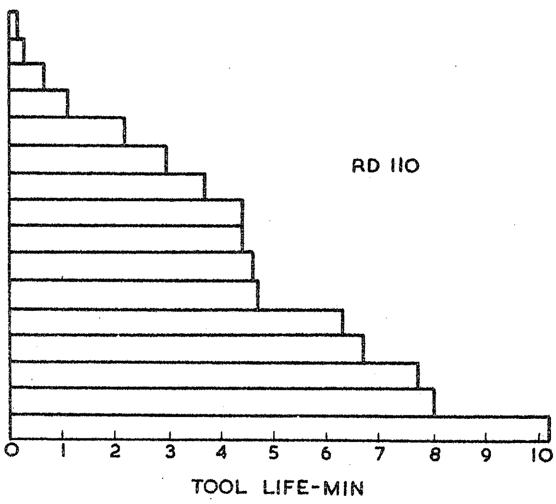

FIG. 3.

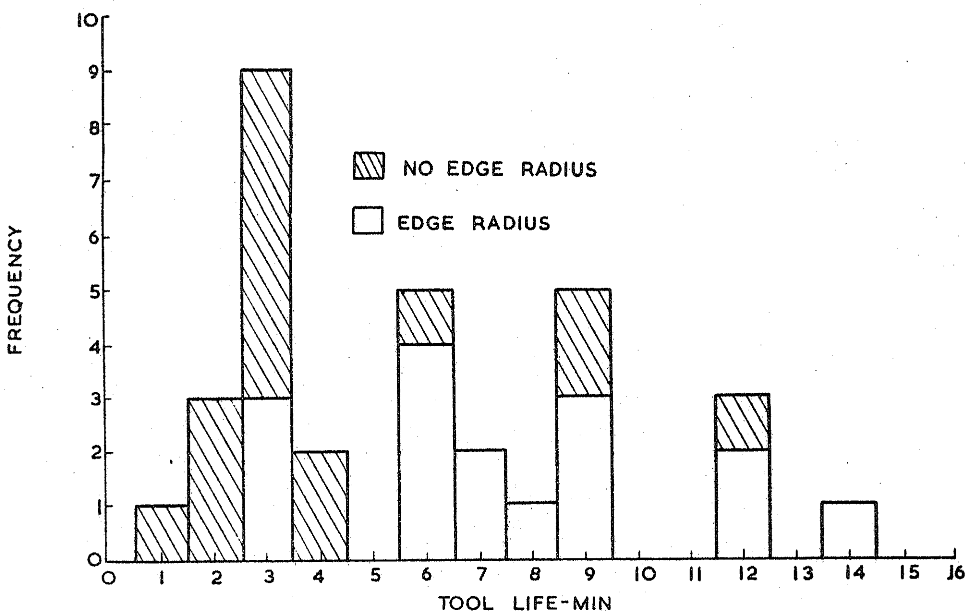

FIG.4. SIP.

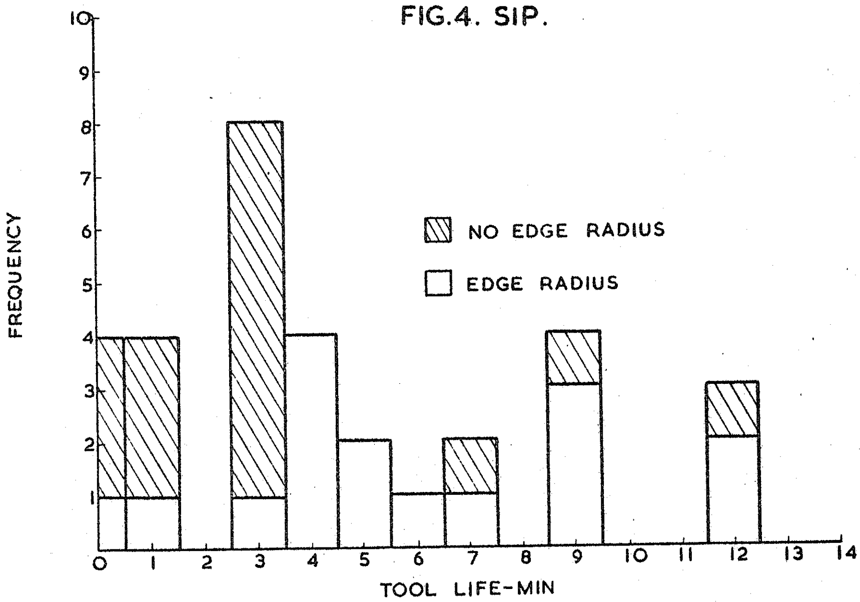

FIG.5. RD 107.

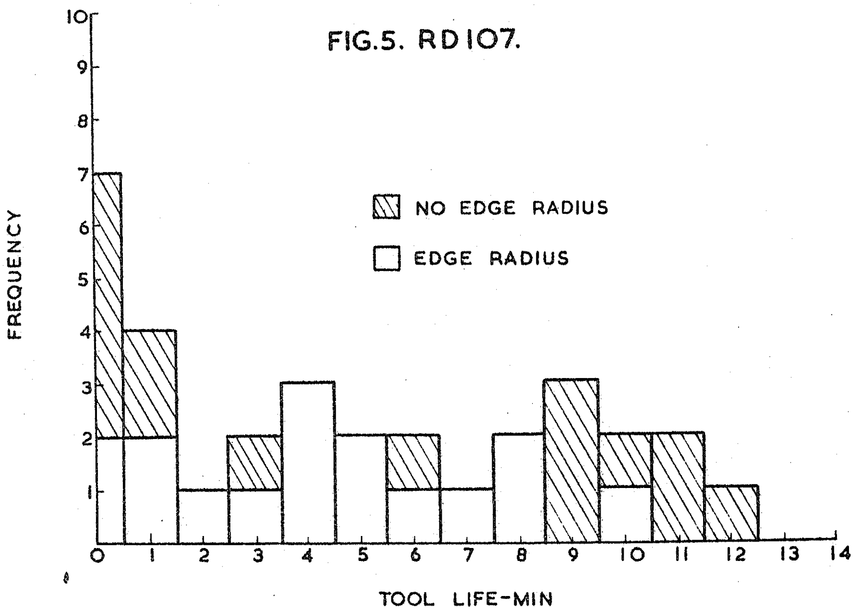

FIG.6. RD 110.