

INTEGRATED SHARPENING SYSTEM FOR THE CARD CYLINDER

A.A. Ball
Rieter Corporation
Spartanburg, SC

Abstract

The production trends toward increased carding rates and the consequent reduced cylinder wire lifetime, plus the acceptance of low profile wire have increased the tendency to avoid or delay grinding of the cylinder wire. This leads to a deterioration of sliver quality.

Rieter has developed an integrated system for sharpening the cylinder wire (IGS). It is self-contained in each card and is programmed to periodically cycle and sharpen the wire during the carding operation. The function is fully automatic and maintains the condition of the cylinder wire whereby the carding process is improved. The nep reduction in carding remains more consistent, minimizing nep levels and thus producing better quality sliver.

Additionally, with the IGS, the lifetime of the cylinder wire is normally extended because of the constant maintenance of the wire condition.

Introduction

The carding process is the heart of the spun yarn manufacturing system. In addition to producing the first basic sliver, the card is expected to remove trash and neps at ever increasing production rates. Developments of additional devices and elements can improve the card's potential, but carding performance is primarily dependent upon the condition of the clothing and the setting of the licker-in, cylinder, flats, and doffer.

It is well recognized that as the flats and cylinder wire wear and become dull, the efficiency of nep and trash removal deteriorates. This can be partially overcome by periodically grinding both elements and then resetting the flats to the cylinder (fig. 1).

Throughout the lifetime of the clothing, there is "Baseline" performance of sharpened and well set conditions. The more the wire is worn, the worse is the base performance. Also, throughout the lifetime of the clothing, the rate of deterioration increases and the time intervals between grindings become shorter, and eventually it becomes impracticable to continue to grind excessively worn wire.

It is also obvious that grinding the cylinder is delicate and time consuming and is avoided whenever possible. In many

cases, the flats will be ground and set without maintenance of the cylinder wire. This can result in excessive wear of the cylinder wire, which then requires a severe subsequent grinding action with the result being a shortened lifetime of the cylinder clothing.

Due to developments in the carding machines and card clothing, the card production rate is being constantly increased. This usually results in a slight reduction in the productive capacity of the clothing and a dramatic shortening of its lifetime. As can be seen in fig. 2, as the card production rate is increased to 200 lbs/hr, the card clothing must be changed somewhere in the order of every six months. Of course, the wire life is primarily determined by the abrasiveness of the materials being carded and the quality required by the end products.

This shortening of the cylinder lifetime leads many plants to sacrifice cylinder wire maintenance and avoid grinding. This has the aggravating effect of further reducing the wire life.

The introduction of "Low Profile" wire has also led to a "Don't Touch It" opinion. Many plants are afraid to grind the cylinder because of difficulties in judging the degree of grinding.

Unfortunately, the practice of minimum care of the cylinder wire is a major negative step in the challenge of yarn and fabric quality.

IGS - The Integrated Sharpening System

The IGS was developed to eliminate the traditional methods of grinding the cylinder wire. In design, it had to be compatible with the basic carding machine and be sufficiently simple and reliable as to be acceptable to the cardroom personnel.

The IGS incorporates a sharpening stone, which is mounted on a belt carried in an aluminum profile section. The section, fig. 3, is permanently installed between the plates under the cylinder. The stone is periodically moved across the width of the wire to lightly sharpen the teeth. During its return to the parked position, it is moved away from the cylinder and does not contact the wire, fig. 4.

The activation of the sharpening cycle is pre-programmed and is based on the expected lifetime of the cylinder wire. The time interval between cycles is reduced as the wire becomes worn. In fig. 5, a typical IGS cycling curve is shown. It is normal for 400 cycles to be performed before the wire is changed. The stone is replaced when the wire is changed. During the first half of the program, the stones cycle an average of once every few days (3 - 5 days), whereas during the last part of the program the stone is cycled several times per day, fig. 6.

During the development and evaluation phases, the following points were considered:

- Type of stone
- Sharpening rhythm
- Impacts on sliver quality
- Maximum sharpening of specific wire types
- Metallic contamination due to sharpening
- Fire hazard

Results from Plant Experiences

The first IGS was installed in June 1993 and the basic concept was successfully demonstrated. Since then, the value of the system has been recognized and units are installed worldwide.

Sliver Quality

The benefit in carding quality is of major significance. The consistency of nep removal throughout the cylinder wire lifetime and the “Baseline” of neps after flats grinding and setting are greatly improved. Fig. 7 shows a comparison of the card sliver neps with and without the IGS. In many cases, the worst levels of neps with the IGS (immediately before flats grinding and setting) are better than the baseline of the conventionally ground card.

Increased Wire Life

Additionally, it has been found that the cylinder life expectancy is increased by up to 30% when the IGS is used. The following table shows two typical examples:

Cylinder Wire Life Extension

90 kg/hr (200 lbs/hr) Plant “A”	
No grinding 300,000 kg	= 20 weeks
Conv. grinding 400,000 kg	= 27 weeks (+33%)
IGS sharpening 450,000 kg	= 30 weeks (+50%)
50 kg/hr (110 lbs/hr) Plant “B”	
Conv. grinding 600,000 kg	= 71 weeks
IGS sharpening 800,000 kg	= 95 weeks

It appears that the wear of the wire is aggravated when the wire is dull and that a consistently sharp tooth results in reduced wear and better carding. With IGS the cylinder wire is always sharp, even at the end of its useful lifetime. Fig. 8 shows typical wear. With the IGS system, it becomes necessary to replace the cylinder wire when the wire has eventually been worn and sharpened to its limits and fiber transfer from cylinder to doffer is compromised.

Sharpening During Carding - No Downtime

The IGS stone sharpens the wire during the carding process - production is not interrupted. The stone is mounted in the profile section and operates in such a way as to prevent metallic contamination of the sliver. Neither contamination

nor fire have been generated as the system has been put through rigorous testing procedures.

The automatic function and operation during production means that the cylinder wire is always sharp. There is no downtime for cylinder grinding, which normally requires parts of the card to be stripped, grinding apparatus to be mounted, and the subjective judgment of “how to sharpen” and “what is sharp”. Traditional cylinder grinding can take from 2 to 6 hours, depending upon card types, grinding stones and the people availability. Obviously, an automatic system is preferred to minimize variability in sharpening and reducing downtime.

Reliable and Safe

In addition to the technological, operational and economic considerations, the IGS system has performed reliably and safely. The spring loading with electromagnetic security device ensures that the stone cannot stop at one location and inadvertently wear down the wire. The stone is automatically deactivated when power is cut off.

There has been no case of the stone damaging the wire during the programmed sharpening cycles. Overall, the IGS system is much safer to use than the traditional cylinder grinding technique.

Summary

The successful development and introduction of IGS system met the primary objectives of the project and has demonstrated benefits as follows:

- More consistent nep removal throughout wire lifetime
- Lower Baseline of neps (after flats grinding and setting)
- Lower peak nep levels
- Extended wire life
- Elimination of traditional cylinder grinding
- Reduced downtime
- Reliable and safe

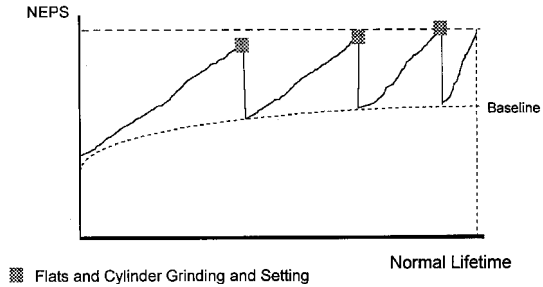
The IGS system facilitates “Quality Carding” and will prove to be invaluable in the constant struggle to maximize productivity, minimize maintenance and ensure sliver quality.

Cylinder Wire Life

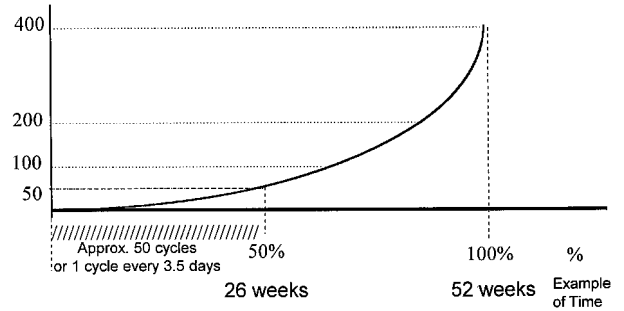
Carding Rate lb/hr	Life-Weeks 800,000 lb prod.	Life-Weeks 1,200,000 lb prod.
75	64	96
100	48	72
150	32	48
200	24	36

Typical NEP Curve In Card Sliver

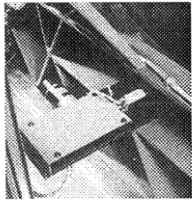
With Flats and Conventional Cylinder Grinding



Example of IGS Cycle Frequency

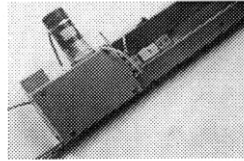


InteGrated Sharpening System (IGS)



For Quality

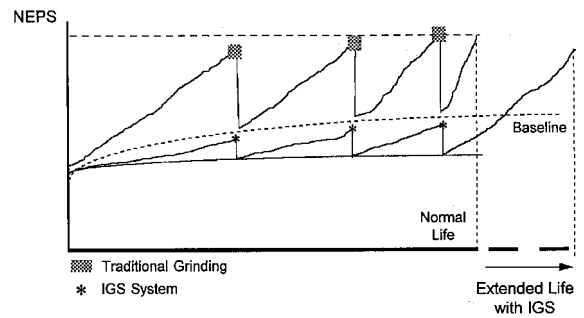
- Ensures constant quality over lifetime of cylinder wire
- Suited for latest wire generation



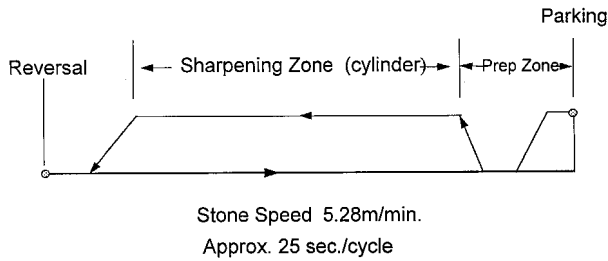
For Output

- No downtime for cylinder wire grinding
- Fully automated, computer controlled system

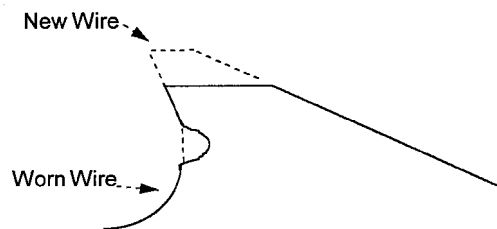
Typical NEP Curve in Card Sliver



IGS Sharpening Path



Worn Wire with IGS



Typical IGS Cycling Curve

