

SILK, *n. s.* } Sax. *weole*; Goth. *silke*;
 SILK'EN, *adj.* } Dan. *silke*. The produce
 SILK'WEAVER, *n. s.* } of the bombyx, see below:
 SILK'WORM. } the derivatives following
 the root: and *silken* being often used for soft;
 tender.

Full many a lady fair, in court full oft
 Beholding them, him secretly envies,
 And wished that two such fans, so *silken* soft,
 And golden fair, her love would her provide. *Spenser.*
 He caused the shore to be covered with Persian
silk for him to tread upon. *Knolles.*
 The worms were hallowed that did breed the *silk*;
 And it was dyed in mummy, which the skilful
 Conserved of maidens' hearts. *Shakspeare. Othello.*
 Let not the creaking of shoes, or rustling of *silks*,
 betray thy poor heart to woman. *Shakspeare.*
 Men counsel and give comfort to that grief
 Which they themselves not feel; but, tasting it,
 Their counsel turns to passion, which before
 Would give perceptual medicine to rage,
 Fetter strong madness in a *silken* thread,
 Charm ach with air, and agony with words. *Id.*
 All the youth of England are on fire.
 And *silken* dalliance in the wardrobe lies.

Shall a beardless boy,
 A cockered, *silken* wanton, brave our fields,
 And flesh his spirit in a warlike soil,
 Mocking the air with colours idly spread,
 And find no check? *Id. King John.*
 These kinds of knaves, in plainness,
 Harbour more craft, and more corrupter ends,
 Than twenty *silky* ducking observants
 That stretch their duties nicely. *Id. King Lear.*
 Grasshoppers eat up the green of whole countries,
 and *silk-worms* devour leaves swiftly.

Bacon's Natural History.
 She weeps, and words addressed seem tears dis-
 solved,
 Wetting the borders of her *silken* veil. *Milton.*
 Without the worm, in Persian *silks* we shine.
Waller.

Broad were the banners, and of snowy hue,
 A purer web the *silk-worm* never drew. *Dryden.*
 The Chinese are ingenious *silkweavers*. *Watts.*
 Dress up virtue in all the beauties of oratory, and
 you will find the wild passions of men too violent to
 be restrained by such mild and *silken* language.
Id. on the Mind.

SILK. The culture of this important article
 of manufacture has hitherto been considered as
 the exclusive property of other climes, although
 we have the most positive evidence that the
 worms when reared in this country produce a
 material as well calculated for the manufacturers'
 use as those of France and Italy. As this is a
 subject that has lately occupied the attention of
 the Society for the promotion of Arts and Manu-
 factories, who have printed a series of valuable
 practical observations from the pen of Mr. Ste-
 phenson, we cannot do better than commence
 our article by an analysis of their contents.

It appears that Mr. Stephenson was for several
 years a resident in the provinces of Languedoc
 and Quercy, where the utmost attention

is paid to the manufacture of silk. He begins
 by giving some account of the mulberry tree.
 He observes that there are two kinds of the black
 mulberry tree which have been cultivated in
 France. The first of these bears a fruit well
 known, and frequently presented at table, being
 the same which is cultivated in our gardens in
 the neighbourhood of London. But the leaves
 of this tree have been found, from experience,
 to be too harsh and too succulent, to prove in
 every respect a proper food for the silk-worm;
 and the silk it yields turns out to be coarse, and
 of an inferior quality. The second kind of the
 black mulberry tree carries a fruit inferior to the
 other in point of size, and improper for the table;
 but the leaf of it has been found to be
 superior to the first, as food for the silk-worm;
 and it is less harsh, less succulent, and yields
 silk of a finer quality than the one first men-
 tioned. This second sort of the black mulberry
 is, in all probability, the particular kind which
 is said to be at present cultivated in the kingdom
 of Valencia, in Spain, for the use of their silk-
 worms: and, indeed, many of their old planta-
 tions in France consist of this sort. But the
 new plantations consist wholly of the white
 mulberry tree, hereafter to be mentioned, which
 is the only one they now cultivate in all their
 nursery grounds, for the use of their silk-worms.
 There is a third sort, known by the name of
 the white mulberry, the leaf of which is more
 tender and less succulent than either of the other
 two, and has been found to produce silk of the
 finest and best quality.

Some people have been led to think that this
 kind of the mulberry tree does not carry any
 fruit, and that it can only be propagated by lay-
 ers; but in this particular the fact stands much the
 other way. For, though the white mulberry
 may not perhaps produce any fruit in a climate
 so far to the north as ours, yet the truth is, that
 in climates such as that of the south of France,
 this tree carries fruit in very great quantities,
 though it is of a smaller kind than either of the
 two already mentioned. It is of a dusky white
 color, rather inclining a little to the yellow; and
 contains a number of small seeds, like mustard
 seed; from which large nurseries of this valuable
 tree are now annually raised all over the southern
 parts of France.

For a number of years after the culture of
 silk was introduced into France, the people were
 accustomed to employ the leaves of all the dif-
 ferent kinds of mulberry trees before mentioned,
 promiscuously: and some grafts of the white
 mulberry from Piedmont, and from Spain, which
 carried a larger leaf than the one they had got
 in France, having been obtained from these
 countries, these grafts were put upon French
 seedling stocks, which had the effect of increas-
 ing greatly the size of the leaves, and was re-
 garded as an acquisition, as it certainly produced
 a larger stock of leaves as food for the worms.
 The consequence of which was that this prac-
 tice of grafting prevailed for a great many years
 all over Provence and Languedoc. But Mon-
 sieur Marteloy, a physician at Montpellier, who
 had made the culture of the silk-worm his par-
 ticular study for a number of years together, at

last made it clearly apparent to the conviction of every body, by a regular course of attentive and well conducted experiments, that the leaf of the seedling white mulberry was the food of all others the best for this valuable insect; as the worms which were fed with this particular leaf were found to be more healthy and vigorous, and less subject to diseases of any kind, than those that were fed upon any of the other kinds of leaves above mentioned; and that their silk turned out to be of the very best quality. Since that time, namely, 1765, a decided preference has been given to this particular leaf beyond all the others.

As our British gardeners are more intelligent in their business than any of the French gardeners, it may, by some, perhaps be reckoned unnecessary to say any thing here, with respect to the culture of the mulberry tree: but when it is considered that the culture of this tree has been so anxiously attended to in France, for a long period of years past, and they succeed perfectly in this culture, it may not be deemed altogether improper to add here the method used in France in cultivating the mulberry tree.

Mr. Stephenson goes on to observe that their first object is to make choice of a spot of ground for their seed bed, of a gravelly or sandy soil, which has been in garden culture, or under tillage for some time, and which they know to be in good heart. When this ground is thoroughly dressed, they make drills at the distance of two feet from each other, in which they sow the seeds, in the same manner as they usually do lettuce for salads. They then cover the seeds lightly with some of the finest earth, after putting it through a sieve; and, if the weather happens to be dry, they water it slightly once or twice a week, as they judge to be necessary. These seeds they sow as above, at any time from the end of April to the end of May, and even during the first week in June; and some gardeners, the better to ensure success, were in the practice of sowing the seeds at three different times during the same season: to wit, the first sowing in the last week of April; the second about the middle of May; and the third in the beginning of June. When the plants are fairly above ground, they take particular care to keep them clear from weeds, and, from time to time, to point with a spade or a hoe the ground in the intervals betwixt the different drills.

After remaining for two years in the seed bed, they take up the plants: such of them as are of the size of a writing quill, they plant out in the nursery grounds; each plant at two feet distance from each other in the row, and the rows at three feet distance from each other, that there may be room for cleaning and dressing the ground betwixt the plants. At transplanting, they cut off nearly half the root, and also cut off the tops at about six or seven inches above the ground. All the other plants, which are too small for the nursery, they plant out thick by themselves, to remain for another year, or two, if necessary: after which they plant them out in the nursery grounds as above. The most proper time for transplanting the mulberry tree is just after the fall of the leaf in autumn.

When the plants in the nursery are sprung, they take care to strip off the side buds, and leave none but such as are necessary to form the head of the tree. If the plants in the nursery do not shoot well the first year, in the month of March following they cut them over about seven inches from the ground, which makes them come on briskly the year following. When the plants are grown to the size of one inch diameter, they plant them out in the fields where they are to remain, making the pits where they plant them of the size of six feet square, and dressing the ground for twenty inches, or two feet deep.

During the first year of planting out, they leave the whole buds which the trees have pushed out on the top until the following spring, when they take care to leave none but three or four branches to form the head of the tree; and, as the buds come out, they take off all those which appear upon the body of the tree, from the bottom all the way up to those which are left to form the head of the tree; and for several years after, at the seasons above mentioned, they take care to open the heads of the trees, when too thick of wood, and particularly to cut off any branch which seems to take the lead from the rest, and to engross more of the sap than what falls to its share, that the different branches may increase equally as much as possible. After the trees are planted out, and likewise while the plants are in the nursery grounds, they take care to dress the ground about the trees regularly three or four times a year, which greatly assists the trees to get on.

Here it is proper to mention that it is the practice in France to plant out some of their young plants from the nursery by way of espalier, in some sheltered situation, in a garden, for example, where the soil is not over rich: and, if it can be had, where the soil has a great proportion of gravel or sand; the intention of which is, to procure early leaves for the worms in their infant state; as these leaves generally come out more early upon dwarfish plants in a sheltered situation, than upon the trees planted out in a more open exposure; and upon this occasion they have also recourse for tender leaves to their young plants in the seed bed and nursery grounds.

Any quantity of the seed of the white mulberry can be obtained either from Montpellier or Marseilles, where it is regularly to be found for sale in the seed shops. It may also be obtained by the same means from Spain; the seed from which country is even preferable to that from France, as the Spanish tree carries a larger leaf than that of France, and has the leaf equally tender and good as the other, when used from the seedling trees.

From the experiments carried on by M. Marteloy, that gentleman made it fully appear that the leaves of the trees which grew in a rich soil were by no means proper food for the silkworm, as they were too luxuriant and full of juice for them; and that the leaves of those trees which were raised in a gravelly or sandy soil, where no manure was employed, were greatly to be preferred.

From these experiments, also, one of the rea-

sons, and apparently the principal one, may now be pretty clearly pointed out, which rendered abortive the trials made in England, during the reigns of James I. and Charles II., for introducing the culture of silk into Great Britain; though that reason was altogether unknown in England, at the times these different trials were made. It appears to have been only this, that they had on other food to give to their worms but the leaves of the black mulberry, carrying the large fruit usually presented at our tables, which is now altogether rejected in France as an improper food for the worms; and which was rendered infinitely more destructive for these insects by the trees which produced them having been all of them reared in the richest grounds in England, namely, in the garden grounds about London, which we know are in a manner yearly loaded with dung.

The mulberry trees ought not to be pruned the first year after planting out, for fear of making them bleed too much; but in the second spring it is reckoned advisable to dress their heads, and to continue to repeat that dressing yearly, during the next ten or twelve years; taking care to make them hollow in the middle, so as to give a free passage for the air, and to render it easy to gather the leaves. After the first twelve years are over, it will be sufficient if a dressing of the same kind is regularly given to them once every three years. But as some of the branches may probably be broken annually, in gathering the leaves, care must be taken to prune all such branches as may happen to be thus broken, to prevent the trees from suffering materially by such accidents. In planting out the mulberry tree, in the field where it is to remain, care must be taken to cover the roots properly, so that the earth may not lie hollow upon them, which would injure the plant. They should also take care to prop the different trees with stakes, to prevent them from wind-waving; placing straw next the body of the tree, to prevent the bark from being hurt; and it will be proper also to surround them with briars or brambles, to preserve them from all injury from cattle.

Here it is proper to remark that the second crop of leaves which come out upon the mulberry trees, after having been stripped of their first leaves for the use of the silk-worm, are not allowed to fall off themselves in the autumn. They are gathered for the second time with care, a little before the time they would fall naturally, and are given for food to their sheep, and eaten by them with greediness, and by that means turn out to good account to the farmer. Before the culture of silk was introduced into that part of Languedoc which is near to the mountains of Cevennes, the peasantry over all that neighbourhood were miserably poor, as their soil, which is mostly gravel and sand, was incapable of carrying crops of any kind of grain whatever. But as it was found, upon trial, to answer remarkably well for the mulberry tree, the people entered with great alacrity into the culture of silk; and they have succeeded so well in that lucrative branch, that, from having been amongst the poorest, they are now more at their ease than most of the peasantry of that kingdom.

As an encouragement to the small heritors and farmers to plant mulberry trees upon their grounds, the French government are at an annual expense in keeping up large nurseries of these trees in many different parts of the country, whence the small heritors and farmers are liberally supplied gratis with whatever numbers of these trees they desire to plant out upon their grounds; and proper directions are ordered to be given along with the trees, by the gardeners who are charged with the care of these public nurseries, that the people to whom the trees are thus given may know how to treat them properly. This beneficent public measure is attended with great advantage to the country, as the poorer people are by this means saved from the trouble and expense of rearing the trees, until they come to be of a proper size for planting out in the fields, where they are intended to remain.

When the young mulberry trees are in the seed bed, and even when afterwards planted out in nursery grounds, and likewise for several years after they are planted out in the fields to remain, you must be careful every night, in the spring and summer seasons, to examine with care, all round your plants, for a little snail without a shell, which is very fond of the bark of these trees when young, and preys upon them prodigiously. These snails will cut over your young plants in the seed beds and nursery grounds, and will even continue to prey upon the trees till they are pretty old; and, though they do not absolutely kill the trees when planted out, yet they hurt them greatly, and retard their growth. These snails, therefore, must be gathered up every night as above mentioned, a little after sun-set, which is better than in the morning, because the mischief they occasion is generally done in the night; and they must be burnt, or otherwise effectually destroyed; for if you do not kill them they will find their way again to the trees.

Mr. Stephenson then proceeds to give an account of the manner used in France for disengaging the seeds from the fruit of the mulberry, which requires a considerable degree of labor as well as attention. Having gathered the quantity of fruit you propose to set apart for seed, which must be thoroughly ripe before it is pulled, you put the fruit into a large tub or vessel, where you cause a person to tramp and press it with his bare feet, in order to bruise the whole of it thoroughly, and by that means disengage the seed from the little pods or cells in which it is contained. You must at the same time have in readiness another tub, which must be pretty deep, into which you introduce a piece of flat wood, which must be made to rest upon the sides of the tub, at the distance of six, eight, or more inches from the bottom of the tub, as you shall judge to be necessary for your quantity of fruit. This cross piece of wood is calculated to support a round cane sieve, which is to rest upon it. This sieve must be very fine, that is, the holes must be very small and close set together, that as little of the pulp of the fruit as possible may go through the holes along with the seed.

Things being thus prepared, and the tub filled

another, especially when this is done by sea, you must order them to be put into a bottle, which ought not to be filled more than half full, that the eggs may not lie too close together, which might run the risk of heating them, and causing them to hatch. The bottle being but half full, leaves sufficient room to the eggs to be tossed upside down, by the motion of the vessel, which keeps them cool and fresh, and hinders them from heating. After putting the eggs into the bottle, let it be carefully corked; a cover of leather put over the cork; and let that be sealed, to prevent any danger of changing the eggs. When corked and sealed, as above, put the bottle into a double case, or box of wood; not only to preserve the eggs from all damp from the sea or other ways, but also to protect them from too much heat, which would cause them to hatch. If the bottle is too full, the eggs will lie too close upon one another, and will in that case heat of themselves, and hatch, and consequently in both cases must be lost.

The eggs that are duly impregnated by the male butterfly are of a gray cindery color, which color they preserve till they are properly prepared for hatching. The eggs which are not duly impregnated are readily to be distinguished from this circumstance, namely, that after having been kept for some time they always continue to be of a yellow color; and I need scarcely add that all such eggs are good for nothing, and ought therefore to be thrown away. There is no distinguishing betwixt good and bad eggs, but by the change of color, after being kept for some time as above mentioned. One ounce of eggs will produce 40,000 worms; and so in proportion for a larger or smaller quantity.

The advancement of the season determines the time of preparing your eggs for hatching, as you proceed to that as soon as you observe that there is a prospect of having a sufficient quantity of food for your worms, by the advancement of the leaves of the mulberry. But, in order to be properly prepared for this work, you must begin a month before the usual time of hatching; first, to put your eggs in little divisions, from half an ounce to an ounce, which you must place upon a piece of clean white paper, upon plates, for example; and put those plates containing the eggs in a place a little warmer than where you had kept them during the winter; for example, if you have an alcove bed, place them upon the shelf within the alcove. Let them remain in that situation for the first five or six days; after which you must prepare some little chip boxes, perfectly clean and neat, seven inches long, four inches broad, and four inches high, and cover them on the inside with clean white paper, into which put the different divisions of your eggs, having a small box for each division, and place these boxes in a basket, upon a stool or chair, at the foot of your bed, making one of the mattresses of your bed go underneath the basket; and cover the basket on the top, first with some cover of woollen cloth, which pin close over it, and above that place a bed cover above all, so as to keep in the heat communicated by the mattress to the eggs; in which situation let them remain for six days longer;

after which increase the heat to 14° of Reaumur's thermometer, preserving that heat equal, night and day, by means of a little fire in some corner of the room at a distance from the bed. In the morning, when you get up, put a heater of one kind or other; for example, a tin bottle with hot water, or a foot stove, into your bed betwixt the sheets, and proportion that heat so as to equal the heat you give to the bed when you lie in it yourself, keeping up the same heat, as nearly as you can, until you go to bed again yourself in the evening. Having kept them in this situation for eight or nine days, you must then put your different divisions of eggs into little pieces of old linen cloth, which must be washed thoroughly clean for that purpose, as the least dirtiness in the cloth would prove prejudicial to the eggs: each piece of cloth should be of the size of a foot square; turn up the ends of the piece of cloth, and tie them with a bit of thread as near to the top or end as possible, by means of which the eggs will lie loose, and can be shook and turned from time to time, without untying the knot; replace these packets in the basket, and cover them up as before, turning and shaking the seed in the packets three or four times a day, that it may receive the heat equally. On putting the eggs into these packets, increase the heat to $14\frac{1}{2}^{\circ}$ of the thermometer, and keep up that heat night and day, as equally as possible: for which purpose have a couple of thermometers in your room for your direction. After the eggs have remained in the little packets for three or four days, increase the heat to 15° ; and in four days more, if the weather seems settled and very promising, increase the heat gradually to 16° , visiting and turning the eggs from time to time as before.

When the eggs begin to turn white, and the mulberry trees are so far advanced as to be out of danger from cold winds or slight degrees of frost, increase the heat gradually to $17\frac{1}{2}^{\circ}$, or 18° at most, to quicken the hatching of your eggs, and to make the worms come out as nearly at the same time as possible; but never increase the heat to more than 18° , because a greater heat never fails to push the worms too fast, and to render them red at their first coming out. When the worms are red at their first coming out, it is a sign the eggs have either been bad, or ill kept over winter, or overheated; that is, too much forced when laid to hatch. Worms of this color are good for nothing, and are therefore to be thrown away, to avoid the expense of feeding them, since they will never produce cocoons. When the worms are entirely black, upon their first appearance, it is a sign of their having been perfectly well managed, which gives great hopes of success.

When the eggs first begin to take a white color, put them into little chip boxes, and cover each box with a piece of clean white paper, pricked with many holes in it, to allow the worms to come through, taking care to inspect and shake the eggs from time to time in the boxes, that they may have equal access to the heat; and, when the worms are ready to appear, put a few mulberry leaves upon the paper, to which the worms will readily attach themselves as they

come out; and, by means of the leaves, you can easily take out the worms as they appear, in order to put them into different little boxes; and then give them some of the tenderest leaves, cut into small pieces, to feed on, giving them at the rate of three meals each day. As the leaves when very young will dry so much, even in an hour's time, if exposed to the open air, as to be unfit for the use of the young worms, you must put them into a clean glazed pot; but take care to place them loose, that they may not press too much upon each other; cover the head of the pot with a wet linen cloth, and place the pot in a vault or cellar (or, in case you have none, into the coolest part of your house), by which means the leaves will keep fresh and good for two or three days together. Besides, you must take care to have always in the house at a time a stock of leaves sufficient at least for three days' provision for your worms, to secure you in food for them during such length of time, in case of wet weather, as nothing is more pernicious to the worms than giving them wet leaves for their food; for which reason be careful never to pull the leaves when wet, either with rain or dew, except on absolute necessity; and in that case you must spread them out, and turn them from time to time with a long wooden fork, that the leaves may be perfectly dry before you give them to the worms.

It may here be added that it is the general opinion, in France, that the leaves afford a more wholesome food for the worms when they have been gathered four or five hours, than fresh from the tree—and more particularly so if the trees grew upon any soil other than sand or gravel, because the keeping them so long so far diminishes the over richness of the leaf. The persons employed in pulling the leaves must be careful to have their hands clean, and free from every strong offensive smell, such as that of garlick, onions, or tobacco, &c.; and they ought to be particularly attentive not to bruise the leaves in pulling them.

When the worms are first hatched, keep each day's production separate by themselves, as it is of high consequence to have each parcel brought up as equal as possible, that all the worms contained in it may be in readiness to mount for making their cocoons at one and the same time. After setting apart separately the production of each of the first four days, what then remains of the eggs to be hatched may be thrown away, as these later worms are always found to be weakly, few of them completing their cocoons; so that the attempt to rear them is always attended with an unnecessary waste of leaves, besides the trouble they occasion to no purpose. When the worms are just come out, keep them in a heat not exceeding 15°; and even then there is no occasion to cover them by putting on the heads of the boxes, as it is better for the worms to have abundance of free air. But, if the weather should happen to prove cold, you must in that case put on the heads of the boxes at night, or cover them with a double napkin, taking care, however, not to let it touch the worms, for fear of hurting them; and take off the head of the box or napkin in the morning, when you give a

feed to the worms, as early as you can; at four or five o'clock, but not later than the last. In that early state the three different meals should be given to the worms at the distance of six hours from each other. When the worms are coming out they are not to be left scarcely a moment, as they ought to be gathered from the boxes as fast as they make their appearance; and, as this work goes on in the night as well as the day, it becomes a very hard task at that time. M. Marteloy, who always carefully attended to this particular himself, generally went to bed at nine o'clock in the evening during this critical period and rose again at midnight, which was quitting them as little as possible. But this great attention at this time is only requisite in large operations; for example a pound of eggs, or any quantity above it.

Before proceeding to the further treatment of the worms newly hatched, it may be proper here to give some description of the stage and baskets necessary for the carrying on of this culture, as these ought to be in readiness some time before they are wanted. The stage ought to be erected in a large room, with windows on each side of it, so as to be able to command a thorough air when necessary, the walls and floor of which should be examined with the strictest attention, in order to fill up every little hole or crevice that can give access either to rats or mice, as both these animals eagerly devour the silk-worms whenever they can find an opportunity for that purpose. In Languedoc and Quercy they make the stage six feet, but more frequently only four feet and a half broad, so that a person, by going first to the one side and afterwards to the other, may be able with ease to reach over the whole breadth, both for the advantage of giving the leaves to the worms, and for clearing away their litter more easily. At every nine feet distance, in the length of the stage, they fix a post in the floor of a height sufficient to support the roof, and to those posts they nail a piece of wood across the stage, which piece of wood serves to support the baskets to be hereafter mentioned which rest upon the cross-bars of wood at the two ends; so that these bars ought to be four inches broad, which allows two inches for each basket to rest on, as the baskets join the one to the other at the cross bars. The stage, being four feet and a half broad, takes two of these baskets to fill up its breadth. They make their stage to consist of as many shelves as the height will admit of, keeping at the distance of twenty inches from each other. The lowest table or shelf ought to be made six inches broader than the shelf immediately above it, that the lowest may project three inches on each side farther than the one above it; and so on in proportion with all the other tables or shelves; the uses for making this difference of breadth in the different shelves shall be afterwards particularly explained.

It has been already observed that rats and mice are extremely destructive to the silk-worms when they can get access to them; for which reason every precaution should be used to protect them against such dangerous visitors. For this purpose, therefore, the following one is ge-

nerally attended to:—They cover the foot of each of the posts of wood which support the stage with a piece of strong smooth paper, which is nailed to the wood with tacks, to the height of a foot above the floor; by which means, when these vermin attempt to mount, their feet slide upon the paper, so that they can get no hold. A hoop of glass of the same height, made of a size proper for the wood, might, perhaps, be found to answer the purpose better. The ant, or pismire, is also a most dangerous enemy to the silkworms; to guard them from which, the usual practice, where there is any danger from these insects, is to put a quantity of hot lime round the foot of each of the posts which support the stage, which fully answers for that purpose. Cats and poultry of all kinds are likewise destructive to the worms, and must therefore also be guarded against with care. When the worms are young, they are put into wicker baskets three feet long, and eighteen inches broad, the edges or sides of which are made from two to three inches high. They make them of that size in order to be the more portable.

When the worms come to be placed upon the stage, they are put into baskets four feet and a half long, and two feet three inches broad, and the sides or edges of them are from two to three inches high, and of the thickness of about three quarters of an inch. The bottoms of the baskets are made of plaited reeds, after being split in order to make them lie flat. They are bound all round with a slip of wood, a little more than an inch broad, and about a quarter of an inch thick, to keep them together, which is nailed down, and three cross bars of wood are nailed across the back of each basket to keep it firm.

It is proper to observe that care should be taken to place the stage in such a position as not to allow the sun to dart directly upon the worms, as they are not able to bear the heat of it in this manner when it is great. It will even kill them, especially when they are young; and, if it should not go that length in a colder climate than the south of France, it will, notwithstanding, have the effect to torment them, and render them very uneasy, and prevent them from eating with their usual appetite. If the sun darts upon them when they are large, you will see them fly from it as fast as they can, and seek for shelter in the shade, even at the expense of the want of their food. When young, they are not able to get out of the way, and by that means are often killed by it, as above mentioned.

But to return to the treatment of the worms upon their being newly hatched: it is proper to observe that too many leaves should not be given to them at one time, and that the leaves given should be spread very thin; because, if too thickly put on, a great number of the worms, as they are then so small, will run the risk of being lost amongst the litter, from which they will not be able to disengage themselves; and you must be careful to cut the leaves small during the first ten or twelve days, where the number of your worms is such as to admit of your doing so: but, if your quantity of worms is large, it would require too much work to cut the leaves for them, so that in such case you must give them entire.

When the worms are in their first age you need only clear away the litter once, because their ordure at that time dries as fast as they make it, being in small quantity. When the litter is to be taken away for the first time, you have only to turn the parcel upside down, and so pull off such a quantity of the litter as you find necessary, which is the most expeditious way of cleaning them at that time. In giving the leaves to the young worms, you must make the leaves lie hollow upon them, to give air to the worms. When put on too flat and close, they prevent that free circulation of the air which is at all times necessary for the health of these insects.

During the whole of the first age, the leaves of the young plants of the mulberry, in the seed bed and nursery, as being the tenderest, are greatly preferable to the leaves of older trees as food for the young worms, for which reason it becomes of importance to have always a succession of young plants coming on yearly in your nursery grounds.

When the silk-worms enter upon their sickness, they abstain from that moment from all manner of food. As soon, therefore, as you observe some worms of a parcel begin to grow sick, in place of three give them only two meals a day; when more of them sicken, confine them to one meal only; and from the time you observe most of them sick you must give them no more food, till the whole parcel, or at least the far greatest part of them, get over their sickness (by having cast off their old skin), that you may carry them all equally on, at least as nearly so as possible, which saves a vast deal of trouble in the management.

When the silk-worm gets over his first age or sickness, he is of a grayish color, and his little trunk, or point of his head, is of a jet black color, by which he is then distinguished. When he gets over his second sickness that little trunk is of a brown color. When he gets over his third sickness his head is remarkably large, which is the distinguishing mark at that time. And, when he gets over his fourth sickness, he is of a brownish-yellow, or deep buff color.

You must not clear away the litter from the worms while they are about changing their skin, or what is called their sickness; but as soon as they have got clear of their old skin then you are to remove all litter.

During the second age it is advisable still to continue to feed your worms with the leaves from the young plants in your nursery, as these are still preferable to those of older trees for the worms at this time. You must now begin to be attentive to clear away the litter from time to time, so as to prevent all danger of its heating, which proves highly injurious to the worms. These insects are remarkably fond of cleanness, which besides helps to enliven them, and gives them a keen appetite for the first leaves which are given to them always after cleaning. The litter is taken away in the following manner:— You scatter some fresh leaves upon one corner of the basket, to which the worms having attached themselves, which they will readily do, you then take up the worms by means of the leaves and stalks they cling to, leaving the litter under-

neath. Having thus taken up all the worms from that corner, and placed them above those adjoining to them, you then clear away the litter from that corner, and carefully sweep together, with a little broom of twigs or heath, all the refuse and excrement, which you must remove entirely before you replace the worms in their station; and in the same manner you must proceed with the rest, till you have thoroughly cleaned the whole basket.

During the third age make use of the leaves of such trees as have been planted out in the field, but reserve the leaves of your oldest trees for the fourth age, as these last leaves are reckoned the best for the worms when come to their maturity. Be attentive to cleaning away the litter as before directed, which, during the third age, should be done at least four or five times; and take care to clear away, from time to time, all dead worms the moment you observe them; and to throw aside also regularly all such worms as appear to be diseased, to prevent them from infecting the rest, which will happen if this article is not pursued with the strictest attention. All the worms which you observe to grow of a yellow color, and to have their skin shining, are strongly diseased, and must be immediately thrown away, for fear of infecting the sound ones. These diseased worms sometimes void a yellow liquid at the tail, and it often also bursts out at other places of their bodies. These must always be attentively removed the moment they are observed; but it becomes more essentially necessary before the worms enter into their third sickness, because at this time they become most dangerous, by voiding the yellow liquid above mentioned, which is poisonous to the worms, and exceedingly contagious; insomuch that every worm that happens to touch this liquid is sure to be infected with the same distemper, which has hitherto been found to be incurable.

It has been remarked that it is improper to change the worms during their sickness, because it may occasion the loss of some of them. But it is necessary to add that, if the litter at that time should prove to be in such quantity as evidently to run the risk of heating, before the worms can get quit of their old skins, which they generally do not accomplish in less time than two days and a half, it is better to suffer the loss of a few worms, by removing the litter at that time, than to run the risk of losing the whole parcel, which undoubtedly would happen if the litter should be heated before the operation is over of their changing their skins. This article of keeping the worms clean will appear to be of high importance in the silk culture, when it is added that it is commonly computed that the loss sustained yearly in France, by the death of the worms during the times of their four different sicknesses, by being smothered in the litter, by the great quantity of litter, leaves, and worms above them, and by the litter's happening to grow damp, and to heat at these critical periods, is not less, upon an average, than between 2,000,000 and 3,000,000 of livres annually, which is equal almost to a tenth part of the whole yearly produce of silk in France, which is computed at 30,000,000 of livres.

Being now arrived at the fourth age, the time approaches when the worms will mount in order to form their cocoons; and the person, therefore, who pursues the culture of silk, must now begin to prepare for that important period. One of the first objects of his attention must be to provide himself with a sufficient quantity of small brush-wood, for making the cabins of the worms; and there is nothing more proper for this purpose than heath or broom, when either of these can be obtained; when neither heath nor broom is to be had, any other kind of small brush-wood will answer, preferring always such as is bushy at the top, and whose twigs are of a sufficient strength to support the weight of the worms. But it is to be remembered that the slender brush-wood is the best, that you may be able to bend it which way you will. Strong brush-wood is not so pliable, and by that means not proper for the purpose. Having provided your brush-wood, it may be proper to prepare a parcel of baskets, for such of your worms as are soonest ready for mounting, in the manner practised at Montauban, in Quercy, which is done as follows:—You take a round willow basket, which you dress with brush-wood, putting the wood round two-thirds of the basket, and leaving the other third open for putting in the worms, and to give an opportunity to clear away their litter. You then pull the ends of the wood together at the top, so as not to press too closely upon each other, and so tie them with a little twine or pack-thread, to keep them in their place; after which you put a paper cap, pretty large, upon the top of the wood, it having been found that the worms are fond of making their cocoons under a cover of this kind, as it affords an opportunity of attaching some threads of silk to the paper, which enables them to fix their cocoons the more firmly in their place.

In putting up the cabins, on the stage, the two rows of brush-wood at the extremities of the stage are made much thicker than the others, especially for six or eight inches above the shelf, to prevent the worms from getting out at the ends and falling over the stage. In putting up the other rows, you lay a little piece of wood, or a reed, across the stage for each row; and, in putting up the brush-wood, you make the first turn to the right hand, and the second to the left; and so alternately, keeping the reed in the middle, which binds all fast.

In dressing the stage with the brush-wood it is advisable to cover the pillars which support it, and to cover likewise the top of the stage with brush-wood. In constructing the cabins great care must be taken to put up the brush-wood in such a manner as to allow a passage for the worms between the different branches, which, however, must not be too wide; and it is right to make a great number of the points of the brush-wood touch the shelf, because it affords the greater opportunity to the worms to mount. Many people at Montauban put a number of roses, or other sweet-smelling flowers, upon the pillars which support the stage, and in other parts of the room, with a view to sweeten the air. But the best apparent means for this purpose is to take care to keep up a free circulation of fresh

air in the room, by keeping open all the windows, and the doors also, if you find that to be necessary.

In forming the arches of the little cabins with the brush-wood there is always a little opening at the top of each pillar, occasioned by the curve or top of the circle. Take care to make this opening pretty wide, because it has been observed that the worms make choice of that opening, by preference, to fix themselves in making of their cocoons. In order to make this opening of the width it ought to be, the brush-wood should not be altogether straight, but rather crooked or bending. These openings are not only evidently the choice of the worms; but another advantage also arises from them, namely, that your cabins by this means contain a greater number of worms than it is possible for them to do when these openings are too small, and consequently fewer cabins will answer your purpose. When the brush-wood is quite straight, it must necessarily occasion these openings to be made. The brush-wood ought to be quite stripped of its leaves, and perfectly dry.

If, in forming the cabins, you place the brush-wood quite upright, the worms when mounting run a great risk of tumbling down; and those worms which tumble down are for the most part destroyed by the fall. In order to avoid this inconvenience, you must make the brush-wood which forms the sides of the arch slope a little, by which means you secure much firmer footing to the worms in mounting. Besides, when you form the cabins, you must be at pains to cut off all the very small slender shoots, which when left to themselves, and not properly bound in with one another, have not strength sufficient to carry the weight of one worm, far less of several; and which, if left, must for that reason always occasion the loss of a good many worms, by their tumbling down, as above mentioned.

In describing the stage, it was said to be proper to make the lowest shelf six inches broader than the one above it, that the lowest may project three inches on each side further than the one immediately over it; and to make the same difference of breadth in all the other shelves progressively as you go up to the top of the stage, which three inches of breadth in the different shelves is intended to receive the worms which may happen to fall from the shelf above. And therefore these different projections must be covered with brush-wood, when once your cabins are well furnished with worms, as this will help to break the fall of such worms as may happen to tumble down. And for the same reason it is advisable, when once your cabins are well furnished with worms, to put a little brush-wood in the bottom, and at the entrance of each cabin, as it will be of service to such worms as fall from the brush-wood above, and afford them a proper convenience for making their cocoons in case they should be so stunned with the fall as to disable them from mounting again on the branches.

But, to return to the treatment of the worms during the fourth age: as soon as you find several of your worms have got over their fourth sickness, you must pick them out and put them by

themselves; that is, all those that get over that disease for the first two days may be put into one parcel, those of the next two days into another parcel, and so on with the rest, that each separate parcel may be carried on as equally as possible. The most attentive care must also be given to clear away the litter regularly every day; and, if it can be done, it would be advisable to clear away the litter twice in the twenty-four hours, especially during the four or five days immediately before mounting. If this cannot be done, as it is often found to be difficult to get it accomplished when the quantity of worms is large, you must, however, constantly make it a rule to clear away the litter regularly in such a manner as to prevent it at any time from increasing so much in quantity as to make it run the smallest risk of growing damp and heating, which never fails to destroy the worms.

Many people, during the four or five days which precede mounting, which the French call the *grande fraize*, are in the custom of giving from four to five meals a day to the worms, giving a large quantity of leaves at each meal. But it seems much more advisable to give them fewer leaves at a time, and, to repeat their meals oftener even to the number of eight or nine times in the twenty-four hours, according as you find them in appetite; by which means the leaves are more quickly and thoroughly eaten up, without occasioning so great an increase of the litter. But, what is of still more consequence, the fresh leaves so often repeated never fail to give a fresh edge to their appetite; so that, in fact, in the space of twenty-four hours, the worms actually eat up a much larger quantity of leaves than they could have done by following the other practice of four or five meals a day, as none of the fresh leaves are spoiled by their treading upon them. This practice of course hastens the worms to their full maturity, and upon the whole saves a considerable quantity of leaves, because few or none of them are lost amongst the litter, besides that the operation is by this means sooner brought to a conclusion, and the worms always kept in high health and appetite by it. Upon these occasions let it be a fixed rule to feed them at night immediately before going to bed, and as early as you possibly can in the morning.

There is another particular to which it is proper to pay attention, and that is, that the moment a basket of worms is cleared from the litter, the litter should be instantly carried out of the room, and along with it all the dead worms you can find, in order to prevent, as far as you can, any bad smell from taking place in the room, which is always hurtful to the worms, nothing conducing more to their health than cleanness and preserving always good air in the room.

During the four or five days which precede the mounting, the worms eat with the most voracious appetite, and in that period consume an incredible quantity of leaves; so that the supplying them with fresh leaves, and the clearing away of the litter, become at this time a most laborious, incessant, and fatiguing work for those who attend them. You will know when the worms are ripe by observing them with attention when you give them fresh leaves. Those that are ripe, in-

stead of eating, avoid the fresh leaves, and run over them as fast as they can; and you will observe them wandering about on the sides or rim of the basket. You will also know it by looking at them on the side opposite to the light, as you will then find them to be transparent, like a new laid egg, and of the color of the silk, which is also much the same with that of a new laid egg. When they are nearly ripe their bellies begin to grow transparent first of all; but they are never thoroughly ripe till their heads are transparent also. You must not be too hasty in putting up the brush-wood on the baskets on the stage for the worms to mount. This ought not to be done till you observe a good many of your worms offering to mount, because the brush-wood keeps the worms too close and warm, and exposes them to the danger of that disorder which the French call the *touff*, which is very fatal to the worms, and which does not seize them till they are just ready to mount. When they are perfectly full, and ready to mount, they are rendered feeble by too great heat, and the silk fairly chokes them, so that a great deal of fresh air becomes more particularly necessary for them at this time than at any other. For this reason it is even thought advisable not to put up your brush-wood until you have seen a cocoon fairly made upon the stage. At any rate you can have some of your large baskets (of which you should have an ample provision) ready dressed with brush-wood, into which you can from time to time, as you observe them, put such of your worms as you find are fully ripe for mounting. Besides, when you see a whole parcel ready to mount, you have only to take the basket which contains them out of its place, and put up one of those which are already dressed with the brush-wood, by which means you can put your worms directly into the little cabins prepared for them, which will render your work much easier than it would be otherwise, and make it less hurrying. The basket thus emptied of the worms should be instantly dressed with brush-wood, to be in readiness for the next parcel that shall be ready for mounting. Not a minute is to be lost when the worms are fully ripe, so that a number of these additional prepared baskets are of the utmost consequence at this time.

In preparing the little cabins for the worms you must make choice of such small brush-wood as is bushy at the tops, as already mentioned; and, in arranging them, you must intermix the tops of them with each other, which will render them thicker in the heads; but taking care always to leave little openings betwixt the twigs, so as the passage for the worms may not be stopped, which is attended with this advantage, that it affords a great many little places proper for the worms to form their cocoons in. When the heads of the brush-wood are too thin, the worms find themselves at a loss to fix themselves, and spend a great deal of their strength in ranging from branch to branch to find a proper place for them. In placing your brush-wood, you must order it so that the bottom parts of it shall stand as close to one another as possible, that the worms in groping about may every where find bushes to cling to. In using many kinds of

brush-wood, where the tops are very bushy, this will of course put the bottoms at a distance from each other. But these vacancies you must fill up with little twigs, for the purpose above mentioned; to wit, that the worms may every where find branches to crawl on.

When you put up the brush-wood betwixt two baskets, that is, when there is one basket placed over the head of another, as is always the case on the stage, you have only to cut the branches of an equal length with one another, but about eight or nine inches longer than the distance betwixt the two baskets; then, resting the bottom part upon the undermost, you bend the top in a curve downwards, either entirely to one side or to both, as the bushyness of the brush-wood will allow of it. The ranges are made across the breadth of the basket, at the distance of about eighteen or twenty inches from each other, so that you may easily put in your hand from one side to the other, to enable you to clean the intervals from time to time from the litter, as you shall find it necessary, which ought to be done at least once in twenty-four hours after the bushes are put up, and even twice if you can find time for it. The bushes are placed in such manner as to form with their heads little arches betwixt each row of the branches. By placing the bushes as above, they stand erect and firm, because they press equally upon the undermost as well as on the upper basket.

When the worms are mounted on the brush-wood, care must be taken not to suffer anybody to disturb them by handling or touching the brush-wood; because, when they begin to work, their first operation is to fix so many threads of silk to different parts of the branches, which threads are to serve to support and hold up their cocoons in their proper poise. If any one of these silk threads is broken, by handling the branches, the worm finds, when he comes to work in the cocoon, that by the loss of that thread the cocoon has lost its poise, by which means, as it does not remain steady, he cannot work with advantage, so as to finish his cocoon properly. Disappointed by this means of continuing his work, he pierces the cocoon, quits it altogether, and throws out his silk at random wherever he goes, by which means his silk is wholly lost, as is the worm also, as he finds no place to lodge in with propriety, in order to prepare for his last change of state, when he is to come out a butterfly. Some of the threads of silk, which it has been already said the worm attaches to the different branches, upon his first beginning to work, are likewise sometimes broken by another worm working in his neighbourhood, which is attended with the fatal consequences above mentioned, though this last is an accident which happens but very seldom. Such of your worms as you find loiter below, without mounting, notwithstanding they are ripe, you must be careful from time to time to place upon the brush-wood, which is ranged at the two ends and along the sides of the stage. There are always some of the worms which are lazy, or have not strength enough to mount on the branches, which however are strong enough to make good cocoons when they are placed where

they can make them without the fatigue of mounting the brush-wood. Those which are so unlucky as to tumble from the brush-wood should also be placed with the other weak worms, because the fall generally diminishes their strength greatly; and those which you then place upon the brush-wood should be covered over with a piece of paper, to which they attach the threads of silk to keep their cocoons steady. You may also place some of the weak worms in papers, made up in the form of a cone or sugar-loaf, in which they will make their cocoons extremely well.

Great attention must also be paid to visit carefully from time to time all the different cabins, in order to remove immediately all diseased and dead worms; because the last, if left, will presently stink, and occasion a bad smell in the room, which would particularly annoy the worms which are at work in making their cocoons in the same cabin; and the diseased ones would infect the others which are sound.

When it is observed that a great proportion of the worms of the same basket are ripe, and that they are wandering about in quest of the brush-wood, the common practice has been to place the whole worms of that basket at once into the cabins for mounting. But this practice is attended with no small degree of inconvenience and danger, because it is impossible to manage your worms in such a manner that the contents of a whole basket shall all of them be ready to mount at the same instant. The consequence then is, that those which are ripe mount directly, and those which are not ripe remain in the cabins, and must have food given to them till such time as they are ready to mount in their turns, during which time the litter must be changed frequently to prevent corruption: but, what is worst of all, the worms which are mounted on the brush-wood, before beginning to shut themselves up entirely in their cocoons, discharge a quantity of liquid matter, which falls upon the worms below in the cabins, and wets and dirties them prodigiously; and that glutinous liquor, drying and hardening upon their skins, prevents their perspiration, and deprives them of that pliancy and agility which are so requisite to enable them to mount, as well as to make their cocoons. The consequence often is that the worms thus wet with that glutinous liquor contract diseases and die, at the very instant they are ready to mount; and as these diseases are too often contagious, by the worms bursting, the contagion is spread over the rest, which become also infected, and so the whole which remained in the cabins are often entirely lost.

Some few people, who are more attentive, and are sensible of the dangerous consequences of the above method, follow a different practice. They have the patience to pick out the worms, one by one, from time to time as they observe them to be ripe, which they then place in the cabins, and which never fail to mount immediately, when they are properly chosen; that is, when the person who gathers them is a proper judge of their real point of maturity, which discovers itself by their bodies, but more particularly their heads being perfectly transparent, as before mentioned. The

other worms, which are not ripe, they leave in the basket, and give them their food in the usual manner, till they become ripe in their turns, when they are constantly gathered up from time to time, and put into the cabins as they come to maturity. By this means you change them with ease, and they are safe against being wet with that glutinous liquor above mentioned, which from repeated experience has been found to have such pernicious and destructive consequences.

In putting the ripe worms into the cabins, take care to place them first of all in the middle of the cabins, that the middle may be well furnished with worms before you place any at the sides. Should you begin first with the sides, or outward ends of the cabins, you will find it extremely difficult to supply the middle of the cabins with worms, without disturbing and even destroying some of those which are mounting on the sides, in reaching in with your hand towards the middle.

The cocoons should be allowed to remain upon the brush-wood for six or seven days after the last of the worms of that particular parcel are mounted. After the cocoons are taken down they should be assorted according to their colors, setting apart all the weak cocoons, and such as are double. Those of each color which have a shine upon their surface, and thence called satiny, should also be put by themselves, as they form the second sort of silk. The double cocoons form the coarsest silk of the whole. All the floss, or loose silk, which is round the outside of the cocoons, must be carefully taken off; because the better the cocoons are cleared from that outer silk the better they play in the basin, and of course the better the silk will wind off.

In clearing off the floss silk from the cocoons, when taken down from the branches, it is customary to make choice of those which are judged to be the best for seed, which are put aside by themselves, and afterwards from the whole of those to pick out in pairs such as are judged best for the purpose; taking care in this last choice to pick out an equal number of males and females, as far as one can judge of the different sexes by the cocoons. In doing this care must be taken to keep the cocoons of the same day's mounting always separate by themselves, that the butterflies may pierce the cocoons at the same time. If the good cocoons taken from the whole are all first mixed together, and from this general heap the cocoons are afterwards picked out in pairs for breeding, the consequence will be that there will be set aside the cocoons of worms that have mounted the brush-wood upon different days, which of course will have the effect that the butterflies will pierce the cocoons unequally; that is, not on the same day, but at times distant from each other; so that there will not be an equal number of males and females produced at the same time, which must occasion the loss of a great many of the butterflies, and consequently the quantity of eggs or seed will fall short of what was intended; which shows the necessity of precision in keeping the cocoons of each day apart. When you happen to have more females than males you must employ the

males of the preceding day a second time, that you may not lose your supernumerary females. But this is only to be done upon an urgent case of this kind ; because it is greatly preferable to cause the males to serve only once if you can calculate so as to have always an equal number of both sexes for copulation. The double cocoons are to be distinguished by being much thicker than the others, generally broad, and not quite round.

In taking the cocoons off the brush-wood pick them off carefully, especially if there are any dead worms amongst them, which presently corrupt ; because such of the cocoons as touch these dead worms are spoiled by them, as they contract by that touch a gluiness from the dead worms, which hinders the silk from winding off properly from the cocoon. The best manner to know the good from the bad cocoons is to press them at the two ends with your fingers. If they resist well that pressure, and appear hard and firm betwixt your fingers, the cocoons are certainly good. Though they appear firm, upon pressing their sides with your fingers, they may still not be entirely good, the pressure at the two ends being of all others the best manner of knowing the good ones.

After the cocoons are taken down from the brush-wood, such of them as are intended for seed must, with the utmost care, be cleaned from all the floss or loose silk which is about them ; which, if allowed to remain, would greatly hinder the butterfly from getting out of his cell ; after which, with a needle and thread, you must thread the cocoons by the middle, like a string of beads. But in doing this you must take care not to hurt the insect in the cocoon with the needle. You are only to pierce just as much of the skin of the cocoon as is sufficient to attach it to the thread, and this is done at the middle of the cocoon, to leave the two ends of it free, as you cannot be certain at which of the ends the insect will pierce the cocoon. This being done, you hang up the cocoons against the wall of the room by a nail, until such time as the butterflies come out.

When putting the cocoons upon the thread, in order to prepare them for breeding, be at the pains to place a male and female cocoon alternately upon the thread, that they may be near each other for copulation when they come to pierce the cocoons ; and, when the butterflies come out, you place them upon a piece of clean woollen cloth, that is perfectly smooth, having no nap or pile upon it, which may be hung upon the back of a chair. The male is easily to be distinguished from the female by his body being more slender, and by fluttering his wings oftener and with a great deal more force than the female. The female, after copulation, will proceed to lay her eggs upon the cloth, to which they will closely adhere ; and upon which you let the eggs remain till about a month before the usual time for hatching, when they are to be taken from the cloth, which is generally done by means of a thin piece of copper coin, which in France passes for a penny (*un sol marque*), and which is found perfectly to answer the purpose. The cloth upon which the eggs are laid is folded up lightly and

kept till the proper season in a drawer or closet in a dry room, but not too hot. Every female butterfly is calculated to produce from 300 to 400 eggs. The reason for recommending the eggs to be taken off the cloth, about a month before the usual time of hatching, is this, that it can then be done without the smallest injury to the eggs, which at that time are perfectly hard and firm ; but, if delayed till the time of hatching, the case becomes greatly altered, because the eggs gradually soften by the approach of the spring, so that they cannot then be taken from the cloth without the evident risk of destroying a great part of them.

Was it possible to wind off the silk from the other cocoons before the insect naturally pierces them, that is the best time for doing it, because the silk at that time winds off with much greater ease than afterwards. But, as that is found to be impossible, two methods have been pursued to destroy the insect in the cocoon, that they may wind off the silk at leisure and with full convenience. The first method, which was followed in France for that purpose, was to destroy them by placing the cocoons in baskets in a baker's oven ; but, if the oven happened to be a little hotter than was proper, the silk was by that means scorched and often very much hurt by it. They therefore tried to kill the insect by the steam of boiling water, which could not at all hurt the silk, and they succeeded ; so that the placing them in the oven is now wholly laid aside. The killing of the insect by the steam of boiling water is performed in the following manner :—They build a little furnace of brick of a kind of oval form, the ground part of which is for holding the wood or charcoal which they use upon this occasion ; and, to make the fire burn properly, they have a little iron grate in the furnace, upon which they place the wood or charcoal ; and over that, at a little distance, they place a little copper cauldron, which they fill with water, and make it boil by means of the fire underneath. Above this cauldron they have another iron grate, upon which they place the cocoons, in a little open basket composed of twigs, which is made pretty open between the twigs, to let the steam and heat of the boiling water have the easier access to the cocoons. To this cauldron, and the grate above it for holding the basket with the cocoons, you have access by a little door which opens above the entrance for the fire. The furnace is arched over the top with bricks, that, when the door above mentioned is shut, the steam may be retained within, which, in the space of eight minutes, is found effectually to kill the insects within the cocoons. The basket is then taken out and put aside, to let the cocoons dry, as, upon coming out of the furnace, they will be all of them wet with the steam ; and they then place another basket in the furnace with more cocoons, taking care so to keep up the fire as to have the water in the cauldron always boiling. Charcoal is preferable to wood for fuel, upon this occasion, because it has no smoke. The smoke of wood spoils the color of the silk, and diminishes its lustre. The smoke of pit coal would be still worse.

Here it is proper to add that after the insects

have been killed by the steam, as above mentioned, care must be taken to stir about and move the cocoons regularly, at least once a day. If this is neglected, the insects will corrupt, and breed worms in the cocoons, which will destroy the silk. After the cocoons are taken out of the furnace, and dried a little, as before directed, they should be wrapped up in a good thick woollen blanket, to keep in all the hot steam, and to prevent all access to the exterior air. This is done with a view to stifle any of the insects which may happen to be yet alive, and which, if immediately exposed too much to the open air, might revive and recover their strength. They are left covered up in that manner with the blanket for five or six hours together; after which they are to be taken out of the basket, and spread out upon a table, and are afterwards to be stirred and moved about regularly every day, as directed above. And you then assort the cocoons according to their different colors, of which they have three sorts in France; namely, the white, the yellow, and those of a greenish color.

When the insects are once killed, the sooner you wind off the silk from the cocoons the better; because it can then be done more easily than after they have been kept some time; upon which account they always wind off the silk as fast as they possibly can; and it is done in the following manner:—They build a little copper cauldron into a small furnace of brick, with a fire-place under it, as in the other furnace already described, exactly in the same manner as we do in Britain at the sides of our rivers, for the washing of linen at our bleach fields; at the end of which they have a large reel, which turns round with the hand, and by a foot-board, and two or three little pieces of iron at proper distances, with eyes to them, by which to conduct the threads to the reel. The cauldron above mentioned they fill with water, and keep it always boiling with a fire of wood or charcoal; the last, however, being preferable, on account of its being free from smoke. They then put from twenty to thirty cocoons at once into the boiling water, and with a small brush of little twigs (of heath for example) they keep stirring the cocoons about. The heat of the boiling water dissolves the gum that is naturally about the silk, upon which, as the cocoons are continually touched and tossed from side to side amongst the water by the little brush, the ends of the silk attach themselves to the brush. When the woman who manages the brush perceives that she has got hold of the ends of the silk by it, she takes hold of the silk thread with her hand, puts aside the brush, and pulls the silk towards her, which disengages itself with ease from the cocoon; and this she continues to do till she has got away all the floss or outside silk of the cocoons. When she observes she has come to the fine silk, she breaks off and separates the coarse from it, which coarse silk she puts aside. She then applies her brush again till she has got hold of the end of the fine silk, all of which she sets apart, every fine thread by itself, by fixing it to a piece of wood kept near to the furnace for that purpose, till she has arranged the whole, or at least the greatest part, in this manner, which

by that means are in readiness to be thrown in to form the thread of silk which is to be wound off. This done she puts together the threads of as many of the cocoons as she inclines, according as she wants to make the thread fine or coarse. These she joins together; and, after having put the silk through one of the eyes of two of the pieces of iron which are placed for conducting the thread to the reel, she fixes the silk thread to the reel; upon which another woman, who attends to manage the reel, begins to turn it about with her hand, and keeps it in motion by applying her foot to the foot-board, and by this means winds off the silk from the cocoons, which is done with great swiftness.

As soon as one or more of the cocoons are exhausted, the woman who manages the cocoons in the cauldron, or basin, supplies their places from time to time with others; taking care while these are winding off to prepare others for keeping up a continual supply, and taking care also to observe that the silk winds off regularly from all the cocoons she puts in play together. As she is obliged to have her fingers almost every other instant amongst the boiling water, in order to manage the cocoons properly, she has a basin of cold water at hand, into which she dips her fingers alternately with the other, to prevent scalding them. But, in spite of her best care, a woman who works any time at this management finds her fingers at last so affected, by the influence of the boiling water, that they are for some time in such a state she has scarcely any feeling with them: but this afterwards goes off gradually. Here it must be observed that, in forming the brush before-mentioned, great care must be taken to have the points of it exceedingly small; because, if the points are large and coarse, the silk will not take up fine from the cocoons, but will rise off thick and clotty, which will prevent its winding off properly upon the reel.

The winding off the silk is always performed in the open air, generally in some garden, to prevent any accident from the fire, and more particularly to prevent any bad effects from the bad smell of the dead worms, which stink prodigiously. For these reasons this work is not suffered to be performed in any large town, but must always be done without the walls. When the day's work is over they make a fire of brush-wood, into which they throw all the dead insects, which are taken from the bottoms of the cocoons opened with a pair of scissors for that purpose, and burn them together, in order to prevent any bad consequences from their stench and smell. This is done every night regularly before the work-people retire for the evening. As the manufacturers of the silk, and merchants who want to sell it, buy up large quantities of the cocoons, some of these people will have from ten to twenty of these little furnaces going at a time in the same garden, and even sometimes more. As the whole of the silk cannot be entirely got off by the reel, what remains upon the dead insect is put aside with the coarse part of the silk, which is taken from the cocoons in the beginning, till you meet with the fine thread which is proper for the reel. The dimensions of the stove and basin made use of at Montauban, and described above, are as follows:

Height of the stove from the ground, twenty-two inches and a-quarter. Length of the stove twenty-nine inches and a-half. Breadth of the stove twenty-four inches. Height of the iron bars for supporting the charcoal from the ground, for holding the fire, twelve inches and a quarter. Width of the door, or opening, at the bottom of the stove for taking out the ashes by, and for giving air to the fire, nine inches and a quarter. Width of the door, or opening, at which you put in the charcoal for supporting the fire, seven inches and a half. Length of the oval copper basin, which is built in on the top of the stove, for containing the hot water, in which the cocoons are put when they wind off the silk, twenty inches and three-quarters. Width of that basin sixteen inches and a half. Depth of the basin three inches and three-quarters. Breadth of the rim of the basin one inch and a quarter.

Spring water or rain water, as being soft, is the only proper water to be used in the basin. Draw-well water is altogether improper for this purpose, because it is hard, and does not properly dissolve the gum which is naturally upon the silk.

The water in the basin must be wholly changed twice a day; it is filled in the morning before setting to work, and the second time immediately before the people go to dinner, as it requires some time to make it boil.

When you first put the cocoons into the hot water, if the silk rises thick upon the brush, it is a proof that the water is too hot. If you cannot catch the threads of silk with the brush, it is a sign that the water is too cold.

When the cocoons are in play, if they rise often to the little iron conductors, it is a proof that the water is too hot. If the cocoons will not follow the thread, it is a sign that the water is too cold. By attending to these observations, you can easily manage so as to give that degree of heat to the water that is proper for the cocoons.

If there should happen to be any sand amongst the water in the basin, the heat makes it rise to the surface, where it fixes itself upon the cocoons. This is easily known, because, where there is any sand upon the cocoons, it makes the thread break, as if cut with a knife. For this reason the utmost care must be taken to guard against it, by cleaning the basin with the greatest attention. The fear of having sand is one of the reasons for changing the water of the basin at mid-day, and even oftener, if found to be necessary. When they find that there is a little sand, and that they wish to avoid changing the water, on account of the loss of time which that operation requires, as the water must be boiling before you can go on with the winding; in this last case, they cover the face of the brush all over with a parcel of the coarse silk, which is laid aside, and then put the face of the brush into the water, making it reach the bottom of the basin, along which you draw the brush gently, to catch hold of the sand with the coarse silk, to which it will immediately cling when it comes in contact with it. You then drag the brush gently up the side of the basin, and thus bring out the sand along with it. This operation, several times repeated,

cleans your basin of the sand, without your being put to the trouble and loss of time in changing the water.

Take care to keep up your fire under the basin in such a manner as to secure having the water always of the same degree of heat, and to throw in your addition of cold water by little and little at a time, so as it may make as little odds as possible in the degree of heat. When you throw in too much cold water at a time, so as to alter the requisite degree of heat, the silk of the cocoons which are in the basin at that time, loses its color, and grows perfectly pale; which silk, so rendered pale, it is said, will not take any dye properly, which by that means diminishes the value of your silk.

In beating the cocoons in the basin, with the brush, you must carry your hand as lightly as possible, so as just to touch the cocoons slightly. If you beat too hard, the threads of silk, in place of coming off singly, cling together in lumps, which, as it prevents its winding off, occasions the loss of the silk, as it will then only answer as waste silk. When you take the fine threads to throw them to that which is winding off, they must not overlap your finger more than an inch; if too long, they will not join well, but hang down and occasion a lump, which causes the thread to break, as it is then too large to pass through the eye of the little iron conductor.

In winding off the silk you must be attentive to keep the thread wet, to make it slip along the more easily towards the reel. And, when the wheel has remained any time idle, you must also wet all the thread betwixt the basin and two pieces of iron, which makes the thread run the more easily.

Be attentive also from time to time to wet with water the cord, and the little wooden wheel, which moves the wooden regulator, in order to make it act properly. If this is neglected, the cord, by being dry, will not turn the regulator as it ought, by which means the silk will be placed unequally upon the reel, which may have this farther disadvantage, to cause the silk threads upon the reel to cling and stick to each other, by having been brought into contact before the first threads have had time to dry. For that wooden regulator is calculated to place the threads in such a manner upon the wheel as to make them touch one another only obliquely, and in as few places as possible at first, that the silk as it comes from the cocoons may have the time requisite to dry, before it comes to be fully in contact with that which follows. When the silk threads cling together, by being too soon brought into contact, the silk is rendered good for nothing.

The cocoons called satiny, from their resemblance to satin, require only that the water should be moderately hot in the basin. The same degree of heat that is necessary for the fine cocoons would entirely spoil the others, by making the silk come off thick, and what they call bourry. You find out the degree of heat necessary for these, by examining with care in what manner the silk comes off from the first quantity of cocoons you put into the basin; and, if you find it comes off thick, you must add cold water by

degrees, till you find the just proportion for them. They must not be allowed to remain long in the hot water, and there should only be a few of these cocoons put into the water at a time. If these circumstances are not attended to, the silk comes off thick, as already mentioned, which, in winding, makes the thread break at every moment, and not only greatly diminishes the quantity of your silk upon the reel, but also considerably hurts its quality, by rendering it coarser.

When once the reel has the quantity of silk upon it judged to be sufficient—the produce of about three pounds of cocoons, for example—you take it off, and put another reel in its place, that the work may not be interrupted. The silk ought to remain for six or eight hours, or even more, if you can allow it with your convenience, as it ought to be perfectly dry before it is taken from the reel.

When the cocoons which were first put into the basin are nearly finished, you must cause the wheel to be stopped; at which time, with a ladle full of holes, like a drainer, you take out the cocoons which were in play, each parcel on the opposite side. They are put into plates kept at the side of the furnace for that purpose; and are taken out of the basin for the following two reasons: first, that they may not be mixed with the new cocoons, which are put into the basin to be prepared for winding, as already mentioned; secondly, because if these cocoons, which are already in part wound off, were left in the boiling water till the new ones are prepared, it would have the effect to prevent the silk from winding off from the cocoons with that dispatch and propriety which are necessary in that operation.

As soon as you observe that the silk is wound off from the cocoon, you must take out the bottom of the cocoon containing the insect from the basin and throw it aside; because, if left in the basin, it will spoil the water, and consequently destroy the color of the silk.

You must be at pains to keep an equal number of cocoons working at each end of the basin, in order to keep the thread of silk of an equal size. When you have fewer on one side than the other, the silk becomes smaller at that side, of course, which also has the constant effect to break the thread. In order to keep the thread at both sides of an equal size, you must throw in the cocoons, one by one, and never more than two at a time. If you throw in many together, for example, four or five at once, it throws the weight to that side, when the thread immediately breaks, because by that means the equilibrium is lost.

In putting the silk thread round the two little pieces of wire, for conducting it to the reel, fixed to the little wooden wheel, you must turn the thread round to the right-hand for the bit of wire placed on the right; and turn it round to the left hand, for the piece of wire placed on the left.

The quicker the motion of the wheel is, the better the silk winds off, and the better the ends join to the thread, which is, indeed, one of the great reasons that make it wind off well. One might be apt to imagine that the rapidity of the

motion might overstrain and break the thread, but from constant experience it has been found that the thread never once breaks from the rapidity of the motion; but, on the contrary, that the quicker the motion is the more advantageous it is for winding the silk.

When you have put the quantity of silk upon the reel which you think proper, you then pick and clean off all the loose silk with your fingers; after which you take a little handful of the coarse silk, and after washing it to make it thoroughly clean, and squeezing it, you must dip it in some cold clean water, with which, in the flat of your hand, you rub over the silk upon the reel, a great many different times, all round the reel; stroking up also the silk with the flat or palm of your hand. After which you then pour some clear cold water also upon the silk; and you then turn round the reel with all the velocity in your power, for about eight or ten minutes, in order to shake off all the water effectually; which done, you take off the reel, and put it in some airy place to dry; but you must not expose it to the sun, which would quite eat away and spoil the color. This is done to clean the silk effectually and to give it a gloss.

In preparing the double cocoons for winding off, they put more of them into the basin at once than of the finest kind. But, before putting them into the basin, they must be well cleaned from all the floss, or waste silk, which is on the outside of them, that they may play properly in the basin. The water also must be boiling hot; and as the silk they yield is of a coarser quality than the other, and has a good deal of the floss silk or bour upon it, the girl who turns the wheel takes the opportunity, while the other woman is preparing the cocoons in the basin for winding, to clean and pick off the loose silk from that which is already on the reel. In winding off the fine silk, there are always two hanks of silk put upon the reel at the same time. But, in winding off the silk from the double cocoons, they confine themselves to one hank only at a time upon the reel.

The next object which occurs is the method observed by the French, in the preparation of their floss, or waste silk, which they call *filoselle*; and which they do in the following manner:—all the cocoons which have been pierced by the butterflies being collected together, they add to these all the light cocoons, which they judge to be improper for winding off, after the insects have been cut out, as before-mentioned; and to these they also add all the bottoms of the cocoons which had been thrown aside from the basin, after winding off their silk.

Such of the floss silk as you wish should retain the yellow color, you put into a large copper kettle, and cause a person to tramp it with her bare feet, in the same manner as the women in some parts of Scotland tramp their linens when they are washing them. From time to time they turn the cocoons upside down with their hands and so go on tramping them again with their feet. This operation is continued for nearly two hours together, turning them, and giving them a little more fresh water from time to time, till it is found that the silk of the cocoons sepa-

rates properly, upon tedding it out with your fingers : and as, in tramping with the feet, the edges of the heap of cocoons will very often escape the stroke of the foot, you turn the edges into the middle. When you find it properly separated, you carry it to the river ; put the cocoons into a clean cloth tied up, to prevent the silk from mixing together. You then pour fresh water upon them from time to time, till you find that the water runs off from the silk perfectly clear, without being tinged with any sort of color. When you find this to be the case, you spread out the silk to dry by the sun ; and, when it is thoroughly dry, the operation is completed. For the subsequent processes in the manufacture of silk see WEAVING.