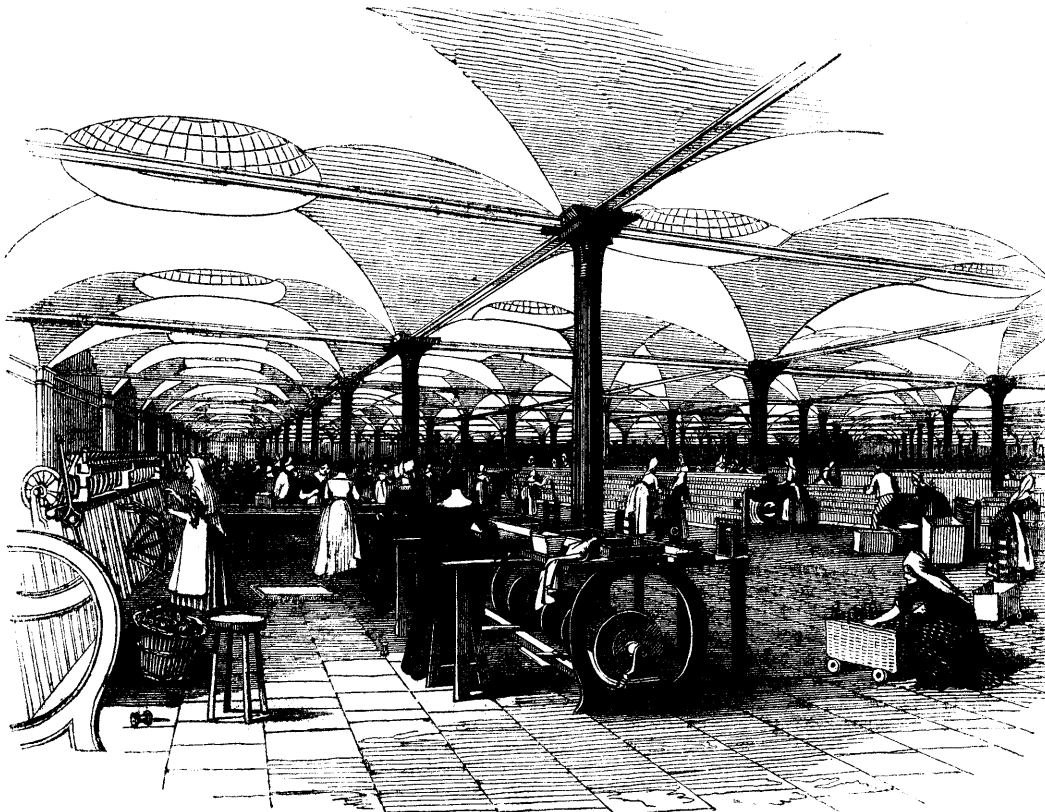


A DAY AT A LEEDS FLAX-MILL.



[Interior of Marshall's Flax-Mill.]

EVERY one knows of what materials *cotton*, *silk*, and *woollen* goods are made; but the same cannot perhaps be said respecting *linen*, because the latter, unlike the three former, is not expressed by the same term that expresses the raw material from which it is made. In the Latin language the name for flax is 'linum,' and in all the languages of the south of Europe, derived from the Latin, the name is somewhat analogous, such as 'lin,' 'len,' 'lino;' but in the north the name is totally different, being presented under the three forms 'flax,' 'flachs,' and 'vlasch,' in English, German, and Dutch. It will be seen, therefore, that our common name for the raw material is derived from the Gothic name for flax, while that for the manufactured goods is derived from the Latin name for flax. This may appear a trifling matter; but we believe it has been the means of preventing many persons from being able to answer the question, "From what is linen made?"

A description of one of the immense flax-factories of modern times will give us an opportunity at the same time to glance at the arrangements by which flax is worked up into linen and other woven fabrics. The linen-manufacture, considered as distinct from flax-spinning, is an example rather of domestic than of factory operations, and therefore we may not have a better opportunity than the present to notice it. As the flax, too, is partially prepared before it reaches the flax-mill, it may be well to speak briefly of the flax-growers and their operations; in short to trace the history of a piece of linen cloth from the seed to the loom.

The flax-plant has a green stem from a foot and

a half to two feet high; and the flaxen fibres are derived from a kind of inner bark to this stem. It is cultivated more or less in a great number of countries, but Holland and the district around Riga are those whence we obtain our chief supply. The soil (a rich loam) being carefully prepared, the lin-seed (that is, the seed of the 'linum,' or flax-plant) is thrown on broadcast, about a hundred and seventy pounds to the acre, and slightly covered with earth by a harrow or hurdle. The surface is next rolled, trodden, or pressed flat and smooth, and in a short time the plants appear above the surface. As soon as the flax is a few inches high, the weeds are carefully taken out by women and children; and when the flax begins to get yellow at the bottom of the stem, it is ripe for plucking, if fine fibres for lace and cambric be required, but is too young if the seed be required to be preserved; and the cultivator therefore decides on the proper time for getting in his crop. The pulling is done carefully by small handfuls at a time, in fine weather; and the handfuls are laid upon the ground to dry, two and two, obliquely across each other. Soon after this they are collected in larger bundles, and placed with the root-end on the ground, the bundles being slightly tied near the seed-end, and the other end being spread open for the access of air. When sufficiently dry, they are tied more firmly in the middle, and placed in long narrow stacks on the ground, eight or nine feet high and twenty or thirty long. Several of these stacks are built up in the same field, and thatched at the top.

When the flax has dried in the stacks, the seeds are

severed, either for planting, or for the various preparations of linseed: this is done either by beating the upper end of each plant with a kind of bat, or by drawing the plant through a sort of comb which will not admit the capsule. The plants are then, either in that or the following season, *steeped*, a very important operation, the object of which is to separate the bark from the woody part of the stem, by dissolving a glutinous matter which had caused it to adhere, and also by destroying some minute vessels which are interwoven with the longitudinal fibres, and keep them together in a kind of web. Near Courtrai in Flanders the steeping is effected better than anywhere else, and is thus managed:—The bundles of flax are placed alternately with the seed-end of the one to the root-end of the other, as many being tied together as will make a thick bundle about a foot in diameter. A strong oak frame-box, measuring about ten feet square by four deep, is filled with these bundles, set upright and closely packed. The skeleton box is then immersed in the river Lys, boards loaded with stones being placed upon the flax till the whole is sunk a little under the surface of the water. The bottom does not reach the ground, so that the water flows over and under it. There are posts driven into the river to keep the box in its place, and each flax-steeper (for this is a separate trade at Courtrai) has a certain space of river-bank to himself. As soon as the fibres are found to separate readily from the wood, the flax is taken out of the water, the bundles untied, and the flax *grassed*, that is, spread evenly in rows on a plot of smooth grass which has been mown or fed off. It remains spread out upon the grass for a fortnight in fine weather, till the woody part becomes brittle, and some of the finest fibres separate from it of their own accord. It is taken up, tied up when quite dry into bundles, and carried into the barn, there to remain till ready for the operation of *breaking*. This steeping or '*water-retting*' is sometimes effected in stagnant pools; and there is also a kind of retting sometimes adopted called *dew-retting*, which consists in exposing the stalks to the action of dew on the grass for a considerable period.

The flax grown in England and Ireland has been hitherto much inferior to Dutch and Belgian flax; but attempts are now being made in Ireland which require a slight notice here. In the spring of the year 1841, a Society was formed at Belfast (the head-quarters of the Irish linen trade) for "the improvement of the growth and preparation of flax in Ireland." It was supported by many noblemen and gentlemen in the north of Ireland, who subscribed funds for working out the objects of the Society. In a pamphlet detailing the proceedings at the first meeting of the Society, there is proof abundant adduced to show that the proper mode of cultivating flax is not understood by the Irish farmers. "In the most fertile districts of the country," it is stated, "the culture of flax is totally unknown, in others the crop is neglected, in some given up from partial failures; and even when regularly brought into rotation, its management is so little comprehended, as to yield little satisfaction to the consumer, and scarce half of those profits to the grower that it might do. The source of failures and reasons for non-accomplishment of this, have now been clearly understood by intelligent parties to be attributable solely to carelessness, such as not properly preparing the ground, weeding, steeping, grassing, and swingling or cleaning the flax; and these being all faults referable to the farmer himself, he willingly finds excuses, blaming season, water, or anything but his own ignorance or indolence, and rests perfectly satisfied that a crop of flax cannot be rendered as profitable here as on the Continent." As a means of affording practical instruction to the Irish flax-growers, the

Society proposed to send intelligent men to Flanders, to witness the operations as there conducted, and to bring over one or two experienced foreigners to Ireland as instructors. In the spring of 1842 the first annual meeting of the Society was held, and a detail was there given of the proceedings consequent on the original resolutions. Mr. Skinner, the secretary of the Society, had gone over to Belgium in the autumn of 1841, accompanied by a few intelligent young farmers; and after witnessing the whole operations connected with the flax-culture during a period of several weeks, they had returned to Ireland, to impart to their neighbouring farmers the information which they had gained. M. Deman and Joseph Quintelier, two Belgians, the former an agriculturist and the latter a labourer, were also invited or engaged by the Society to superintend in person the proceedings of the Irish flax-growers, or at least to offer advice and afford assistance wherever required. Printed directions were also drawn up, for the preparation of the soil, the sowing of the seed, the selection of seed for sowing (Riga seed being deemed the best), weeding, pulling, rippling, watering, grassing, milling, and hand-scutching the flax. Some of the flax resulting from these improved methods of proceeding has reached the hands of the Leeds flax-spinners, and the quality has been such as to give encouragement for further attempts. We believe that during the present year one of the Flemish flax-growers has been engaged by the agriculturists of Norfolk to impart instruction in this art to the farmers of that county.

We now proceed. The flax—whether grown in Russia, in Holland, in Ireland, or elsewhere—after having been steeped, grassed, and dried, is in a fit state for the separation of the fibre from the woody portion, a process which is called *breaking* or *scutching*. Two plans are adopted, according to the extent and importance of the arrangements. In the domestic manufacture, where the flax-grower is to a certain extent a flax-dresser also, the flax is crushed between wooden bars so as to break the woody portion in many places, without breaking the fibre. The flax is then ready for *scutching*, whereby all the fragments of boon are beaten out, leaving the fibres in a more or less cleansed state. This is effected by holding the flax in a kind of groove, and beating it in every part with a wooden staff or bat. Many machines, of more or less complexity, have been invented for facilitating the process of breaking and scutching, some for use among domestic manufactures, and others adapted rather for a manufacturer on a large scale. The machine now more commonly employed in the latter case is a kind of mill, having three fluted cylinders, one of which is made to revolve by horse or water power, while the other two are carried round by the first. The flax-plants are passed between these cylinders while thus revolving, and the stalk or boon is by this means completely broken without injuring the fibres. The scutching is effected in the same mill by means of four arms projecting from a horizontal axle, arranged so as to strike the boon in a slanting direction, until the bark and other useless parts of the plant are beaten away.

It is in this state, *i.e.*, after the boon has been loosened and removed from the fibre, that the flax is transferred to the *Flax-Mills*, those large establishments of modern times in which the fibres are spun into thread for the seamstress and lace-maker, or into yarn for the weaver. We may now, therefore, introduce the reader to one of these important factories.

Messrs. Marshall, of Leeds, to whose courtesy and kindness we are indebted on the present occasion, have a flax-mill in that town which is among the largest factories in the empire. It gives employment

to no less than twenty-three hundred persons, and in it also is prepared the yarn from which thread is made by seven hundred persons employed in another factory owned by the same firm at Shrewsbury; thus making three thousand operatives engaged in the various stages in the preparation of flax. When it is considered that a girl employed at a spinning-machine of modern times can spin as much yarn as a hundred hand-spinners could at a former period, this large number of operatives will illustrate in a striking degree the vast extension which must have been given to flax-spinning within the last few years. Several causes have led to this; among which is a change in the import duty formerly imposed on flax, while another is the excellence of the yarn spun by the admirable machines now used; and indeed the yarn can be sold cheaper than the inferior yarn of former times. In a Committee of the House of Commons on Manufactures, in 1833, Mr. Marshall stated, in reference to the improvement in the linen trade, "The great-improvement has been in the mechanical spinning of the flax, which has enabled our linen manufacturers to extend the trade so much as they have done. Before the flax was spun by machinery, the French and Belgian spinners were so superior to anything that we had in this country or in Ireland, that the linens were a great part of them imported from Flanders or from the north of Europe." It was stated that at that time the firm employed about thirteen hundred hands; but that nevertheless the quantity of flax spun was so large, that this did not comprise above a fourth of the numbers so employed in Leeds. It was also explained, that under the new and extended mode of conducting the flax manufacture, the large firms purchased their raw flax direct from the foreign ports, while manufacturers of smaller capital purchased from intermediate merchants. Of the effects which the use of mill-spun yarn, instead of home-spun, is producing in the linen trade of Ireland, we shall have to speak in a future page.

The flax-mill which we are about to visit is situated in a south-western suburb of Leeds, called Holbeck, on the south of the river Aire. The buildings comprising it are scattered over an area of many acres, and exhibit to view an assemblage of structures of different sizes and ages, resembling a little town which has grown with the growth of its manufactures, not on any very symmetrical plan, but as convenience from time to time suggested. The older portions of the factory present the appearance which is so familiar in respect to factories generally, viz. a broad and lofty front studded with rows of windows to a height of six or seven stories; and the interior, in like manner, presents the customary factory features of long galleries and rooms, filled with machines attended by operatives of both sexes and various ages; with an accompanying noise and bustle, which, though apparently to a stranger indicative of confusion and disorder, are really so only to those who are not familiar with the admirable arrangements and discipline whereby alone a large factory can be conducted.

But the "new mill," a building which has attracted a good deal of notice within the last two years, and of which a description was read before the Institute of Civil Engineers, is too remarkable to be included in a slight notice of the buildings generally: it must occupy a place by itself. It is neither like other factories in the outside nor in the inside, the height nor the depth, the walls nor the roof. We believe that Mr. Smith, of Deanston, who combines so singularly the skill of a mechanician with the skill of an agriculturist, was the first to adopt this style of factory construction; and Messrs. Marshall's is the second, and a much larger and more complete specimen of the same kind. On proceeding down Marshall Street, we first pass a long

range of dark brick buildings, forming the main portion of the old mill; and then we come to an open space between the old and new mills, with an arched passage leading from the one to the other. In this opening, or rather somewhat behind it, is situated the tall chimney of the new mill, a chimney having the form and proportions of the oft-described 'Cleopatra's Needle' of Egypt. We next come to a building, not yet entirely finished, which is to form the offices and counting-houses of the factory; exhibiting a front analogous to that of an Egyptian temple, derived from the drawings and designs of Bonomi and David Roberts. Then we arrive at the mill itself, which exhibits on the eastern side a façade one story in height, a range of eighteen windows, very much larger than are customarily used in factories, a range of eighteen pillars or pilasters, and a kind of projecting cornice running along the top; the whole having an Egyptian character in the general appearance and arrangement, and the whole front being formed of stone. The other sides exhibit externally nothing remarkable, if we except the great length.

Let us next visit the interior. Here the eye takes in at a glance an amount of space which, we believe, no room devoted to manufactures anywhere else exhibits. Indeed this is one of the largest rooms in the world. It measures three hundred and ninety-six feet long by two hundred and sixteen broad, covering nearly two acres of ground. Perhaps these dimensions will not give such a familiar idea of the size of the room as a comparison between it and other well-known buildings; and we have therefore made a few calculations to afford this latter kind of illustration. When we say, then, that this enormous room covers one and a half times as much space as the extreme outer dimensions of the General Post-Office in St. Martin's-le-Grand, five times as much as Westminster Hall, seven times as much as Exeter Hall, nine times as much as the new Town-hall at Birmingham, eleven times as much as Guildhall; and that if the largest four club-houses in London, viz. the Reform, the Carlton, the Travellers', and the Athenæum, were placed side by side, their united length would not equal the length of this room,—its vastness will become in some degree appreciable. It might at first thought seem strange why such an enormous one-storied structure should be built, since a given area of ground would obviously afford more working-room if story upon story were built, as in usual cases. But the advantages resulting from this plan are stated to be "convenience of supervision, facility of access to the machines, the power of sustaining uniformity of temperature and moisture, the absence of currents of air, which are so objectionable in other mills, the simplicity of the driving gear, and the excellent ventilation, which is so desirable for the health of the work-people."

The room presents to view about fifty pillars placed equidistant and supporting the roof. This roof is formed of brick, and consists of sixty-six flattish domes or groined arches, each about thirty-six feet span. In the centre of each arch is a skylight of large dimensions, being thirteen or fourteen feet in diameter, and rising conically to a height of eight or nine feet above the roof, thus presenting on the whole a surface of ten thousand square feet of glazed skylight, by which a very efficient light is admitted to the room. As the room is about twenty feet high, there is a degree of airiness, or freedom in the atmosphere (if we may use such a term), not often observable in factories. Although the machines in the room are very numerous, yet so ample is the space left between the avenues along which they are ranged, that the eye glances along the vista uninterruptedly, there being several parallel

ranges of machines extending the entire length of nearly four hundred feet. The earlier stages of flax-preparation, which are somewhat dusty, are not carried on in this room, the processes being chiefly 'drawing,' 'roving,' 'spinning,' and 'twisting' the flax, all of which require the clean and elegant machinery incident to spinning, and the workpeople employed being almost exclusively females. Each machine has over it a tablet on which entries are from time to time made, specifying the quality of yarn then being made, the quantity, the number of spindles, or other matters of a similar kind.

When we descend beneath this great room, we find a series of vaults and passages, all formed of substantial brickwork, employed chiefly in regulating the warmth and ventilation of the rooms above. There is a steam-engine of eight horse-power which forces air through ranges of pipe in two large steam-chests, where it becomes heated, and is from thence conveyed up into the mill. There is also an arrangement of valves and doors by which the air is brought to any desired temperature according to the season; or it may have imparted to it any degree of moisture best suited to the preparation of the flax. The ventilation is aided by valvular openings at the summits of the conical skylights. The vaults also contain the shafts for communicating to the room above the motion from a pair of very large steam-engines.

Having gone beneath the giant-room, we may next go above it; and here a stranger is apt to be puzzled in no small degree. To "take a walk in the fields" on the top of a factory seems strange enough; yet such is the impression likely to be made at a first glance. The whole surface is covered with full and luxuriant grass, not artificially smooth like a lawn, but with such slight undulations of level as make the resemblance to a field more striking. If a visitor were to go on the roof before seeing the inside of the building, he would infallibly think that the room had been excavated out of the solid ground; and the sixty or seventy skylights, rising up conically from the grass to a height of two or three feet above his head, induce him to ponder whether any gardening operations are being carried on; whether these glass enclosures—a sort of hybrid between cucumber-frames and greenhouses—are the scene of any experimental researches on plants. On looking down one of these skylights, however, the spindles and bobbins are seen working away by thousands; and the inquiry then naturally suggests itself why this form of roof has been adopted. The brick arches which form the ceiling of the great room are covered with a layer of rough plaster, then with an impermeable coating of lime and coal-tar, as a kind of asphalt; and in order to prevent the heat of the sun from cracking this composition, a layer of about eight inches of good mould is laid over it, and grass-seed sown therein. During the greater part of the year, the natural state of the ground efficiently protects the roof from the alternations of heat, frost, rain, &c.; while a little watering in the height of summer completes the preservation. The mode of draining this surface of two acres is not the least curious among the features of the place. Every one of the fifty or sixty iron pillars supporting the roof (each one at the intersection of four domes or groined arches) is a hollow tube, down which the rain-water passes to the sewer beneath. The top of each of these tubes, open to the air, is covered with a wire grating which will admit water, but not earth. The slight undulations in the grassy level are made in order that the water may flow towards the gratings, and thereby prevent the settlement of water where, through having no outlet, it would do injury.

When on the roof of the mill, we can see a neat red

brick building which forms the *School* belonging to the factory; and as such schools are becoming more and more important in connection with the factory system, we will glance at its arrangements before witnessing the manufacturing operations. The school-house has been built expressly for its present object. It contains, besides private apartments for the master and mistress, a boys' school-room measuring eighty feet by thirty-six, a girls' school-room nearly as large, and a class-room for lectures, &c., between the two. One of the rooms contains an organ. In the boys' school there are benches arranged on the class or monitorial system, each bench having a kind of shelf beneath it, on which the boys place their caps, and a monitor's seat which is also a box for containing books. Although intended principally for the factory children, yet these schools are open to all the children in the neighbourhood of the factory, whose parents choose to adopt the regulations laid down for its good governance. By the operation of the Factories Act, all the children in a factory are bound to attend school for a certain period each day: those who work in the forenoon must attend school in the afternoon; those who work in the afternoon are at school in the forenoon. Hence there is a distinction in the schools belonging to Messrs. Marshall between the 'half-time hands' and the other scholars; the former being those engaged in the factory, and under the influence of the Factories Act, and the latter being other children living in the neighbourhood. Altogether there are about three hundred and fifty boys, and a hundred and eighty girls, who are under the care of a master and mistress engaged expressly for the school. The school-rooms are comfortably warmed by hot-water apparatus; and there is a large plot of ground outside the building which serves as a playground. As to the internal discipline of the schools, there is the same busy hum, the same thumbing of slates, pencils, and books, the same mixture of the slow-moving with the quick-moving intellect, of the meek and placid boy with the young rogue who looks as if he loved marbles better than books, as in most schools. The boys mostly wear a kind of short pinafore made of coarse flaxen cloth, called a 'harding' or 'harden'; and their appearance on the whole is certainly indicative of good health and high animal spirits.

Let us now see what are the processes to which the flax is subjected in this factory. The material comes thither in the form of small bundles called 'heads,' measuring probably two feet in length, and weighing a few pounds each. These heads of flax are taken to one of the upper floors of the building, where the preparatory processes are conducted. This upper floor exhibits one of the most busy scenes that can be conceived. The whole area is covered with machines of one kind or other attended by a multitude of workpeople, chiefly young boys; and as the flax has in it much more dust and dirt than are found in cotton, silk, or wool at an analogous stage of the process, the atmosphere of the room contains a larger amount of floating dust, to remove which large fans or blowing-machines are employed.

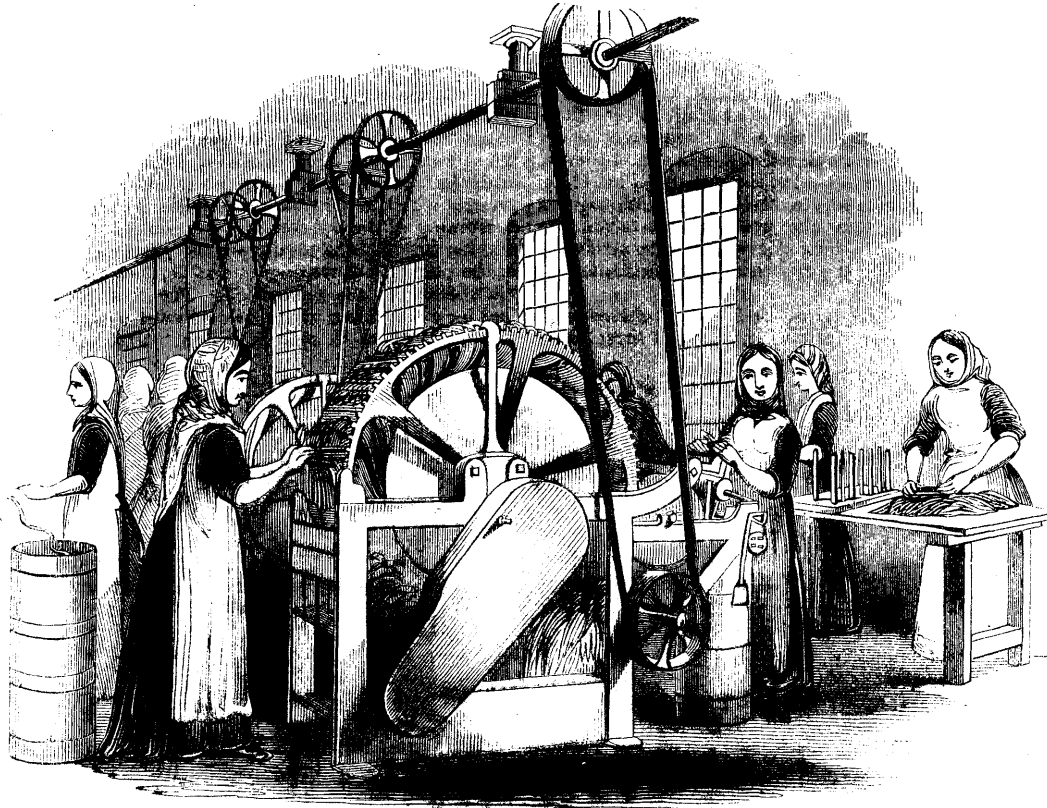
When the heads of flax are ready for working, they are 'scutched' out at the ends, that is, they are held in a machine which subjects the ends of the fibres to a rude sort of combing or beating. They are then cut or broken in two places, so as to divide each fibre into three portions, which are of different qualities, the middle one being the best. There are distinctive names applied to flax of different colours; thus the 'blee' is the dark-coloured, and the 'white' is the light-coloured portion.

Then ensues a chain of processes so continuous and so remarkable that it may be deemed the most charac-

teristic part of flax-dressing; this is the *heckling*, a process which separates, straightens, cleanses, and in some cases splits the fibres. In the domestic system of manufacture the process of heckling is thus carried on:—The instrument employed, called the *heckle*, is a square piece of wood covered with rows of iron teeth about four inches long. The fineness of the heckle is chosen with reference to the quality of the flax, and heckles differing in this respect from each other are used in succession, the coarsest first, greater degrees of fineness

next, and the finest to give the last degree of smoothness and finish to the flax. The operation of heckling is performed by the workman grasping a handful of flax by the middle, and first drawing one side or end, and then the other, through the teeth of the heckle, until every particle of extraneous matter is removed, and the whole of the filaments are arranged in distinct, even, and parallel layers.

But with the modern heckling-machines the process is very differently conducted. There is a series of



[Flax-heckling.]

twelve or fourteen machines, arranged in two rows, and attended by about eighteen hands, mostly children; and every handful of flax has to pass successively through all these twelve machines, and under the care of all these eighteen work-people, during the process of heckling. There is, too, so much bustle, passing to and fro, and handing from one to another, that the contrast between this process and the preparation of cotton is very marked. In the first place there is a kind of bench or table midway between the two rows of machines, at which children are engaged in fastening the flax into iron clasps or holders. These clasps are long frames capable of admitting the handfuls of flax, which they hold tightly at one end, leaving the other end of the flax floating freely; nuts and screws being employed to fix the flax in the clasp. When several clasps are thus filled, other children take them one by one, and adjust them to the surface of a cylinder, until the cylinder is supplied with its proper portion of flax, ranged in several rows parallel with the axis. This cylinder is then made to rotate, and the floating or free end of the flax, while sharing in the rotation of the cylinder, meets with a range of teeth or combs, by which it is combed out, and cleansed from the coarser impurities which may remain among the fibres. The machine is then stopped, and the frames or clasps con-

taining the flax are taken from it and placed on the cylinder of the second machine in the row, differing in no degree from the former, except in having a finer comb or heckle to act upon the flax. When this second heckling is finished, the clasps are in like manner removed from the second machine and placed upon the cylinder of the third, where the heckling process is again performed, but by a heckle rather finer than either of the former. So it goes on to a fourth, a fifth, and a sixth machine; all being ranged in a row, all being similar in their general mode of action, but each one presenting finer heckle-teeth, and therefore reducing the flax to a state of greater fineness and smoothness than the one which preceded it. It is a very general principle in the cotton manufacture that the material transfers itself from one machine to another with scarcely any interference on the part of the work-people; but there is probably something in the nature of flax-preparation which renders that continuity of action unattainable. Among the eighteen young operatives engaged at this set of machines, each one has a particular duty to perform, and all are occupied very actively.

The six or seven machines, of which we have spoken, heckle the flax in one half of its length only. It is not removed from the clasps during the above transfer, and

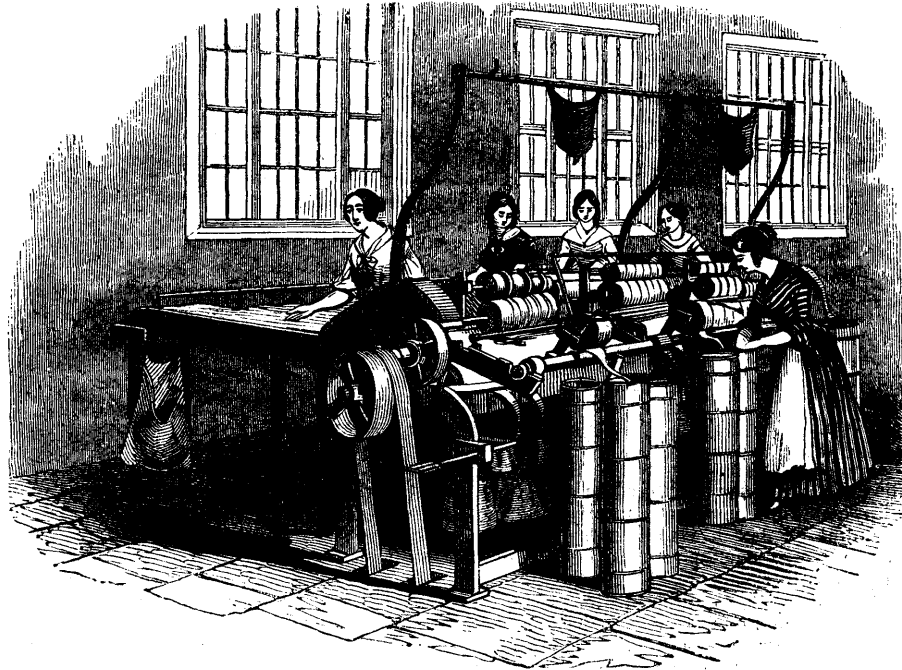
therefore each fibre is combed or heckled only at the part which is free or untouched by the clasp. To heckle the clasped portion is the operation of the remaining machines and their attendants. When the clasps are taken from the sixth machine, they are not put upon the seventh, but are carried to the bench between the two rows of machines, where some of the children unscrew the clasps, release the hitherto confined end of the flax, and clasp it by the other end; all which is done with singular quickness and dexterity. As fast as the flax is thus clasped, the clasps are taken by other children, and placed upon the first machine of the second series, where the rough and unheckled ends undergo their first heckling. From this machine the clasps are removed to a second, and from thence to a third, a fourth, a fifth, &c.; until at length every fibre of flax has been heckled from end to end six or seven times, and the whole rendered soft, silky, and glossy. The very great attention paid to the process of heckling is one of the circumstances to which the recent progress of the flax manufacture may probably be attributed; since the beauty of the yarn afterwards to be produced depends very much on the cleanness and smoothness of the flax.

There are other kinds of heckling-machines employed under some circumstances. One of these has a

double kind of comb by which the flax is heckled on both sides at once. The mechanism is so arranged that the teeth act first on the extreme ends of the flax, and gradually go deeper and deeper, till the whole length of the fibre comes under their operation.

We have next to follow the heckled flax to the rooms where it is further prepared for spinning. From the heckling-room the flax is carried to the sorting-room, where there are a number of men provided with boxes divided into numerous compartments. The heckled flax being laid out on a bench or table, the sorters examine it by small portions at a time, and separate it into many different qualities, according to the fineness and fitness for different kinds of yarn. This is an operation requiring much of that discrimination of touch which is observable in wool-sorting.

It will be remembered that the flax, so far from being in one continuous band or sliver, is yet only in the form of distinct fibres, each about ten inches long; and the process which it next undergoes has for its object the combining of these fibres into the continuous band just alluded to. This is analogous to processes exhibited in the cotton and woollen manufactures, so far as the main features are concerned. The flax, after being laid on a travelling apron, is conveyed by heckle-teeth to a series of small rollers, which 'draw' it out into



[Drawing the heckled Flax, or 'Line.']

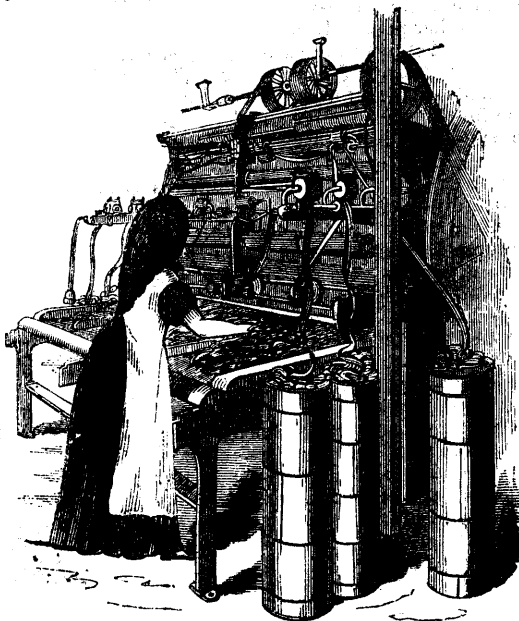
a continuous sliver or riband. Over and over again is this process repeated, the continuous sheet or band of flax being doubled and re-doubled, and carded after each doubling, until it presents a uniform width and thickness in every part. At one time it is exhibited in the form of a narrow band about an inch and a half in width, and this by subsequent 'drawing' or extension is diminished to a beautifully smooth and glossy band an inch in width. All the drawings or extended bands fall into tall cylindrical cans, and are from thence conveyed to other machines where a similar process is conducted, until at length the most perfect equality of width and thickness is obtained in every part; for unless this equality is produced, no after process can prevent the yarn from being irregular.

We must here speak of the *tow* which results from the preparatory processes, and of which mention has not yet been made. When the flax is fitted into the clasps and adjusted to the heckling-machines, the heckling-teeth not only comb out the fibres straight and parallel, but also remove irregular, short, or defective fibres, as well as dust and dirt. The dirt falls to the bottom of the machine, and is thence removed; but the waste fibres cling to the teeth of the heckle, and there remain during the process of heckling. When the clasps are removed in order to be transferred to another machine, the heckle-teeth are seen to be full of flaxen fragments, and these fragments, constituting *tow*, are, by means of an apparatus attached to the machine, removed from the teeth in the form of a continuous sliver; so that while the machine is



[Doubling the Drawings.]

heckling the fibres of good flax, it is also making a band or ribbon of the inferior portion. Each machine produces its own portion of tow sliver; but as the flax itself becomes finer and finer in proportion to the number of heckling machines through which it has passed, so do the tow slivers become finer and finer, and they are thus capable of being classified into six or eight different qualities. In the language of the factory, the flax ceases to be called by that name after it has passed through the heckling-machines; the good portion is then called '*line*,' and the inferior '*tow*,' both are afterwards spun into yarn, but the yarn so produced has different degrees of excellence. Other machines are used, by which tow is converted into slivers by carding, analogous to cotton and wool processes.



[Tow-carding.]

When the slivers, whether of *line* or of *tow*, have been brought to the desired breadth, thickness, and equality, they are carried to the '*roving-machines*,' where they are transformed to the state of a soft, small, cylindrical cord. There are two combined movements

whereby this is effected; the sliver is drawn out or elongated, and it has a slight twist imparted to it as a means of enabling it to cohere and to bear the subsequent action of the spinning-machines.

These spinning-machines we have next to notice. They are on the '*bobbin-and-fly*' principle, '*mule-spinning*' not having, we believe, been introduced in the flax manufacture. These machines constitute the main feature in the great room of the new mill. The drawing, roving, and spinning, being comparatively clean processes, are here conducted; and great care is observed in maintaining not only a given temperature, but also a given degree of moisture in the air. There are both hygrometers and thermometers in the room, to indicate the state of the air at any given time. Flax, unlike cotton, silk, wool, or worsted, is spun wet, as a means of obtaining a finer and smoother yarn; and within the last few years the use of warm water, instead of cold, has been introduced for this purpose. The same flax, prepared in the same way, can be spun to a much higher number, or much greater degree of fineness, with hot water than cold; and this is doubtless one of the improvements to which the recent progress of the flax manufacture may be attributed. The spindles by which the yarn is spun revolve some thousands of times in a minute, and the wet yarn thus throws off a continuous spray by the centrifugal force thereby generated; the girls and young women who attend the machines wear therefore a kind of thick apron to protect themselves from the spray. The water is contained in a kind of oblong trough attached to each machine, and steam is admitted by a small pipe as a means of bringing the water to the required temperature.

When the yarn is spun, it is destined either for weaving or for thread. If for weaving, the yarn is reeled into hanks on a hexagonal reel, to be afterwards made up into bundles of twenty hanks each, containing sixty thousand yards. But if the yarn is to be made into thread, it is carried to other machines in the same room, where two yarn-threads are twisted together, and converted into the hard and firm thread used in needlework and lace-making. The process of thread-making is also carried on at a factory belonging to the same firm at Shrewsbury.

Here, then, the operations of a flax-mill terminate. If the flax-yarn is woven into any kind of linen or flaxen fabric, that is an additional feature. At Messrs. Marshall's works the operations cease when the yarn and thread are produced, and we believe the same to be the case in most flax-mills. We will, therefore, glance in other directions to see how the flax is worked up into cloth.

Barnsley in Yorkshire, Dundee in Scotland, and Belfast in Ireland, are the three centres of the linen and flax-cloth manufactures, mostly conducted on the domestic or hand-loom system, but in other instances on the factory or power-loom system. The flax-fabrics woven in and around Barnsley consist of linen, duck, check, drabbet, tick, huckaback, diaper, drill, toweling, and a mixture of flax and cotton called '*union*.' These goods are, generally speaking, not made in large factories; but there are '*manufacturers*' at Barnsley and some other towns in Yorkshire, who purchase flax-yarn from the spinners, and give it out to hand-loom weavers, who weave it into cloth at their own homes, bring it back to the warehouse of the manufacturer, and receive payment for their labour.

In Scotland, Dundee takes precedence in coarse flaxen and hempen goods, and Dunfermline in fine linens, such as shirtings, damasks, and table-linen. Sheetting, bagging, sacking, sail-cloth, and dowlas are made to an immense extent in Dundee, where indeed this kind of manufacture is more prominent than any other, and forms at present the staple of the place.

Floor-cloth canvas, of the enormous width of eight yards, is made at Dundee; and we believe that nearly all the floor-cloth manufacturers of London obtain their supply of canvas either from Dundee or from other towns in Scotland. The flax-manufacture in other branches has also made such rapid progress, that the Dundee linens and sheetings come into the market at a price which the weavers in other places can scarcely compete with. In 1839 there were about five thousand hand-loom weavers engaged on linen fabrics in Dundee; and we believe that the power-loom has not yet been very extensively introduced into the linen-trade; the Dundee mode of conducting the manufacture being very similar to that in Barnsley.

In the year 1840, the Commissioners on the Hand-loom Weavers Enquiry published reports from some of the assistant commissioners; and among these reports those from Mr. Otway and Mr. Muggeridge give some interesting details concerning the linen-trade of Ireland, of which we will here avail ourselves.

The flax fabrics woven in Ireland are chiefly fine and coarse linens, canvas, sacking, and damask. The mode of conducting the manufacture at present is very different from what it was at the beginning of the present century. At that time each weaver bought or raised and prepared his own materials, from which he made his linen web, and sold it in the public market, or by private contract, to agents or travellers who went round the country making purchases. Those weavers who had more than one loom intrusted them either to other members of their families, or to apprentices or journeymen, under their own personal inspection. The latter were frequently remunerated by what was termed 'the fourth penny,' that is, each journeyman received, as his wages for weaving a piece of cloth, the fourth part of the gross sum for which such cloth was sold. Out of the remaining three-fourths the owner of the loom derived his profit and the cost of the yarn. Many weavers, who were small farmers also, had from three to six or eight looms in their houses. The spinning and various preparatory processes which the flax underwent were chiefly performed by the female branches of the family; and the owner, his apprentices, and journeymen worked either at the loom or in the field, according as the season or other circumstances rendered most advantageous.

But at the present time the manufacture is conducted on four different systems:—1st. The weaver works on his own account, holding at the same time a small piece of land; 2ndly. The weaver is a 'cottier,' who works for manufacturers without holding land; 3rdly. The weaver works for manufacturers, and has at the same time a farm; 4thly. The weaver works for manufacturers in a weaving-shop or factory. The last-named of these systems is the one which is now growing more into use; it is said to be not much relished by the hand-loom weavers, as there is a kind of stringency in factory regulations to which they were not before accustomed; but it is said by the Hand-loom Commissioners that the weavers can earn more in a given time than under the old system, besides being freed from many irregularities to which hand-loom weavers are subject. It is, however, in some one of the first three systems that the Irish linen-weavers are to be seen most characteristically. The Irish weavers as a body seem to

love freedom and a potato rather than factories and better food. The Assistant Hand-loom Commissioners state that they visited the cabins of some of the weavers, and found them in the lowest depths of filth, squalor, and wretchedness, but that the inmates were still cheerful and—if such a word may be used—apparently contented. Under the domestic system of weaving, where the weaver has to go and buy his yarn, and then go to market to sell his woven cloth, the loss of time is seriously great; but this source of loss is not the only one: the habits and customs of the people lead to a formidable list of such losses. A weaver on one occasion undertook to prove to Mr. Muggeridge that an Irish weaver's year contains only two hundred days, and the demonstration would be laughable were there not reason to believe that there is too much truth in it. "I confess," says Mr. Muggeridge ('Hand-loom Weavers Report,' p. 726), "that the proposition was new to me, and my informant, with perfect gravity, thus logically and, as he considered, unanswerably demonstrated it:—'You will allow,' said he, 'an Irishman has fifty-two Sabbaths on which he should not work?' 'Granted.' 'There then is fifty-two days. Not an Irishman in the county Armagh that does not attend at least one market weekly: there go fifty-two more days. Where's the man, if he be at all respectable, that won't devote his afternoon or half-day to the wake or funeral of his friend or neighbour? and it's a poor neighbourhood that there won't be one death in a week: there go twenty-six days more. Then, you know, there are our saint-days, and our holy-days, and our birth-days; and may be Dan will be getting up a precursor or a tithe-meeting, or the likes o' that, which a man is bound to attend for the love of ould Ireland. And now make your reckoning, and see whether a man will have more than two hundred days in a year he can call his own.'"

When Mr. Otway was making his inquiries at Drogheda, it happened from some cause or other that the hand-loom linen-weavers were earning less than in any other part of Ireland; they did not even seem to know that others were earning higher elsewhere. "A person ignorant of Irish economy," says Mr. Otway, "would decide that a weaver earning but three shillings and four-pence per week, and having a family of six to support, must starve; but this is not the case, though, poor fellow! he and his are badly off. With the manure he collects (and in this respect he and all his family are industrious), he is able to plant as much potatoes as will last him from three to four months on ground obtained gratis from some neighbouring farmer, who is glad to give the potato-crop for the sake of the corn-crop which the manure will enable him to obtain next year." The man's earnings are applied to eke out the supply of provisions, to pay rent, and to procure clothes, while the wife and children fatten a pig, or sell eggs and poultry, or go out begging among the small farmers in the vicinity; so that the means of obtaining subsistence are derived from many different sources. In other parts of Ireland the linen and canvas weavers were carrying somewhat better wages; and there is now going on a gradual transition towards the factory arrangements of the linen trade.