

# SPINNING OF LONG VEGETABLE FIBRES.

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## CHAPTER I.

### THE LONG VEGETABLE FIBRES OF COMMERCE.

*Origin.*—With the exception of aloe, agave or sisal, New Zealand, Mauritius and Manila hems, which are produced from the leaves of the plants of these names, the long vegetable fibres of commerce are obtained from the stalk of the plant. When the fibre is found in the leaf of the plant it is usually imbedded in pulpy or woody substances. When it is found in the stem of the plant it surrounds the woody matter, lies near the surface, and is only covered by a coating of gummy matter which binds the fibres together. The separation of the fibre from the stem or leaves of the plant is effected either by hand or by machine, both methods being usually aided by natural or hastened fermentation, or by chemical treatment.

*Flax Plant.*—Flax, French *Lin*, German *Flachs*, is the fibre obtained from the stems of a plant the botanical name of which is *Linum usitatissimum*. This plant will grow in any temperate climate, and is cultivated to some extent in almost every country of Europe. Russia produces a very large proportion of the world's supply, and then, in order, come Belgium, Holland, Ireland, France, Germany and Italy. Little or none of the flax grown in Ireland, France, Germany or Italy is exported, but is used up by local spinners. Belgium and Holland, on the other hand, export almost all, and spin but little of the flax which they themselves produce, the reason being that the Belgian spinner spins a coarse yarn into the composition of which the cheaper Russian flax largely enters.

A deep sandy loam is the soil which best suits the flax plant. After a fine and level seed-bed has been prepared by ploughing and harrowing, a reliable brand of seed should be sown rather thickly broadcast over the field and covered in by a passage of the harrow.

The fibre produced is of better quality when the seed is thickly sown, since the stems then grow up straight and do not branch until quite high

up. Branching spoils the quality of the flax for spinning purposes, and is to be avoided. Two and a half bushels per acre is a suitable quantity of seed to give good results. When a "braird" appears, and is a few inches long, the field should be carefully weeded, as the value of the fibre will be much reduced if it be afterwards found that weeds are mixed with it.

Towards the middle or end of August the plant should be ready for pulling. The best spinning fibre is obtained if the flax be pulled before it has quite reached maturity, or at the moment when the stems begin to get yellow at the base, and the seed balls become firm. When the hands are obtainable the stems should be pulled up by the roots, as the fibre obtained in them is more suitable for spinning than if the stems be cut down, as they sometimes are in America, where labour is scarce and dear. In pulling, it is of the utmost importance that the long and short stems be kept separate as much as possible, and also that the root ends be kept perfectly even, as the yield of fibre will be thereby improved, both in the subsequent scutching and hackling processes. The stems are next tied up in bundles, and the seed removed by pulling the top ends through a sort of coarse comb called a "ripple."

*European Hemp.*—European hemp is a taller and coarser plant than flax, but is sown and treated in a similar manner. It is grown almost everywhere that flax is grown, except in Ireland. Russian, Italian and French are the best known varieties, and almost the only ones which are exported.

*Manila Hemp.*—Manila hemp is grown in large quantities in the Philippine Islands, Borneo and Java. It is obtained from the leaves of a plant belonging to the banana family. The plant grows to a height of about twenty feet, the stem being enveloped in the long leaves which contain the fibre. The leaves are cut down periodically, the inner ones producing a rather finer fibre of a lighter colour than that obtained from the older and outside leaves.

*Sisal Hemp.*—Sisal hemp or Agave fibre is indigenous to Yucatan, and is largely cultivated in the Bahamas and in Florida. The leaves of the plant which contain the fibre average five to six feet in length, and are cut down every year after the plant is about four years old. The best quality of fibre is grown on gravelly soil of medium quality.

*Mauritius Hemp.*—Mauritius hemp is a plant very similar to the former, and requires the same treatment. The leaves and fibre are rather longer.

*New Zealand Hemp.*—New Zealand hemp, or *Phormium tenax*, resembles Manila somewhat, but is of inferior quality and strength. It is also produced from the leaves of a plant, the yield of fibre being about 16 cwts. per acre.

*Jute.*—Jute is the bast fibre obtained from the stem of a plant which is principally grown in the north and east districts of Bengal. The finest jute is grown in the high ground, and the middle qualities on the river banks, deltas, etc., known as “Salilands.” A hot, damp climate without too much rain is most suitable for the proper development of the plant.

*Ramie, Rhea, or China-grass.*—There are two sorts of plants which produce ramie or fibre of similar appearance. One, called the *Boehmeria tenacissima*, has leaves of which the backs are green; the other, the *Boehmeria nivea*, has leaves with white backs, and is the ramie plant proper, the former plant being often called rhea. Ramie fibre is generally of a brighter colour than rhea, and is finer, but rather weaker. The fibre called China-grass is produced from either of these two plants. Rhea is grown in Sumatra, Borneo, Java, Malacca, India and Mexico; ramie principally in China and Formosa. The attempts which have been made to cultivate the plant in European countries have ended in failure, as the winter is too cold.

A suitable soil is one which is moist, but not sodden; a friable loam with a porous subsoil. A hot and rainy climate is the most suitable, for dry heat kills the plant. It is perennial, and gives from two to five crops of fibre per annum, for many years in succession. When it is produced from seed, it is only possible to get one crop of fibre the first year; but if root cuttings be planted, two crops are usually gathered. An acre will produce about 16 tons of green stems per annum, if four crops be taken, and from these stems about 130 stone of fibre may be extracted. If the plant be produced from seed, the latter should be germinated in open boxes placed under cover. The most approved way is to first fill the boxes with earth, and then spread over the surface a thin layer of fine loam in which the seeds are mixed. No watering should be done for fully a week, when the seed leaves begin to appear. The plants may then be watered with a fine watering can. When the young plants are about two or three inches high, they should be carefully transplanted into specially prepared beds, care being taken that the roots are kept surrounded with a ball of earth. They should be set at a distance of about three feet from each other, as in this way too much branching is prevented, branching producing short fibre. When the stalks are long enough they are cut down.

*Decortication.*—When, as in the case of Manila hemp and Agave fibre, the filaments are covered by a succulent pulp, the latter is removed by scraping, leaving the fibre bare.

*Retting.*—When, on the other hand, the fibre surrounds the woody matter, as in the flax and European hemp plant, retting or rotting is resorted to, to dissolve and decompose by fermentation the gummy matter which binds the fibre to the stem. The retting process may be done in

two ways; the quicker method being known as water-retting, and the other as dew-retting. Water-retting is done in either still or running water. Flax and hemp steeped in rivers is usually of a nice yellow colour, and much appreciated by spinners. Flax and hemp steeped in still water is of a darker colour, but of good spinning quality if the water be soft and stagnant and free from mineral salts in solution. The best results are obtained when the flax straw is protected from contact with the earthy sides of the dam or from floating scum, by straw, and placed in openwork crates or baskets. Ten to fifteen days, according to the temperature, is required by the steeping process. In the Courtrai district of Belgium, where the finest flax which the world produces is steeped in the sluggish waters of the river Lys, the factors prefer to steep their flax for a comparatively short period the first year, and then to dry and store it until the following year, when they complete the retting process.

In India, jute is steeped in the like manner, either in running water or in retting dams.

The greatest care must be taken that the retting process does not go on too long, as the fibre is thereby weakened. When it is found that the fibre separates easily from the woody matter, the stems are removed from the water and spread out to dry upon the ground.

Dew-retting consists in spreading the freshly-pulled flax or hemp straw lightly over the field and allowing it to remain there until the action of the sun, rain, and dew has accomplished the partial dissolution of the gummy matter which binds the fibre to the wood.

The one objection that weavers have to using yarns spun from dew-retted fibre lies in the fact that dew-retted yarns turn a darker colour when boiled. When fully bleached, however, linen made from dew-retted fibre has a more brilliant whiteness than that made from water-retted fibre.



FIG. 1.—Hand-scutching blade.

*Breaking and Scutching.*—In order that the fibre may be easily separated from the wood, the flax or hemp straw must be perfectly dry and thoroughly retted. It is then quite easy to break up the “boon” by beating the straw upon a flat surface with a mallet, or by the use of a primitive wooden press of intersecting bars, called a “break,” and then to thoroughly clean the fibre by repeated blows of a wooden scutching blade (fig. 1). This primitive method is still practised in many a cottage home in Ireland, Belgium, Holland, Russia, Germany, and

Italy, upon flax and hemp straw. The fibre produced, however, is now nearly always sold either directly or indirectly to the mills, as the use of the old spinning-wheel has almost entirely ceased.

Farmers now generally bring their flax straw to a scutch-mill, where it is cleaned in large quantities by steam or water power. The machinery consists first of all of a "breaker" (fig. 2), which has a series of pairs of fluted rollers which crush the straw and break up the boon into small pieces, which, if the stems have been sufficiently retted, are easily separated from the fibre by the strokes of a beater. The best flax breakers have six or seven pairs of comparatively small rollers, fluted rather finely to different pitches, so that they may break the boon into as small pieces as possible. The efficiency of the machine is further increased by turning the

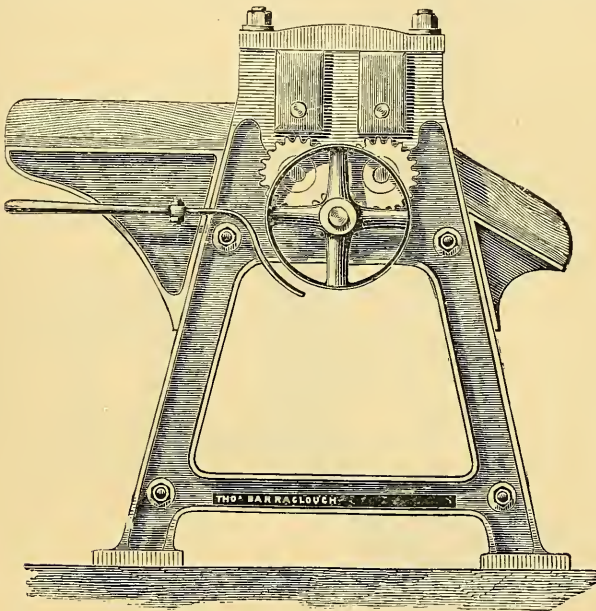


FIG. 2. — Flax straw breaker.

rollers backwards and forwards alternately by means of cranks, connecting rods, ratchet wheels, and detents. The crank producing the forward motion has the longer stroke, so that the straw passes through the machine. According to the most common method of flax scutching, the broken straw is held in a notch in an upright plank or "stock," while revolving beaters or "handles" of wood or light iron, shown in fig. 3, strike repeatedly and knock out the shove.

*Cleaning.*—The long flat leaves of the New Zealand hemp plant are cut down and subjected to the action of a stripper similar to the flax scutcher's handles, which detaches much of the bark. The partially cleaned fibre is then put into a trough through which water circulates, and is washed and scraped with a flat piece of wood. The fibre is then "grassed" and

partially bleached by the action of the sun and air, after which it undergoes a further scutching process, which softens, cleans, and renders it a saleable article. Hitherto the New Zealand hemp put upon the market has been of a very coarse description, and only suitable for spinning into rope yarns or binder twine. Quite recently, however, a German chemist professes to have discovered a means of preparing the fibre in such a way that it may be spun much finer. He selects the leaves of the younger plants only; and removing the brown edges, boils the leaves in a solution of the alkaline salts, borax, soda, or sodium bicarbonate. The moist and warm leaves are then beaten with wooden hammers until the woody tissue has

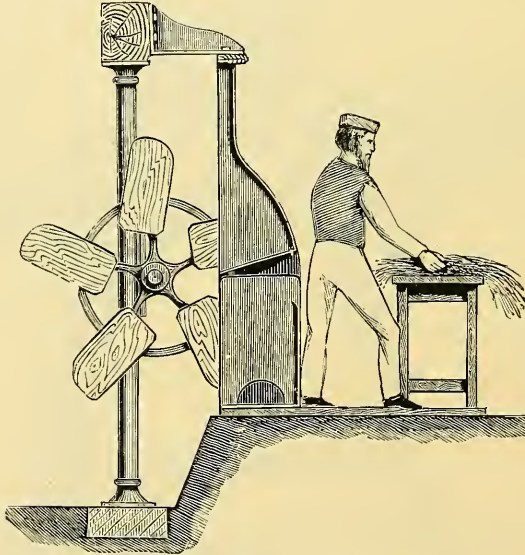


FIG. 3.—Flax scutcher's stock and handles.

been loosened and opened up. The fibre is then completely cleaned by washing in warm soap and water and subsequent hackling.

Manila hemp is cleaned by the natives, who scrape the pulp from the newly-cut leaf-stalks, leaving the fibre, which they hang out to bleach and dry. There is not, as far as the author is aware, any machine which can show such satisfactory results as does hand labour.

*Decortication and Degumming.*—Decortication should be practised upon the stems of the ramie plant when in a green state, because when they become dry the outside skin becomes hard and brown and most difficult to remove. Up to the present time no machine has been found to give such good results, as regards yield and clean fibre, as the manual process practised by the women and children in China, who produce from the ramie or rhea plant the fibre known as China-grass. Hand decortica-

tion is a long and costly process, because a woman can produce only a few pounds of fibre per day. This she does by placing a few green stems on a flat board and scraping them with a piece of wood, in order to remove the woody matter, with as much of the gum as possible. A good decorticating machine should do the work as well as it can be done by hand without breaking or "slaving" the fibre. Many decorticating machines have been patented, but most of them have been found defective. The best-cleaned fibre still contains from 20 to 30 per cent. of gum, which must be removed before it can be spun into fine yarns. The degumming may be conveniently effected by employing the process and the apparatus invented by Boyle. This process consists in passing the material through tanks of chemical solutions—bleaching it, in fact.

Vegetable fibres are almost without exception of cellular structure. In the case of flax and hemp the so-called fibres are composed of ultimate or shorter fibres joined together by the gummy matter or pectose before referred to. Bleaching dissolves out and oxidises the colouring and gummy matter, and leaves disjointed the ultimate fibres of pure white cellulose. It is only with such fibres as ramie, the ultimate length of which is very long, that such treatment may be resorted to before spinning, as, were flax or hemp bleached before spinning, the yarn produced would have comparatively little strength.

Boyle's degumming process for ramie consists in passing the material through a trough containing weak soda lye, and then through a feeble solution of hydrochloric acid, which acts upon the soda remaining in the fibre and sets up fermentation. The material is then passed on to a third tank similar to the first, and then to a fourth containing a solution of permanganate of potash. The fifth tank contains a mixed solution of hyposulphite of soda and hydrochloric acid, the sixth hyposulphite of soda, and the seventh a solution of hydrochloric acid alone. On leaving the latter bath the fibre is washed in pure water, and then steeped in a weak solution of soap and water, in order to give it back a little of the oleaginous matter extracted by the action of the soda. The material should be passed through these successive baths between endless openwork travelling aprons, in thin layers, in order that the fibre may preserve its parallelism and not become too much matted. Between each bath it passes between wringing rollers to remove superfluous moisture.

True China-grass, from which much of the gum has already been removed by hand-scraping, does not require such severe chemical treatment as that just described. It is sufficient to boil it in soda lye, to steep it in chloride of lime solution and then in an acid bath, repeating these two latter processes, with a washing in pure water between each, until the gum has completely disappeared and a pure white flasse is produced. The fibre should be placed in the kier or boiling-pot, between trays of wire

network one above the other, to prevent the matting of the fibre. The trays of fibre are placed in the pot with the lye at 3° Tw., and allowed to boil for about seven hours. The fibre is then taken out, rinsed in pure water to remove all traces of soda, and then steeped for ten or twelve hours in chloride of lime solution at  $\frac{1}{2}$ ° Tw., contained in a stone trough. When taken out of this steep it is again rinsed in pure water and placed in a solution of sulphuric acid or vitriol at 1° Tw., where it is left for some hours, and then again thoroughly washed. If all traces of gum have not completely disappeared, the two latter processes are repeated as frequently as required.

“*Prepare*” for *Ramie Fibre*.—After the fibre has been submitted to all this chemical treatment it will be found to be rather harsh and dry. In order that it may lend itself easily to the following operations, it will be found advantageous to give it back its suppleness by treating it with oily matter or “prepare,” to replace that which has been removed by the action of the soda and the acid. A good result will be attained by steeping the fibre, before finally drying it, in an oily solution prepared as follows:—To every 15 quarts of boiling water add 200 grms. of glycerine, 200 grms. of Castile soap, 100 grms. of white wax, and 50 grms. of tallow.



## CHAPTER II.

### THE RISE AND GROWTH OF THE SPINNING INDUSTRY.

*Primitive Methods.*—It may truly be said that the flax and hemp spinning industry had its birth with the nineteenth century, for when that period opened the spinning of these fibres was in practically the same primitive state as it was in the early days of the Christian era, as revealed to us by Egyptologists and others. It is even questionable if, in the remote ages of the past, the inhabitants of certain countries had not even greater skill in such arts than had our great-grandfathers.

*Invention of the Wet Spinning of Flax.*—Flax and linen are repeatedly mentioned in Old Testament history. In Biblical times yarn was no doubt spun with the aid of the spindle and distaff, and later on, with the hand spinning-wheel. The invention of Arkwright, at the end of the eighteenth century, of the principle of roller drawing, was the true starting-point of the development which all branches of the spinning industry have since attained. It was not until forty years later, however, that the fundamental principles of modern long vegetable fibre spinning were first discovered. The principle which applies to all these fibres without distinction is the use of gills in the preparing process; the other is the use of hot water as a softening and macerating agent in the spinning of fine numbers from flax and hemp. Both these principles were discovered by a certain Philippe de Girard, who set himself to win a prize offered by Napoleon Bonaparte for the best machine for spinning flax. In the course of his experiments he tried steeping the fibres in hot water and then drawing them the one over the other, and twisting them between his fingers. Having heard of Arkwright's principle of roller drawing, Girard had no difficulty in constructing a machine to carry out his ideas, and started the first mechanical flax wet-spinning mill. One of Girard's employés soon afterwards joined Mr Marshall and founded the once well-known mill in Leeds—the first English wet-spinning mill.

*First Mills.*—In the year 1828 the first Irish flax spinning mills were started—one in Belfast by Messrs Mulholland, and the other in Castlewelland by the Messrs Murland. The English had meanwhile so improved the original models of Girard that they wished to keep the trade to themselves, and threatened any machinist who should give away any patterns

or drawings with a heavy fine. In spite of all, the French succeeded in procuring English frames, and in 1835 a flax spinning mill was started in Lille and another at Essommes. Further information was gained as to English methods of construction by a French engineer named De Coster, who, going to England, got employment as an ordinary labourer in the works of one of the leading flax machinists, and returning to France some years afterwards, started a workshop for the building of flax machinery, fitting up about forty small mills within the next three years.

Previous to the discovery of the advantages of employing hot water to soften the gummy matter binding the fibres together, and thus enabling them to be drawn out and spun fine, the few hundred mill spindles which had been running could only produce the coarser dry-spun numbers. Fine numbers could only be spun by hand upon the old spinning-wheel, and it is probable that, had the principle of hot-water spinning not been discovered, the linen trade would never have attained its present dimensions.

*Early Use of Hemp.*—Hemp has probably been grown almost, if not quite, as long as flax. Herodotus tells that the Scythians used the narcotic properties of the plant to produce a sirop which they called Hasechisch, from which comes our word assassin, either because it was used as a poison or because people under its influence frequently committed murder. The Scandinavians, Germans, and Scythians have cultivated hemp for many centuries. Catherine de Medicis is said to have worn underclothing of considerable fineness made from hemp, which at that time was considered to be quite a novelty.

*Rise of the Manila, Jute, and Ramie Spinning Industries.*—The development of the Manila hemp, jute and ramie spinning industries is of comparatively recent date.

In days gone by these fibres were only used, by the natives who grew them, in the roughest possible fashion.

Ramie was indeed woven into a cloth, but the yarn was not spun nor twisted, being in fact merely the fibre split into lengths which were attached together at the smaller ends.

The jute spinning industry, which at first made slow progress, has within the last half century attained enormous proportions.

Ramie spinning, owing to the difficulties experienced in decorticating and degumming the fibre, is still but a struggling industry, and yet in its infancy.

At the present time the number of spindles spinning flax may be reckoned as follows:—

Ireland, . . . . .	860,000 spindles.	Belgium, . . . . .	300,000 spindles.
England and Wales, . . . . .	90,000 ,,	Russia, . . . . .	300,000 ,,
Scotland, . . . . .	180,000 ,,	Germany, Austria and	
France, . . . . .	456,000 ,,	Silesia, . . . . .	573,000 ,,

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### CHAPTER III.

#### THE RAW FIBRE MARKETS AND THE PURCHASE OF THE RAW MATERIAL.

*Flax and Hemp Trade Centres.*—As far as the manufacturer is concerned, the market in which he purchases his raw material is either a centre of production or, if the latter is in some distant land, the port at which the fibre arrives. Foreign hemp, for instance, arrive at and are bought and sold in Liverpool or London, Russian flax in Belfast and Dundee, jute in Dundee and Dunkerque, etc. The fibre is shipped by exporting houses, and sold by their agents at market price on its arrival. Important spinners, of flax for instance, often find it to their advantage to employ their own buyers to visit or reside in the districts in which the fibre is grown, and to buy direct from the farmers or scutchers. Most of the large Irish flax spinning mills have their buyer stationed, at least during the buying season, at Courtrai, Ghent, or Brussels, from which centres they may reach the surrounding markets. There is, nevertheless, room for a considerable number of merchants and commission houses, who in like manner have their agents and buyers engaged at home and abroad.

Needless to say, a competent buyer must be an expert judge of the raw material, and experienced in the manners and customs of the markets in which he buys. Few men are good judges of the raw fibre who have not themselves worked it in the mills. It requires experience of this sort to know how the fibre will work out, the yield it may be expected to give, the length to which it may be spun, and its consequent value.

Russia, Belgium, Holland, Ireland, France, and Germany are the principal flax-producing countries.

*Russia.*—The chief Russian markets are Riga, Pernau, St Petersburg, Kostroma, Bejetsky, Kashin, Pskoff, Witebsk, Jaropol, Mologin, Seretz, Ostroff, Werro, Opotochka, Dorpat, Wiasma, Mochenetz, Longa, Vologda, Jaroslav, Rjeff, Sytcheffka, Ouglitch, Otbornoj, Iwashkower, Viatka, Novgorod, and Archangel. Riga, Pernau, Reval and St Petersburg are the chief ports of export. The Gulf of Riga is closed by ice during several months of the year, during which period the port of Reval, being open on account of its position, is most used. A good deal of tow as well as flax comes from the fine dew-retted districts of Kashin, Kama, etc.

Other districts in which the fibre is principally dew-retted are those of Vologda, Kostroma, St Petersburg, Slanetz, and Bejetsky. The water-retted fibre is grown principally in the Livonian, Crown and Hoffs districts.

The finer sorts of Russian hemp are grown in the neighbourhood of Smolensk, Rosslawl, Juchnow, and Mossalsk, while the coarser sorts come from Orel, Karatschew, Pensa, Kursk, and Briansk. Riga and St Petersburg are the ports of shipment. Cronstadt, which is the port of St Petersburg, is closed by ice from November until April.

Russia exports about 230,000 tons of flax and tow every year, and about 50,000 tons of hemp and tow in the same time.

The Russian flax trade is largely carried on by Jews. Dishonest dealing in the way of mixing foreign substances with the flax, watering it and stuffing the heads with tow, became so notorious, that in 1899 the Russian government made it law that—

- (1) Flax must contain no admixture of refuse, and must not be damped to increase its weight.
- (2) The bundles of flax must not weigh more than 20 lbs., and must consist of fibre of like quality and scutching.
- (3) They must be tied with one band only at a distance of one-third from the top, so that the ends of the fibre will hang down freely, and so that the fibre may be examined without loosening the bundles.
- (4) The bands with which the bundles are tied must be of flax.

These rules have had a good effect, and it is now not so common as it was to find stones, sand, and pieces of metal in the heads of Russian flax.

The Russian peasants bring their flax to market in the winter time, when the roads are covered with snow and in good order for the sledges. It is bought up by the buyers connected with exporting houses, and by them "bracqued" or sorted into its various qualities. It is then baled up in bass matting or tied up in "bobbins," and shipped to Scotland, Ireland, France, or Belgium.

Among the sorts of flax shipped from Riga are the Crown flaxes, the Hoffs, the Wracks, the Drieband, the Zins, and the Ristens. The marks of the Crown flaxes are K, PK, SPK, HK, HPK, HSPK, GK, GPK, GSPK, WK, WPK, WSPK, ZK, HZK, GZK, R, HR, GR, and WR, the letters meaning respectively, K = kron or crown, P = puik or picked, S = sanft or sweet, superior, H = heel or yellow, G = grau or blay, Z = zins, W = weiss or white, R = risten.

The marks of the Hoffs flaxes are HD, PHD, FPHD, SPHD, SFPHD, WSD, WPHD, WFPHD, and WSFPHD. Here H stands for Hoffs, D for drieband (tied with three bands), F = fein or fine, and the other letters as in the Crown. The marks of the Wrack flaxes are W, PW, HPW, GPW, and WPW. W means Wrack and white, the other letters as in the Crown.

The Drieband marks are D, PD, SD, PSD, LD, PLD, and DW. S here means Slanetz, and L= Livonian. Pernau "District" flax is grown in the neighbourhood of Pernau, and shipped in the state in which it leaves the peasants, with a good deal of shove left in the top end. Pernau flax is this "district" flax opened out in Pernau and partially re-scutched, making it worth £2 per ton more. Flax shipped at Pernau comes from either of two districts, Livonia or Fellin, the latter being of a finer quality and fetching £2 per ton more. The Pernau marks are LOD, OD, D, HD, R, and G. For Dunabourg and Kowns flaxes the Riga marks are usually employed. For Ostrow the marks of both Riga and Pskoff are used, and sometimes figures also. Pskoff flax is usually classed as OD, PW, W, OW, O, OO, OOO, P1, PII, PIII. Flax from Reval and Dorpat is exported in bobbins, and has usually been re-scutched. The following are the ordinary marks : G, R, HD, D, OD, and OOD.

The principal districts from which the flax known as Archangel comes are Vologda, Ustjuga, Jaroslav, Kama, Totma, and Viatka. Its marks are 1st Cr., 2nd Cr., 3rd Cr., 4th Cr., Zebrack No. 1, and Zebrack No. 2. Archangel flax is dew-retted, and is usually of a silver blay or reddish foxy colour. It is exported in bales weighing each about 500 lbs. The tare at Archangel varies according to the weight of the mats. The weight of the cords is not deducted. Navigation on the White Sea is only open from June to October. The Bracque, official and compulsory, exists in Archangel. Flax which has not been bracqued cannot be exported from this port.

The flax exported from St Petersburg is either Slanetz (dew-retted) or Motchenetz (water-retted).

Slanetz flax, which is exported in mats, is usually classed into 1st Cr., 2nd Cr., 3rd Cr., 4th Cr., Zebrack No. 1, and Zebrack No. 2.

Motchenetz flax is classed into Obernoy 12, 9, and 6 head. It is exported in bobbins.

At Königsberg, part of the flax is classed on the present Riga method, and part by the old classment, which is—

FWPCM = fine white picked Crown Marienburg.

FGPCM = fine grey picked Crown Marienburg.

WPCM = white picked Crown Marienburg.

LPCM = light picked Crown Marienburg.

FPCM = fine picked Crown Marienburg.

PCM = picked Crown Marienburg.

P1 = picked No. 1.

P2 = picked No. 2.

The "rise" in price for the various marks varies with different years. Take Riga, for instance, with K as base at £18 per ton. The "rise" in

lbs. per ton for the several marks are :—H = 1, P = 3, S = 4, G = 3, W = 4, and Z = 10.

The Russian weights used in the flax trade are the Berkowitz = 10 puds = 400 Russian lbs. =  $356\frac{1}{2}$  English lbs. ; the pud = 40 Russian lbs. =  $35\frac{1}{2}$  English lbs. The money used is the rouble, which at par is equal to 3s. 2d.

*Ireland.*—Almost every flax-growing district of Ireland has its special characteristic. Cookstown district is one of the best, producing a strong warpy flax. Magherafelt, Randalstown, Lisnaskea, Armagh and Newry all produce good flax. Monaghan, Cootehill and Ballybay are, as a rule, of medium strength. Strabane and Letterkenny are generally very wefty and badly handled. County Down flax is very often of a light colour, and a large-fibred thread flax. Strabane, Letterkenny and Ballymoney flax is generally made up in large bundles containing about three stones, and sold at so many shillings per cwt. In the other Irish markets flax is sold per stone of 14 lbs.

Irish hand-scutched flax is getting rarer and rarer. Hand-scutching used to be a favourite winter occupation for the farmer's family, but old times are changed, and the flax is now almost invariably sent to the scutch mill. To facilitate the hand-scutching process the peasants dried the straw in the smoke of the chimney, which gave the flax a smoky smell and an appearance not unlike Riga flax.

*Belgium.*—The flax-growing districts of Belgium have likewise their characteristics, and the expert flax buyer can distinguish their products by their smell and appearance.

Flax from Lokeren and St Nicholas is generally of medium strength. The Bruges and Wetteren districts produce a very strong flax. Ghent and Waereghem flax is usually badly scutched. Malines flax is not so strong as Bruges, but is fine, and a superior weft flax. The Ypres district produces a good strong flax which has a good deal of spinning quality and yields well. The above-mentioned Flemish flaxes are what are termed the "blue flaxes," being steeped in still-water dams or "holes," in distinction to Courtrai flax, which is of a yellow or golden colour on account of its having been steeped in the waters of the river Lys. The steeping of flax is a very important industry in the neighbourhood of Courtrai. Not only is the straw grown in the immediate neighbourhood employed, but the factors go out and buy up the best Dutch, Flemish and French flax straw, and bring it home to be steeped or retted in their river, which gives a particularly good result. The value of Courtrai flax is in some measure due to the skilful manner in which the flax is handled and scutched—a result brought about by the system of treating the flax on such a large scale. It is a pity that a co-operative system of steeping and scutching by experts has not been introduced in other districts and lands, for it is

impossible for the farmer to have the same skill at this particular work as the specialist.

The price of Courtrai flax is reckoned in crowns per sack. A Flemish crown = 5 francs 80 centimes or 4s. 7d. A Courtrai sack of flax = 41 bottes =  $127\frac{1}{2}$  lbs. avoidupois. There are therefore 72 bottes in a 2-cwt. bale, or 720 per ton. Bruges flax is priced in stuivers per stone of 8 lbs.  $4\frac{3}{4}$  ozs. A stuiver = 9·07 centimes, or nearly one penny. There are 27 stones in a 2-cwt. bale of Bruges flax, or 270 stones per ton. In the Waereghem market a stone of flax weighs only 6 lbs. 11 ozs., so that there are 335 stones of this flax per ton. A Ghent, Wetteren or Welle stone is still lighter, there being 340 stones per ton. There are 360 stones per ton of St Nicholas, Malines and Lokeren flax. The confusion caused by the local differences in these old weights has led to the almost universal adoption of payment in francs per 100 kilogrammes. The Belgian towns and villages which we have just mentioned have their weekly flax markets in the winter months, which are visited by the buyers. Courtrai has an exceptionally small market, as most of the flax is bought up by the buyers at the scutch-mills.

The chief centres for Flemish dew-retted or Walloon flax are Tournai, Namur, Ath, Leuse, Liège and Gembloux. Flax from the Liège market is usually fine and well handled. It is sold per botte of 3 lbs. 3 ozs. There are consequently 700 bottes per ton.

Namur flax is often "stuffed" in the head and made up. Tournai is a strong and well-worked flax. Flax from Ath is also usually of good quality. In the Walloon districts the flax is sold at so many sous per botte. A sou is equal to one halfpenny.

*Holland.*—Dutch flax, which is sold in stuivers per stone of 6 lbs.  $3\frac{1}{2}$  ozs., is usually of a dark colour, having been steeped in holes in peaty land. The Dutch stuiver is worth about three-halfpence. There are 36 stones per 2-cwt. bale, or 360 stones per ton. The flax is almost all sent into Rotterdam, where the market is held every Monday. Dutch flax being grown in large farmer's lots, is much more regular than Flemish. Friesland flax is also shipped from Holland. It is a long, hard flax, usually used for coarse thread yarns. It is rather hygroscopic, having been steeped in brackish water. The flax is classed according to quality by letters, and the qualities subdivided into sorts by crosses, thus:—F, Fx, Fxx, G, Gx, Gxx, etc.

*France.*—In France, both the dew- and water-retted systems are in vogue, and, in the case of the Bergues district, both systems are employed upon the same flax, which is first partly dew-retted on the grass and then finished in the dam.

The river Lys, which has its origin in France, is again used for steeping purposes, but without the results obtained on the Belgian side. The chief

centres of steeping on the French side are Deulemont, Comines, Wervicq, Bousbecque, and Halluin. Flax from Valenciennes and Hasnon is fairly fine, and is paid for in francs per botte, of which there are 720 per ton. The flaxes of Flines and Douai are of good quality and light colour. Bergues flax is strong and yields well, but is of a bad colour. The French flax known as "Lin du pays" is dew-retted, and comes chiefly from the districts of Prêmesques and Beaucamps.

Flax grown in the Picardie district is generally dew-retted. It is badly handled, fire-dried, hard and poor. It is chiefly used for coarse dry spun yarns.

Flax from the Moy district is water-retted and sold per botte, of which there are 730 per ton.

Bernay flax is paid for in francs per 110 French pounds, of which there are 2040 per ton.

*Hemp-growing Areas.*—Russian hemp comes chiefly from the governments of Orel, Poltava, Kalouga, Simbirsk, Thernigow, Mohilew, Koursk, Tambow and Smolensk.

St Petersburg hemp is usually divided into three qualities called "clean," "outshot," and "half-clean."

The different qualities of Riga hems are distinguished by such letters as MR, BPH, POH, etc.

Koenigsburg hems include "clean," "cut," and "schiking," and are of a greenish shade.

Among the French hems are those of Picardie, which is white or grey, and of good and fine quality. Anjou hemp is light coloured, and has a strong and regular fibre. Hemp from the Bourgogne country is very coarse and brown, and only suitable for rope yarns.

The principal sorts of Italian hemp are Piemont and Bologne, which are often over twenty feet in length. Bologne hemp is smoked in the ordinary chimney or over the ammoniacal smoke of burning feathers, horn, etc., and has a silky and regular fibre. The base of Italian hemp prices is that of the mark PC.

In the United States of America hemp is grown in Missouri, Michigan, Illinois, Kansas, Tennessee, Minnesota and Kentucky.

In the Manila hems the whiteness of the fibre designates its grade. The ordinary qualities, such as are used for binder twine, include "current," "fair current," and "brown." Mauritius hemp is classed as "fair," "fully fair," and "good"; and New Zealand hemp as "good fair Wellington," "fair Wellington," etc.

Among the Indian hems are Bombay, Jubbalpore, Allahabad and Sumn hemp.

*Hemp Prices.*—The following list will give some idea as to the relative values of the various hems :—



	£	s.	
Italian base PC, . . . . .	36	0	per ton.
Russian Riga F.S.P.R.H., . . . . .	35	0	„
„ Riga summer dried F.S.P.H.R., . . . . .	32	0	„
„ Königsberg navy, . . . . .	28	0	„
„ St Petersburg, . . . . .	24	0	„
Manila “good current,” . . . . .	36	0	„
„ “superior second,” . . . . .	28	0	„
„ “good brown,” . . . . .	26	0	„
„ fair current, . . . . .	30	0	„
„ fair brown, . . . . .	23	0	„
„ Sorsogon current, . . . . .	30	0	„
„ fine marks, . . . . .	45	0	„
Naples I. Paesano, . . . . .	32	0	„
„ II. Paesano, . . . . .	28	10	„
„ I. Marcianise, . . . . .	28	0	„
„ II. Marcianise, . . . . .	26	10	„
„ I. and II. Canapone, . . . . .	28	0	„
Indian sun hemp, . . . . .	15	0	„
„ sisal hemp, . . . . .	29	0	„
New Zealand “fair Wellington,” . . . . .	22	0	„

*Jute Marks.*—Jute fibre is classed as “first,” etc., and the various qualities denoted by such marks as Heart JC, Lightning D, Circle SSS—D, Triangle RB—2, Red Diamond SS—2, etc.

*China-grass.*—China-grass is chiefly shipped from Hong-Kong, the price being from £50 to £60 per ton.

*Fibre-selling Conditions.*—The usual conditions of sale and expedition of fibre are as follows :—

F.O.B. The seller must put the fibre on board the ship at the port of export. The buyer must furnish the ship for the time of delivery arranged.

C. and F. Cost and freight. The selling price includes the cost of the fibre and the freight. The buyer must insure it.

C.I.F. The selling price covers all cost, insurance and freight. The insurance is usually made according to the conditions of the picking clause when the insurance company agrees. It is made at the risk and peril of the buyer, on whom falls the responsibility of the solvability of the insurance company. He has the right to demand a policy of insurance. In the C. and F. and C.I.F. arrangements the freight is deducted from the invoice and paid to the captain by the buyer, on the arrival of the bales. In the F.O.B., C. and F., and C.I.F. arrangements, the fibre travels at the risk and peril of the buyer. The mats for stowing the fibre in the ship, the harbour dues at the port of arrival, the duty, if any, and statistics, are at the cost of the buyer. The invoice is made out at the place of shipment, and the quantities allow a latitude of 5 per cent. more or less. Delivered on the quay :—The cost of discharge, weighing and putting on the quay, are paid by the seller. Delivered at station :—

All cost and risk are at the expense of the seller until the bales arrive at the station. Delivered on waggon:—The cost and risk are borne by the seller until the bales are put upon the waggon.

In the three latter cases the invoice is made out according to the weight found by a sworn weight-master at the port of arrival. The weighing is done in draughts of not less than 3 cwts.

The cost of lading by a railway company is included in the cost of transport.

In the case of shipwreck or fire the seller is not bound to replace the fibre lost or destroyed.

When fibre to be sent by railway is sold "free on rails" or "on waggon" at the place of expedition, the seller must put the bales on the waggon and furnish a receipt for same. The cost of lading is, of course, included in the cost of transport.

When the sale price includes the cost of the fibre and its transport, the seller deducts the cost of transport in conformity with the terms of the International Tariff from the invoice, the buyer having to pay it on the arrival of the bales. In this case the fibre travels at the risk of the buyer.

When the bales are to be delivered at the station at the place of destination, the risks of the road are run by the seller, who must pay the cost of transport, duty, and statistics.

The sending of the bales in a fixed time only involves the obligation to put the fibre on board the ship or train before the expiration of the appointed time.

The tare usually allowed on Russian flax and tow is as follows:—At Archangel the tare given corresponds with the weight of the mats surrounding the flax, tow, or codilla.

At St Petersburg the tare is the actual weight of the mats and thick ropes. For flaxes without mats, such as Pskoff, Pava, Louga, and Soletsky, which are sent from St Petersburg, the actual weight of the large ropes is allowed.

At Riga and at the stores of Riga houses in the interior a tare of  $3\frac{1}{2}$  Russian lbs., or nearly 3 lbs. avoirdupois, is allowed per mat.

For Reval, Narva, Pernau, and Ostrow in bobbins or mats, no tare is allowed for cords.

For sales F.O.B. payment is made by bills at three months from the putting on board, or at three months from the time arranged for delivery, if the ship does not arrive at the proper time for loading.

The most usual conditions of sale concerning the quality of Russian flaxes are:—

At St Petersburg, the average quality of the deliveries of the dealer as indicated in the contract of sale. The average quality of a growth, Vologda, Yaroslaw, Onglich, Rjeff, etc.

