

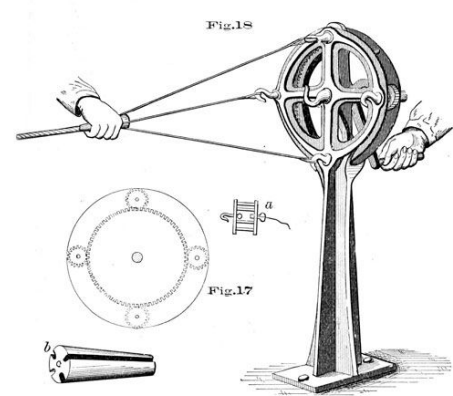
'Help Make a Rope' Demonstration

This demonstration shows how rope would have been made on board ship. The Plymouth Cordage Company is where ropemaking would happen on an industrial scale. The building is now ¼ its original length of 1,050 ft. (the Cordage Company now is 250 ft). The Cordage Company could produce a rope of about 600 ft. (100 fathoms) from the 1,050 ft. building. A fathom is equal to 6 ft.

Overarching Themes.....	1
Equipment used to Make Rope.....	2
Types of Fibers used in Ropemaking and Differences.....	3
Components and Phases of Ropemaking.....	4
Steps for the Rope Making Demonstration.....	5
Terms to Know.....	7

Overarching Themes

- Technology and Fiber Use in Rope
- Trade and where Ropemaking Fibers originated
- Types of Workers engaged in the Ropemaking Business
- Why is 19th-century Ropemaking Relevant today?



Technology and Fiber Use in Rope: In our modern time, rope is made from synthetic materials (ie mostly plastics). In the 19th century, plastic hadn't been invented yet, and thus rope had to be manufactured from natural fibers. Rope is an extremely useful tool: the oldest pieces of string date back 50,000 years, to the time of Neanderthals (the string was discovered during an excavation in France). Twisted fiber is a foundational piece of technology. The discovery of the string in the excavation suggests that Neanderthals had figured out how to twist plant fibers together to make cord and thereby could have had the potential to craft rope, nets, and other equipment.

Trade and Origin of Ropemaking Fibers: Trade was very important to the movement of fibers to manufacture rope. By the 19th century, global trade was growing. In addition to hemp, which could be grown in the US, beginning around 1830 fibers such as Manila from the Philippines were also used in rope manufacture here in the United States. Across New England there were many Cordage Companies (also sometimes known as Ropewalks) engaged in the business of rope manufacture from a variety of different fibers.

Types of Workers Engaged in the Ropemaking Trade: Workers in the ropemaking trade had different jobs and different skills. Ropemaking was a dangerous job. Workers running the machinery to manufacture rope worked long hours in excessive heat and freezing conditions. Spinners walked backwards working the fibers into yarns, which could be difficult and dangerous. Ropewalks were also very prone to fires; our ropewalk here at the Museum caught fire three different times during its working life. *See the panels inside the Cordage Company for more information on the workers and their livelihoods.*

Why is 19th-century Ropemaking Relevant? Ropemaking speaks to the ingenuity of people in the 19th century. It is also a product that is heavily used on board ships- then and now. Rope is still important in so many industries - from sailing and boating, to shipping, and even residential and home use. Without the discovery of how to spin fibers into yarns, we would not have any knitted garments or woven clothing. There would be no lines or nets with which to catch fish. The manufacture of rope is an integral part of civilization.

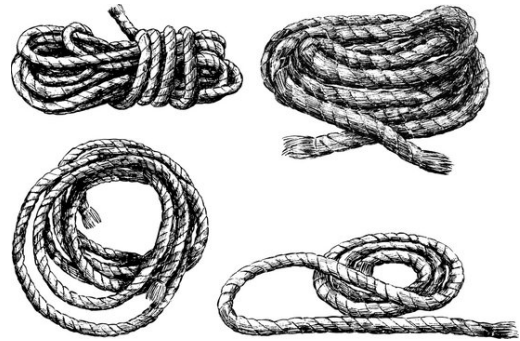
Equipment used to Make Rope

- **Ropejack** - this device was used on board ships in order to spin second-lay line. It spins the yarns together into strands, which are then spun together into rope.
- **Loper** - the hooked implement which allows strands to spin together into rope
- **Forming Top/Laying Top** - the grooved implement used to control the tension/stiffness of your rope (hard lay versus soft lay)
- **Yarns of your Fiber of Choice (Sisal)** - the ropemaking demonstration will use Sisal from Mexico to make rope
- **Knife and Maul** - to cut the rope off the ropejack at the end of the demonstration, and to cut the rope into segments to distribute to children

Types of Fibers used in Ropemaking and Differences

Types of Rope on the Rope Board:

- **Hemp**
- **Manilla**
- **Sisal**
- **Cotton**



Hemp: Hemp is made from the Cannabis Sativa plant. Fibers are generally 10-15 ft. in length. Hemp fibers are extremely strong; however, when the fibers are processed, hemp loses its natural waterproofing. Therefore, hemp rope must be tarred (with pine tar) before use to waterproof it, as it is susceptible to rot if it gets wet. Because hemp rope is so strong and will not stretch or shrink due to humidity or dryness, it was used for the standing rigging on ships (everything that holds up the masts). Hemp was replaced in the later 19th century with steel cables. The Morgan originally had hemp standing rigging, but it was later replaced with steel cables. The Conrad, built in 1882, was originally rigged with steel cable standing rigging.

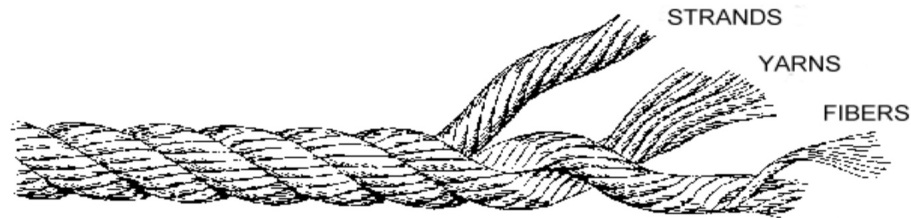
Hemp was not ideal to use for running rigging because it was prone to rot or, alternatively, because the sticky tar stuck in the block and tackles. Although not ideal, hemp was used for running rigging before the US began to import Manila from the Phillipines around 1830.

Manilla: Manila gets its name from the port it comes from: the port of Manila in the Philippines (this is the same fiber used in manila envelopes). The plant is a relative of the banana plant. Manila does not lose its natural oils when it is processed, so it does not need to be tarred. It does, however, shrink when it gets wet. Because of this shrinkage, it was not used for standing rigging. Manila was instead used for the running rigging—the lines that move the sails--on ships.

Sisal: Sisal comes from the Agave plant. Its fibers are much shorter than Manila and Hemp, so the rope that it produces is much “hairier” or pricklier (rope splinters are not

fun). It is very difficult and expensive to source good quality Manila or Hemp fibers for ropemaking today; this is why many ropes are made of synthetic materials (and for strength and durability). Sisal today is used for baling hay, cat scratchers, packing twine, and door mats.

Cotton: Cotton fibers are *very* short, and therefore would not be used for any weight-bearing ropes. Cotton rope could be used for flag halyards.



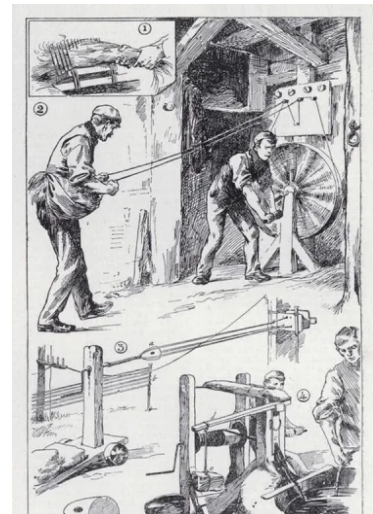
Components and Phases of Ropemaking

There are three phases when making rope: **Spinning Yarns**, **Forming Yarns into Strands**, and **Laying Strands into Rope**.

Spinning Yarns: This portion has been done for you. Spinning yarns involves processing the individual plant fibers, separating out the longest and straightest fibers, and spinning them into yarn (similar to the idea of spinning yarn used in knitting, or thread used in sewing). A good spinner could walk **8 miles a day** backwards spinning yarns.

Forming Yarns into Strands: This is done on the ropejack. The yarns are strung between the ropejack and the looper. The forming/laying top is then inserted at the end closest to the looper. The ropejack is then turned counterclockwise to begin spinning the yarns into strands. This will be right lay line. Almost all rope in the 19th-century was right lay line, with a few exceptions.

Laying Strands into Rope: Also done on the ropejack. Eventually, the yarns will be spun together into tight strands. From here, the looper will begin to be pulled forward, and the



strands will lay together between the laying top and the loper. The laying top will be pushed forward by the rope forming, until it has gone the entire distance between the loper and the ropejack, ending at the ropejack.

After Laying the Strands into Rope, the newly made rope would be stretched on a normalizing machine to create even tension across the entirety of the rope.

There is about 10-30% shrinkage from the length of the yarns to the finished rope, which is why the *Cordage Company* could only produce a 600 ft. piece of rope although the building was much longer.

Steps for the Rope Making Demonstration

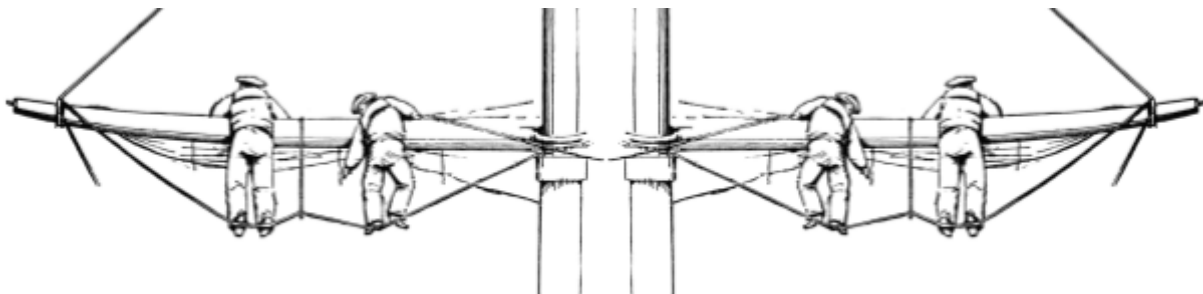
1. Gather your Equipment.
2. Place the Ropejack in its holder outside the Clam Shack (adversely, if it is raining, move all equipment to the ropejack inside the Cordage Company.
 - a. Make sure the gears attached to the ropejack are engaged (together)
3. Place the bucket of sisal on the side of the ropejack closer to the Clam Shack. Place the ditty bag of tools behind the sisal bucket.
4. When ready, give one person the job of the Loper. Explain they will be holding it like you might if you were water skiing, and bring them 10-15 ft. back from the ropejack. Draw a line for them to stand behind.
 - a. If you are standing behind the ropejack, all visitors should be standing on the right side of the ropejack.
5. Take your yarn and tie one end to one of the hooks on the ropejack. String the yarn back and forth from the ropejack to the loper, ensuring there are 2 yarns on each of the 3 hooks. Cut off the end of the yarn and tie it off to the ropejack.
 - a. Ensure the person holding the loper keeps light tension on the yarns.
6. Take the Forming/Laying Top and insert it between the strands nearest the loper. Ensure that the three strands are separated, and each is sitting in one of the three grooves on the Forming Top.
7. Leave the Forming Top in between the strands, and move to stand behind the ropejack. Instruct the visitors to get in a line on the right of the yarns/strands.

8. Show the visitors how they will be cranking the ropejack - *counterclockwise* - towards the shed; if you have a lot of visitors, you can limit them to making 10-15 turns each on the handle on the ropejack.
9. Return to the Forming Top and prepare the visitors to begin turning the ropejack. Once visitors have finished their turns on the ropejack, have them walk around the left side of the rope forming and get back in line.
10. Instruct the person handling the loper that the loper will begin to pull them forward, and they should keep light tension against the loper, but do not hold it back.
 - a. You will be allowing the rope to push the Forming Top forward until it makes contact with the ropejack.
 - i. Here, discuss what is physically happening as the rope forms
11. Once the rope is fully formed, cut it off of the ropejack. Ask the visitors what would happen if you were to let go, then put a knot in the end.
12. Ask visitors what would happen if the other end of the rope at the loper were to be removed, then ask the visitor handling the loper to take their end off. Show the loop at the loper end.
 - i. Here, discuss the normalizing machine. Show the difference in tension, stiffness between the two ends of the rope.

You have now finished the ropemaking demonstration! If visitors have questions, answer them, and direct them to walk through the Cordage Company if they would like to see ropemaking on an industrial scale.

A Fun Fact for Visitors: What is the difference between a rope and a line?

A line is a rope with a job to do. Any rope that has just been made does not have a job, but a piece of rope that does a specific thing (for example, all the standing and running rigging on your ship) is a line. Of course, there are always exceptions to the rule; two exceptions are the boltrope on sails and the footropes on ships.



Terms to Know*In order of appearance in this text*

- Fathom - a measurement sailors would use. 1 fathom equals 6 feet.
- Second-Lay Line - rope that has been taken apart down to individual yarns to be spun into shorter ropes. Usually this was done when a line on a ship broke, and the sailors did not want to waste the rest of the material.
- Yarns - individual pieces that compose the strands of the rope. They are spun from individual plant fibers. Strands are made from these.
- Strands - rope is made from strands. Rope is usually 3-stranded. The way you make rope with a larger diameter is to add more yarns into each strand
- Hard Lay - very stiff rope. Example: Cowboy Lariats
- Soft Lay - rope that is very flexible, where the lay is able to be opened easily.
- Maul - a wooden mallet used to hit the top of a knife to cut rope cleanly
- Fibers - individual “strings” of a plant used in ropemaking. Yarns are made from fibers.
- Tarred (Pine Tar) - waterproofing material used to cover hemp line
- Standing Rigging - lines used to hold masts in place on sailing ships, also the vertical part of the ladder-like structures (known as battens or ratlines) sailors climb to handle sails. The standing rigging was made from hemp rope.
- Running Rigging - lines used to maneuver sails. Anything that is moving or “running” on a ship. In the early days, running rigging was made from hemp line. After manila was discovered and imported, many sailing ships swapped to having their running rigging made of manila
- Block and Tackle – pulleys and the lines running through them
- Synthetic Materials - plastics that have been turned into yarns to make rope in our modern time. Most rope made now is braided as opposed to spun
- Halyards - from the term haul yard. A line on a ship used to pull up something, especially sails.
- Right Lay Line - rope that is spun to the right. Looking at rope, you can distinguish right lay line from left lay. Most rope in the 19th century was right laid.

- Normalizing Machine - a machine used to create even tension/stiffness throughout the entire length of a rope. To see a normalizing machine, go into the Sail Loft
- Boltrope - a rope that is sewn into the entire exterior of a sail to help create structure and protect the sail from ripping
- Footrope - a line on a ship that hangs from the yards. Sailors stand on the footrope in order to set or furl sails.