Bethlehem Steel Corporation Visit February 17th, 1960

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TO: as noted

FROM: M. Durak and W. Hill

SUBJECT: Bethlehem Steel Corporation
Rod Mill
Johnstown, Pennsylvania
Visit - 17 February 1960

Upon arrival we visited with Mr. A. Reynolds for about three-quarters of an hour discussing our interest in rod mill compacting equipment and the change in the rod laying and core and door mechanism from hydraulic to motor operation. Mr. Reynolds confessed that he knew absolutely nothing about the reconfiguration of the reals. This was quite surprising particularly in view of the fact that Mr. Reynolds' assistant, Mr. Robert Bogar, is considered to be an expert on hydraulic equipment and its application. Mr. Reynolds did not have a single thing to say concerning difficulties with the mill, in his opinion it was working very well, as no complaints had been registered, and in January it had set a new tonnage record.

We went out into the mill and talked with Joe Brown and Dick Walsh at length about the reconfiguration of the reals. Two reels have already been changed back to mechanical drives and the remaining four will be reconverted as soon as possible. The basic reasons for changing back to mechanical drives was given as follows:

1. The pins drift down while the coil is forming and the back rod turns climb over the top of the core pins, thus spoiling the coil.

2. The pins do not lower quick enough during stripping.

3. Support structure for actuating cylinder was not rigid enough. - This was expected by ESC.

All of the blame for the poor performance of the hydraulic operation was placed upon the failure of the pumps and counterbalance valves due to loss of pressure. The fluid which the ESC safety department forced them to use is water-based Shellaris and this will not perform well in the vane-type pumps. We asked if piston-type pumps would have been more serviceable but they insisted that they would only consider vane-type pumps due to the ease by which they can be repaired and rebuilt. Dick Walsh attended Vickers trade school in Detroit, therefore, it is reasonable to suppose that he has been exposed to the merits and limitations of both types of pumps.

Walsh was asked to describe what he would recommend for successful hydraulic performance and he stated the following:

a. The hydraulic fluid should be mineral oil with fire protection provided by use of external extinguishing equipment such as fog, steam or spray nozzles piped to the quench fire in the danger areas. He preferred Avalon 50 fluid.

b. All pumps should be equipped with manual isolation valves because check valves cannot be relied upon to prevent loss of oil when a pump is opened up.
c. The stand-by pump or pumps should not be automatically operated. They should be so manifolded that they can be used to replace any single individual pump temporarily out of service so that it may be repaired during operations. It was stated that a complete rebuild of the vane-type pumps can be done in four hours if the pump can be removed.

d. All valves should be piped with hose on the pressure lines to absorb shock. In designing the hose connections a minimum number of different sizes and lengths should be maintained for ease of replacement. (It was explained that we have already adopted this procedure.)

e. Pump suction strainers should be of the indicating type to show when the screens are plugging up.

They are very pleased with the performance of the "Tell-Tale" filters which have been installed. These are made by Rossen of Hazel Park, Michigan. A 1-1/2" Rossen filter was used with a 1" Vickers pump on the system serving the billet switch.

Laying Reels

During the month of January the only major delay was due to the lubrication system serving the Laying Reels. In a period of sixteen operating hours 2500 gallons of water was sucked up into the reel gear housing due to the failure of the cooling water to drain off through the blocked up drain passage from the cascade troughs. The water passed through the 11 drives and was removed from the lub system service tank. The lack of adequate sealing between the gear chamber and the forced air cooling area has already been recognized on other installations where this has caused loss of oil. The Bethlehem and ASW reels should be investigated to prevent further difficulty of this nature.

Finishing Mill Drive Spindles

The Morgan spherical gear type roll spindles have practically all been replaced by Spicer universal-type heavy duty automotive spindles. At present there are six pair in service and more are on order to completely equip the right-stand drive. Thus far, they have had a full year of service with this design and they are very well pleased with the performance. Only three failures have occurred and each was due to cobbles in the mill. Failures when they do occur have been with no damage to other equipment. Under excessive torque a weld shears which allows the driving member to rotate while remaining piloted to the driven portion. This is a very good feature which our coupling spindle assembly lacks.

The cost advantage of this spindle is significant. It was stated that our spindles are quoted at $1,000.00 each and the Spicer spindle costs them $16.00. Actually, they use the M.C.Co. roll end coupling box and the taper bored drive side coupling hub on either end of the Spicer universal spindle flanges. As BSC state it, they can buy at least three Spicer spindles for the price of one Morgan spindle.

Since using the lighter weight Spicer spindles, they have recognized several other advantages.

1. There has been no significant wear of the roll wobbler end flats.

2. There has been no need of replacement of coupling box driving inserts.
3. They believe the spindles have reduced the amount of wear on roll neck thrust bearings due to the reduction of spindle vibration.

4. Removal of housings is much improved as the telescopic feature of the spindle and lighter weight makes removal much easier.

Our personal observation of the Morgan spindles in use on stands 16 and 17 disclosed very sloppy fits between the coupling boxes and roll ends. It was impossible to define the rear end steady outline of the coupling boxes and spindles due to their off-center position on the roll ends. Piloted coupling boxes have, of course, eliminated this condition on more modern mills.

Of the three Spicer coupling failures which have occurred in one year's service, two heard the flange bolts at the drive end and one broke the weld as described above.

The spindles used are Spicer 7710 SF Series 1700 illustrated on BSC Dwg. 85239.

Roll Neck Thrust Bearings

The Morgan type outboard thrust bearing units using SKF 72-26 bearings have had a far better service record during the past year than during the previous period. They attribute this improvement to better maintenance, improved lubrication and the lighter weight spindles. It is reported that they no longer lose bearings while in service. Bearings have been nursed through a week's run after indicating distress.

They lubricate the bearings by a Farval automatic system using a #30 valve with full stroke on an 8 minute cycle using Gulf XXX EP grease.

The ball thrust bearings are reconditioned after a period in service. New bearings cost $105.00 against a reconditioning cost of $65.00. SKF recondition the bearings in their Indiana Bearing Service Plant. The races are reground and oversize balls and new cages complete the rebuild.

SKF Roll Neck Bearings

In spite of the improved service which they are now having with the anti-friction outboard thrust bearings, the maintenance department finally disclosed that they were in the act of equipping the finishing mill with SKF anti-friction roll neck bearings with built-in thrust bearings somewhat similar to the Bliss-Knox installation at Keystone. The reason for taking this action was blamed on the excessive cost of thrust bearings which account for 80% of their bearing expense. They claim that the trouble is due to the restriction of vertical movement of the outboard thrust bearing which causes the bearing to take on an excessive radial load. They realize that the care of the outboard bearings shouldn't be clamped tight at least during case adjustments, but the operators pay no attention to this fact and they cannot be persuaded otherwise.

Since SKF was called in on the original thrust bearing failures, it is logical to believe that they have used this opening to promote their own anti-friction roll neck bearings. One man said that Ed Ramsey, who has engineered this conversion, stated that he intended to discontinue the installation of the SKF bearings on this mill with H.C.Co.
The design was recognized as being similar to the Keystone installation. The preloaded, back-to-back ball thrust bearings, which are carried in the work side bearing chock, are mounted on a sleeve extension of the radial bearing, but undercutting prevents them from picking up radial load. Thrust adjustment is very clumsy being affected by the clamping of two opposed nuts which position the outboard races of the thrust bearings axially within the chock. The inner nut is loosened and tightened by a pin which must pass through a cored hole in the chock housing.

The Keystone housings were open top design and the Bethlehem housings must change rolls through the windows. The work side chock is designed to permit a "O" hook to engage a cylindrical extension which appears to be a poor arrangement which necessitates the above described awkward thrust adjustment.

The BSC people are quite pleased about the anticipated saving in water. At present they report each stand requiring six 1-1/4" lines, and after the conversion only two 1-1/4" pipes will be necessary for pass and guide cooling.

The major excuse for changing from phenolic to anti-friction bearings has been the comparison of bearing costs between the Johnstown mill and the SKF equipped United mill at J & L Aliquippa. The following figures were quoted:

**J & L Aliquippa Mks. United Rod Mill**

<table>
<thead>
<tr>
<th>Section</th>
<th>Bearings</th>
<th>Brng. Life Tons</th>
<th>Inspection Period Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finishing</td>
<td>SKF</td>
<td>320,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Intermediate</td>
<td>SKF</td>
<td>600,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Roughing</td>
<td>Timken</td>
<td>820,000</td>
<td>75,000</td>
</tr>
</tbody>
</table>

**Bearing Replacement Cost**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Cost</th>
<th>Cost per Ton</th>
<th>Total Cost</th>
<th>Cost per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>$6,765.00</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td>6,725.00</td>
<td>3%</td>
<td>$20,120.00</td>
<td>13%</td>
</tr>
<tr>
<td>1959</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

*During conversation it was stated that BSC bearing replacement cost was 20% per ton.*

BSC have purchased two sets of SKF bearings for stands #23 and #22. The chocks for these bearings were made by BSC from SKF drawings. It is expected that these two sets will be in service by the end of March. Drawing Numbers Z-5458 and Z-5462 dated 7-8-59.

**Repeaters**

The mounting of the vertical rollers in the repeater abutment was criticized from the standpoint that the removal and replacement of any roll is a job which takes four riggers eight hours due to the fact that the entire abutment assembly must be dismantled. It was suggested that each roller be mounted in a cartridge with an upper bolted flange so that they can be individually removed with a minimum amount of effort.
In discussing the product mix on the rod mill Joe Brown cited the following, which he claimed to be the major reason why the mill doesn't show its full potential as compared to others working under better conditions.

21.8% of the mill's down time is charged to roll changing due to product mix.

For January 1960

Production - 28,556 tons
Average - 40 Tons/hr
Yield - 94.21

Product Mix
1st Week 7/32" 4 BWG 1/4" #2 9/32 19/64
5/16 21/64 11/32 #23 #21 #19
2nd Week 7/32 4 BWG 23/64 3/8 25/64
13/32 27/64 #17
3rd Week 7/32 4 BWG
7/16 29/64 15/32 1/2 31/64
17/32 35/64 9/16 37/64 43/64
4th Week Repeat 1st Week

By comparison the yield and product mix for #1 and #2 Sparrows Point mills were cited.

<table>
<thead>
<tr>
<th>Mill</th>
<th>Product</th>
<th>Yield</th>
<th>Delays due to Roll Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 SP</td>
<td>7/32 only</td>
<td>91.01</td>
<td>7.42%</td>
</tr>
<tr>
<td>#2 SP</td>
<td>Deformed GB</td>
<td>91.50</td>
<td>15.13%</td>
</tr>
<tr>
<td>Johnstown</td>
<td>Sea Above</td>
<td>94.21</td>
<td>21.8%</td>
</tr>
</tbody>
</table>

The eight-hour tonnage produced while we visited the mill was 855 tons. This product is going to the Laying Reels. There was not a single cobbie in 8 hours.

In Drives

It was stated that in some of the main drives the gears began to sound very noisy and the bearings were changed and the noise diminished. Bearing wear was stated to be about .018" on the bushings which were replaced.