May 7, 1940. F. E. AURAND, JR 2,199,383

CUTTING TOOL

Filed May 27, 1938 2 Sheets-Sheet 1

Fig. 1.

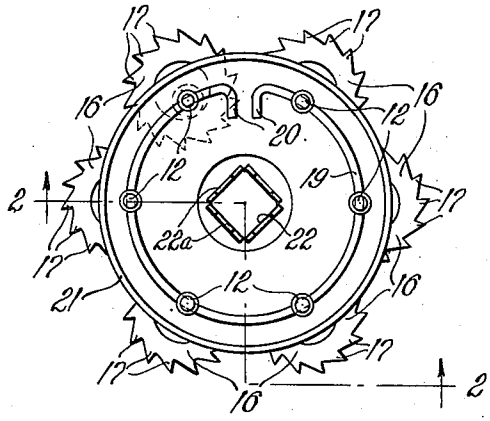


Fig. 4.

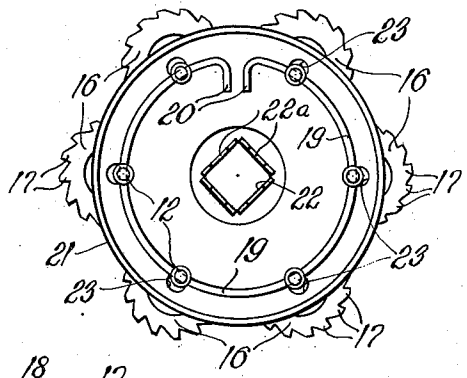
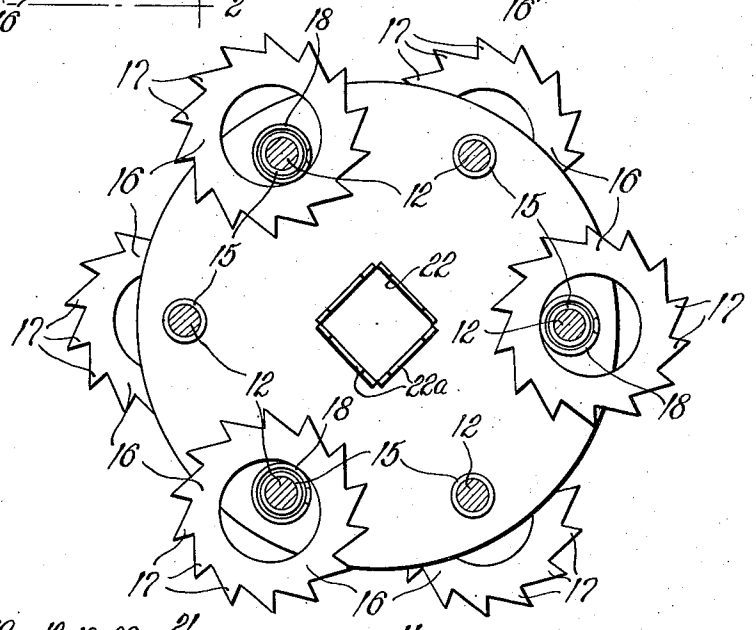


Fig. 3.



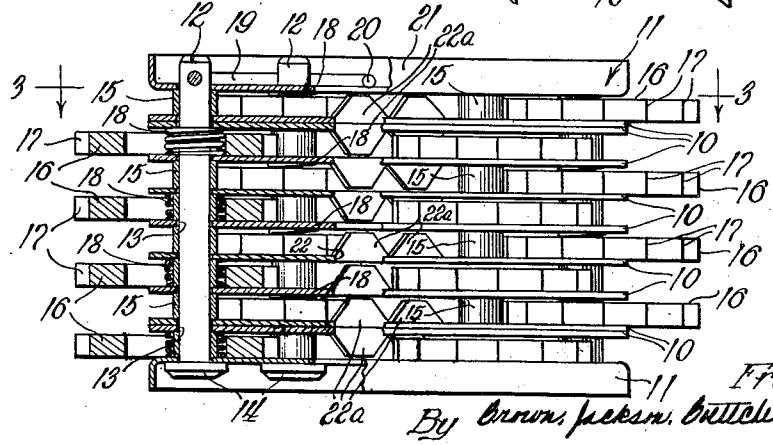


Fig. 2.

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CUTTING TOOL

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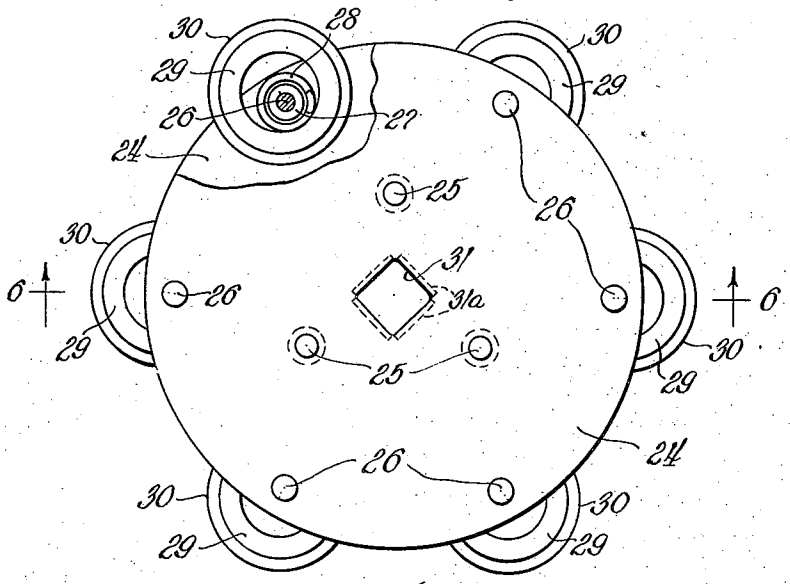


Fig. 5.

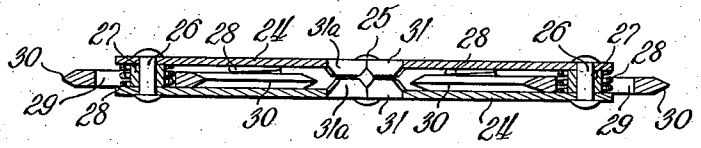


Fig. 6.

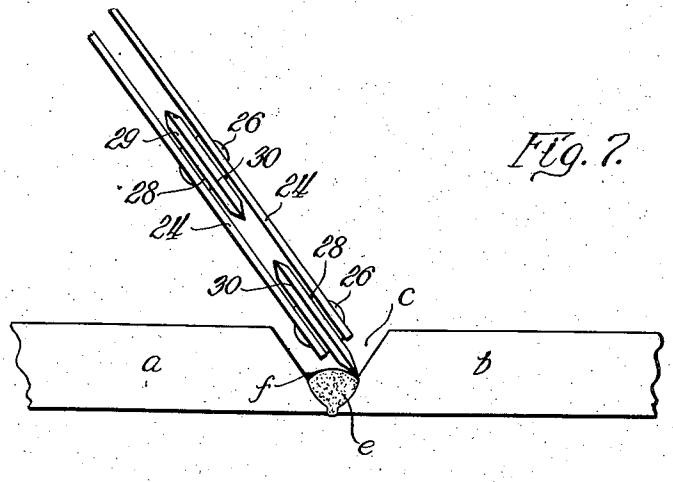


Fig. 7.

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2,199,383

UNITED STATES PATENT OFFICE

2,199,383

CUTTING TOOL

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Application May 27, 1938, Serial No. 210,334

12 Claims. (Cl. 29—81)

This invention relates to cutting tools, and has to do with cutting tools of the type of the rotor disclosed in Patent No. 1,874,220, for Portable surface cleaning tool, granted to Frank E. Aurand, August 30, 1932.

The instant invention is in the nature of an improvement over the rotor or cutting tool of the above identified patent. It is directed particularly to the provision of a tool of the character referred to, better able to withstand the severe shocks and stresses to which it is subjected in use, and to the provision of improved means for more effectively absorbing the shocks incident to the inward and the outward movements of the cutting members, due to the reaction from impact thereof with the surface being cleaned and to centrifugal force. More specifically, I provide coil springs confined under compression and means for opposing radial bodily movement of such springs, the latter serving to cushion the movements of the cutting members, the springs and the cutting member being disposed about pins or journal members from which the springs are spaced, the pins securing a plurality of discs together in spaced relation with the terminal portions of the pins projecting beyond the end discs of the stack, and such end discs being formed so as effectively to reinforce the stack while also serving as guards for the projecting terminal portions of the pins. Further objects and advantages will appear from the detail description.

In the drawings:

Figure 1 is a plan view of a cutting tool embodying my invention;

Figure 2 is a sectional view taken substantially on line 2—2 of Figure 1, on an enlarged scale, partly shown in elevation;

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 2;

Figure 4 is a view similar to Figure 1 showing the condition of the tool after it has been used for a considerable time;

Figure 5 is a plan view, partly broken away and in section, of a modified form of tool embodying my invention;

Figure 6 is a sectional view taken substantially on line 6—6 of Figure 5; and

Figure 7 is a semi-diagrammatic view of two members having beveled ends being welded together, showing one use of the tool of Figures 5 and 6.

The tool of my instant invention is intended for use as a rotor to be mounted upon and driven by a shaft of a surface cleaning tool, such as that disclosed in the above identified patent. It comprises a plurality of coaxial intermediate discs 10 and discs 11, together constituting a stack. The discs 10 and 11 are secured together by hardened steel pins 12 passing through the discs, with slight clearances 13, these pins being provided at their lower ends, as viewed in Figure 2, with enlarged heads 14. Preferably, bushings 15, of suitable material such as hardened steel or brass, are disposed between the discs 10 and 11, about pins 12, spacing the discs apart, it being noted that two discs 10 are placed together adjacent each end disc 11, for reinforcing purposes. In certain cases the bushings 15 may be omitted.

A plurality of annular cutting members 16, formed of hardened steel and provided with outwardly projecting teeth 17, are mounted between the discs 10 and 11 about bushings 15 and pins 12, the latter and the bushings together constituting journal members about which the cutting members are movable. The cutting members associated with each pin are arranged in staggered relation, lengthwise of the rotor, to the cutting members of the next adjacent pin, as shown, the pins being spaced apart circumferentially of the discs and uniformly, as illustrated. A coil spring 18 is mounted about bushing 15, or pin 12 if the bushing is omitted, in spaced relation thereto, within each of the cutting members 16. Each end portion of this spring is ground to a long taper providing a flat surface of considerable area which seats against the face of an adjacent disc, as will be clear from Figure 2. The interior diameter of the respective cutting members 16 is materially greater than the exterior diameter of the spring 18, as will be clear from Figure 3, so that the cutting members are free for movement between the discs substantially perpendicular to pins 12, in the use of the tool.

The upper end portions of pins 12 are suitably bored substantially diametrically thereof for reception of a locking member 19. The latter is in the form of a split ring formed of spring wire, the end portions of this ring projecting a considerable distance beyond the adjacent pins and being provided with angularly disposed terminal elements 20 effective for preventing withdrawal of the locking member from the pins, as shown in Figures 1 and 4. Member 19 bears upon the upper surface of top disc 11, as shown in Figure 2, and cooperates with the pins 12 for holding the discs of the stack in assembled relation and

preventing relative movement of the pins endwise of the stack, the discs being then held in close contact with the ends of the spacing bushings 15. The springs 18, after the end portions thereof have been ground to a taper as described, are retempered and hardened and are of such length, when free of pressure, that they are placed under considerable compression when in position in the assembled rotor. Due to the compression to which the springs are thus subjected, and the considerable area of contact between the flat end surfaces of the springs and the discs, considerable frictional resistance is offered to radial bodily movement of the springs and, due to the spacing thereof from the bushings 15, the springs are capable of radial distortion. Each of the end discs 11 is cup-shaped, as shown, having a circumferential flange 21 projecting therefrom outward and lengthwise of the stack or rotor, these flanges enclosing the end portions of the pins and serving as guards therefor, the flange of the upper disc 11 further serving as a guard for the locking member 19. The cup-shaped end discs also serve materially to reinforce the rotor structure, enabling it better to withstand the shocks and stresses to which it is subjected in use, as will be obvious.

Each of the discs 10 of the stack is provided with a centrally located non-circular opening 22, which may be square as shown, for reception of a correspondingly formed drive shaft upon which the rotor may be mounted in the manner disclosed in the above identified patent. In providing the opening 22, the metal of the disc preferably is cut diagonally of the opening, the segments defined by the intersecting cuts being bent substantially perpendicular to the disc. That provides a plurality of flanges 22a of considerable area, disposed for contact with the flat sides of the shaft. Better support for the discs is thus provided, and wear of the discs on this shaft is reduced, which is conducive to longer life of the stack. The clearance 13 between the pins 12 and the discs 10 permit of slight relative movement between the discs in mounting of the rotor upon the drive shaft, assuring that each of the discs will be positively driven. In use, the rotor or cutting tool is appropriately supported adjacent to the surface to be cleaned and is moved over such surface, the rotor being driven at high speed. The cutting members 16 are thrown outward by centrifugal force and the teeth 17 thereof impact the surface, exerting a chipping effect which quickly removes scale, rust, paint or other coatings from the surface, leaving the latter in a clean and bright condition. When the cutting members thus impact the surface being cleaned they are driven inwardly of the rotor at considerable velocity, due to the impact reaction. As they pass beyond the surface being cleaned, they are again driven outward under considerable velocity, by centrifugal force. In these inward and outward movements, the cutting members strike the springs 18, which are first distorted radially and may then be moved bodily in a radial direction in opposition to the friction exerted between the ends of the spring and the adjacent discs. In this manner, the spring 18 first stops movement of the cutting member 16, exerting a cushioning effect due to the inherent resiliency of the spring, after which the spring and the cutting member move together subject to the braking action exerted by the frictional contact between the ends of the spring and the discs. In this manner the springs and the discs cooperate to cushion the movements of the cutting members in a highly efficient manner, considerably prolonging the life of the tool.

The action of the springs 18 in cushioning the movements of the cutting members is supplemented to an appreciable extent by the spring 19, since the pins 12 have clearances through the discs, as previously noted, and member 19 yieldingly resists movement of the pins in either direction under impact of springs 18, in the movement of the latter with the cutting members 16. After the tool has been in use for some time, the openings through which the pins 12 pass become worn into the form of slots 23 extending substantially radially of the discs, as shown in Figure 4.

Accordingly, the pins 12 are capable of greater movement inward and outward, radially of the rotor or tool, than is the case when the tool is first put into use. Under such conditions, the member 19 supplements the springs 18 to a considerable extent in cushioning the movements of the cutting members 16. To that end, the end portions of member or spring 19 project a considerable distance beyond the adjacent pins 12, as above noted, and as shown in Figure 4. This permits of considerable wear of the discs by the pins 12 while assuring continued effective use of the tool, thus further prolonging the useful life thereof.

In the modified form of tool shown in Figures 5 and 6, two discs 24 are secured together, in spaced relation, by means of an inner series of rivets 25 and an outer series of rivets 26, equally spaced circumferentially of the discs, with spacing bushings 27 mounted about the rivets. Coil springs 28 are mounted about bushings 27, in spaced relation thereto, and are confined under compression between the discs, in the manner previously described. Cutting members 29 are mounted about the respective springs 28, these cutting members being of annular formation and having an interior diameter materially greater than the exterior diameter of the springs. The outer circumferential portion of each cutting member 29 is beveled from the opposite faces thereof to provide a cutting edge 30. The discs 24 are provided with central non-circular, conveniently square, openings 31 and flange 31a for mounting of the tool upon a correspondingly formed drive shaft. This tool is well adapted for grooving or cutting, or analogous uses.

In Figure 7 I have shown, fragmentarily, two metal members *a* and *b* disposed end to end with the ends thereof beveled to define a welding trough *c* for reception of weld metal *e* used in welding these members together. During the welding operation a certain amount of slag *f* tends to collect at the sides of the welded in metal. The presence of the slag is objectionable as interfering with the obtaining of a mechanically strong and fluid-tight weld, and should be removed, particularly in cases where a fluid-tight weld is essential. The tool of Figures 5 and 6 is particularly suitable for that purpose, since the cutters are well adapted to operate in corners for removing undesired material therefrom, as will be clear from Figure 7, in which the tool is shown as cutting out the slag from one side of the weld metal *e*. This tool is also well suited for cutting metal to provide beveled surfaces, such as the beveled ends of the members *a* and *b*.

In the use of the tool of Figures 5 and 6, the cutting members 29 are driven outwardly and inwardly under considerable velocity, in the same manner as in the tool of Figures 1 to 4, inclusive.

These movements of the cutting members 29 are effectively cushioned and braked by the springs 28 coacting with the discs 24, in the same manner as the movements of the cutting members 16 of the tool shown in Figures 1 to 4, inclusive, are cushioned and braked.

Within the broader concept of my invention, the coil springs may be replaced by members made of rubber, copper or other suitable relatively soft or resilient material, spaced from the journal members and in tight frictional contact with the discs or free therefrom. The cushion members thus provided serve to absorb shocks incident to reciprocation of the hardened cutting members, preventing contact of the latter with the hardened journal members. That affords protection against crystallization of the hardened parts, resulting in increased life of the tool and elimination of the hazard of breakage of any of such parts, due to crystallization, in the use of the tool.

It will be understood from the above that changes in construction and arrangement of parts of my invention may be resorted to, without departing from the field and scope of the same, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred forms only of my invention have been disclosed.

I claim:

1. In a cutting tool, a body portion, a journal member carried thereby, a cutting member disposed about said journal member for relative movement substantially perpendicular thereto, and shock absorbing means disposed substantially concentrically about and spaced from said journal member radially thereof.

2. In a cutting tool, a body portion, a pin carried thereby, a cutting member disposed about said pin for relative movement substantially perpendicular thereto, and a coil spring mounted about said pin with provision for radial distortion of said spring and for opposing bodily radial movement thereof whereby impact of said cutting member with said spring is cushioned by radial distortion of the latter.

3. In a cutting tool, two discs, means securing said discs together comprising a pin perpendicular to said discs, a cutting member disposed about said pin for relative movement substantially perpendicular thereto between said discs, and a coil spring mounted about said pin with provision for radial distortion of said spring and for opposing radial bodily movement thereof whereby impact of said cutting member with said spring is cushioned by radial distortion of the latter.

4. In a cutting tool, two discs, means securing said discs together comprising a pin perpendicular to said discs, a cutting member disposed about said pin for relative movement substantially perpendicular thereto between said discs, and a coil spring mounted about said pin with provision for radial distortion of said spring, the latter being confined under compression between said discs effective for opposing radial bodily movement of said spring whereby impact of said cutting member with said spring is cushioned by radial distortion of the latter.

5. In a cutting tool, a plurality of substantially coaxial discs spaced apart, pins spaced apart circumferentially of said discs and securing them together, cutting members between adjacent discs disposed about said pins for relative movement substantially perpendicular thereto, and coil springs mounted about said pins with provision for radial distortion of said springs, the latter being confined under compression between said discs with the end portions of said springs flattened and seating against said discs.

6. In a cutting tool, a plurality of substantially coaxial discs, pins spaced apart circumferentially of said discs and securing them together, bushings disposed about said pins spacing said discs apart, cutting members disposed about said bushings for relative movement substantially perpendicular thereto, and coil springs mounted about said bushings spaced therefrom and confined under compression between said discs with their ends seating against said discs effective for resisting radial bodily movement of said springs.

7. In a cutting tool, a plurality of substantially coaxial discs, pins spaced apart circumferentially of said discs and securing them together, bushings disposed about said pins spacing said discs apart, cutting members disposed about said bushings for relative movement substantially perpendicular thereto, and coil springs mounted about said bushings spaced therefrom and confined under compression between said discs with their end portions tapered providing flat surfaces of appreciable area seating under pressure against said discs.

8. In a cutting tool, a plurality of substantially coaxial discs, journal members comprising pins spaced apart circumferentially of said discs passing therethrough with clearances and securing them together, said pins projecting at one end beyond the top disc, cutting members between adjacent discs disposed about said journal members for relative movement substantially perpendicular thereto, said discs being subject to wear in substantially radial outward direction by said pins in the use of said tool, coil springs mounted about said journal members spaced therefrom and confined under compression between said discs, and a wire spring passing through the projecting ends of said pins holding them in said discs, the ends of said wire spring being spaced apart and the terminal portions thereof projecting an appreciable distance beyond the adjacent pins, said spring becoming effective for resisting outward movement of said pins radially of said discs as wear of the latter by said pins progresses in the use of the tool.

9. In a cutting tool, a plurality of substantially coaxial discs, pins spaced apart circumferentially of said discs passing therethrough with clearances and securing them together, said pins projecting at one end beyond the top disc, cutting members between adjacent discs disposed about said pins for relative movement substantially perpendicular thereto, said discs being subject to wear in substantially radial outward direction by said pins in the use of said tool, and a wire spring passing through the projecting ends of said pins holding them in said discs, the ends of said wire spring being spaced apart and the terminal portions thereof projecting an appreciable distance beyond the adjacent pins, said spring becoming effective for resisting outward movement of said pins radially of said discs as wear of the latter by said pins progresses in the use of the tool.

10. In a cutting tool, a stack of substantially coaxial discs, pins spaced apart circumferentially of said discs passing therethrough and securing them together, and cutting members between adjacent discs disposed about said pins for relative movement substantially perpendicular thereto, an end disc of said stack being cup-shaped and ex-

tending outward axially of said stack about the end portions of the pins projecting through said end disc providing a guard about said projecting pin end portions.

11. In a cutting tool, a stack of substantially coaxial discs, and pins spaced apart circumferentially of said discs passing therethrough and securing them together, the terminal portions of said pins projecting outward beyond the end discs of said stack, said end discs being cup-shaped defining outwardly extending circumferential flanges enclosing said projecting portions of said pins and effective as guards therefor.

12. In a cutting tool, a body portion, a journal member carried thereby, a cutting member disposed about said journal member for relative movement substantially perpendicular thereto, and resilient radially distortable shock absorbing means disposed about and spaced from said journal member and confined against radial bodily movement.

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