Oct. 30, 1956 P. M. McKENNA 2,768,422

FILE AND METHOD OF MAKING THE SAME

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Fig. 1

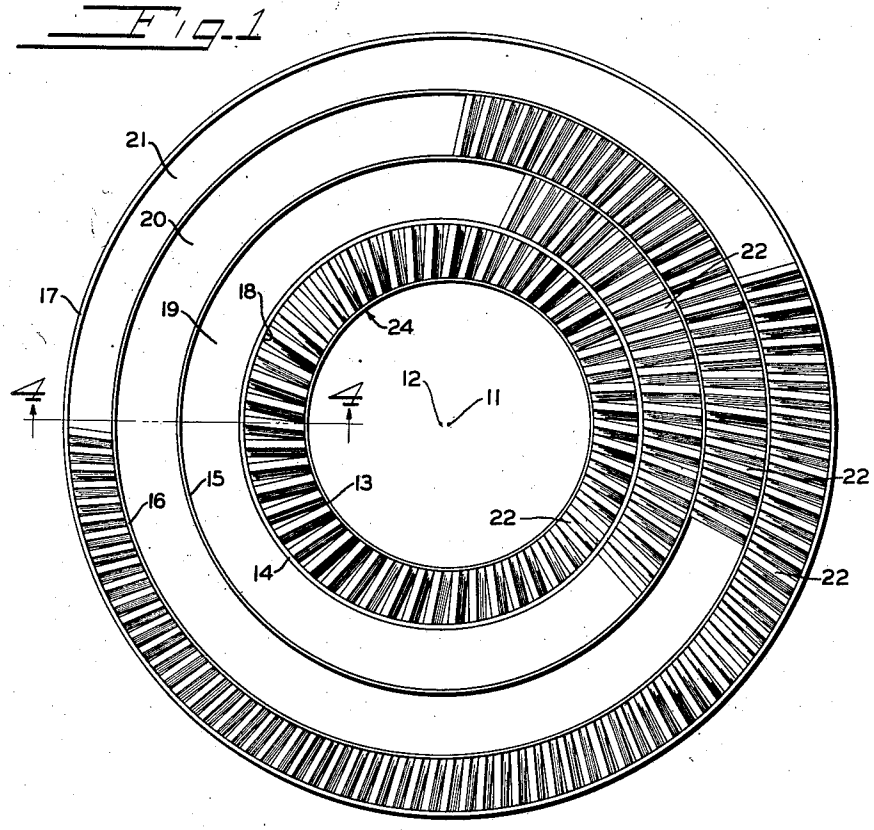

Fig. 2

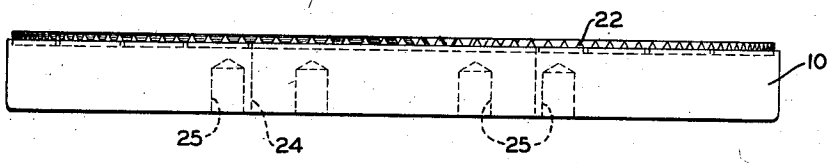

Fig. 3

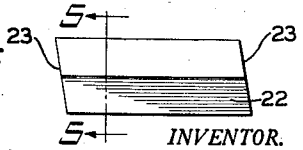

Fig. 4

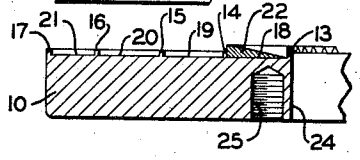

Fig. 5



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Fig. 6

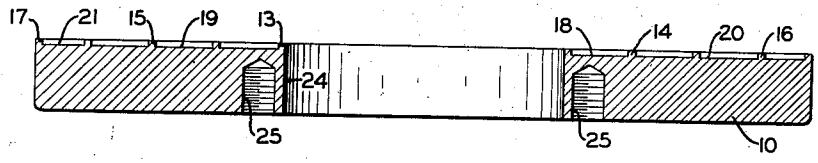


Fig. 7

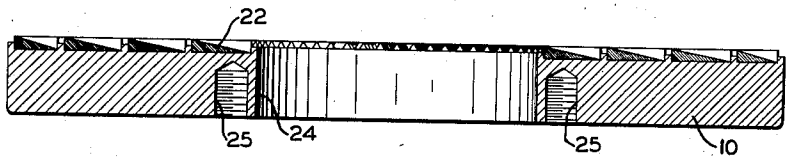
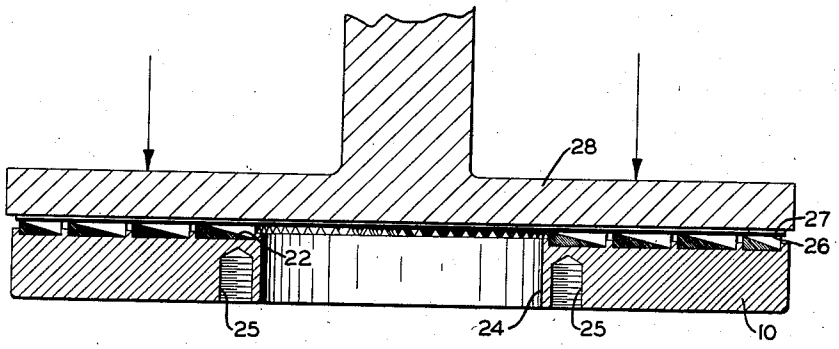


Fig. 8



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2,768,422

FILE AND METHOD OF MAKING THE SAME

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Application April 27, 1950, Serial No. 158,485
12 Claims. (Cl. 29—78)

My invention relates to improvements in files and method of making the same, and has to do, more particularly, with an improved rotary file and an improved method for making such a file.

The principal object of my invention is to provide a more efficient and satisfactory file than any heretofore known.

A further object of my invention is to provide a very efficient file which can be manufactured economically and efficiently.

Another object of my invention is to provide a practical and efficient file which makes use of cemented hard carbide compositions for the working surfaces of the file.

Another object of my invention is to provide an efficient and economical method for manufacturing files in large quantities.

Further objects, and objects relating to details and economies of construction and operation will definitely appear from the detailed description to follow. In one instance, I have accomplished the objects of my invention by the devices and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention, and various steps of a method of making it, are illustrated in the accompanying drawings, in which:

Fig. 1 is a plan view of a rotary file embodying my invention, part of the cemented hard carbide inserts being omitted for greater clarity in illustration.

Fig. 2 is a view of this file in side elevation.

Fig. 3 is a top plan view of one of the cemented hard carbide inserts.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1.

Fig. 5 is a sectional view through one of the inserts taken on the line 5—5 of Fig. 3.

Fig. 6 is a sectional view through the metal base for the file illustrating the first step in the manufacture thereof.

Fig. 7 is a similar sectional view through the base showing the cemented hard carbide inserts assembled thereon, and

Fig. 8 is a similar sectional view showing the step of copper brazing the hard carbide inserts in position.

In the drawings the same reference numerals refer to the same parts throughout the several views and the sectional views are taken looking in the direction of the arrows at the ends of the section lines.

In general, my improved file comprises a metal base on which a plurality of cemented hard carbide inserts are seated side by side and parallel to each other and to which said inserts are rigidly secured, each of these inserts being in the form of an elongated triangular prism, a right-section of which is an equilateral triangle. These inserts are preferably arranged and secured in the base in a plurality of parallel courses with the apices of the triangular prisms uppermost so as to form cutting edges which extend transversely of the courses and lie in a common plane. When my invention is embodied in a rotary file, these courses are preferably with their adjacent or intermediate annular side edges concentric with an axis which is displaced from the axis about which the base is adapted to rotate in use. The file may include an outer course, the inner edge of which is concentric with the displaced axis and the outer edge of which is concentric with the axis of rotation, and it may include an inner course, the outer edge of which is concentric with the displaced axis while the inner edge thereof is concentric with the axis of rotation. The inserts are preferably secured to the metal base by copper brazing.

I find it desirable to form a plurality of annular channels in the metal base in which the cemented hard carbide inserts are seated side by side with their apices projecting from the channels to form cutting edges. The inserts are preferably inclined so that the cutting edges intersect a line normal to the side wall of the channel at an angle of about 10°. Of course, when a rotary file is to be constructed these channels are annular with annular inner and outer edges or side walls.

The improved method of my present invention comprises assembling a plurality of cemented hard carbide inserts in the form of triangular prisms upon a metal base side by side with the apices uppermost and lying in a common plane, pressing said inserts to seat them on the base and securing them to the base while subjected to this pressure. I prefer to secure the inserts to the base by a copper brazing operation. This may be effected by placing a sheet of copper on top of the assembled inserts, pressing it against the inserts and subjecting the assembly to a temperature above the melting point of copper in a hydrogen atmosphere while maintaining such pressure. I prefer to form the cemented hard carbide insert by extruding a bar of hard carbide composition and of triangular cross section, cutting said bar into sections of desired length and then sintering the sections to form the inserts. The bar is preferably cut in planes intersecting its longitudinal axis at an angle of about 10° so that the ends of the sections and, hence, the ends of the inserts, intersect a plane normal to the longitudinal axis of the insert at an angle of about 10°.

Referring to the numbered parts of the drawings, in which I have shown a rotary file adapted to be rotated about an axis indicated at **11** in Fig. 1, there is a metal base **10** which is cylindrical and coaxial with the axis of rotation **11**. Concentric ridges **13** and **17** are formed on the upper surface of base **10** concentric with the axis of rotation **11**. Ridges **14**, **15** and **16** are also formed on the upper surface of base **10** and are concentric with each other and with an axis **12** which is displaced slightly from the axis of rotation **11**. In the rotary file illustrated this displacement is 1/16". Ridges **13**, **14**, **15**, **16** and **17** are spaced from each other and form the annular channels **18**, **19**, **20** and **21** in the upper surface of base **10**. The intermediate channels **19** and **20** are of uniform width throughout while the inner channel **18** and the outer channel **21** are of varying width because their inner and outer walls are concentric with respect to different centers.

Each of said channels is filled with a plurality of cemented hard carbide inserts **22**, each of which is an elongated, triangular prism, a right-section of which is an equilateral triangle. The flat faces of these prisms are seated on the bottoms of the channels **18**, **19**, **20** and **21** with the apices projecting above the channels and forming cutting edges extending transversely of the channels. As shown in Fig. 3, the ends **23** of the inserts **22** lie in planes intersecting a plane normal to the longitudinal axis of the inserts at an angle of 10°. These inserts are assembled in the channels with the end faces contacting the side walls of the channels, with the result that the cutting edges of these inserts intersect a radius from the displaced axis **12** at an angle of 10°.

These cemented hard carbide inserts are rigidly secured in their seated arrangement in the channels, preferably by a copper brazing operation which forms a very secure and satisfactory bond between the inserts and the metal of the base.

The inserts 22 are preferably formed of a cemented or sintered tungsten carbide composition such as is well known in the art, but, of course, may be formed of other cemented hard carbide compositions, if desired.

The base is provided with a central opening 24 concentric with the axis of rotation 11 which may receive the hub of a device for clamping the base 10 to a shaft by which it is to be rotated. Screw holes 25 are formed in the base surrounding the central opening and extending upwardly from the bottom of the base for receiving clamping screws by which the base is secured to the device by which it is to be rotated.

Although it is to be understood that I am not to be limited to any specific dimensions of the parts, I will indicate some of the principal dimensions used in the rotary file illustrated herein. Each insert has a cross section of an equilateral triangle one-eighth of an inch high. These inserts are slightly less than a half inch long. As stated above, those in channels 18 and 21 vary in length, the shortest being about a third of an inch long while the longest are slightly less than a half inch in length. The rotary file illustrated is six inches in diameter and, as shown, it has four courses of inserts, there being forty-eight of these inserts in the inner course, sixty-six in the next course, eighty-seven in the third course and three hundred and nine in the outer course. If an eight inch file were to be constructed it would have four intermediate courses, or a total of six courses. A ten inch rotary file would have six intermediate courses, or a total of eight courses, as would a twelve inch file. In the file illustrated the channels 18, 19, 20 and 21 are about 1/16" deep.

The cemented hard carbide inserts 22 may be made by extruding a long bar of hard carbide composition of triangular cross section and of such dimensions that, after sintering, the insert will be of the required size. This extruded bar of hard carbide composition is cut into sections in planes intersecting a plane at right angles to the longitudinal axis of the bar at an angle of 10°. These sections are then sintered in accordance with the usual practice to form the sintered or cemented hard carbide composition illustrated in Figs. 3 and 5 and used in making this file.

The base 10 is first formed with the channels 18, 19, 20 and 21 therein as shown in Fig. 6. The base will also be formed with the central opening 24 and the screw holes 25. The next step is to assemble a plurality of the cemented hard carbide inserts 22 in the channels with their bases seating on the bottoms of the channels and with their apices projecting therefrom. The inclined ends 23 will be placed against the side walls of the channels with the result that the cutting edges of the inserts will intersect a radius from the displaced axis 12 of an angle of about 10°. Having assembled the inserts in the channels as thus described a relatively thin sheet of electrolytic copper 26, for instance, .005 of an inch in thickness, will be laid upon the tops of all the inserts. A sheet of asbestos 27 will be laid on top of the sheet of copper and pressure applied in the direction indicated by the arrows in Fig. 8 by means of a flat platen 28, which holds the copper against the tops of the inserts and holds the inserts to their seats in the bottoms of the channels. While such pressure is maintained, the assembly is subjected to a temperature of about 2100° F., exceeding the melting point of copper, in an atmosphere of hydrogen with the result that the inserts 22 are brazed and rigidly secured to the base 10 by a copper brazing operation.

Instead of this method of copper brazing the inserts in position, the base, and, more particularly, the channels 18, 19, 20 and 21, may be copper plated with a thin film of copper and then the inserts 22 assembled in the copper plated channels. These inserts are held to their seats as by means of a flat platen 28 and the assembly subjected to a temperature exceeding the melting point of copper in a hydrogen atmosphere for the purpose of securing the inserts in place by copper brazing.

I am aware that the file construction and the method of making it shown herein may be varied considerably without departing from the spirit of my invention and, therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by United States Letters Patent, is:

1. A rotary file comprising the combination of a metal base adapted to be rotated about an axis and having a plurality of annular channels formed therein which are divided by an annular division concentric with an axis eccentric with the axis of rotation, and a plurality of disconnected cemented hard carbide inserts in the form of triangular prisms seated side by side in said channels and secured therein with their apices extending above the surface of said base to form cutting edges.

2. The combination of claim 1 in which the ends of the prism inserts define planes intersecting a plane normal to the longitudinal axis of the prism at an angle of the order of 10° and said inserts are so arranged in the channels that each cutting edge intersects a radius from the axis of rotation at an angle of the order of 10°.

3. The combination of claim 2 in which the outermost channel has an outer wall concentric with the axis of rotation, and a plurality of cemented hard carbide inserts in the form of triangular prisms secured side by side in said outer channel with their cutting edge apices projecting from the channel and extending transversely thereof.

4. A rotary file comprising the combination of a metal base adapted to be rotated about an axis and having formed therein a plurality of annular channels the bases of which are in a single plane normal to said axis, a plurality of said channels having annular walls concentric with respect to an axis displaced with respect to said axis of rotation, there being an outer channel, the inner wall of which is concentric with respect to the displaced axis and the outer wall of which is concentric with respect to the axis of rotation, and an inner channel, the outer wall of which is concentric with respect to said displaced axis and the inner wall of which is concentric with respect to said axis of rotation, and a plurality of disconnected cemented hard carbide inserts in the form of triangular prisms seated side by side in said channels and rigidly secured therein with their apices projecting uniformly from said channels to form cutting edges extending transversely thereof, the inserts in said intermediate channels being of uniform length and those in the inner and outer channels being of varying length.

5. The combination of claim 4 in which the inserts are so secured in the channels that each cutting edge intersects a radius from the displaced axis at an angle of the order of 10°.

6. The method of making a file including the steps of forming a plurality of cemented hard carbide inserts in the form of triangular prisms, assembling a plurality of said inserts side by side on a metal base in a plurality of radially spaced annular rows with their apices uppermost and lying in a common plane, applying pressure to said inserts to seat them on said base by a flat surface engaging said apices, and securing said inserts to said base while subject to said pressure.

7. The method of claim 6 including the steps of supporting a copper sheet on the apices of said inserts, applying the seating pressure thereto through said sheet, and heating the assembly in a hydrogen atmosphere, to a temperature exceeding the melting point of copper, while maintaining said pressure.

8. The method of claim 7 including the steps of forming a plurality of parallel channels in said base and assembling said inserts in courses in said channels.

9. The method of claim 6 including the steps of extruding bars of hard carbide composition having the cross-sectional form of an equilateral triangle, cutting said bars into sections of the desired length, and sintering said sections to form the triangular prism inserts.

10. A rotary file comprising the combination of a metal base adapted to be rotated about an axis and having a plurality of annular channels formed in one face thereof bounded by annular side walls, the annular outer side wall of the outermost channel and the annular inner wall of the innermost channel being concentric with the axis of rotation and the intermediate annular side wall between the channels being concentric with an axis displaced from the axis of rotation, and a plurality of cemented hard carbide inserts in the form of triangular prisms, seated side by side and extending transversely of said channels and secured therein with their apices extending above the face surface of said base to form cutting edges.

11. The combination of claim 10 in which the ends of the prism inserts define planes intersecting a plane normal to the longitudinal axis of the prism at an angle of the order of 10° and said inserts are so arranged in said channels with said plane ends adjacent the opposite walls of said channels.

12. A rotary file comprising the combination of a metal base adapted to be rotated about an axis having defined on one face thereof a plurality of annular areas bounded by annular defining means, the outer annular defining means of the outermost area and the inner annular defining means of the innermost area being concentric with the axis of rotation and the intermediate defining means between the areas being concentric with an axis displaced from the axis of rotation, and a plurality of cemented hard carbide inserts in the form of triangular prisms, seated side by side and extending transversely of said areas and secured therein with their apices extending above the face surface of said base to form cutting edges.

References Cited in the file of this patent

UNITED STATES PATENTS

94,590	Gage	Sept. 7, 1869
818,633	Lord	Apr. 24, 1906
945,623	Sleade	Jan. 4, 1910
992,437	Metcalf	May 16, 1911
1,000,526	Lammel	Aug. 15, 1911
1,451,809	Bell	Apr. 17, 1923
1,472,960	Conklin	Nov. 6, 1923
1,571,559	Smith	Feb. 2, 1926
1,708,003	Weinman	Apr. 9, 1929
1,746,205	Thomson	Feb. 4, 1930
1,829,531	Neilsen	Oct. 27, 1931
1,866,044	Kress	July 5, 1932
1,887,373	Emmons et al.	Nov. 8, 1932
1,908,887	Breeler et al.	May 16, 1933
1,942,016	Andrus	Jan. 2, 1934
1,951,856	Balke	Mar. 20, 1934
1,964,972	Binns	July 3, 1934
2,178,590	Kraus	Nov. 7, 1939
2,211,183	Tytus et al.	Aug. 13, 1940
2,271,960	Taylor	Feb. 3, 1942
2,306,620	Futhey	Dec. 29, 1942
2,367,221	Kraus	Jan. 16, 1945

FOREIGN PATENTS

3,355	Great Britain	Oct. 16, 1873
152,836	Great Britain	Oct. 28, 1920
542,911	Germany	Jan. 29, 1932
558,767	France	June 1, 1923