

April 3, 2010

ROPEWALKS, THEIR USE & OPERATION. By K.Harrison.

This short article will try to give some idea, not so much about making a rope walk, but more on their use, and perhaps more importantly, whether the model maker should contemplate making one. There are many designs in books and internet articles, but I have noticed that the average model maker has many questions about the mechanics of actually making model rope.

Some such questions are:

1. What is the longest rope one can make? How do you calculate the rope diameter the machine will make?
2. How many turns does one make at the whirls?
3. Does one need a top in order to make well defined rope?
4. What weight should be added to the looper end?
5. Can the machine be hand wound rather than motorized?

And quite a few more but first it would be best to look into the end result, the all important rope and the nomenclature of the various parts of the machine.

Why do modelers want to make their own rope? Well one can buy it, that is certain and I will add at the end some possible suppliers. I think the best answers are these:-

1. It is fun to do.
2. The modeler has control over the sizes he wants to make. This is important if you want your model's rigging to be in scale. IE generally, rope diameter decreased in size as it went from deck level to mast head and standing rigging was larger diameter than running rigging.
3. He can choose his own material.
4. If he runs short he can make more quickly, without ordering online with possible delays and much expense.
5. He can make right handed and left handed rope, either three or four stranded. More on that later.

Perhaps the first thing to look at is the make-up of rope, both in real life and modeling. Rope is made up of twisted yarn and in the following picture you will notice that although the rope is R.H, the individual strands are L.H. This must be remembered at all times when making model rope!



AN EXERCISE IN UNDERSTANDING HOW ROPE IS MADE.

The LH photo below shows two pieces of three strand model rope about 12" (30cms.) long. The white rope is RH ,the brown one is LH Take up one end of the RH rope between index finger and thumb and similarly the other end with the other hand. Twist one end counter clockwise, then bring the ends together. The rope will transform itself into a LH rope as seen in the second photo! If you do the same with the LH rope, but this time, twist it clockwise, it will be transformed into a RH rope.

You are creating torsion in the rope or threads and this is the first stage performed by one end of the rope making machine, the WHIRLS. The second phase of the rope making machine, similar to bringing the ends together, is performed by the LOOPER.

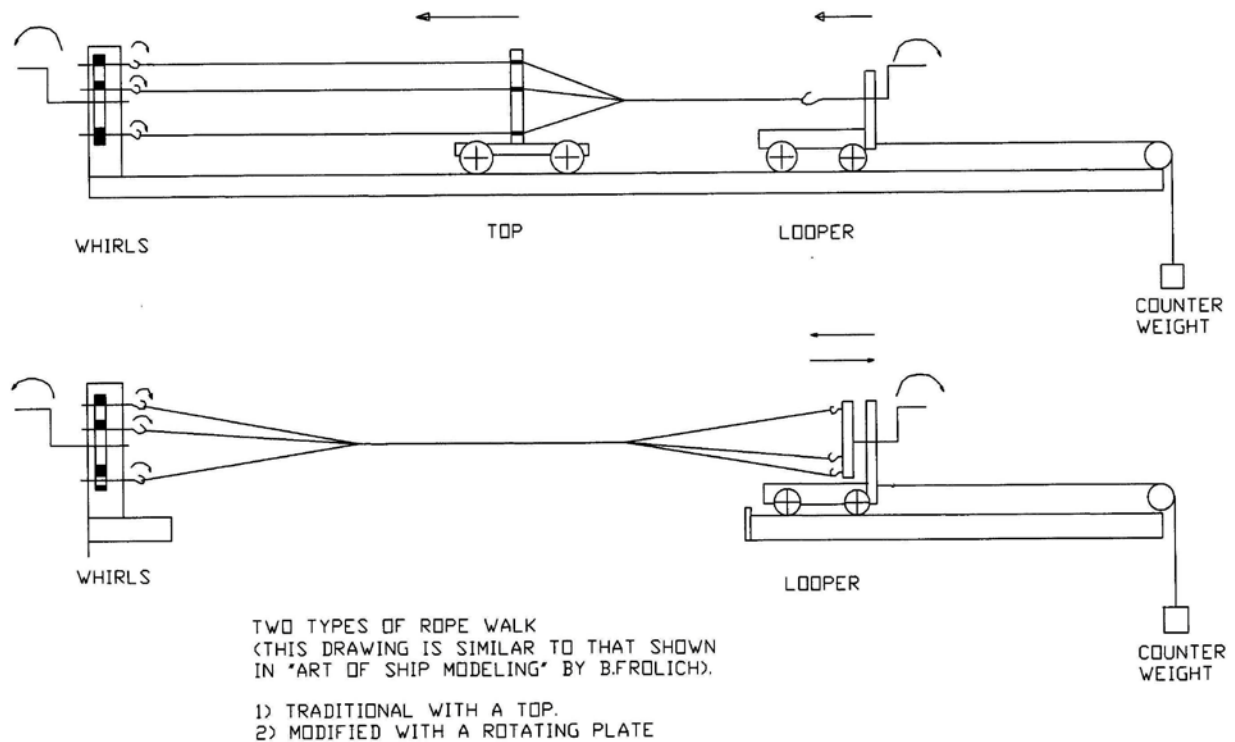
The rope is not well defined in the second photo but sufficient for you to understand what is happening. The whirls and looper never work at the same time. Whirls operate first then the looper to lay up the rope.



Conclusion: RH rope is made from LH thread and vice versa! This cannot be stressed enough.

Now, let's consider a sad fact of life and that is, our material for making model rope whether cotton, linen or polyester is RH. A friend has assured me that he has found LH thread in milliner's stores but quite frankly I never have. Does this mean one can only make LH rope? No! Definitely not. The whirl end of the machine must unwind the thread until it becomes LH.

TWO BASIC ROPEWALKS & THEIR OPERATION.



The above sketch shows a conventional ropewalk with a top, which is shown as the middle carriage on wheels. The geared whirls are on the left and the looper is on the right, also on wheels.

The top's function is to keep the strands well separated. This tends to define the rope into a tight pattern with the strands running approximately at 45 degrees to the axis of the rope.

The second type of ropewalk has no top. After the first phase of winding the threads by the whirls, the looper is turned in the opposite direction and laying up of the rope is achieved. The rope may or may not be as well defined as the conventional ropewalk. It depends on the skill of the operator.

You will notice that the first ropewalk supports its looper and top on a rail or floor and goes right up to the whirls. The topless ropewalk on the other hand has only a short carriage or bed on which the looper runs.

A weight is attached to the looper of both styles to keep the strands reasonably taut throughout the winding and lay up of the rope. It usually relies on gravity to maintain the tension. At the end of this article is a link to a Danish modeler's ropewalk & he operates his machine from the whirls end only, by keeping tension on a string attached to the back of the looper. The string goes over a pulley at the rear of the looper and then back to the whirls. No gravity required.

Notice the arrows which denote "movement" of the parts. Why does one have this movement in a ropewalk? Well, as mentioned earlier, we are torsioning the threads in the first phase and this has the effect of shortening them. You can expect to finish up with a rope approximately a quarter to one third less than the original length of the threads. In other words, if you want to spin a finished rope about 10feet (3m.) long you should have a bed, carriage or floor about 12 ½ feet (4m.) long.

My own feeling on this, is that on a ship model at a scale of 1:48 you need a lot of rope for the shrouds of a warship or merchant barque. It is therefore best to choose your design carefully and spin a fair amount of rope at one time.

ADVANTAGES/DISADVANTAGES OF THE TWO STYLES OF ROPEWALK.

CONVENTIONAL: (top illustration on page 3)

This ropewalk will make a tight and well defined rope.

However, as the top has to travel almost up to the whirls, a long bed or carriage has to be constructed, including extra parts. IE. The top itself and a wheeled carriage for the top.

TOPLESS: (bottom illustration on page 3)

This ropewalk has one less part to worry about, namely, the top. Because the looper only travels about one quarter the length of the rope at set-up, a short carriage can be constructed roughly 5feet (1.5m) long for a 15 feet(4.6m.) long finished rope. The carriage can be made in "knock down" style for easy storage.

Sometimes this ropewalk may have slight imperfections in its appearance, or at least that is my experience. It can however be corrected by watching the lay-up as it occurs, stopping the machine and stretching the rope a little, then continuing.

OPERATION OF A BASIC ROPEWALK.

The sketch on page 3 shows the whirls and looper as hand cranked. A simple ropewalk can be bought or made in this mode but there is a great deal of winding to do at both ends of the machine and I will describe a few ways of motorizing both whirls and looper.

1. Both ends can be driven by a 3/8" reversible variable speed drill.
2. They can be driven by a sewing machine or fan motor with reversing switch and foot operated speed controller. If using a sewing machine motor, ensure first that it can be reversed.
3. By far the best and cheapest way to drive them is by DC motors (or gearmotors) using wall adaptors (AC current to DC), reversing switches and variable speed controllers.

SETTING UP THE MACHINE.

Because I use a topless machine I will describe how this is made ready and operated for a 3 strand rope. A machine with a top is similar.

The whirls are fixed to some structure such as a door post and I find it best to have them about chest high. It is the choice of the operator. The centre line of looper disc and the top should be located exactly in line with the centre line of the whirls and at a distance away to give the expected finished rope length.

Thread of choice is now tied to one hook on the whirls. It is then taken to its respective hook on the looper, over to another hook on the looper and from there taken to a hook on the whirls, then over to the last hook on the whirls. From there, it is finally tied off at the last looper hook. For a larger diameter rope, two or three threads can be laced between the hooks of the whirls and looper following the same procedure. You must endeavour to make the tension of all three threads as equal as possible. This is very important in ensuring a good rope. To help doing this, it is best to clamp or hold down the looper temporarily on its carriage. The looper should be near the rear end of the carriage. Remember! It is going to travel along the carriage once the operation begins!

A weight is added to the string at the rear of the looper and should almost touch the floor. Here I must revert to one of the questions asked on page 1. How big is the weight? Another sad fact! There are no empirical formulas. The operator must use a weight sufficient to keep the threads taut at start up. If you use a very heavy weight using small thread you risk breaking the whole rope at lay up and it makes a big mess. The weights can be added to a small pan tied to the end of the string. They can consist of machine nuts and bolts, or lead fishing weights. Make a note of the weight you are using AND the diameter of the threads used for the rope. This can be very useful in making the same diameter rope next time.

Release the clamp from the looper end and start the whirls. Assuming you have loaded the machine with RH thread, start the whirls so as to UNWIND them. I find it's best to start at a slow speed and build up. If too fast a speed, the threads may tangle. You will notice a strange thing happens. The threads will tend first to sag, then, as they become LH, tighten up and the looper will start to slowly travel along the carriage. You are on the right track! How many turns do you make before stopping the looper? Again, no definite data but if you had measured the start up distance between whirls and looper disc, divide that by 4. That is the approximate distance the looper has to travel along the carriage.

Stop the whirls. Go to the looper end. Start the looper, but in the opposite direction to the hooks in the whirls. The rope will start to lay up. Keep going till you see that the rope is being well defined meaning its strands are at about 45 degrees to the axis. I find it best to stop now and again to inspect the rope and stretch it here and there between two hands.

As you can see a great deal depends on the skill of the operator and it behooves you to write down any observations as to thread diameter, type of thread, counterweight at the end of the looper, length of thread at start up and length of rope when finished.

When satisfied with the look of your rope, apply some glue to both ends, wait a while, then cut it loose. You may find that it curls horribly (an indication you may have over wound at lay up), but do not despair. It needs what is called "hardening off". I first again stretch it between my hands in various places along its length and then hang it as high as possible with a weight clamped to its end. Congratulations! You have spun a RH rope. If at start up you had turned the threads so as to tighten them, you would finish up with a LH rope. The amount of spinning time is less for a LH rope.

The last operation is to measure the finished diameter. This can be done either with a micrometer and a light touch or by wrapping the finished rope around a dowel between two marks, say 0.25" (6mm.) apart on it. Count the number of turns and divide the distance by the number of turns. The rope should not be wound too tightly. If using a micrometer, open the micrometer to the approximate diameter (do this by eye) and then just by laying the rope at the gap, see if it will drop through. If it does not, open the gap slightly. Keep doing this, a few thousandths of an inch (0.08mm) at a time, until it just drops through. Note the reading. Perhaps not dead accurate but close! This measuring should also be done on the start up thread and noted.

Before leaving this chapter I should answer the question of maximum length that a rope walk can do and if you have noticed the things I don't know about ropewalks, you may guess what is coming. Well, a fellow modeler assured me he had spun about 100feet in his back yard. He did say however that the threads tended to sag under their own weight and there was a danger of entanglement. My feeling is that a maximum should be about 20 feet (6.2m). The reason being, you can look along the threads to see if the looper is traveling along the carriage with no problem.

A ropewalk with a top becomes impractical for very long ropes because of the long carriage required.

THREAD MATERIAL.

For modeling purposes, the most popular materials are linen, cotton and polyester. I cannot give much information on material other than cotton. I did buy some linen thread a year or so ago, but noticed it had some flat areas every few feet (30cms.). It is supposed to be a very good material. I did not spin any. Polyester is probably a material of choice for modelers who do RC sailing ships.

My own choice is a brand of crochet thread called Cordonnet Special and is made by DMC, a French company but it is easily available in USA , Canada, and Europe. The thing about Cordonnet Special which I like is, it is made up of three individual threads and each thread is also made of three threads. This makes it look very much like real rope and can be used in the smaller diameters for running rigging straight off the ball. Cordonnet comes in about nine different diameters, colour white and ecru. It can be dyed a straw colour for running rigging and medium brown for standing rigging.

CALCULATING THE FINISHED ROPE SIZE WHICH THE MACHINE CAN MAKE.

The following table provides some idea of the possible diameters of rope which can be produced by a ropewalk. Note that these are my own measurements using Cordonnet and other materials may give different results. Another factor is how tight the finished rope is spun.

Remember that the machine can be loaded with more than one thread per hook in a three strand set up, but I have not given any figures for other than three threads and then using that rope to make a LH rope. I encourage you to extend the table, experiment with more threads and make notes accordingly.

An approximate guess to start with can be achieved by adding the diameter of the three start-up threads and multiplying by 0.7.

MODEL ROPE SIZE CHART
(FROM B.FROLICH'S BOOK "THE ART OF SHIP MODELING")

DMC THREAD NUMBER		3	5	7	10	15	20	30	50	60	70	80	100
DIAMETER	INS.	/	/	/	.025	/	.018	.017	.013	.0125	.012	.011	.0105
	MM	/	/	/	.64	/	/	/	/	/	/	/	/
2 STRAND HAWSER (R.H.)													.01 .25
3 STRAND HAWSER (R.H.)		.055 1.4	.047 1.2	/	.049 1.0	/	.039 .85	.036 .8	.027 .7	.023 .6	.028 .55	.027 .5	.025 .4
3 STRAND CABLE (L.H.)		2.8	.101 2.6	/	.086 2.2	/	/	.07 1.8	/	/	/	/	/

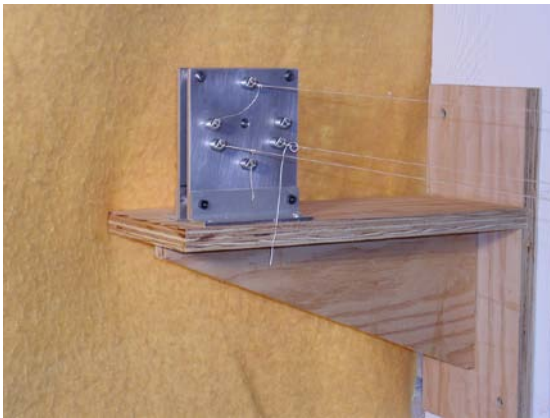
REV. NOTES:

- 1) 3 STRAND CABLE IS MADE BY LAYING UP 3 STRANDS OF R.H. HAWSER
- 2) I HAVE NOT BEEN ABLE TO FIND DMC SIZES 3,5,& 7 BUT THEY ARE PRESUMABLY AVAILABLE.
- 3) 2 STRAND HAWSER DOES NOT MAKE A VERY GOOD ROPE BUT CAN BE DONE.

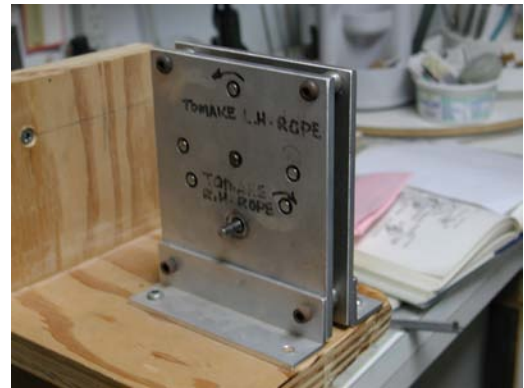
There is no doubt that a good deal of money and time can be spent in making a ropewalk and it is up to the modeler to decide if it is worth it. Model rope can be bought from at least two suppliers I know and one even supplies LH rope. I will give addresses at the end of this article. You can probably take an educated guess at the amount of rope you require from your ship plans, figure out how many models you do a year, (here, I am smiling) and then decide if you would like to try it. A very simple one can be made from plywood, a few bushings or bearings, some hooks and trolley wheels. I have a friend who uses an electric shaver head as the whirls. But do not forget that you can make different sized rope than the suppliers and with a good deal of fun, after the learning process is overcome.

On the photos below you will notice that the first photo shows five hooks. This enables either a two, three or four strand rope to be spun, depending on the initial set up. Whatever pattern is chosen, the threads are equi-distanced around a circle. This ensures a better rope lay up.

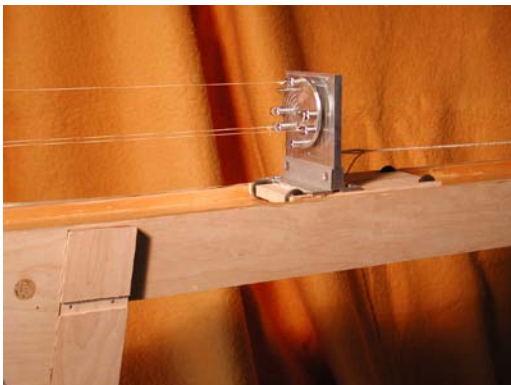
SOME PHOTOS OF ROPEWALKS



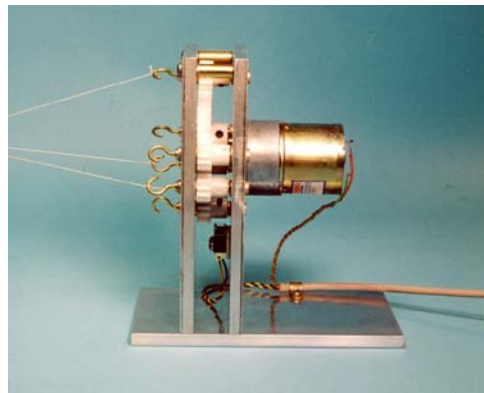
WHIRLS AT START UP



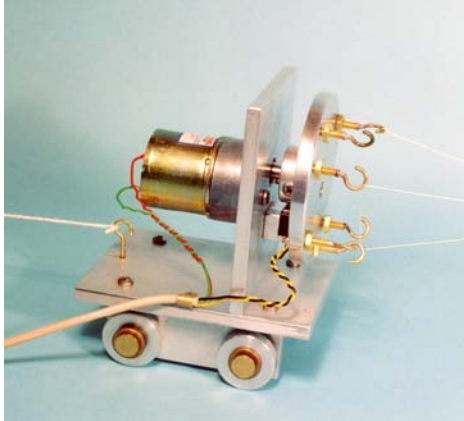
WHIRLS- REAR



LOOPER AT START UP



WHIRLS WITH DC GEARMOTOR



LOOPER WITH DC GEARMOTOR



LOOPER ON CARRIAGE

LINKS.

I will give a few links to material suppliers and a ship modeler who has gone a step further in simplifying the lay up of the rope at the final step. He takes the threads to the looper but the looper disc does not turn at lay up, thus eliminating an extra motor.

Two of the threads are removed from their hooks on the whirls and transferred onto the other hook. He then starts the whirls and the whirls do the lay up. Clever! This is similar to “bringing the torsioned threads together” as mentioned on page 2.

A Danish ropewalk with simplified lay up.

<http://www.museumshipmodels.com/ropemaking.htm>

Building a ropewalk with top by Phil Krol

<http://www.modelshipworld.com/phpBB2/download/ropewalk.pdf>

A topless ropewalk with plans by K.Harrison. (Model Shipwright’s Database)

http://www.modelshipwrightsdatabase.com/Articles/14frolich_style_ropewalk.htm

A new twist on rope making by Tom Nance.

This article appeared in “Ships in Scale” magazine September/October 2003 Vol.X1V number 5. The inventor designed a machine with a footprint of only 12” x 24” x 8” high. (30 x 60 x 20 cm high). It torsions the strands and lays up the rope simultaneously. The machine may be marketed shortly by the “Byrnes Model Machines” of Florida.

Ropewalk machine by ModelExpo

<http://www.modelexpo-online.com/product.asp?ITEMNO=MS110>

Thread material (Threadneedle Street)

<http://www.threadneedlestreet.com/>

Left handed rope (Morope) made in Germany.

<http://home.foni.net/~agondes/en/left.htm>

Cotton and Linen Threads (Thread Exchange).

http://www.thethreadexchange.com/miva/merchant.mv?Screen=CTGY&Store_Code=TT&Category_Code=model-ship-thread

Rigging line by model expo

http://www.modelexpo-online.com/search.asp?SKW=cat1_II

Australia:

Barbour Linen Thread

<http://birdsall-leather.com.au/home.php?cat=106>

Gutermann Threads (Australian Agent) -Parkinson and Manns Pty Ltd (WA)

<http://www.parkinson-mann.com.au/proddetail.php?prod=Gutermann>

Oxella / PolyCotton Threads

http://www.shann.com.au/clo/pro_threads.html

YLI and Bear Threads

Cotton On Creations (Australian Agent)

<http://www.cottononcreations.com.au/> (click on catalogues)

Cordonnet/DMC Embroidery Threads:

Available widely; however, once source is Lyns Fine Needlework

<http://www.lynsfineneedlework.com.au/threads-0.htm>