US00RE38151E

(19) **United States**

(12) **Reissued Patent**

Penkunas et al.

(10) **Patent Number: US RE38,151 E**

(45) **Date of Reissued Patent: *Jun. 24, 2003**

(54) **ROTATABLE CUTTING BIT**

(75) Inventors: **Joe Penkunas**, Wake Forest, NC (US); **Neil Portnoff**, Towanda, PA (US)

(73) Assignee: **Kennametal Inc.**, Latrobe, PA (US)

(*) Notice: This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/933,234**

(22) Filed: **Aug. 20, 2001**

Related U.S. Patent Documents

Reissue of:

(64) Patent No.: **4,865,392**
Issued: **Sep. 12, 1989**
Appl. No.: **07/074,210**
Filed: **Jul. 16, 1987**

U.S. Applications:

(63) Continuation of application No. 06/756,210, filed on Jul. 18, 1985, now Pat. No. 4,725,099.

(51) **Int. Cl.**[7] **E21C 35/18**

(52) **U.S. Cl.** **299/111**; 175/426

(58) **Field of Search** 299/111, 113, 299/110, 79.1; 175/426, 428

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,847,921	A	8/1958	Heckathorn	172/699
3,268,259	A	8/1966	Snipe	299/111
3,356,418	A	12/1967	Henley et al.	299/113
3,397,012	A	8/1968	Krekeler	299/104
3,498,677	A	3/1970	Morrow	299/102
3,519,309	A	7/1970	Engle et al.	299/107
3,663,063	A	5/1972	Johnmeyer et al.	299/107
3,796,464	A	3/1974	Hansen et al.	299/104

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

DE	1275499	4/1969
DE	2442146	3/1976
DE	2644992	4/1978
DE	2820642	11/1978
DE	2821673	4/1980
DE	2846744	4/1980
FR	1350451	3/1963
GB	1110495	4/1968
GB	1112446	5/1968
GB	1294717	11/1972
GB	2041289	9/1980
GB	1601470	10/1981
SU	316835	10/1971
SU	468994	7/1975
SU	646047	2/1979
SU	899916	1/1982

OTHER PUBLICATIONS

American Mine Tool Drawing T104 23 (Mar. 29, 1983) Long Rock Tip.

Kennametal Catalog for "Carbide Tools" (1980) B80–43 (10) LO.

(List continued on next page.)

Primary Examiner—Heather Shackelford

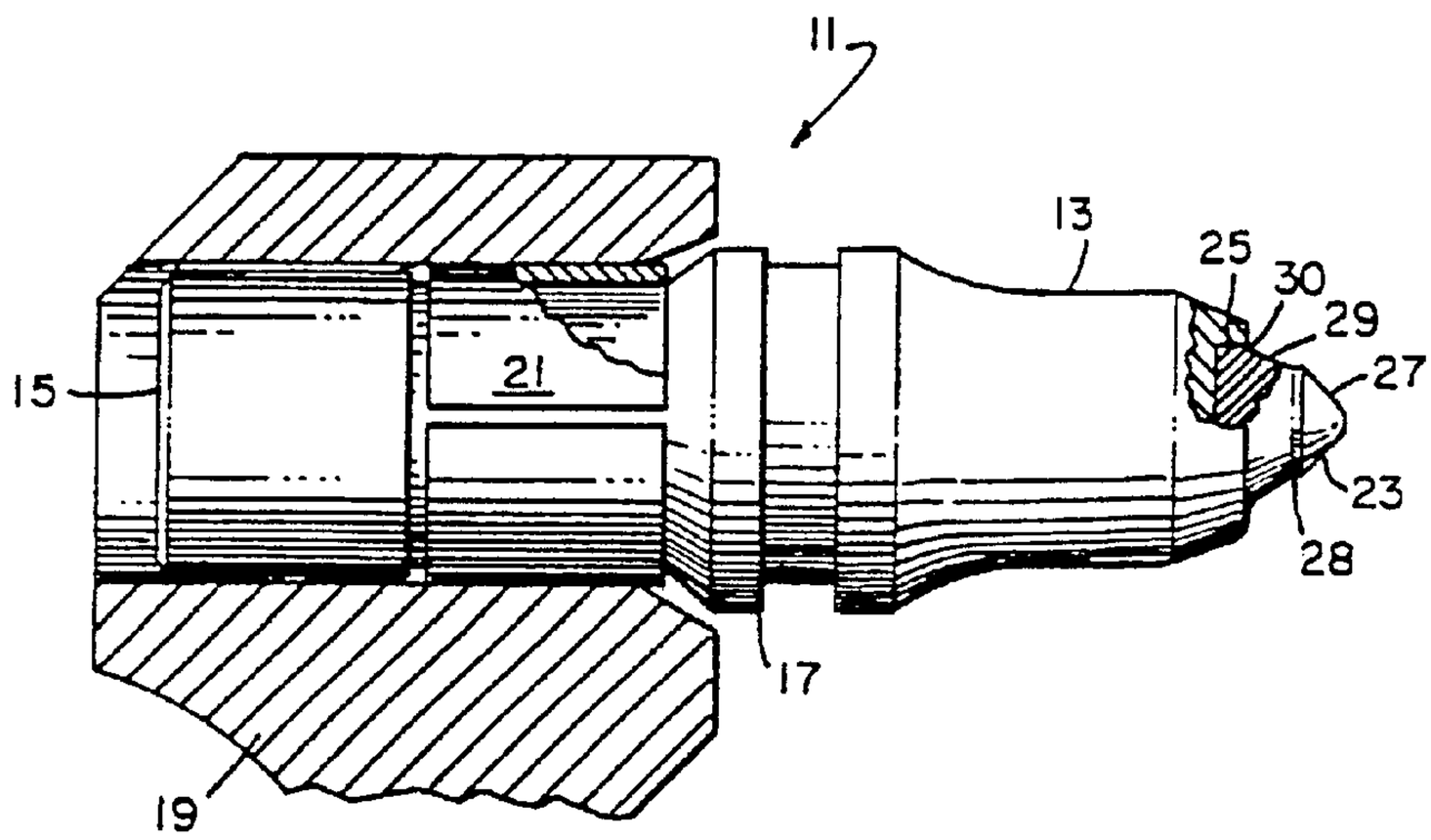
Assistant Examiner—John Kreck

(74) *Attorney, Agent, or Firm*—Kevin P. Weldon

(57) **ABSTRACT**

A rotatable cutting insert of improved geometry having a shank depending from a head portion and having a hard insert mounted therein, includes an insert having a conically shaped tip section, a base section contiguous with a first intermediate section, a second intermediate section contiguous with both tip and first intermediate section, and where the diameter of the second intermediate section is equal to the maximum diameter of the tip but is smaller than the diameter of the base section.

56 Claims, 1 Drawing Sheet



U.S. PATENT DOCUMENTS

3,807,804	A	4/1974	Kniff	299/113
3,830,321	A	8/1974	McKenry et al.	175/332
3,997,011	A	12/1976	Staroba	175/400
4,065,185	A	12/1977	Elders	299/110
4,084,856	A	4/1978	Emmerich et al.	299/104
4,149,753	A	4/1979	Stoltz et al.	299/107
4,163,581	A	8/1979	Krekeler	299/102
4,201,421	A	5/1980	Den Besten et al.	299/107
4,216,832	A	8/1980	Stephenson et al.	175/540
4,333,687	A	6/1982	Barnstorf	299/81.2
4,484,783	A	11/1984	Emmerich	299/107
4,497,520	A	2/1985	Ojanen	299/111
4,542,943	A	9/1985	Montgomery, Jr. et al.	299/102
4,547,020	A	10/1985	Ojanen	299/111
4,561,698	A	12/1985	Beebe	299/104
4,582,364	A	4/1986	deMey, III	299/111
4,938,538	A	7/1990	Larsson et al.	299/111
5,161,859	A	11/1992	Larsson et al.	299/111

OTHER PUBLICATIONS

General Electric Drawing for CCT–765–CB Tip (Mar. 27, 1979).

Multi–Metals Drawing C–14455–7 (Sep. 5, 1973).

American Mine Tool "Competitive Evaluation Report" (Jun. 29, 1982) by R.W. Ojanen.

"Rock cutting experiments with point attack tools," Collier Guardian Coal International Apr. 1980 Pp. 47, 49–50.

Mining Journal, Apr. 2, 1965 "Cap Tip For Picks".

Advertisement for Mining Supplies Ltd in Colliery Guardian, Oct. 4, 1962.

American Mine Tool Drawing T–104–13 (Nov. 30, 1982).

American Mine Tool Drawing AM722M (Oct. 13, 1982).

American Mine Tool Drawing SC–12 (May 8, 1982).

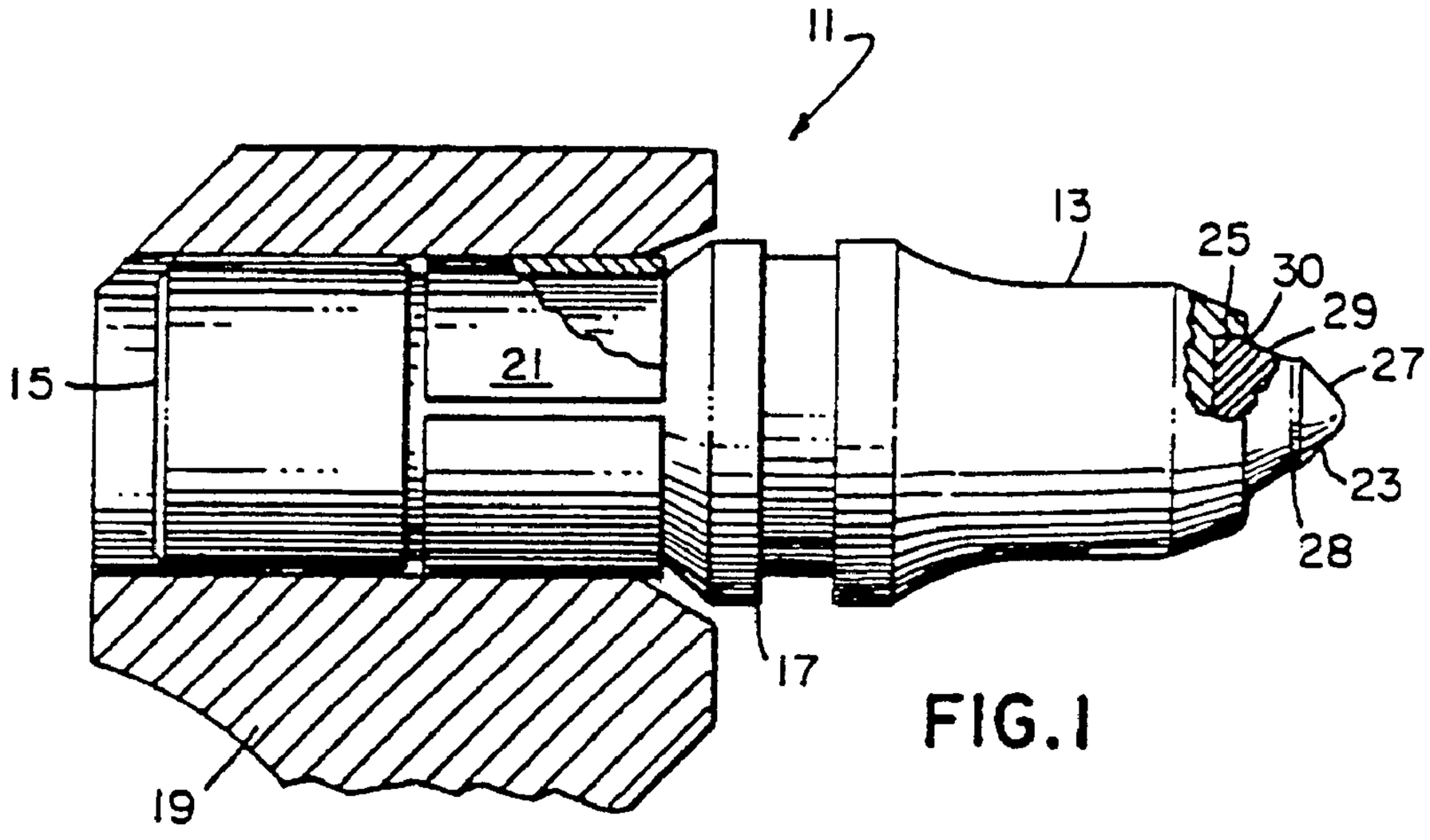


FIG.1

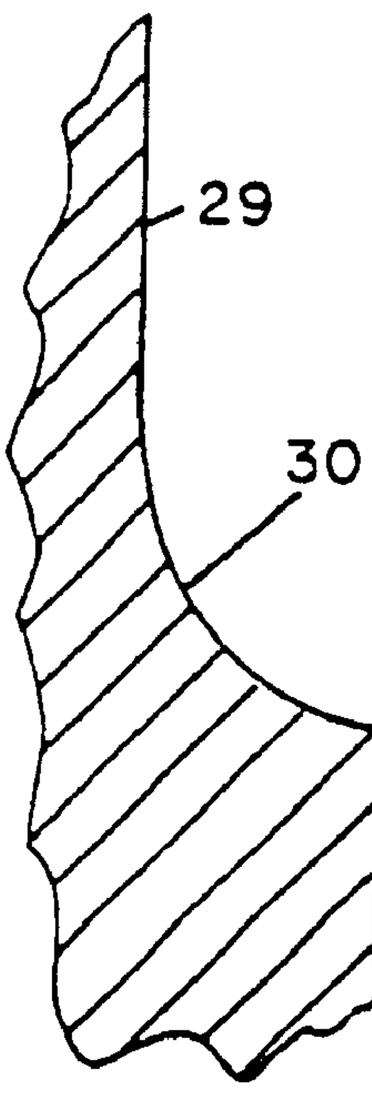


FIG.4

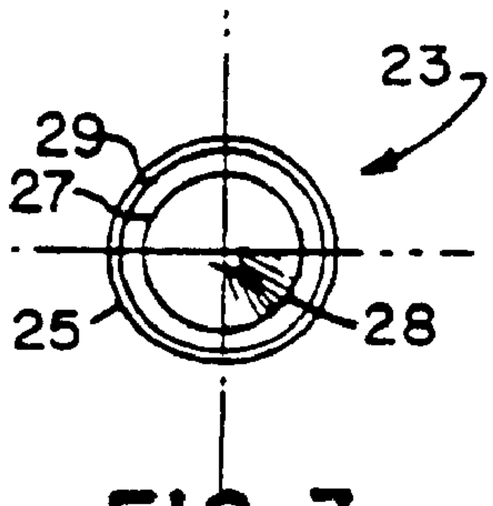


FIG.3

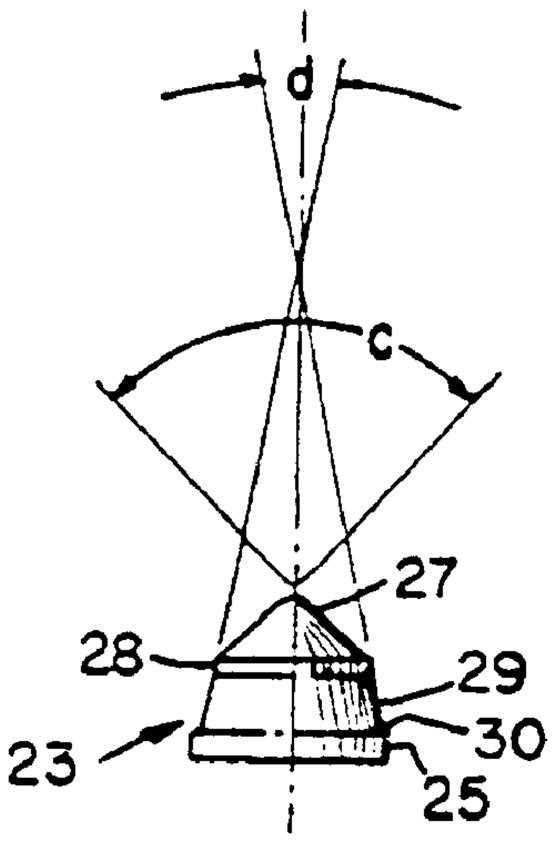


FIG.2

ROTATABLE CUTTING BIT

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This is a continuation of co-pending application serial no. 756,210 filed on 7/18/85 now U.S. Pat. No. 4,725,099.

FIELD OF INVENTION

The present invention relates to a rotatable cutting bit of the type having an improved head portion and depending shank.

BACKGROUND OF INVENTION

Bits that are used in mining and for removing road surfaces are typically mounted in a machine having a power driven cutting wheel.

When employed on abusive material such as concrete, the attack bits encounter high pressures and undergo excessive steel wear around the tip section. Currently employed conically shaped tips not only experience degrees of blunting, thereby reducing machines speed, but also suffer from the presence of manufacturing flaws which can lead to total bit failure.

One example of commercially successful bits is described in U.S. Pat. No. 4,497,520, issued on Feb. 5, 1985 to Ojanen and assigned to the same assignee as the present invention. The patent discloses and claims a rotatable cutting bit where the head portion consists of a base section, a conical tip section with a maximum diameter, and an intermediate section contiguous with the base and tip sections. Under manufacturing conditions the dies used in forming these bits experience wear at the point of maximum tip diameter (the seam) resulting in unwanted accumulation of uncompressed carbide material (flashing). Commonly known methods of polishing, such as mechanical tumbling, remove the flashing but generate stress cracks along the same thereby increasing the likelihood of bit failure.

As a consequence of the commercial success of assignees Patent No. 4,497,520, consideration has now been given to improvements in construction relative to methods of manufacture for such tooling for better quality and control in production volumes.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided, a rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said second diameter, said second and third diameters each being less than said first diameter, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section.

The present invention alleviates the disadvantages of premature blunting and the formation of manufacturing

flaws by providing a small diameter tip and by providing an adjoining cylindrical intermediate section. In production, the tip end plunger completes its compression stroke on a vertical section of the die rather than on the angular seam section of the prior art, thereby reducing die wear and the associated problems of flashing accumulation and stress crack formation.

DRAWINGS

FIG. **1** is a partially sectioned view of a bit mounted in block.

FIG. **2** is a side view of a tip;

FIG. **3** is an end view of a tip; and

FIG. **4** is a cut-out side view of the fillet section joining the first intermediate section and the base section.

DETAILED DESCRIPTION

Referring to the drawings, FIG. **1** shows a rotatable bit **11** having a head portion **13** and a depending shank portion **15**. The head portion **13** and shank **15** are coaxially aligned with the head **13** having an enlarged section **17** which prevents the head **13** from being forced into the opening in the mounting block **19**. The shank portion **15** which is a cylindrical configuration includes a sleeve **21** which is radially contracted when present in the opening so as to hold the bit **11** in the block **19**.

A hard insert **23** typically made of a carbide material is fixedly secured to the forward end of the head **13**. Preferably the base section **25** of the insert **23** is positioned in the socket and brazed in such a manner that the braze flows over and around the base section **25**.

In accordance with the principals of the present invention, the insert **23** includes a plurality of sections coaxially aligned with the head **13** and shank **15** of the bit **11**. The sections include a base section **25**, a tip section **27**, a first intermediate section **29** contiguous to both the base **25** and a second intermediate section **28**, and a tip section **27** contiguous with the second intermediate section **28**.

The tip section **27** tapers outwardly at an included angle "c" of from about 83 degrees to about 93 degrees. Preferably the angle is about 88 degrees. The point portion of the tip may be rounded to promote even wearing. Preferably the tip **27** extends downwardly in an axial direction toward the base **25** a distance of from about 0.12 to about 0.18 inches. The maximum diameter of the tip **27** is from about 0.36 to about 0.44 inches, and most preferably about 0.40 inches.

The second intermediate section **28** extends downwardly from the junction with tip **27** or forwardly from the junction with the first intermediate section **29** along a longitudinal direction a distance of about 0.02 to about 0.05 inches and most preferably about 0.03 inches. The second intermediate section **28** is cylindrical in shape and exhibits a uniform diameter equal to the maximum diameter of the tip **27**.

The first intermediate section **29** extends downwardly from the juncture with the second intermediate section **28** or forwardly from the juncture with the base **25** along a longitudinal direction a distance of about 0.22 to about 0.28 inches. Preferably the first intermediate section **29** has a frusto-conical shape and tapers outwardly to the base section **25** at an included angle "d" of from about **17** to about **23** degrees. The taper is outwardly from the junction with the second intermediate section **28** to the junction with the base **25**. The first intermediate section **29** has a maximum diameter less than the diameter of the base **25**.

The base section **25** preferably has a diameter of from about 0.60 to about 0.66 and most preferably about 0.63. The

extension of the base **25** in the axial direction or the height of the base is from about 0.05 to about 0.11 inches preferably about 0.08. As illustrated in FIG. **3** and FIG. **4**, a fillet **30** may be utilized to give a smooth transition from the base **25** to the first intermediate section **29** whereby the base **25** forms a shoulder with the first intermediate section **29**. The transition is in the form of an arc of radius between about 0.15 inches and about 0.25 inches which sweeps out a distance starting from the base section **25** forwardly to a diameter in the first intermediate section **24** of between about 0.54 to about 0.60 inches and preferably about 0.60. A more severe transition between the first intermediate section **29** and the base **25** often results in the formation of stress cracks along the fillet thereby increasing the likelihood of bit failure.

The total axial length of the hard insert is the sum of the axial lengths of the tip section (0.12 inches to 0.18 inches), the second intermediate section (0.02 inches to 0.05 inches) (which is a fifth distance), the first intermediate section (0.22 inches to 0.28 inches), and the base section (0.05 inches to 0.11 inches). It can this be seen that the axial length of the hard insert, which is a sixth distance, can range between 0.41 inches to 0.62 inches. Using the preferred dimensions, the axial length ranges between about 0.45 inches and about 0.57 inches.

The ratio of the fifth distance, which is the axial length of the second intermediate section, to the first diameter of the base section ranges between about 0.03 and about 0.08. Based upon the preferred dimensions, this ratio of the fifth distance to the first diameter equals about 0.05.

The ratio of the fifth distance (the axial length of the second intermediate section) to the sixth distance (the overall axial length of the hard insert) has a range between a minimum ratio and a maximum ratio. The minimum ratio is the ratio of the minimum fifth distance (i.e., 0.02 inches) to the maximum sixth distance that uses the minimum fifth distance. This sixth distance (i.e., 0.59 inches) used to arrive at the minimum ratio equals the sum of the maximum axial length of the tip section (0.18 inches), the minimum axial length of the second intermediate section (0.02 inches), the maximum axial length of the first intermediate section (0.28 inches), and the maximum axial length of the base section (0.11 inches). This minimum ratio equals about (0.02/0.59) 0.03. The maximum ratio is the ratio of the maximum fifth distance to the minimum sixth distance that uses the maximum fifth distance. The sixth distance equals the sum of the minimum axial lengths of the tip section (0.12 inches), the first intermediate section (0.22 inches), and the base section (0.05 inches), and the maximum fifth distance (0.05 inches). This maximum ratio equals about (0.05/0.44) 0.11. Based upon the preferred dimensions to the extent they are set forth, the preferred ratio of the fifth distance to the sixth distance ranges between about (0.03/0.57) 0.05 and about (0.03/0.45) 0.07.

Since variations of this invention will be apparent to those skilled in the art, it is intended that this invention be limited only by the scope of the appended claims.

I claim:

1. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section said insert is fixedly held to said head portion by brazing.

2. A rotatable cutting bit according to claim **1** wherein said tip section tapers outwardly at an included angle of from about 83 degrees to about 93 degrees.

3. A rotatable cutting bit according to claim **2** wherein said first intermediate section extends forwardly along the longitudinal axis from said base section to said second intermediate section a distance of from about 0.22 to about 0.28 inches.

4. A rotatable cutting bit according to claim **3** wherein said second intermediate section has a cylindrical shape **[**and extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches**]**.

5. A rotatable cutting bit according to claim **4** wherein said base section extends forwardly along the longitudinal axis a distance of from about 0.05 to about 0.11 inches.

6. A rotatable cutting bit according to claim **5** wherein said first diameter is from about 0.60 to about 0.66 inches.

7. A rotatable cutting bit according to claim **6** wherein said second diameter is from about 0.36 to about 0.44 inches.

8. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, substantially all of said first intermediate section projects forwardly of the forward end of said head portion, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section said insert is fixedly held to said head portion by brazing.

9. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and

integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of from about 17 to about 23 degrees, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section said insert is fixedly held to said head portion by brazing.

10. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of from about 17 to about 23 degrees, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section said insert is fixedly held to said head potion by brazing, said braze flowing over and around said base section.

11. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having a coaxially aligned and integral sections, said **[**section**]** *sections* comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter of from about 0.60 to about 0.66 inches, said tip section having a maximum second diameter being from about 0.35 to about 0.44 inches and being conically shaped with an included angle from about 83 degrees to about 93 degrees, said first intermediate section having a maximum third diameter, said second

intermediate section having a maximum fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape angling outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of about 17 to about 23 degrees, said first intermediate section and said base forming a fillet at the junction thereof whereby said base forms a shoulder with said intermediate section, said insert is fixedly held to said head portion by brazing.

12. A rotatable cutting bit according to claim **11** wherein said first intermediate section extends forwardly along the longitudinal axis from said base section to said second intermediate section a distance of about 0.22 to about 0.28 inches.

[13. A rotatable bit according to claim **12** wherein said second intermediate section extends forwardly along the longitudinal axis from said first intermediate section to said second section a distance from about 0.02 to about 0.05 inches.**]**

14. A rotatable cutting bit according to claim **[13]** *12* wherein said base section extends forwardly along the longitudinal axis a distance of from about 0.05 to about 0.11 inches.

15. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having a coaxially aligned and integral sections, said **[**section**]** *sections* comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter of from about 0.60 to about 0.66 inches, said tip section having a maximum second diameter being from about 0.36 to about 0.44 inches and being conically shaped with an included angle from about 83 degrees to about 93 degrees, said first intermediate section having a maximum third diameter, said second intermediate section having a maximum fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape angling outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of about 17 to about 23 degrees, said first intermediate section extends forwardly along the longitudinal axis from said base section to said second intermediate section a distance of about 0.22 to about 0.28 inches, said first intermediate section and said base forming a fillet at the junction thereof whereby said base forms a shoulder with said intermediate section, said insert is fixedly held to said head portion by brazing.

16. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having a coaxially aligned and integral sections, said **[**section**]** *sections* comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, said base being fixedly mounted in said socket and having a first diameter of from about 0.60 to about 0.66

inches, said tip section having a maximum second diameter being from about 0.36 to about 0.44 inches and being conically shaped with an included angle from about 83 degrees to about 93 degrees, said first intermediate section having a maximum third diameter, said second intermediate section having a maximum fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape angling outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of about 17 to about 23 degrees, said first intermediate section and said base forming a fillet at the junction thereof whereby said base forms a shoulder with said intermediate section, said second intermediate section extending forwardly along the longitudinal axis from said first intermediate section to said second section a distance from about 0.02 to about 0.05 inches, said insert is fixedly held to said head portion by brazing.

17. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having a coaxially aligned and integral sections, said section comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, *said second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance of about 0.02 to about 0.05 inches,* said base being fixedly mounted in said socket and having a first diameter of from about 0.60 to about 0.66 inches, said base section extends forwardly along the longitudinal axis a distance of from about 0.05 to about 0.11 inches, said tip section having a maximum second diameter being from about 0.36 to about 0.44 inches and being conically shaped with an included angle from about 83 degrees to about 93 degrees, said first intermediate section having a maximum third diameter, said second intermediate section having a maximum fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape angling outwardly from the junction with said second intermediate section to the junction with said base section at an included angle of about 17 to about 23 degrees, said first intermediate section and said base forming a fillet at the junction thereof whereby said base forms a shoulder with said intermediate section, said insert is fixedly held to said head portion by brazing.

18. A rotatable cutting bit according to claim 1 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

19. A rotatable cutting bit according to claim 8 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

20. A rotatable cutting bit according to claim 9 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

21. A rotatable cutting bit according to claim 10 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

22. A rotatable cutting bit according to claim 11 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

23. A rotatable cutting bit according to claim 15 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

24. A rotatable cutting bit according to claim 16 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

25. A rotatable cutting bit according to claim 17 wherein said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a distance of about 0.03 inches.

26. A rotatable cutting bit according to claim 1 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

27. A rotatable cutting bit according to claim 26 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

28. A rotatable cutting bit according to claim 26 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

29. A rotatable cutting bit according to claim 8 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

30. A rotatable cutting bit according to claim 29 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

31. A rotatable cutting bit according to claim 29 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

32. A rotatable cutting bit according to claim 9 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

33. A rotatable cutting bit according to claim 32 wherein the second intermediate section extends forwardly along the

longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

34. A rotatable cutting bit according to claim 32 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

35. A rotatable cutting bit according to claim 10 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

36. A rotatable cutting bit according to claim 35 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

37. A rotatable cutting bit according to claim 35 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

38. A rotatable cutting bit according to claim 11 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

39. A rotatable cutting bit according to claim 38 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

40. A rotatable cutting bit according to claim 38 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

41. A rotatable cutting bit according to claim 15 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

42. A rotatable cutting bit according to claim 41 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

43. A rotatable cutting bit according to claim 41 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

44. A rotatable cutting bit according to claim 16 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

45. A rotatable cutting bit according to claim 44 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

46. A rotatable cutting bit according to claim 44 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

47. A rotatable cutting bit according to claim 17 wherein the hard insert having an overall axial length, and the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 3.4 percent and about 11.4 percent of the overall axial length of the hard insert.

48. A rotatable cutting bit according to claim 47 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5 percent and about 9 percent of the overall axial length of the hard insert.

49. A rotatable cutting bit according to claim 47 wherein the second intermediate section extends forwardly along the longitudinal axis from the junction with the first intermediate section to the tip section a distance that ranges between about 5.5 percent and about 6.5 percent of the overall axial length of the hard insert.

50. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a fifth distance, said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section, said insert is fixedly held to said head portion by brazing, and the ratio of the fifth distance to the first diameter ranging between about 0.03 and about 0.10.

51. The rotatable cutting bit according to claim 50 wherein the ratio of the fifth distance to the first diameter equals about 0.05.

52. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, the hard insert having an overall axial length equal to a sixth distance, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a fifth distance, said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section, said insert is fixedly held to said head portion by brazing, and the ratio of the fifth distance to the sixth distance ranging between about 0.03 and about 0.12.

53. The rotatable cutting bit according to claim 52 wherein the ratio of the fifth distance to the sixth distance ranges between about 0.05 and about 0.07.

54. A rotatable cutting bit comprising a head portion, a shank portion depending from said head portion along a longitudinal axis, said head portion having a socket at the forward end, a hard insert having coaxially aligned and integral sections, the hard insert having an overall axial length equal to a sixth distance, said sections comprising a base section, a tip section, a first intermediate section contiguous with said base, a second intermediate section of uniform diameter contiguous with said first intermediate and tip sections, said second intermediate section extends forwardly along the longitudinal axis from the junction with said first intermediate section to the tip section a fifth distance, said base being fixedly mounted in said socket and having a first diameter, said tip section being conically shaped and having a maximum second diameter, said first intermediate section having a maximum third diameter, said second intermediate section having a fourth diameter equal to said maximum second diameter, said second and third diameters each being less than said first diameter, said first intermediate section has a frusto-conical shape and angles outwardly from the junction with said second intermediate section to the junction with said base section, said first intermediate section at said base forming a fillet at the junction thereof whereby said base forms a shoulder with said first intermediate section, said insert is fixedly held to said head portion by brazing, and the ratio of the fifth distance to the first diameter ranging between about 0.03 and about 0.10, and the ratio of the fifth distance to the sixth distance ranges between about 0.03 and about 0.12.

55. The rotatable cutting bit according to claim 54 wherein the ratio of the fifth distance to the sixth distance ranges between about 0.05 and about 0.07.

56. The rotatable cutting bit according to claim 54 wherein the ratio of the fifth distance to the first diameter equals about 0.05.

57. The rotatable cutting bit according to claim 56 wherein the ratio of the fifth distance to the sixth distance ranges between about 0.05 and about 0.07.

* * * * *