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2,455,348

PROCESS OF MAKING SPARKING WHEELS

Filed Aug. 25, 1945

2 Sheets-Sheet 1

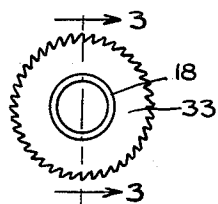


Fig. 1

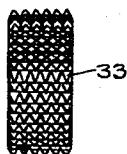


Fig. 2

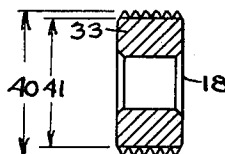


Fig. 3

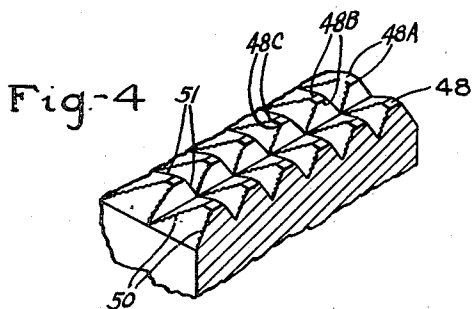


Fig. 4

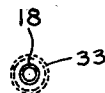


Fig. 5

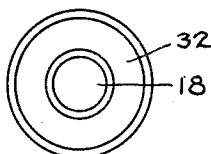


Fig. 6

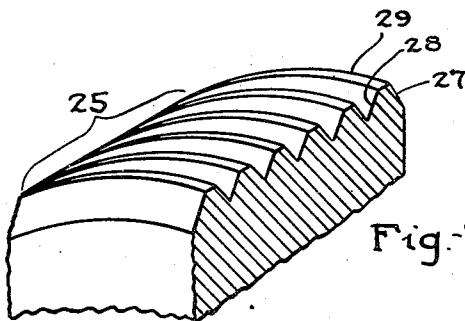


Fig. 7

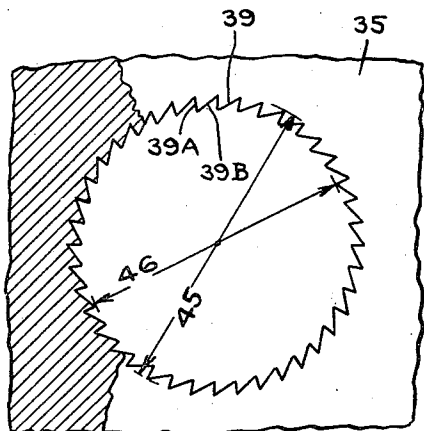


Fig. 12

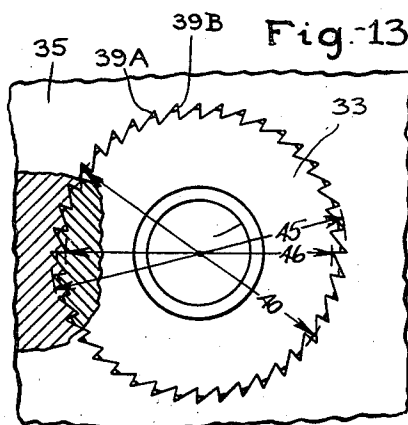


Fig. 13

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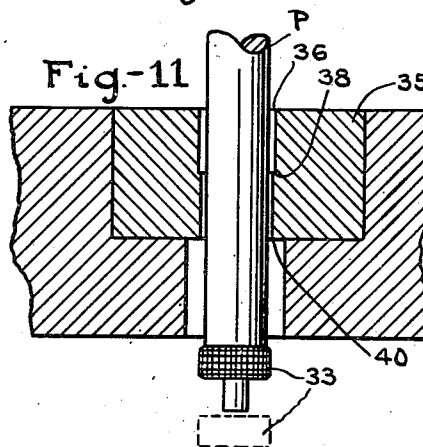
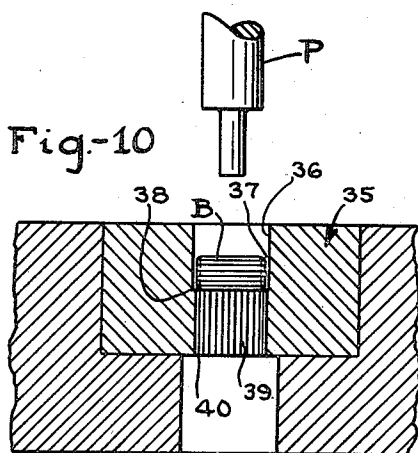
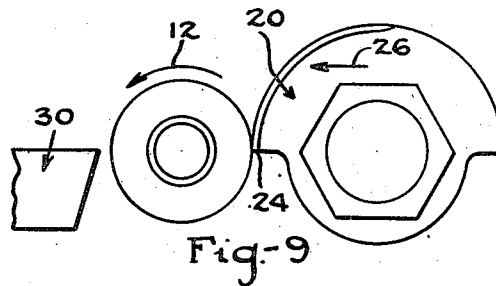
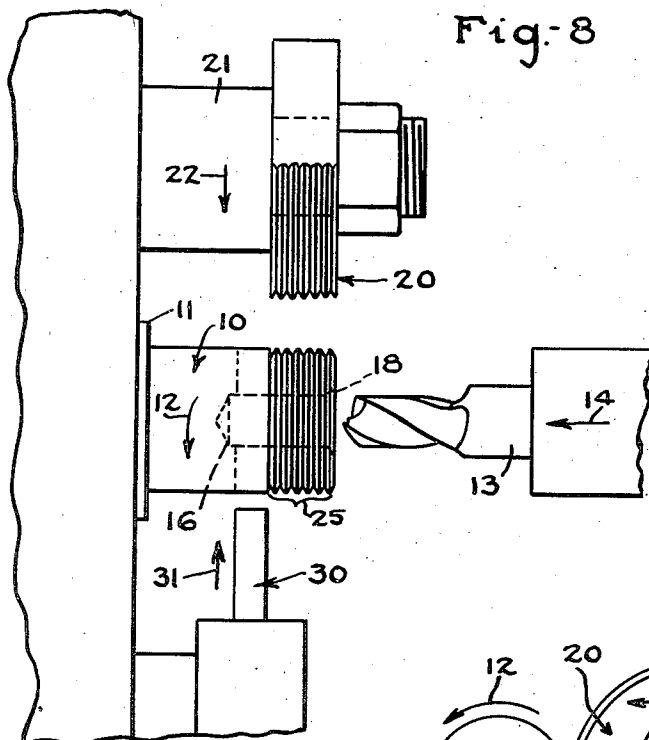
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PROCESS OF MAKING SPARKING WHEELS

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Application August 25, 1945, Serial No. 612,639

4 Claims. (Cl. 76-101)

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This invention relates to abrasive surfaces for use in connection with pyrophoric materials to produce a spark for ignition purposes. A primary purpose of the invention is to provide an improved spark wheel for pocket lighters and to provide an improved method of making such spark wheels. More particularly it is an object of the invention to provide a method of making spark wheels and surfaces and the resultant product, wherein the spark wheel or surface has a plurality of burred-edged teeth on its operative surface.

Other and further objects of the invention are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated with reference to the drawings in which:

Figure 1 is an enlarged side elevational view of the improved spark wheel device made in accordance with the present invention;

Figure 2 is an enlarged front elevational view corresponding to the spark wheel shown in Figure 1;

Figure 3 is a cross sectional view taken along the lines 3-3 of Figure 1;

Figure 4 is a much enlarged fragmentary isometric view showing a portion of the spark-producing rim of the spark wheel shown in Figure 2;

Figure 5 is a side elevational view of the spark wheel made in accordance with the present invention showing an actual size device;

Figure 6 is an enlarged side elevational view of the spark wheel blank during the process of manufacture;

Figure 7 is a much enlarged fragmentary isometric view, partly in section, of the spark wheel blank during the process of manufacture;

Figure 8 is an enlarged fragmentary view of a screw machine showing the stock used in making spark wheels being grooved, drilled and preparatory to the cutting off operation;

Figure 9 is an enlarged fragmentary view showing the groove-cutting and cut-off tools;

Figure 10 is an enlarged cross sectional view of the cutting operation showing the broaching die and punch about to begin the broaching operation;

Figure 11 is a view corresponding to that shown in Figure 10 and illustrating the spark wheel after having been pushed through the broaching die and as it is about to be ejected;

Figure 12 is an enlarged plan view, partly in section, of the broaching die used in Figure 10; and

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Figure 13 is an enlarged plan view, partly in section, showing the broaching die with the spark wheel blank therein during the broaching operation.

Throughout the drawings corresponding numerals refer to corresponding parts.

Referring to the drawings, in the manufacture of abrading devices used with pyrophoric material it has heretofore been customary to provide a file-like surface or a surface which is provided with a plurality of parallel, sharp, cleanly cut, cutting teeth of chisel-like configuration. I have discovered that a sharp file-like cutting surface does not produce satisfactory results under all circumstances and is likely to become loaded with the residue of the pyrophoric material, thus preventing adequate production of sparks for ignition purposes. In making spark wheels for any sparking device in accordance with the present invention, a piece of round stock generally designated 10 is placed in a screw machine which is shown in Figure 8. The stock is held by means of a chuck 11 which is rotated in the direction of the arrow 12. Adjacent the rotating stock there are positioned a drill and chamfer to generally designated 13 which is moved toward the work in the direction of arrow 14 to a depth such as to drill out the stock as shown by the dotted lines 15. The drill thus produces a central aperture on which the wheel ultimately made will turn and the aperture is chamfered, as illustrated at 18. Either prior to the drilling and chamfering operation or after that operation has been completed, the outer surface of the stock is grooved by means of a grooving tool generally designated 20 which is mounted upon a slide 21 that is movable in the direction of arrow 22 from the position shown in Figure 8 to the position shown in Figure 9 in which the cutting edges 24 of the teeth are shown as they begin to engage the surface of the rotating stock 10 and begin to cut into the surface a plurality of grooves illustrated by the bracket 25 in Figures 7 and 8. It will be understood that as the grooves are cut the tool 20 is moved further towards the stock in the direction of arrow 26 until grooves of specified depth are cut into the stock.

Referring to Figure 7 it will be observed that the grooves are generally of the acme thread type having slanting sides 27 and 28 and a top flat surface or land 29. The exact angularity of the slope of the sides 27 and 28 is not important, nor is the exact width of the land 29 important, but this general shape is preferred so as to provide a maximum amount of edge surface of the tooth since

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this assists in the sparking ability of wheel ultimately produced, as hereinafter explained.

After the grooves have been cut, as illustrated in Figure 8, a cutting off tool generally designated 30, Figure 8, is moved toward the work in the direction of arrow 31 until it reaches the depth of the drill hole 16 whereupon the then cut off wheel blank drops and the operation is repeated on the next succeeding unit.

The resultant grooved wheel blank 32, which is illustrated in Figure 6, is then sent through an external broach or die generally designated 35 illustrated in Figures 10, 11, 12 and 13, thus making the finished spark wheel 33. The die block has an aperture 36 which is slightly larger than the maximum diameter of the grooved wheel blank so as to provide a slight clearance at 37 to the depth 38. Below the depth 38 there are a plurality of teeth 39 having the configuration shown in Figure 12. The teeth are angularly shaped, much like internal saw teeth, and they extend throughout the depth of the die from the level 38 to the bottom 40. The teeth, as illustrated in the enlarged view, Figure 12, have one side 39A which is approximately along a radius running through the axis of the die, the opposite side of the tooth being slanted off, as indicated at 39B. The angles of these slants are not critical. The maximum diameter 45 of the die teeth is slightly greater than the maximum diameter 40 of the grooved blank (see Figures 3, 12 and 13), and the minimum diameter 46 of the die teeth is approximately equal to the diameter 41 of the base of the grooves in the grooved blank (see Figure 3). Accordingly, when the grooved blank 32 shown at B in Figure 10 is forced through the die by means of the plunger P, the teeth 39 cut or scrape a plurality of tooth cuts lengthwise of the cylindrical blank, these cuts being across the successive lands between the grooves in the blank. Due to the fact that the diameter 45 of the die is more than the maximum diameter 40 of the blank, it follows that there is a slight area or land 48 Figure 4, at the tip of each tooth, which is left after the action of the teeth in the die 35. In the operation of the die 35 the teeth tend to roll-in burrs at each leading corner 48A and along the edges 48B of the land 48. To some extent a burr is dragged out at corners 48C. As a result, when the wheel is viewed under a magnifying glass of $2\frac{1}{2}$ to 5 power, the lands 48 appear to be somewhat dished inwardly due to the piled-up burrs along the sides and to some extent at the corners of most of the edges of the land 48. I have discovered that these piled-up edges or burrs, as they may be designated, are of an advantage as hereinafter described.

Furthermore, the cutting edges of the teeth 39A and 39B in cutting across the grooved blank drag out burrs at the trailing edges 50 of the cut. When the die teeth are sharp the leading edges 51 are cleanly cut, but when the dies are slightly dull there is some deformation here also. These burrs and edges are of a distinct advantage in producing sparks, as hereinafter described. I have discovered that it is of no particular advantage to have particularly sharp teeth in the die 35 because it is desired to produce a deformation along edges struck by the cutting teeth and that the burrs are of an advantage.

The resultant grooved and die-cut blank is then hardened by any approved process such as liquid carburizing. Thus, the cyanide process of hardening may be used. The hardness is carried

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out to a depth of .010 to .015 inch and the hardness is usually 66 to 68 on the Rockwell C scale.

In use the spark wheel has the burrs around most or all of the edges of lands 48 (at the tips of the teeth) and also on the leading and trailing edges of the teeth (i. e. at 50 and 51 and 50' and 51'), the burrs being more pronounced on the edges of the teeth which are on the trailing side of the cut rather than on the leading side of the cut. It is to be pointed out that the cutting teeth 39 do not strike the slanting sides 27 and 28 of the grooves evenly and hence tend to burr up the material even on the leading side of the cut as the cut proceeds. In the sparking operation these burrs are of distinct advantage because they produce innumerable irregularities which assist in the abrading and hence sparking action. Furthermore, the configuration of the tooth presents a much greater length of abrading edges for a given area of contact of spark wheel with the flint or other pyrophoric material, than has heretofore been possible with the usual design of spark wheels. I have discovered that in use the wheels clean themselves well and do not tend to retain the abraded pyrophoric material. Furthermore, during use the burrs tend to break off at irregular intervals throughout the life of the device and thus present new abrading surfaces which maintain the sparking function much longer than in spark wheels of customary design.

The teeth of the spark wheel, illustrated much enlarged in Figure 4, are in the form of pyramids or cones of square cross section, which are truncated at the top or tip end and have an oblique base along the line 53 so that the pyramids or cones are in effect tipped in the forward direction in which the wheel is rotated during use.

In producing a flat abrading surface for use in hand lighters, or any sparking device, a flat blank is used and one surface of it is grooved by means of a die or shaper tool so that it has grooves on it of the shape shown in Figure 7. The blank is then turned at an angle, preferably at right angles, and is then pushed through a second die having teeth such as teeth 39 arranged in a flat plane so as to cut transversely of the grooves in the blank. In this manner a plurality of pyramidal cutting tips of the type shown in Figure 4 may be produced throughout a flat area of an abrading surface.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments herein except as defined by the appended claims.

What I claim is:

1. In the making of spark wheels, the improved steps comprising turning a short cylinder having a plurality of circumferential ridges on its surface, then forcing the cylinder in an axial direction through a die having a cylindrical opening on which there are internal cutting teeth arranged around the inside of the cylindrical opening of the die, the maximum cutting diameter of said teeth being greater than the maximum diameter of the cylinder forced therethrough.

2. The process of making spark wheels which comprises turning a cylinder and grooving the outer cylindrical surface thereof with a plurality of parallel spaced grooves, the grooves being V-shaped and spaced apart so as to leave flat-topped ridges therebetween, drilling the cylinder and

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cutting it off so as to form a blank wheel, then forcing the wheel blank through a die having a cylindrical opening with cutting teeth arranged therearound, said teeth being V-shaped and having a maximum cutting diameter that is more than the ridge diameter of the grooved wheel blanks.

3. The process of forming an abradant wheel from a section of cylindrical metal stock which comprises the steps of first forming in the peripheral surface of said cylindrical section a plurality of side by side circumferential grooves and then axially forcing said grooved cylindrical stock section through a hollow die having a plurality of circumferentially spaced longitudinally extending internal cutting teeth to form intersecting generally longitudinal grooves in said surface and thereby provide a plurality of rows of individual abrading projections at said surface.

4. The making of spark wheels which comprises turning a cylinder having a plurality of spaced grooves circumferentially therearound with ridges therebetween, drilling a pivot hole through the cylinder and cutting it off, then forcing the grooved cylinder in an axial direction through a die having a cylindrical inner surface on which there are cutting teeth spaced

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evenly therearound, the maximum cutting diameter of said teeth being greater than the maximum diameter of the ridges on the cylinder, and then hardening the resultant wheels.

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