

**BILL RUBENSTEIN**

# Making your own simple tools -- SWAT 2006

Bill Rubenstein

*4 1/2" angle grinder  
\$19 @ Harbor Freight*

## Materials

### Tool steel

Drill Blanks – M2 High-speed steel

- Hardened
- Can be ground to shape but not machined
- Short lengths depending on diameter (4 – 6" typical)

Drill Rod – O-1

- Oil hardening – easy to do
- Unhardened – easy to machine or grind
- Normally sold in 36" lengths
- May be used as-is or hardened easily
- Most useful sizes – 1/4, 3/8, 1/2"
- Typical costs:

Tool Bits – M2 HSS and harder

- Hardened
- Intended as cutting tools in metal lathes
- Can be ground to shape but not machined
- Square and rectangular shapes
- Short lengths

Flat Stock – O-1 oil hardening

- Unhardened – easy to machine or grind
- May be used as-is or hardened easily
- Sold in 18" and 36" lengths
- Many sizes available

### Miscellaneous steel

- Allen wrenches
- Screwdrivers
- Wire
- Bench chisels
- Old, used-up commercial tools
- Hacksaw blades
- Sawzall® blades
- Used-up planer blades
- spade bits
- files – do not even think about using files!

## Some other useful materials

- Delrin (Acetal)
- schedule 40 PVC parts, especially couplings
- duct tape
- coat hangers
- 

## Some suppliers of tool steel

<i>Name</i>	<i>Web site</i>
MSC Industrial Supply	<a href="http://www.mscdirect.com">www.mscdirect.com</a>
McMaster-Carr	<a href="http://www.mcmaster.com">www.mcmaster.com</a>
Enco	<a href="http://www.use-enco.com">www.use-enco.com</a>
KBC Tools	<a href="http://www.kbctools.com">www.kbctools.com</a>

## Heat Treating

### Heat treating M2 steel (this is rocket science)

Warm slightly before placing into a furnace which should be operating between 1350° and 1500° F.

After thorough heating, transfer your material to a hardening furnace at 2175° to 2225° F (this depends on the size of the material and the degree of hardening required for the application).

Cool in air, oil, or a molten salt bath operating at 1000° to 1100° F. If you are quenching with oil, it is usually good practice to interrupt the quench by removing the material after it reaches about 1000° F and allow the cooling to continue in the air.

Tools should be allowed to cool to 150° F and then be tempered immediately. The tempering temperature may vary according to the desired hardness, but it is usually in the range of 1000° to 1100° F.

Double tempering is recommended.

### Heat treating O-1 steel (this is NOT rocket science)

Heat to cherry red color – use MAPP gas or Acetylene torch.

Quench in oil.

Heat to straw color.

Cool slowly in sand.

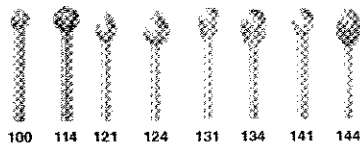
## Tools useful for making tools

- 36 grit grinding wheel
- 4 1/2" angle grinder
- hacksaw
- Dremel® tool
- MAPP gas torch
- lathe
- drill press

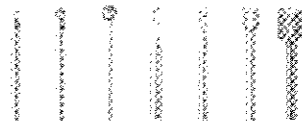
## Things you can make easily

- round skew – 1/4" or 3/8", drill blanks
- 3 point tool – 3/8 or 1/2 drill blanks
- various strange shapes made from round stock
- parting tool, thin parting tool – rectangular tool bits or cutoff blades
- 3/8 beading and parting tool – square tool bit
- bedan – square tool bit
- scraper – rectangular tool bits
- shear scraper – rectangular tool bits or drill blanks
- small beading tool – flat stock
- custom profile tool – flat stock
- chatter tool – hacksaw blades, sawzall® blades
- tapered candle stick boring tool – 7/8" spade bit

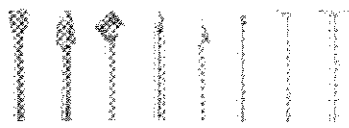
### DREMEL High Speed Cutters



100 114 121 124 131 134 141 144



190 191 192 193 194 196 115



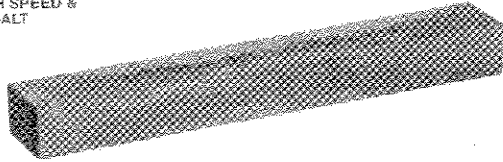
116 117 178 118 125 197 198 199

Part No. 1-829-  
Our Net Price  
\$4.20

HOW TO ORDER:  
Use prefix + style  
Ex: 1-829-100

## Square Tool Bits

GROUND  
HIGH SPEED &  
COBALT



Square	Length	M-2		5% Cobalt		10% Cobalt	
		Part No. 1-420	Our Net Price	Part No. 1-421	Our Net Price	Part No. 1-422	Our Net Price
1/8"	2-1/2"	-008	5.81	-008	\$1.83	-008	\$2.05
3/16	2-1/2"	-012	.86	-012	1.39	-012	2.35
1/4	2-1/2"	-016	.86	-016	1.39	-016	2.26
5/16	2-1/2"	-020	1.09	-020	1.60	-020	2.55
3/8	3	-024	1.86	-024	2.55	-024	3.65
7/16	3-1/2"	-028	2.90	-028	4.10	-----	-----
1/2	4	-032	3.05	-032	4.95	-032	8.00
9/16	4-1/2"	-036	5.50	-----	-----	-----	-----
5/8	4-1/2"	-040	9.50	-040	8.60	-040	15.45
3/4	5	-048	8.00	-048	13.35	-048	22.35
7/8	6	-056	14.70	-056	21.35	-----	-----
1	7	-100	18.48	-100	26.70	-----	-----
1-1/4	7	-116	36.80	-116	54.50	-----	-----

\*SUBJECT TO PRIOR SALE

## LONG SERIES

Square	Length	M-2		5% Cobalt	
		Part No. 1-420	Our Net Price	Part No. 1-421	Our Net Price
1/4"	4"	-117	\$2.08	-117	\$3.15
1/4	6	-118	3.15	-118	3.30
1/4	8	-119	4.10	-119	4.25
5/16	6	-120	3.00	-120	3.98
5/16	8	-121	4.00	-121	5.30
3/8	6	-122	3.90	-122	5.25
3/8	8	-123	5.35	-123	7.10
1/2	6	-124	6.30	-124	8.10
1/2	8	-125	8.45	-125	10.90
5/8	8	-126	12.45	-126	16.80



LONG SERIES

ALSO AVAILABLE  
KONCOR U.S.A.  
- PLEASE INQUIRE -

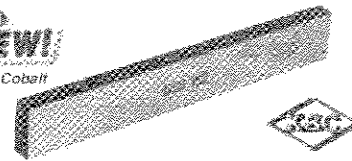
Tatmo Cobalt (M34)  
Crusader (M3)  
Dynacut (M43)

## Rectangular Tool Bits

GROUND HIGH SPEED & COBALT



8% Cobalt



Size	M-2		8% Cobalt	
	Part No. 1-517	Our Net Price	Part No. 1-517C	Our Net Price
1/4 x 3/8 x 2-1/2"	-010	\$2.30	-010	\$3.50
1/4 x 3/8 x 3	-011	2.40	-----	-----
1/4 x 3/8 x 4	-012	2.50	-----	-----
1/4 x 1/2 x 4	-030	4.53	-030	5.60
1/4 x 1/2 x 6	-031	4.95	-----	-----
1/4 x 5/8 x 4-1/2"	-060	7.70	-----	-----
1/4 x 3/4 x 5	-080	5.90	-080	8.75
1/4 x 1 x 6	-480	7.90	-480	13.00
5/16 x 1/2 x 4"	-110	5.51	-110	7.80
5/16 x 5/8 x 4"	-130	7.81	-----	-----
5/16 x 3/4 x 5"	-150	9.83	-150	13.20
3/8 x 1/2 x 4	-170	4.80	-170	7.10
3/8 x 5/8 x 4-1/2"	-180	7.45	-180	8.90
3/8 x 3/4 x 5	-210	9.19	-210	13.00
3/8 x 1 x 6"	-220	13.80	-220	17.30
1/2 x 3/4 x 5	-270	12.09	-270	17.15
1/2 x 1 x 7	-310	18.32	-310	26.20
1/2 x 1-1/4 x 7	-490	23.00	-490	34.05
5/8 x 3/4 x 5"	-350	14.70	-350	21.40
5/8 x 7/8 x 6	-370	23.73	-370	28.60
5/8 x 1 x 7	-410	26.93	-410	33.80
5/8 x 1-1/4 x 7	-411	29.00	-----	-----
3/4 x 1 x 6	-412	25.00	-----	-----
3/4 x 1 x 7	-430	30.87	-430	40.30
3/4 x 1-1/4 x 6	-431	33.00	-----	-----
3/4 x 1-1/4 x 7	-432	39.00	-----	-----

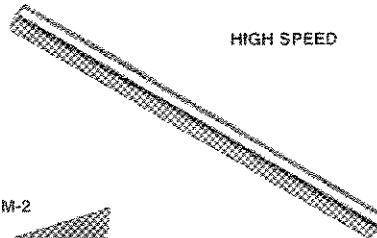
\*SUBJECT TO PRIOR SALE

ALSO AVAILABLE  
KONCOR U.S.A.  
- PLEASE INQUIRE -

Tatmo Cobalt (M34)  
Crusader (M3)  
Dynacut (M43)

## Drill Blanks

HIGH SPEED



## Cut-Off Blades

GROUND  
HIGH SPEED  
& COBALT



ALSO AVAILABLE  
KONCOR U.S.A.  
- PLEASE INQUIRE -

Double Six (M2)  
Crusader (M3)  
Dynavan (M15)  
Tatmo Cobalt (M34)

Size	M-2		5% Cobalt		
	Part No. 1-562	Our Net Price	Part No. 1-563	Our Net Price	
1/16"	5/16"	-----	-099	\$7.59	
3/32	1/2"	-101	3.20	-101	4.20
3/32	5/8"	-102	3.88	-102	4.85
1/8	3/4"	-103	5.25	-103	6.85
1/8	7/8"	-104	6.50	-104	8.50
3/16	1"	-105	11.09	-105	13.65
3/16	1-1/8"	-106	14.28	-106	17.60



## Hardened & Ground Fractional Sizes

Tolerances:  
Up to 1/4" +.0000"/-.0005"  
17/64" & Up +.0000"/-.0009"

Sizes Up To 1/2" are Jobbers Length  
Sizes Over 1/2" are 6" Long

Size	Part No. 1-096		Size	Part No. 1-096	
	Our Net Price	Our Net Price		Our Net Price	Our Net Price
1/64"	-001	5.55	33/64"	-033	58.36
1/32	-002	.55	17/32	-034	9.58
3/64	-003	.55	35/64	-035	9.19
1/16	-004	.86	9/16	-036	9.51
5/64	-005	.71	37/64	-037	9.79
3/32	-006	.71	19/32	-038	10.45
7/64	-007	.71	39/64	-039	19.94
1/8	-008	.71	5/8	-040	10.95
9/64	-009	.71	41/64	-041	11.77
5/32	-010	.77	21/32	-042	12.21
11/64	-011	.77	43/64	-043	12.54
3/16	-012	.93	11/16	-044	13.03
13/64	-013	1.15	45/64	-045	13.53
7/32	-014	1.21	23/32	-046	13.86
15/64	-015	1.32	47/64	-047	14.30
1/4	-016	1.43	3/4	-048	14.30
17/64	-017	1.54	49/64	-049	15.06
9/32	-018	1.65	25/32	-050	15.06
19/64	-019	1.81	13/16	-052	18.48
5/16	-020	1.92	53/64	-053	19.58
21/64	-021	2.08	27/32	-054	19.68
11/32	-022	2.25	55/64	-055	20.13
23/64	-023	2.33	7/8	-056	20.13
3/8	-024	2.50	57/64	-057	22.05
25/64	-025	2.61	29/32	-058	22.05
13/32	-026	3.19	59/64	-059	24.36
27/64	-027	3.37	15/16	-060	24.36
7/16	-028	4.01	61/64	-061	29.09
29/64	-029	4.07	31/32	-062	29.09
15/32	-030	4.23	63/64	-063	29.09
31/64	-031	4.78	1	-100	22.22
1/2	-032	4.78	-----	-----	-----

# 0-1 Oil Hardening 18" Precision Ground Flatstock

- FEATURES:**
- Quality Oil hardening.
  - Non-distorting alloy steel.
  - Soft, ready-to-machine.
  - Packed individually.

**TOLERANCES:**  
 Thickness ±.001"  
 Width: 3/16" to 1-7/8" + .005"  
 - .000"  
 Width: 2" to 6" + .010"  
 - .000"

A. Typical Analysis	
Carbon:	90%
Manganese:	1.20%
Chromium:	.50%
Vanadium:	.20%
Tungsten:	.50%



OR SHEFFIELD, ENGLAND

**QUANTITY DISCOUNT**  
 Over \$200 - Deduct 5%  
 Over \$500 - Deduct 10%

**ALSO AVAILABLE:**  
 0-1 Oversize  
 A2 Precision  
 A2 Oversize  
 D2 Oversize  
 A6 Precision  
 A6 Oversize  
**PLEASE INQUIRE.**

Thickness	Width	Part No. 1-951:	Our Net Price
1/16"	3/8"	-638	3.48
	1/2	-054	2.78
	3/4	-056	3.56
	1	-058	4.28
	1-1/4	-060	5.02
	1-1/2	-062	5.75
1/8"	1-3/4	-044	6.91
	2	-064	7.26
	1/8"	-110	8.63
	1/2	-112	4.24
	5/8	-562	5.14
	3/4	-114	5.29
1"	1	-116	6.27
	1-1/4	-118	7.19

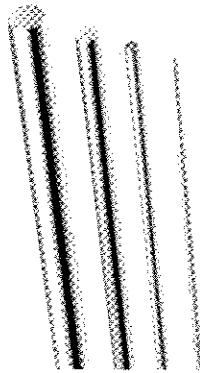
1/4"				
	1/4"	-226	8.23	
	1/2	-228	7.13	
	3/4	-230	8.63	
1		-232	10.16	
	1-1/4	-234	11.53	
	1-1/2	-236	12.73	
	1-3/4	-588	14.32	
2		-238	15.36	
	2-1/2	-240	16.37	
	3	-242	22.06	
	3-1/2	-244	25.56	
	4	-246	28.96	
	4-1/2	-248	32.92	

3/8"				
	3/8"	-286	11.76	
	1/2	-288	10.84	
	3/4	-290	13.11	
1		-292	15.32	
	1-1/4	-294	17.39	
	1-1/2	-296	19.68	
	2	-298	24.13	
	2-1/2	-300	28.57	
	3	-302	33.05	
	3-1/2	-304	37.52	
	4	-306	41.96	
	4-1/2	-308	46.43	
	5	-310	50.90	
	6	-312	59.83	
	8	-314	88.94	

1/2"				
	1/2"	-344	13.34	
	3/4	-346	16.06	
1		-348	18.74	
	1-1/4	-350	21.38	
	1-1/2	-352	24.09	
2		-354	27.14	
	2-1/2	-356	30.16	
	3	-358	36.15	
	3-1/2	-360	47.59	
	4	-362	53.22	
	4-1/2	-364	58.88	
	5	-366	64.88	
	6	-368	75.15	
	7	-612	103.01	
	8	-370	114.24	
	10	-614	157.45	

## Drill Rod

Oil, High Speed, Air, and Water Hardening



**AIR HARDENING & WATER HARDENING**

**Oil Hardening**  
 Oil Hardening: 0-1 Quality  
 Non-Distorting, 36" Length  
 Ground Drill Rods  
 Tolerance: Plus or Minus .0005"

## FRACTIONAL SIZES

Size	Part No.	Our Net Price				Size	Part No.	Our Net Price			
		Oil Hardening 1-950	High Speed 1-960	Air Hardening 1-950A	Water Hardening 1-950W			Oil Hardening 1-950	High Speed 1-960	Air Hardening 1-950A	Water Hardening 1-950W
1/16"	-004	5.54	-----	3.97	3.36	5/8"	-040	58.65	519.37	-----	56.10
3/32	-005	4.80	-----	3.59	3.02	41/64	-041	9.12	-----	-----	7.26
7/64	-007	.93	-----	1.43	.57	21/32	-042	8.58	54.80	-----	7.41
1/8	-008	.86	-----	2.04	.63	43/64	-043	10.03	-----	-----	7.98
9/64	-009	1.13	-----	1.74	.68	11/16	-044	10.51	-----	23.45	8.12
5/32	-010	1.10	-----	2.31	.82	45/64	-045	10.99	-----	-----	8.75
11/64	-011	1.38	-----	2.32	.86	23/32	-046	11.49	-----	25.63	9.54
3/16	-012	1.26	-----	2.82	1.04	47/64	-047	11.99	-----	-----	11.13
13/64	-013	1.54	7.68	2.63	1.04	3/4	-048	12.26	89.48	27.67	8.61
7/32	-014	1.81	-----	3.20	1.14	49/64	-049	13.03	-----	-----	10.16
15/64	-015	1.81	-----	3.31	1.27	25/32	-050	13.57	-----	-----	10.29
1/4	-016	1.76	11.68	3.68	1.39	51/64	-051	14.12	-----	-----	11.91
17/64	-017	1.93	-----	4.23	1.28	13/16	-052	14.68	60.80	32.48	11.30
9/32	-018	2.16	-----	4.23	1.52	53/64	-053	15.25	-----	-----	13.86
19/64	-019	2.40	-----	5.55	1.75	27/32	-054	15.83	-----	-----	12.01
5/16	-020	2.42	17.04	5.31	2.02	59/64	-055	16.42	-----	-----	12.81
21/64	-021	2.72	-----	5.18	1.97	7/8	-056	17.02	121.87	37.66	12.90
11/32	-022	2.98	-----	5.97	2.28	57/64	-057	17.63	-----	-----	13.75
23/64	-023	3.11	-----	6.25	2.56	29/32	-058	18.26	-----	-----	13.87
3/8	-024	3.41	23.88	7.14	2.73	59/64	-059	18.90	-----	-----	14.74
25/64	-025	3.72	-----	7.37	2.84	15/16	-060	19.54	112.30	-----	14.92
13/32	-026	4.03	-----	8.35	3.13	61/64	-061	20.20	-----	-----	15.74
27/64	-027	4.34	-----	8.64	3.38	31/32	-062	20.85	-----	-----	15.92
7/16	-028	4.62	-----	8.75	3.64	63/64	-063	21.55	-----	-----	16.90
29/64	-029	5.01	-----	10.00	3.58	1	-100	20.73	153.29	48.89	15.02
15/32	-030	5.36	-----	11.21	4.14	1-1/16	-104	22.93	-----	-----	16.57
31/64	-031	5.39	-----	11.50	4.50	1-1/8	-108	27.16	-----	-----	16.91
1/2	-032	5.66	41.05	12.85	4.81	1-3/16	-112	30.34	-----	-----	23.32
33/64	-033	6.05	-----	12.54	4.92	1-1/4	-116	31.64	-----	71.54	25.48
17/32	-034	6.05	-----	14.35	5.09	1-1/2	-120	34.89	-----	-----	28.10
35/64	-035	6.81	-----	15.87	5.73	1-3/8	-124	38.29	-----	86.58	30.85
9/16	-036	7.29	-----	15.87	6.00	1-7/16	-128	41.89	-----	-----	33.71
37/64	-037	7.51	-----	15.87	6.50	1-1/2	-132	45.49	-----	102.15	33.72
19/32	-038	8.03	46.20	17.68	6.59	1-5/8	-140	48.66	-----	-----	39.62
39/64	-039	8.46	-----	17.68	7.11	1-3/4	-148	55.37	-----	139.04	45.91
						2	-200	72.94	-----	180.21	58.46

**High Speed**  
 Latrobe Electric Double Six  
 High Speed, M-2 Quality  
 36" Length, Ground and  
 Polished Drill Rods

**Air Hardening**  
 An electric furnace, air-hardening,  
 fine grain, fully spheroidized,  
 100% decarb-free tool steel. Its  
 5% chrome content gives it excel-  
 lent wear and abrasion resistance

**Water Hardening**  
 An electric furnace, fine grain, fully  
 spheroidized, 100% decarb-free,  
 commercial grade tool steel. Its  
 high carbon content allows it to be  
 used without heat treatment for  
 many maintenance applications.