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Rod Mill Pass Grinding Demonstration and Seminar

T. B. Dull, Jr.

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TO: Mr. R. C. Rhoades
FROM: T. B. Dull, Jr.
SUBJECT: Rod Mill Roll Pass Grinding Demonstration and Seminar

The above meeting was attended by Messrs. Griffiths, Dull and Stites on March 26 and 27, 1959, in Dayton, Ohio, demonstrated by the Sheffield Corporation.

History:
In 1940, "plunge forming" or "crush dressing" of grinding wheels, which had been used abroad to some extent, was actively presented to American industry by the Sheffield Corporation. With the Sheffield Crushtrue Dressing Process, a formed steel or carbide roll having the same profile as desired in the work piece is fed into an abrasive grinding wheel until the wheel takes the reverse form of the roll.

Wheels dressed by the Crushtrue Process are sharper cutting, cooler grinding, longer lasting, and grind more pieces per dressing.

Crushtrue Dressing has proved repeatedly to be the simplest dressing procedure for complex contours. It can be used on most surface grinders, cylindrical grinders, annular grinders and on thread grinding machines. It plunge grinds a thread length of the same width of the Crushtrue wheel in one and one-half revolutions of the work piece. It grinds annular work faster than any other method.

Accuracy:
Tolerances on width within .0002" and on radii within .002" can be crushed ground. Grooves as narrow as .020", or less can be Crushtrue ground without difficulty. Straight sides of grooves or shoulders can be held to within .0003" depending on width, depth and accuracy of setup.

Surface Finish:
Surface finish of as low as 8 microinches can be Crushtrueed, depending upon material, stock removal and type of wheel.

Grinding Wheels:
Industry has found vitrified bond grinding wheels, in the range from 80 to 400 grit and falling within a hardness range from "H" to "T", to be dressed most satisfactorily by the Crushtrue Process.

The Demonstration:
The demonstration of the grinding operation was held in the Plant Shipping Department. A Model 180 grinder that had been modified to handle rod mill rolls was used for demonstration purposes.
The grinder was driven by a 15 HP motor with an electro mechanical system taking over the operation of the grinder once the setup had been made by the operator. The crusher roll was made of carbide and was 4-7/8" x 4-7/8" x 3" ID, and contained the proper contour for eight #5 rod passes. (See sketch.) The grinding wheel was a 60 grit alum-oxide wheel and was 20" x 4-7/8" x 8" ID, and contained eight properly contoured #5 rod passes. The coolant used was 155 gals. of 176M Socony-Mobile oil, with 15 gals. thread cut #99. The indexing table was manually operated on this machine, which would be eliminated on a new grinder.

The work piece was a #22 Stand rod mill roll that had been faced down to a 11-1/32" diameter. The roll body was 20-1/2" in length with an overall length of 58-7/16" and was 84-86 scleroscope in hardness. This Crushtrue grinder turns all of the work off of centers.

The object of the demonstration was to complete the roll with 30 grooves of #5 rod passes as shown on the attached sketch. The wheel was crushed in order to allow the grinding of 8 grooves at a time, making it necessary to make 3 indexing moves of 8 grooves each with the last indexing cutting only 6 grooves.

The work piece was set up to .008" cross-feed for the first .056" of depth and then was changed automatically to .004" cross-feed for the last .025" of depth; the work piece was going 34 rpm, with the grinding wheel going 7800 surface ft./min. The work was timed by a stop watch.

The first sixteen passes took 26 minutes to put in the roll with the machine being stopped in order to demonstrate the crushing process on the wheel. Approximately .004" was dressed off of the grinding wheel in a matter of 30 seconds total elapsed time. The total time to do the roll complete with crushing operation, was 58 minutes with manual indexing being used.

A crush-grinder that would be required to handle rolls for our finishing and intermediate stands would cost from $120,000 to $130,000. This would handle a grinding wheel 8" wide x 2½" diameter, and would grind more passes at a time than was demonstrated. The cost of crusher rolls varied from $400 each for a tool steel to $900 each for a carbide. The carbide roll would only require dressing about once a year and would last quite some time. The steel would last only about a third as long, but could be used for those rolls that are not dressed too often. They claimed that approximately five rolls could be completed before the wheel would require dressing. With proper operation it would be possible to get from 500 to 600 crushings from a wheel that would cost from $150 to $200 each. The change time necessary for both wheel and crusher roll is approximately 30 minutes. An electronic wheel balancer is also recommended at an additional cost of $2,000.

In order to make accurate templates and grind the crusher rolls it would be necessary to buy a Model No. 123 Micro-form grinder. This Micro-form grinder is designed for grinding cylindrical work and circular form tools. It permits finished grinding from a drawing requiring neither templates nor masters. The pantograph has a ratio of 50 to 1, and the drawing table will accommodate a 20" x 20" drawing. The approximate cost of this unit is $17,000.
Conclusion:

It can be said that nothing in the industry has caused as much interest in the past six months as the Crushtrue grinding operation, and it further was tested by the large turnout of industry people in Dayton this past week. (See attached sheet.)

The following conclusions have also been made in regards to the Kansas City Plant.

1. Purchase of this type of grinder would require the purchase of a roll grinder that would be able to face off these harder rolls. This would cost approximately $75,000.

2. This grinder would allow the use of harder rolls which in turn would mean the mill would have less down time for pass changes. Less pass wear would also mean better quality rod. This will be needed for grinding skelp rolls.

3. The harder rolls could be dressed on a 1/16" or less diameter whereas now it is necessary to reduce the diameter by 1/8". This would decrease the roll turning time from 5 hours to 1-1/2 hours, thus saving 3-1/2 hours per roll or 7 hours per set, with twice the roll life.

4. The number of Rod Mill roll requirements could be lessened by use of harder rolls.

5. The savings made on roll turning tools could possibly pay for the crusher roll costs.

6. The machine can be operated by a semi-skilled operator, who could be trained in less than 3 months.

7. If the higher Rod Mill speeds force us to obtain a harder roll the only way to machine the piece will be through grinding. In other words, we may be forced to get into this thing with both feet by higher mill speeds.

This type of automation will come sooner or later, and it will behoove all of us to be prepared to face the problem.

Summation of approximate cost of equipment necessary for the job:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Multi-form grinder with electronic wheel balancer</td>
<td>$127,000.00</td>
</tr>
<tr>
<td>1 - Landis 18&quot; x 96&quot; roll grinder</td>
<td>75,000.00</td>
</tr>
<tr>
<td>1 - Micro-form grinder</td>
<td>17,000.00</td>
</tr>
<tr>
<td>10 - Crusher rolls (Carbide)</td>
<td>10,000.00</td>
</tr>
<tr>
<td>10 - Vitrified wheels</td>
<td>2,500.00</td>
</tr>
</tbody>
</table>

$231,500.00

TBD: eg  
cc: Messrs. R. F. Kuhnlein  
W. M. Rankin  
A. H. Griffiths  
W. Stites

T. B. DULL, Jr.  
Supervisor Roll Service