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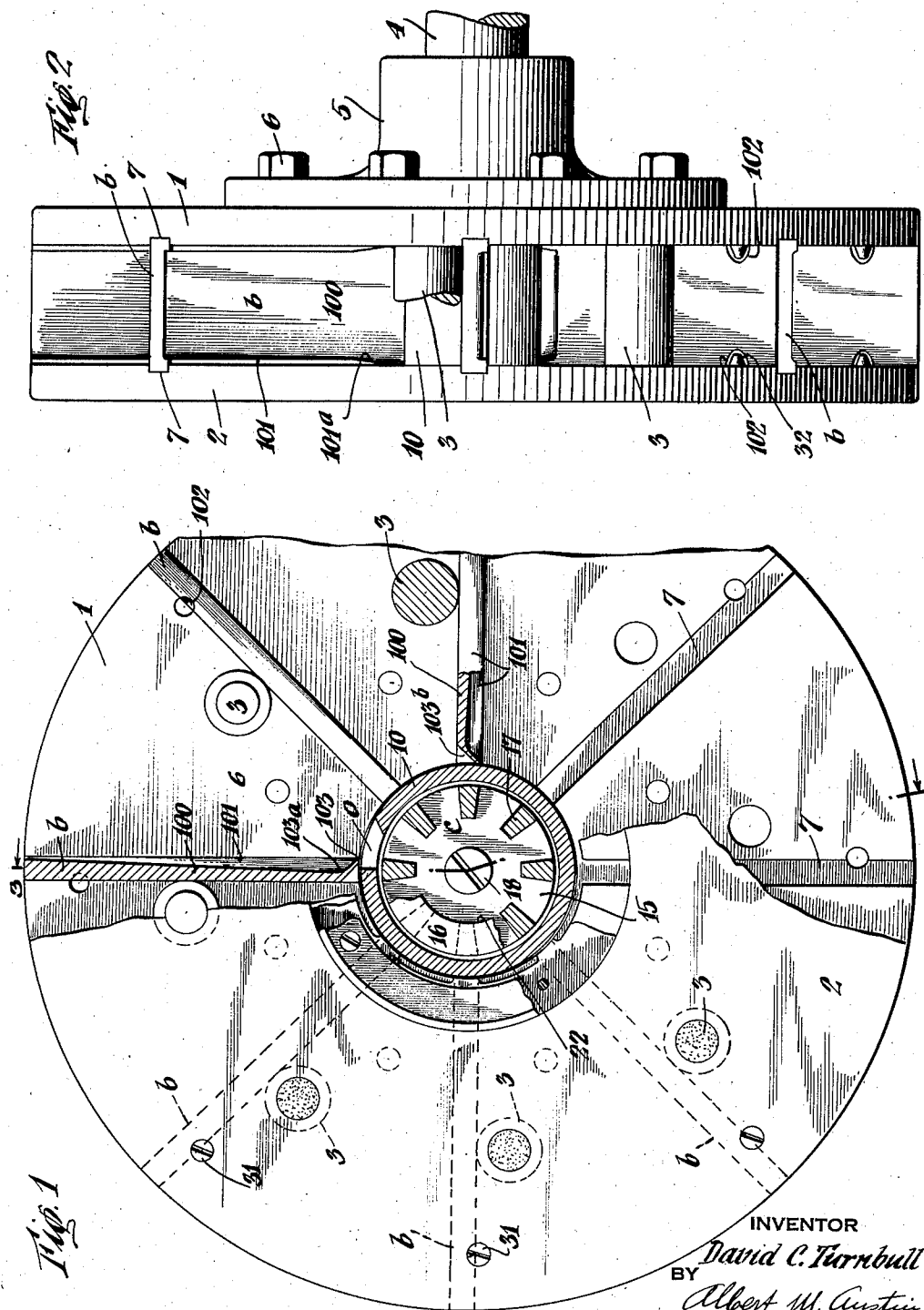
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ABRASIVE THROWING WHEEL

Filed Nov. 17, 1936

2 Sheets-Sheet 1



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ABRASIVE-THROWING WHEEL

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3 Claims. (Cl. 51—9)

This invention relates to abrasive-throwing wheels, and more particularly to improved throwing blades for use in such wheels.

Certain details of the shape of the abrasive throwing blades, shown in this application, are claimed in my copending application, Serial No. 124,815, filed February 9, 1937.

Abrasive-throwing wheels in general used in the cleaning of metallic castings, forgings, bars, billets, sheets and like materials, operate to throw under directional control and against a surface to be cleaned, the abrasive material which generally comprises cracked steel grit, steel shot, or quartz sand. The abrasive-throwing wheels must be rotated at a speed sufficient to hurl the abrasive from the wheel at velocities of 9,000 to 16,000 feet per minute. It is desirable that the wheel be so constructed as to permit a smooth and uniform flow of the abrasive through the wheel and that such parts of the wheel as come into contact with the abrasive should be composed of a material which is as resistant as possible to the eroding action of the abrasive.

Structurally, the abrasive-throwing wheels now in commercial use comprise a series of throwing blades generally of channel form, which extend from the periphery of the wheel inwardly short of the rotating axis of the wheel so as to define a central space or opening. Directional control of the abrasive is accomplished by the provision of a tubular control member which extends into the central opening and is provided with a discharge opening in the circular wall thereof of predetermined but limited peripheral length. Suitable means such as an impeller, comprising a series of radially arranged vanes, project the abrasive fed into the tubular control member through the peripheral opening thereof. The impeller is preferably mounted to rotate with the blade, the tubular control member normally remaining stationary during rotation of the wheel but otherwise adjustably mounted so as to control the direction of flight of the abrasive thrown from the wheel. The blades may be rotatably supported or mounted upon a side wall plate or a pair of spaced side wall plates, as desired, the side wall plates being connected to the drive shaft.

My improved blades are preferably mounted substantially along a radial line extending from the axis of rotation of the wheel, and are each provided with a relatively thin lip portion which extends forwardly or in the direction of rotation of the wheel. The thin lip operates to cleanly scoop up the abrasive ejected from the discharge opening in the control member and per-

mits it to pass along the advancing face of the blade. Since the greatest wear on the blades occurs along the outer end of the blades due to the increasing speed of the abrasive moving thereacross, I preferably gradually increase the thickness of the blades from a point adjacent the lip portion to the outer end of the blades. The lip portion is so shaped and designed that the abrasive is given little or no opportunity to strike the inner end of the blades and rebound inwardly against the outer surface of the tubular control member, but is required to pass either onto the advancing face of the adjacent blade passing over the discharge opening of the control member, or otherwise passing to the rear of said blade and then onto the advancing face of the next succeeding blade. Thus a smooth and even flow of abrasive through the wheel is obtained. The side wall plates, if the wheel is properly constructed, receive very little, if any, wear due to the fact that the abradant is confined within the side walls of the channel-shaped blades in its passage from the opening of the control member to the periphery of the wheel. Any sidewash of the abradant along one side edge of the blade is also substantially limited due to the action of the lip portion of the blade in distributing the abradant evenly over the advancing face thereof.

An object of this invention is to provide an improved abrasive-throwing blade adapted to be associated with an abrasive-throwing wheel, which is so designed as to pick up the abrasive from the abrasive-discharge outlet adjacent the center of the wheel substantially without spattering, which blade possesses great strength and wear resistance where eroding action of the abradant is greatest, and which is conducive to a smooth and uniform flow of abradant over the surface of the blade.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a side view of the abrasive-throwing wheel as it appears when assembled; this view showing my improved abrasive-throwing blade

positioned within the wheel, certain parts being broken away more clearly to illustrate the construction;

Fig. 2 is an end view of the wheel shown in Fig. 1;

Fig. 3 is a transverse cross-sectional view through the wheel taken on line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary perspective view showing a portion of the tubular control member and the adjacent ends of the throwing blades;

Fig. 5 is a perspective view of my improved throwing blade looking at the advancing face thereof; and

Fig. 6 is a perspective view of the throwing blade looking at the rear face thereof.

Similar reference characters refer to similar parts throughout the several views of the drawings and the specification.

The abradant used in abrasive-throwing wheels necessarily must possess a high cutting or abrading efficiency in order to economically and satisfactorily clean, polish, harden, or otherwise treat hard metallic surfaces, such as castings, forgings, billets, bars, sheets, and like materials, which materials are generally coated either with a very hard blue scale or with hard crusty matter adhering to the surface of the metal after casting, forging, or rolling the same. To remove this undesirable scale and foreign matter successfully it will be appreciated that an unusually hard abradant material must be used and projected against the surface to be cleaned at abrading velocities. In ordinary cleaning operations, either cracked steel grit, steel shot, or hard quartz sand or various mixtures thereof, is used as the abradant. Where an abrasive-throwing wheel is used to project the abradant, such wheels must be rotated at very high speed in order to project from the wheel the abradant material at satisfactory abradant velocities ranging generally from 9,000 to 16,000 lineal feet per minute. By way of example, successful abrasive-throwing wheels have been constructed having a diameter of approximately 20 inches, which wheels are rotated at speeds from 2,000 R. P. M. to 3,000 R. P. M. and upward to transmit to the abradant the desired abrading velocity. In wheels of approximately twenty inches in outside diameter, tubular control members have been used varying in diameter from approximately four inches to approximately nine inches and over, and the blades of such wheels have consequently varied in radial length from approximately five to approximately eight inches. It will be appreciated that at such high velocities as above mentioned the abradant exerts a considerable eroding action on such parts of the wheel which come into contact with the abradant, and particularly those parts which are farthest removed from the axis of rotation. This abrading action is particularly severe on the throwing blades and particularly towards the outer ends thereof.

While such abrasive-throwing wheels have already found an accepted place in the foundry and steel industries, it is appreciated that further efficiencies and economies can be achieved if the parts of the wheel most severely subjected to the action of the moving abradant are made of wear-resistant metal and also so constructed that they are able to withstand the wearing effect of the abradant as well as the shocks, impacts and abuse incident to operation, and further so constructed as to move the abra-

dant smoothly and evenly over the surface thereof. Thus by increasing the life of the wearing parts, and particularly the throwing blades, the abrading unit can be operated for a considerably greater length of time without shutdown for replacement and repair.

There is shown for purposes of illustration in Figs. 1 to 3 inclusive of the drawings, one type of abrasive-throwing wheel embodying my improvements herein described. Generally, the wheel may comprise a rear side wall disc 1 and a front side wall disc 2 connected together by a plurality of stud elements 3 suitably secured to the side wall discs 1 and 2. The wheel is mounted on a rotatable shaft 4 having a hub 5 connected by means of bolts 6 to the disc 1. My improved throwing blades 7 extend from the periphery of the wheel inwardly short of the rotating axis so as to provide a central opening or chamber c. Each blade is formed from a hard wear-resisting material which will be presently described, each blade generally comprising a bottom portion 100 and side flange portions 101, providing a channel-shaped member adapted to retain the abrasive therein as it moves across the face thereof. The flange portions 101 of the blade may be arranged to seat within corresponding grooves 7 provided in the side wall discs 1 and 2 of the wheel. Removable screws 31 provided with inner tapered portion 32 project through the side wall discs 1 and 2, and engage the under surface of the blades 7 to retain the blades in fixed position within the wheel, with the flanges 101 in abutment against the overhanging shoulders 8. The blades may each be provided with a grooved recess 102 into which the tapered end of the screws 31 project.

A tubular control member 10, which may have an inwardly extending flange 11 at the inner end thereof, extends into the central chamber c. The control member 10 is mounted independently of the throwing blades 7 and the side wall discs 1 and 2 on a suitable support 12. An impeller is mounted within the control member and fixed to rotate with the wheel. The impeller may comprise a rear side plate 15 and a front side plate 16 connected by a plurality of radiating impeller vanes 17. The impeller may be connected to rotate with the wheel by means of a bolt 18 which screws into the blade centering plate 19 fixed to the rear side wall disc 1 by means of screws 21. Abrasive flows from a feed-pipe 50 into the impeller through the center opening 22 in the front side plate 16 of the impeller. The abradant drops radially across the impeller vanes 17 and is then whirled within the tubular control member 10 until discharged through the discharge opening o therein. The abradant is thrown out through the discharge opening o with considerable force across the inner ends of the blades 7 and into the path of rotation thereof. It will be noted that since the impeller rotates with the blades at substantially the same speed, the abrasive moves gently onto the advancing face of the blades without destructive shock to the abrasive or to the inner ends of the blades. The abrasive gains momentum as it moves across the face of the blades and is thrown from the outer ends of the blades with great force. Under the same operating conditions, a fixed relationship exists between the clock dial position of the discharge opening o in the control member 10 and the clock dial position of the arc of discharge from the wheel. By adjusting the position of discharge opening o, the direction of the

abradant thrown by the wheel may be regulated and controlled. The position of the discharge opening *o* is adjusted by rotating the control member *10* which brings the discharge opening to the point desired.

An important feature of this invention comprises the shape of the throwing blades *b* which are shown more particularly in Figs. 4 and 5. It will be noted that the inner ends of the blades are provided with a relatively thin lip portion *103* which extends at approximately an angle of 45° from the advancing face of the bottom portion *100* of the blades. The free edge of the lip *103* extends relatively close to the exterior surface of the tubular control member *10*, sufficient space being allowed for free clearance only. The lip *103* extends from the control member *10* in the direction of rotation of the wheel. The back surface of the lip *103* is beveled as at *103b* with respect to the back face of the blade, and the front face *103a* of the lip is beveled and slightly rounded so as to smoothly roll into the advancing face of the bottom portion *100* of the blade.

The thin lip *103* serves to cut the abrasive stream discharging from the discharge opening *o* of the control member *10* so as to avoid any interference with the free movement of the abrasive onto the advancing face of the blade. The inner end of the blade lip *103* is preferably approximately only $\frac{1}{8}$ to $\frac{1}{16}$ of an inch or less in thickness so that the abrasive ejected from the discharge opening *o* has little or no opportunity to be deflected by the inner end of the lip *103* inwardly against the outer surface of the tubular control member. Thus, the abrasive discharged from the opening *o* either passes clear of or glides in contact with the advancing face *103* of the lip, or passes under the rear face *103b* of the lip, from whence it will pass directly onto the advancing face of the succeeding blade. Thus, inward spattering of the abrasive is avoided. Also, the construction of the blade above described is conducive of a uniform spread of the abrasive over the entire width of the blade, avoiding a side-wash of the abrasive along one side of the blade as it moves over the same. Sidewash is further prevented by tapering the inside face *101a* of the side walls *101* for a distance adjacent the inner end, as shown in Fig. 5. The tapered surfaces *101a* of the side walls *101* assist in distributing the abrasive deposited onto the advancing face of the blade uniformly over the width of the advancing blade surface.

It is known that the eroding effect of the abrasive increases as its speed or velocity over the blade increases, resulting in greater wear of the blade at the outer end thereof. The life of the blade can be materially increased by gradually increasing the thickness of the blade toward the outer end thereof. As shown more particularly in Figs. 1, 4, 5 and 6, the blade bottom *100* gradually increases in thickness from adjacent the inner end where it may be approximately $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in thickness to the outer end of the blade where it is approximately $\frac{1}{4}$ of an inch in thickness. Tests have indicated that the lip *103* approximately $\frac{1}{8}$ of an inch in thickness, as well as the inner end of the bottom *100* approximately $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in thickness, will last as long as the outer end of the blade having a bottom wall thickness of approximately $\frac{1}{4}$ of an inch. Tests have further illustrated that when the blade is also made of material about to be described, a blade life of from 60 to 100 hours of operation, and over, may be realized.

In accordance with this invention, the wearing parts of the abrasive-throwing wheel, such as the impeller vanes *17*, the tubular control member *10*, and particularly the abrasive-throwing blades *b*, are formed from a composition containing pure iron intermixed with various compounds providing a metallic composition highly resistant to abrasive wear, yet tough and able to withstand the impact and shocks incident to operation. The material further possesses a high degree of structural uniformity so that wear will occur in the material smoothly and uniformly. The material can be economically produced and cast into the desired form at relatively low cost.

More particularly, the metallic composition comprises iron alloyed with carbon, a metal of the molybdenum or tungsten group, chromium, and silicon. To the above materials may be added a small amount of manganese. More particularly, the metallic material may comprise substantially pure iron alloyed with from $1\frac{3}{4}$ to $3\frac{1}{2}\%$ by weight of carbon, approximately 4 to 6% by weight of metal of the molybdenum or tungsten group, approximately 2 to 6% by weight of chromium, and approximately one-half of one percent (.50%) to 2% by weight of silicon. The amount of carbon, molybdenum or tungsten, chromium and silicon added to the iron may be varied within the above limits.

The composition is particularly resistant to abrasive wear caused by the rapid movement of the abrasive material such as steel grit, steel shot, and quartz sand, over the composition surface. The composition is susceptible of being cast to form the desired part of the abrasive-throwing wheel, whether it be the impeller, the tubular control member *10*, or the outer abrasive-throwing blades *b*. The composition formed from the ingredients above specified and thus cast is unusually uniform in granular structure, so that the abrasive-throwing wheel parts formed from the composition will wear with great uniformity.

It has heretofore been attempted to form abrasive-throwing blades of such material as chilled iron, rubber, and a silicon compound intermixed with the iron. Such materials have not proven satisfactory since they are unable to stand the repeated impacts of the rebounding shot and abrasive. Tungsten carbide and chromium carbide must be intermixed with the iron in excessive proportions to produce a material of substantial wear resistance. These compounds are very expensive and must be present in such large proportions as to make the material almost prohibitive in price. Furthermore with the compounds above mentioned, it has been impossible to produce a blade material of sufficient structural uniformity so as to wear evenly, and the blades so made soon become pitted and grooved by the moving abradant so as to prevent the abrasive from moving smoothly over the surface, resulting in increased rapid destruction of the blades, of the abrasive, and in decreased abrading efficiency due to the slowing up of the moving abrasive striking these pits and grooves.

My improved metallic material can be easily cast and formed to produce the abrasive-throwing blades *b* and also, if desired, the impeller and the tubular control member *10*, and such other parts of the wheel as come into direct contact with the moving abrasive. Abrasive throwing wheel parts made from my improved metallic composition possess unusually high abrasion resistance, toughness, impact-resistance, and damping characteristics, a high degree of struc-

tural uniformity, and can be produced at low cost with the assurance that all the blades will possess the same uniform qualities. The life of the abrasive-throwing wheel is thus materially
5 lengthened and a higher abrading efficiency is attained.

An impeller vane 17 is provided for each blade and, as shown in Fig. 4, each of the impeller vanes 17 is positioned slightly in advance of its
10 corresponding blade b. Since the impeller vanes 17 rotate at the same R. P. M. as the blades, the vanes 17 throw out a load of abrasive a through the opening o just in time to be scooped up by the lip 103 as the abrasive a emerges beyond the
15 opening o. The abradant then moves over the face of the blade with increasing velocity, the blade bottom 100 being correspondingly thickened towards the outer end of the blade so as to withstand the increasing wear. As thus con-
20 structed, the outer end of the blade will be worn to the point of uselessness about the time that the lip 103 is worn to the point where satisfactory operation can no longer be obtained. Thus, it is seen that a blade is provided which
25 wears out substantially uniformly throughout its length, obtaining maximum abrading efficiency from the blades.

While certain novel features of the invention have been disclosed and are pointed out in the
30 annexed claims it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

35 1. A blade adapted for use in centrifugal abrasive throwing wheels of the character including a rotor adapted to be driven at high speeds and carrying a plurality of radially extending throwing surfaces with means for feeding abrasives onto the inner ends of said surfaces, said blades having a propelling surface
40 along which the abrasives may be gradually accelerated formed from a metallic compound which is highly resistant to abrasive wear, impact shocks and metal fatigue incident to prolonged operation in the throwing of steel grits, sand and
45 similar abrasive particles at blasting velocities,

said metallic compound including approximately 2 to 3% by weight of carbon, approximately 4 to 6% by weight of metal of the molybdenum group, approximately 2 to 6% by weight of chromium, approximately one-half of one percent to 3%
5 by weight of silicon, and the remainder substantially pure iron.

2. A blade adapted for use in centrifugal abrasive-throwing wheels of the character including a rotor adapted to be driven at high
10 speeds and carrying a plurality of radially extending throwing surfaces along which the abrasives thrown may be accelerated with means for feeding abrasives onto the inner ends of said surface, said blade having a relatively extensive
15 smooth and continuous abrasive impelling surface formed from a metallic compound which is highly resistant to abrasive wear, impact shocks and metal fatigue incident to prolonged operation in the throwing of steel grits, sand and
20 similar abrasive particles at blasting velocities, said metallic compound including approximately 2 to 3% by weight of carbon, approximately 6% by weight of molybdenum, approximately 2 to 3% by weight of chromium, approximately 1 to 2%
25 by weight of silicon, and the remainder substantially pure iron.

3. A blade adapted for use in centrifugal abrasive throwing wheels of the character including a rotor adapted to be driven at high
30 speeds and carrying a plurality of radially extending throwing surfaces with means for feeding abrasives onto the inner ends of said surfaces, said blades having a propelling surface along which the abrasives may be gradually
35 accelerated formed from a metallic compound which is highly resistant to abrasive wear, impact shocks and metal fatigue incident to prolonged operation in the throwing of steel grits, sand and similar abrasive particles at blasting velocities, said compound including approxi-
40 mately 2 to 3% by weight of carbon, approximately 4 to 6% by weight of a metal of the molybdenum group, approximately 2 to 3% by weight of chromium, approximately 1 to 2% by weight of silicon, manganese up to 1% by weight,
45 and the remainder substantially pure iron.

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