HOW TO WEAVE SILK.

In handweaving silk belongs to the "superior" class of fine craftsmanship. This opinion seems to be without ground if one uses very heavy silk yarn. Heavy silk is as easy to weave as mercerized cotton or even easier. The difficulties arising when we weave fine silk are not inherent in the nature of the yarn itself, but in its size. Therefore, what we have to say here about silk, may be applied with certain reservations to other fine yarns as well.

The subject of our discussion will be then not silk in general but such yarn which must be woven with 50 or more ends per inch.

Without even going back to the Oriental origins of silk and the finest fabrics ever woven, we may find in the 19-th century in England - handwoven satins, damasks, and tissue fabrics with an average sett of warp from 300 to 600 ends per inch. Such close setts would be too difficult to start with, perticularly that they require special weaving equipment, not only different weaving methods.

We can begin with silk which can still be woven with standard equipment, i.e. with steel heddles, and normal reeds. For four frame looms about the limit of setting the warp is around 100 ends per inch. With 8 frames it can be increased, but not much. Beyond that special heddles are required.

Let us take as an example silk No.150 (deniers) or No.60 (metric). It will be set at 70 to 80 ends per inch. Therefore a warp 15 inches in width will have from 1050 to 1200 ends.

The first stage of course will be warping. If the yarn is in skeins then it must be first wound on bobbins. Even before this we must decide (when we work with raw silk) whether to boil it off now or after weaving. Boiling off may be done either in skeins (but not on bobbins) or when the fabric is finished. Since during the process of boiling the skeins must be stirred, it is perhaps wiser to leave this operation until later. Otherwise the yarn may get tangled and very difficult to wind on bobbins.

Making bobbins from skeins does not present any serious difficulties except for the time involved. The skein should be placed on a good swift, flattened out, and stretched out as much as possible. Then only they can be untied. The winding can be done by hand, or (faster but not easier) on an electric winder. The latter should have a speed control, because the yarn breaks easily if the start is too fast. The bobbins are of the type used for warping (½ lb), and should be wound in even layers. The winding must be tight, and the layers cross each other at a slight angle. This in case of breakage prevents the broken end from cutting into the already wound yarn. In practice this means a constant oscillatory movement of the hand guiding the thread, as if the hand were shaking. If the yarn breaks the ends should be tied with large, conspicuous knots, but with short ends. During the warping we may decide either to shift these knots to one of the ends of the warp, or to replace them with proper, small and tight ones. Since knots have a tendency to untie or to break, it is always advisable to shift them to the end of the warp.

As usual we have here a choice between the weaver's knot and the square one (reef). The first does not slip but breaks easily, the second is smaller and therefore passes easier through the reed but slips unless it is made very tight.

Warping can be done on a warping frame for short warps, and for long ones - on a warping mill, or at least on a horizontal warping reel. Chaining of the warp should be avoided. The warping must be very accurate and consequently slow. Try to maintain a very low tension, not to cross the ends, and not to pile them up.

Whichever warping method is used, it is advisable to make a lease (cross) at each end of the warp. Otherwise the beaming will have to be done through the lease rods, which means a lot of attention and consequently - slow work.

It is very important to have all the warping equipment very smooth. The wood must have no splinters or cracks. Even the hands (particularly the fingernails) must be smooth, since silk catches on any rough surface. Use smooth gloves if necessary.

The low tension during warping (lack of friction) must be emphasised here again. Even for a very narrow warp there will be a thousand or more of warp ends. If we use only as much as 4 oz of pressure on each warp end, the total tension will amount to hundreds of pounds, which may twist or bend the warping equipment. This is of no importance in sectional warping, but then we must make sure, that all sections of the warp have exactly the same tension, or we shall have stripes parallel to the warp in the texture of the fabric.

Beaming is done best through a raddle with at least 4 dents per inch. The raddle is fixed to the slabstock, and it should be made of highly polished wood.

It is time to say a few words about the loom itself. Again, all the wooden parts where the warp or the woven fabric touches the loom must be very smooth. The type of the loom is important too. The best will be counterbalanced one with a shed regulator for weaves requiring 4 harness-frames, and a double-tie-up jack-type for higher number of frames. A single tie-up (plain jack-type) may be used on the condition that the shed may be adjusted so that there is no friction between the yarn and the moving parts of the loom.

The lease rods must be left in the warp at about the same distance from the harness as the distance from the harness to the woven fabric, so that the front and the back sheds are of about the same size.

The heddles can be the standard steel wire type of good quality for warps set at 100 or less ends per inch. For finer weaving the heddles must be made of silk or possibly nylon.

The reed must be very clean. Old rusty reeds are out of the question.

The beaming is done as usual, but unless the warp is perfect, it must be slow. Sagging ends will wrap around the blades of the raddle, and break eventually. Therefore one must watch the raddle (or the lease rods if only one cross has been made) all the time.

Moderate combing does not seem to harm the warp. The layers of warp must be separated by smooth paper. Do not use here the building paper, but rather wrapping paper in rolls.

The threading is not a problem, but it is very annoying to make a mistake in the middle of a 3000 end warp. Therefore it is better to thread and sley at the same time, with all repeats of the weave or pattern marked in pencil on a piece of paper attached to the reed. Another trouble may be expected when free hanging warp ends twist around each other. It does not matter when they are in large groups, but just a few threads are very difficult to untwist, and this operation must be done very gently.

When selecting a reed, there is no need to go into very high numbers. Just the contrary, since we must avoid the friction, a comparatively open reed will be preferable. For instance No.15 with 5 ends per dent, or 18 with 4 ends per dent. We do not need to worry about the marks left by the blades of the reed in the fabric. If the sett of warp is properly chosen, i.e. if it is close enough, these marks will disappear completely in washing. This is one reason for making rather closely set warps. The other is that with open warps there is too much take-up on the weft, and consequently the edges are drawn in to higher degree tahn the fine yarn will stand. One must remember that such compensatory methods as leaving plenty of weft in each shed are impossible here, because they slow down the weaving which is slow anyhow.

Tying-in (attaching the warp to the apron) must be done very carefully. First comb out each bight (group of warp ends) and tie it to the steel rod in such a way that the tension can be corrected easily. Or use the alternate method of making a knot at the end of each bight, and lacing the bights to the apron with a long cord. The tension of warp must be uniform at the beginning, because slack warp ends will show later on as bright, vertical lines or stripes in the fabric.

Now comes the "gating", or adjusting of the upper and the lower tie-up. Let us suppose that we have a counterbalanced loom. First we must get all sheds very widely open. This is done when the "fell", last pick of weft, is about 8 inches from the reed. The fully open shed should fill nearly the whole height of the reed, but its lower layer should not touch the batten. We start by adjusting the ties between the lamms and the treadles. These should be just long enough to bring the warp close to the lower shaft of the reed, when the treadle is in its lowest position. In most cases it means that the treadle touches the floor. If such a position of the treadle is too low for the weaver, then a piece of wood (2" by 3") may be laid on the floor under the ends of the treadles. This is done so that the shed can not be opened more than necessary, in which case the warp would rub on the reed or the batten.

When all the lower ties are thus adjusted we try to rise the upper part of the shed by shortening the cords of the upper tie-up, until each shed is fully open. If the tie-up is not balanced (not the same number of frames tied to each treadle) then we must use a shed regulator. In this case the only cords which must be adjusted are the ties between the shed regulator and the treadles.

If the number of heddles on any of the frames is very small it is better to prevent this frame from rising too high - it would result in stretched if not broken warp ends. Either wooden stops on both sides of the loom frame, or cords can be used. The latter are of course much easier to install. A cord is tied first to each end of the harness-frame, and then to the lower part of the loom. Its length must be such that the frame cannot rise more than other frames.

We shall avoid most of these difficulties if we select for our first project a plain twill, or diamond twill with fairly regular distribution of warp ends on all frames. Rosepath will give a too small design, but a similar pattern with longer repeats as in fig.1 will give good results.

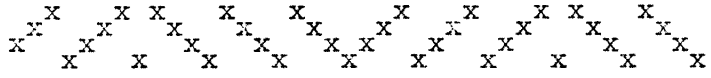

Fig.1

In this case we do not need to use the shed regulator, or any additional ties. The pattern will be about ½" long, and will produce two diamonds of different size.

Now we are ready to start. Or not quite. We must first select the shuttle or shuttles, quills, and finally wind the weft. Shuttles should be inspected very carefully. They must be smooth, even, highly polished, and the points sharp, without any notches which usually appear when a shuttle strikes a hardwood floor. The shape, size and weight of the shuttle are not very important. But the shuttle must be deep enough to hide completely the quill when full.

The quills may be of paper or anything at all as long as they turn freely on the spindle. Their length must be about 2/3 of the length of the spindle. The diameter (outside) rather large; it helps when winding the weft, and the unwinding is easier too. Cardboard tubes on which small quantities of yarn are sold are quite satisfactory. Light wooden bobbins can be also used provided they are short and very smooth.

Winding does not present any problems. Since the quill is short, it will unwind easily in any case. But it should be tight, and it is advisable to cross the yarn when winding (the hand guiding the yarn moves back and forth).

Now comes the weaving, and it is the only really hard part, at least at the start. When working with fine silk for the first time we meet a completely new phenomenon which makes our life miserable. The gum in the silk makes some of the warp ends stick together. The point at which they stick may be anywhere from 1/8 of an inch to 2 inches from the cloth. In each case the weft instead of separating the ends, gets around the obstacle, and later on forms loops, not outside but inside the fabric. The effect would be charming if properly distributed all over the fabric, but it is not. It usually follows the same pair or pairs of warp ends.

To separate the stuck ends we use a very widely open shed. High tension of warp produces the same effect, but unfortunately it results in too much friction at the edges, and finally broken ends. Therefore we weave at a moderate tension and as wide shed as possible.

Since it is really not the size of the shed but the angle which matters (fig.2), therefore we work very close to the batten.

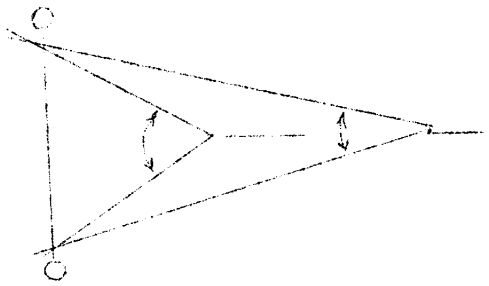

Fig.2.

The stuck ends are about the only major difficulty in weaving fine silk, and it would be worth while to find the best method of separating them. It seems that when we open the shed fast the separation is easier than when we do it slowly. For very slow weaving a perfect solution is to insert a flat stick (picking stick) into eabh shed and press it down to the cloth before throwing the shuttle. But this method is much too slow. Dressings do not seem to help, at least the ones we have tried. What helps however is to have the warp ends as smooth as possible. Ends worn out by friction stick together much easier, and are sometimes difficult to separate. Thus we may repeat once more that each part of the weaving equipment which the warp touches should be smooth and clean. The bobbins, warping reel, lease rods, raddle, and slabstock, heddles, and reed should be all carefully inspected for roughness, dirt, rust, sticky varnish etc.

The rhythm of weaving is here the same as usual. Change the shed at the moment of beating, not before or after. Beat only once but hard. One must be extremely careful how to throw the shuttle. It must get through the shed without striking any warp ends with its point. All such ends will be broken and tying them is not a pleasure.

Twill is much easier to weave than tabby. The sheds are much cleaner and there is hardly any trouble with sticking ends. But the sett of warp good for the twill is too close for tabby. Then if we set the warp for tabby and still would like to have the diagonal in the twill at about 45°, we must use heavier weft or double it.

What happens here is, that after a few yards of weaving, the difficulties seem to be easier to overcome, although apparently nothing changed in the method. This is probably the effect of higher speed and more uniform rhythm.

Once we get over the initial troubles with loops in weft due to the sticking ends, there are two minor problems. One is what to do with knots in warp. The other are broken ends.

The answer to the first is: do nothing. Just weave them in. You may try all other standard methods, but they do not work very well. Broken ends are more annoying. If the same end keeps breaking without any apparent reason, inspect the heddle. It may be rusty or it may "pinch" the thread. Replace with cord heddle. Or it may be the thread itself. If it looks uneven, tie another thread instead, and see what happens. Knots result often in broken or untied ends. Usually the trouble may be spotted well before the end breaks. A loose end shows on the uniform surface of the fabric as a bright line.

Too many ends breaking at the edges indicate too high tension of warp. Two ends breaking at the same time were certainly stuck together behind the harness. Inspect from time to time the warp behind

the frames. More than two ends broken at once may have the same origin, or they may have been struck by the shuttle. This is often the result of a too fast weaving.

This is about all. Now comes the final disappointment. We take the fabric off the loom, and if it was raw silk, we do not like it too much. It is dark, yellowish, and it does not shine at all. Therefore we wash it in mild soap and iron. What we get is cardboard, and a very dirty-looking cardboard too. We wash it and iron it again and the result is the same. If not, that is if the fabric is soft and shiny, it was not raw silk. This is because raw silk contains up to 25% of gum, which should be removed before washing and ironing.

The proper way to "boil-off" the gum is to prepare first a very strong solution of mild soap. We take about 5 ounces of soap (Lux) to one gallon of soft water, bring it to the boiling point and boil or simmer our weaving for about one hour. The best temperature is about 200°F, if we can keep it at this point, but boiling does not injure silk in any visible manner. The weaving must be stirred all the time. Then it is rinsed in hot water to get rid of the gum and of the soap.

All these remarks concern comparatively heavy silk. With still finer yarn we must have special heddles, and be still more careful when warping, beaming and weaving.

We advise the reader to look up the article "Skill in Handweaving" (MW 12), where many of the operations mentioned here are described fully.

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PROBLEMS IN TEACHING — 8-th LESSON

DRAFTING.

There is a whole group of weaves, wich are alike in one respect, even if the fabrics they produce are entirely different. These weaves have so called units of threading, and usually also of treadling draft. This means that the drafts are composed of groups of heddles which occur always in the same number and order. When we make short drafts each group is represented by one square of the graph paper. If there are several identical groups one after another we may also indicate their presence by a number. E.g.:

mmmmmmmmm = 9

As an example of this kind of a weave can serve Summer-and-Winter. It has two different units in drafts for 4 frames:

1-st unit: $\begin{matrix} & x & \\ x & & x \end{matrix}$; 2-nd unit: $\begin{matrix} x & x \\ & & x \end{matrix}$;

In making a short draft we shall mark the first unit on the lower line and the second unit on the upper line. Thus a draft: