MILLWORK

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Power Transmission – Part 2

by Caroline de Marrais

An article in the last issue of *Millwork* explored flat belt pulleys. Now we will move on to a quick overview of the rest of the power train – belts, shafts, bearings, oilers, and gears. So let's start with belts.

Belts help to transmit power from a pulley on a shaft to another pulley on a different shaft. Instead of using belts, sometimes other mills attached the wheel shaft directly to a machine (then the machine couldn't go any faster than the wheel turns), or they used gears (which can be very noisy and difficult to maintain and repair).

Hanford Mills uses flat belts, an early style of belting. Through most of the Mill's history, belts were made of leather. Think about it: cows are not exactly belt shaped, so sections of leather were cemented or laminated together to make belts. The 2006 flood damaged one of the rolls of leather belting in the Mill. The belt delaminated into its original leather sections. We saved the pieces so visitors can see how belts were put together.

At first belts were held together with hand-sewn leather lacing, but metal fasteners were soon available. This made belts easier to install and easier to take apart. There are two types at Hanford Mills. Alligator lacing that can be hammered into place and clipper lacing which look like V-shaped staples.

Clipper laces (top) come ready to install held in place on a paper strip. Alligator lacing (bottom) was installed using a hammer.

A special vise is used to clip laces to belt ends. When the laces are in place, there are loops of metal hanging past the end of the belt. These interlock with laces at the other end of the belt, then a wire is pushed through all the loops, holding the belt together. The wire is easily removed when you want to change the belt, but it doesn't fall out when the machine is running.

There are problems running flat belts. Shafts and pulleys must be perfectly aligned or the belt will not stay on. Even if everything is perfectly lined up, humid or cold weather might prevent the belts from working well or at all. By 1917, John Gates invented the V-belt which eliminated many of these problems. Belting companies were also experimenting with other materials – like rubber, polyurethane-impregnated cloth, and nylon belts.

In the Mill, we still use leather belts wherever we can. We also use impregnated cloth belts. The Museum gets its belts from the Page Belting Company in Boscawen, New Hampshire. Page Belting has been in the business since 1868. Like Hanford Mills, Page Belting managed to survive by diversifying their product lines, adding all types of belt materials as well as washers, gaskets, and hydraulics to the products they offer.

There is one other thing you might notice about some belts. In most cases belts make a flat loop around two pulleys. Every pulley run this way is turning the exact same direction. But what happens

Continued on page 3

In This Issue:

What's News?

The Power of History at Work - At this writing, as gas prices top $4/gallon, we're all very much aware of our dependence on gas power, and the challenges of cutting back on our use of gas-powered vehicles. Yet, as Caroline's articles on the Mill's power transmission system illustrate, the historic power generation we demonstrate at Hanford Mills Museum certainly had (and has) its challenges.

At Hanford Mills our daily activities – winter, spring, summer and fall – revolve around historic power generation – water, steam, gas, and yes, electric power. Will there be enough water in the pond to run the sawmill? Can we reestablish the water turbine system with historic accuracy? Has the icehouse been well packed and insulated so the ice can be used to preserved food in the icebox and for ice cream making? And a multitude of challenges that accompany generating live steam power... just as the Hanfords, and so many businesses like theirs, did a century ago.

Why is it so important to preserve, recreate, interpret and demonstrate the *history of power* at Hanford Mills? These unique examples of historic power help us to generate very powerful historic lessons for our visitors as we bring alive *the power of history at work.*

Hanford Mills Museum gives visitors a unique opportunity to see the type of business that shaped life and work in many rural villages. Tell your friends that it's worth every drop of gas they use to visit Hanford Mills Museum.

The true power of Hanford Mills is the enthusiasm generated by the visitors, volunteers, members and friends who support and celebrate Hanford Mills. Thank you!

Ice packed into the ice house February 2, 2008. We added a few more layers of ice and then packed sawdust around the edges and on top after this picture was taken.

Liz Callahan
Executive Director

In Memoriam

We are sad to report the death of Dan Rion, at the age of 69, on Thursday, May 8, 2008. Dan was a member of Hanford Mills Museum's Board of Trustees. He was also one of the founders of the Museum's Antique Engine Jamboree which is celebrating its 25th year in September. If you ever visited the Engine Show, you saw Dan's great collection of gas and steam powered machinery - he always filled the center of the millyard with his impressive exhibits. To honor Dan's contributions to the Museum and love for engines, the engine show will now be called the Dan Rion Antique Engine Jamboree. The Museum will honor Dan Rion at the Engine Show on Saturday, September 13.

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Continued from page 1

if you want a machine to turn in the opposite direction? You could turn the machine around, but in most cases that would not be convenient. Instead, if the belt is twisted like a figure eight, the pulley on your machine will turn in the opposite direction of its drive pulley.

Belts and pulleys run on steel shafts. They are held above floors or hung from ceilings using bearings. The bearings are another key part of the power transmission system. When two things rub against each other they create friction. If they rub against each other long enough or fast enough friction creates fire. Bearings have two jobs - they have to hold shafts securely in

Continued on page 4

OTHER EVENTS:

Miller's Harvest Festival - Sun., Oct. 12, 2008, 10 am to 5 pm

See the Mill's grist-mill and other food processing machines at work. Celebrate ingenuity and industry. Explore the skill of crafts-people and farmers at work. We will also be demonstrating other industrial and agricultural machinery. Sample food cooked in the historic John Hanford Farmhouse, and try traditional harvest-related crafts and activities.

Members' Holiday Party - Saturday, December 6

Invitations will be mailed in November.

Summer-Fall Workshops

Register Soon - Space & Time is limited!

Photography 101 with your Digital Camera [PDC] -

August. 17 - 10 am to 3 pm

Learn how to take great pictures using your digital camera.

Fee: $40 non-members, $36 museum members, bring your lunch.

So Easy to Preserve [SEP]-

Sept. 6 - 9:30 am to 11:30 am

Learn how to preserve this year's harvest by canning with the Cornell Cooperative Extention.

Fee: $10 non-members, $9 museum members.

Timberframing [TF]-Sept. 20-21, with an extra free day on Sept. 22-9 am to 5 pm

Learn how to build timber frame structures. Bring your lunch

Fee: $150 non-members, $135 museum members.

Let's Begin Quilting [LBQ]-Sept. 20 & 27, Oct. 4 & 11 - 1 to 4 pm

A four day workshop to introduce you to the art of quilting - both hand and machine piecing will be taught

Fee: $80 non-members, $72 museum members.

Return registration & fee to:
Hanford Mills Museum, P.O. Box 99, East Meredith, NY 13757
OR Call 1-800-295-4992 or E-Mail hanford2@hanfordmills.org

Send in the form below and the registration fee to reserve a space today. Or you can register online at www.hanfordmills.org

2008 Summer-Fall Registrations

Name _____

Address _____

City _____ State ____ Zip _____

Phone _____

E-Mail _____

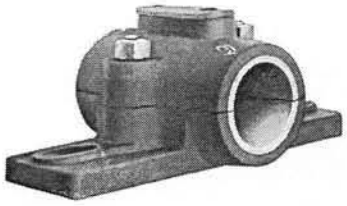
Workshop Number	Fee
_____	_____
_____	_____
TOTAL FEE*	_____

*Don't forget your member's discount!

Continued from page 3

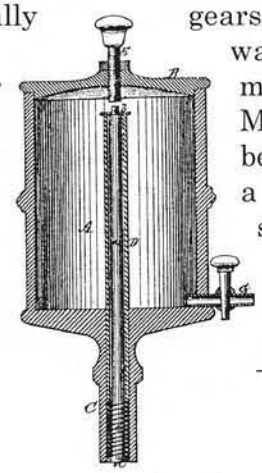
place, but they also have to allow them to rotate with minimum friction.

To make the last job possible, bearings were lubricated with oil or grease and Babbitt metal was used in bearings to help the lubrication work. This reduced friction to a managable level. A poorly maintained bearing could cause a fire in a mill. Babbitt metal was invented by Isaac Babbitt of Taunton, Massachusetts in 1839. Babbitt is a mixture of tin and copper; tin, antimony, and copper; or lead, antimony, and tin. It is resistant to seizing and is the perfect surface for holding lubricants. In the past Babbitt linings for bearings were poured with the shaft in place. It is a dying art – some Babbitt bearings have been replaced with ball bearings or a thin surface layer of Babbitt metal is installed.



Shafts are held by bearings. Babbitt and lubrication allow shafts to rotate in bearings.

Many bearings are fitted with lubricators or automatic oilers so they don't need constant care. Many automatic lubricators were invented throughout the years, but one man stands out due to a saying using his name – Elijah McCoy. McCoy was an Afro-Canadian born in 1843. He studied engineering in Scotland and eventually settled in Detroit, Michigan working for the Michigan Central Railroad. McCoy obtained as many as 57 patents, many for lubrication devices. The legend goes that the expression "the real McCoy" comes from railroad engineers asking for good quality lubricators. Lately, this story has been challenged, but even if the story isn't true it doesn't diminish McCoy's contributions to machinery lubrication.



Patent drawing of a McCoy lubricator.

The Mill's power transmission system also uses a few gears. Gears are less likely to slip, but they can break and they are very noisy. They also require lubrication. There are two main types of gears in use in the mill. A pair of gears connect the waterwheel shaft to the main drive pulley. The Mill also uses a pair of bevel gears which allow a shaft to power another shaft perpendicular to it. When you visit the mill, take a close look at our bevel gear – its right in front of the waterwheel. You'll notice that the teeth on the larger gear are wooden. While they will wear and break faster, wooden teeth are easier to replace and fix. This is a simple introduction to gears.

Now that you know a little more about those pulleys, belts, shafts, bearings, gears, and oilers in our Mill. The next time you are standing by the waterwheel take time to consider the path of power transmission from the waterwheel to the machinery.

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