EQUIPMENT ENGINEERING
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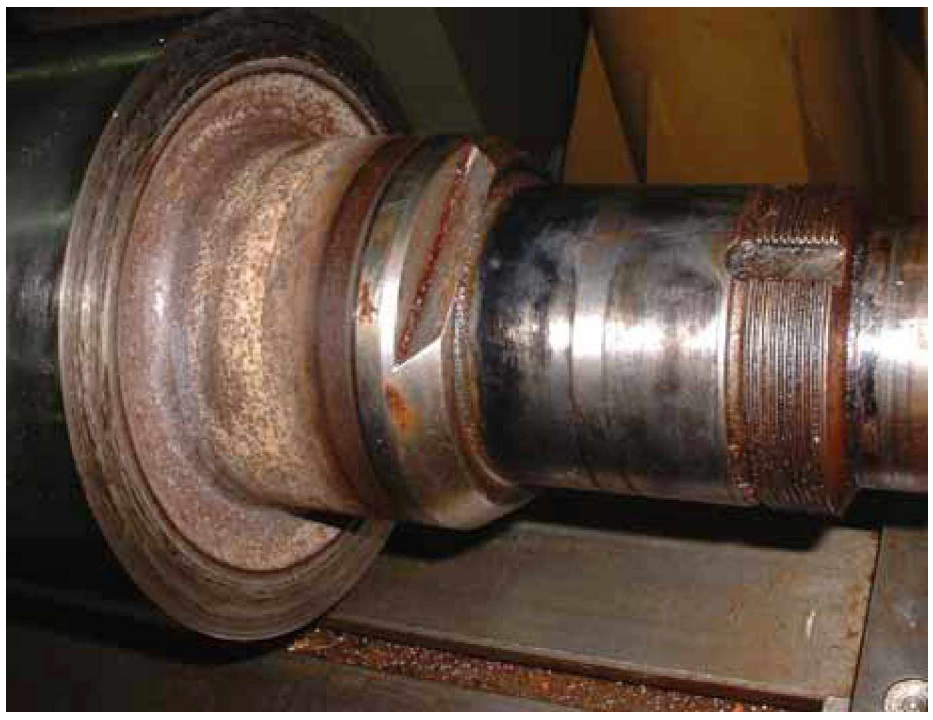
Solving the Crimper Enigma

Part II

By Van Durrett, Vice President, DM&E Corp., USA



Damaged roll.

e`nig´ma something that is mysterious and seems impossible to understand completely.

For most staple fiber manufacturers the crimper is an enigma. For management it is a machine that can constantly need repair and adjustment and can disrupt schedules, destroy fiber, and cost time and money. It can perplex process engineers. For crimper maintenance personnel it can be the focus of many hours of demanding work with a machine that seldom responds to repeated pleas for cooperation.

In the August issue of IFJ we examined causes and cures for tow input failure. As we continue to solve the crimper mystery, this second article addresses the care and feeding of crimper rolls, stuffing boxes and components. We will discuss crimper maintenance, how to select a crimper reconditioning resource, and what to expect on major component repairs. A future article will cover material selection and design considerations for key crimper components.

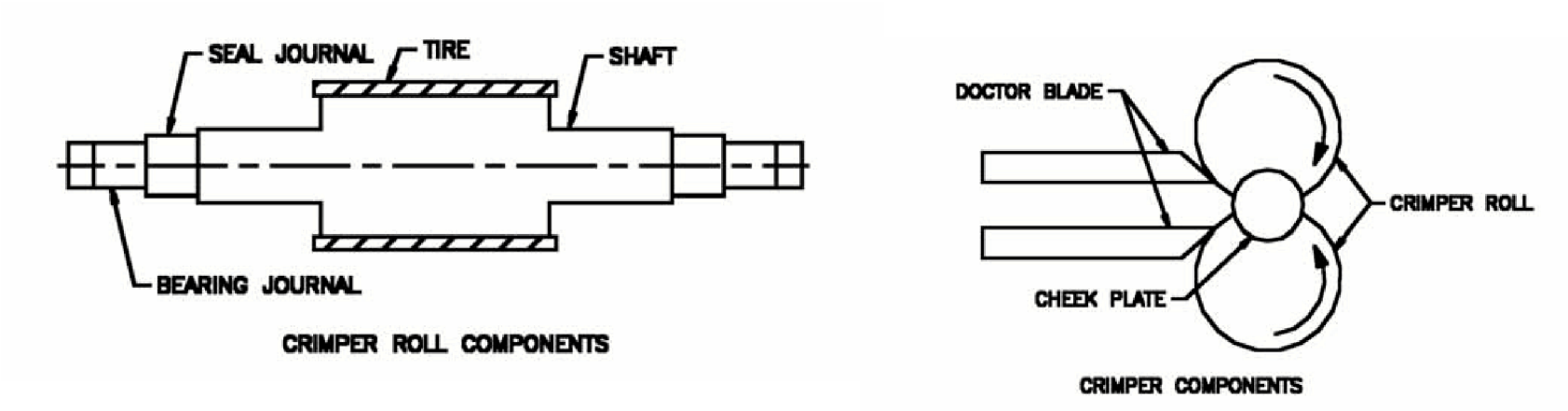
MAINTAINING AT THE PLANT

Tow presentation and incorrect tow tension can cause crimper failure, but these problems originate upstream of the crimper. Determining correct crimper repair and maintenance practices can also alleviate problems for production and maintenance.

The two primary reasons a crimper will require major roll or stuffing box repair are physical damage or mechanical failure. Obviously, physical damage can occur from the crimper ingesting a foreign object. Scissors, fasteners, and other hard metal objects can mysteriously find their way into the tow and into the crimper rolls and stuffing box. Only operator training and good housekeeping practices can prevent foreign objects from entering the crimper.

Excluding a cracked tire or fatigued shaft, most major roll repairs result from bearing failures. Many crimpers operate for thousands of hours without a bearing failure. Bearing life is determined by rotating speed, load and lubrication. Most crimper roll bearings fail prematurely from water contamination or poor lubrication. Bearings are always well lubricated when the crimper is assembled. During continuous operation, it is rare that the bearings receive lubrication often enough or in sufficient quantity. Regular lubrication according to a schedule is essential. Enough grease should be forced through the bearing assembly until it is extruded through the inner seals. If the extruded grease contains water, chances are excellent that water has contaminated the bearings, and bearing failure is imminent.

Use the correct grease. Crimper roll bearings cost thousands of dollars to purchase and install. Reducing costs by using inexpensive grease is false economy. Unless specified by our customer, DM&E installs bearings packed with JAX Magna-Plate 1000 grease. This is a moderately priced, high temperature, water resistant, extreme-pressure grease. Mixing greases can be disastrous. Grease is oil with a thickener. Incompatible thickeners and



Diagrams of the roll and stuffing box parts.

additives can destroy the lubrication capacity of mixed greases.

Crimper roll tires are very hard. Only the smallest scratch can be successfully repaired with a whetstone. It is a common practice in some installations to periodically apply sandpaper or abrasive cloth to the rotating surface of the tire in an attempt to restore the "grip" of the roll. This can be a safety issue, so the procedure must be carefully reviewed. Light cleaning with solvent or an abrasive pad will remove polymer and finish that may be coating the surface of the roll. Hand sanding with coarse abrasives will result in a superficially rough and extremely variable surface finish that deteriorates rapidly.

After assembly of the crimper and before it is released into regular production, maintenance personnel should operate the crimper with cooling water and steam until the roll and crimper temperatures have stabilized. Check bearing temperatures, re-check roll alignment and all clearances.

After the crimper has been placed in production, doctor blades and side plates should be inspected at regular intervals for proper clearance and adjustment. Minor scratches and nicks can be removed with a small whetstone or careful work with a small file. A quick check of the used cheek plates will reveal roll alignment problems.

Even with the best maintenance, severe crimper jams, incorrect adjustments or mechanical failures are inevitable. When this happens, the resulting damage is beyond the ordinary plant maintenance capability. The crimper must be removed from service and disassembled. The rolls and stuffing box components are sent out for major repair.

SELECTING AN REPAIR SOURCE

Everyone who owns an automobile must have a reliable mechanic for repairs. Everyone who owns a crimper must also have a source that can repair and recondition the rolls and stuffing box components. The crimper repair source may not be as convenient as the service station around the corner, but it is still essential. Some crimper owners select this repair and reconditioning source just as they select a mechanic for their automobile. They want someone close, quick and inexpensive. Others make their selection based on quality and knowledge. The quality choice may not be convenient, but quality and consistency of reconditioning and repair for critical crimper components is an absolute must. It is impossible for the process engineer or mechanic to analyze and solve crimper problems when the components are different with each installation or incorrectly repaired.

Here's a checklist for your major repair source:

• Are all components inspected upon arrival, or does the machinist just begin work and fix the things you told him to do?

• Is the inspection recorded? What sort of equipment is used during the inspection? Is there a final inspection? Are these records maintained?

• Does the staff know and understand the tolerances required for proper operation?

• Is there staff dedicated to crimper component repair?

• Does the staff understand crimpers? Can they make recommendations for modifications or repairs based on process experience and sound engineering, or are they just guessing?

• What work do they perform? Do they have the equipment and tools to perform the quality of work required?

The responsibility doesn't end with the repair facility. To verify the work and quality, follow the advice of President Ronald Reagan when he discussed nuclear disarmament during the Cold War. "Trust, but verify." If you can't justify purchasing the equipment (micrometers, surfometers and fixtures) to verify the work on your components, then go to the repair source. Check the equipment and instruments, ask questions and verify the repair results.

MAKING MAJOR REPAIRS

DM&E has successfully repaired, modified and built crimpers and crimper components for more than 25 years. For incoming repairs, every component is inspected for its condition and recorded on an inspection sheet. Serializing the components allows the repair record to be traced for all parts. A specification book is maintained for each customer to assure that unique requirements are satisfied.

Repair of crimper roll shaft bearing and seal journals requires special tools and skills. Various methods are available for restoring damaged surfaces, depending on the shaft material and extent of the damage. DM&E uses submerged arc welding, chrome plating, or special seal sleeves on

Roll being checked for surface fininsh.

these surfaces. Repaired journals are returned to new specifications. Proper tolerances and concentricity are critical for bearing life. Bearing diameters must be held to +/- 0.0002” [0.005mm] and concentricity of all bearing and roll surfaces are held to +/- 0.0004” [0.010mm].

Crimper roll shafts are subject to continuous rotating load. Some shafts eventually fail from fatigue. DM&E recommends that shafts with more than seven years of application be tested for cracking before any extensive and expensive repairs are made. An independent laboratory performs magnetic particle or X-ray inspection.

Roll surfaces should have a uniform surface finish. Replacement and reconditioning of crimper roll tires also requires special tools and techniques. If the roll only requires resurfacing of the tire, this can be accomplished without removing the bearings. DM&E has developed equipment and procedures to supply surface finishes with a Roughness Average (Ra) of 35 to 10. In all cases, the Standard Deviation over the entire surface will be less than 10% of the average Ra. Mating roll widths must be within 0.0004” [0.010mm] to assure proper cheek plate contact, and the widths matched to the stuffing box dimensions. Mating roll diameters must be held within 0.0004” [0.010mm].

Actual crimper tire replacement procedures are closely guarded. Improper installation can result in premature failure of the tire. Crimper tires are held on the shafts with shrink fits. Replacement tires require proper material selection and hardening. Preparation of the shaft surface and control of the mating surfaces are critical to achieve a permanent and leak-free installation. The value of the interference fit is calculated to consider the diameters, the thickness of the tire and the width of the tire. While most replacement tires are manufactured from through-hardened 440C (UNS 44004) stainless steel, stellite and other materials have been used.

DM&E recommends that roll pairs be mated to doctor blades and installed as sets. Optimum performance can be maintained by assuring that the doctor blade width does not exceed the tire width by more than 0.020” [0.5mm]. To maintain this tolerance it is necessary to trim the doctor blade width as the edges of the tire are resurfaced. When it becomes necessary to replace the tire and restore full width to the stuffing box, repair techniques are available to restore the doctor blade widths without purchasing new blades.

SOLVING THE ENIGMA

Many plants will recognize these maintenance and repair practices as something they are already doing. They have their crimper maintenance and repair procedures well managed. They will question why others have not solved the potential problems. Others will examine their operation and see changes they can implement. Crimper performance and production efficiency will improve. They will wonder why it had not been done sooner.

We began to examine the crimper with tow input failure. We continued with an initial look at maintenance of the crimper and its components. Worldwide competition for the staple fiber market is growing. To survive in this market you must solve the crimper enigma. **IFJ**

The author may be contacted at DM&E Corp.
Tel 1 704 482 8876. Email: vand@dmecutter.com